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ISOPAR

A NEW AND IMPROVED SYMBOLIC OPTIMIZING ASSEMBLY ROUTINE FOR THE IBM 650

BY

H. HERBERT HOWE

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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Contents

Page

Illustrations

Tables

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By

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1. Introduction

1.1. What an Optimizing Assembly Routine Does

The purpose of an assembly routine is to relieve the programmer of some of the problems of assigning storage locations to instructions, data, or "temporaries." When he wishes to refer to a storage location, he writes a symbol, which may be mnemonic, such as SINE; the assembly routine assigns a location to that symbol, and will use the same location whenever that symbol appears again. If it is inconvenient to use a mnemonic symbol, the programmer may select a symbol at random, which is used in the same way.

In the case of the IBM 650, an important feature of any assembly routine is that it should assign locations in such a way as to optimize the program as far as is feasible.

It should be clearly understood that three distinct codes are involved: (1) ISOPAR, which is the code actually being performed. (2) The input code, also called the "symbolic code," which is read and transformed one card or a few cards at a time. (3) The output code, or "object code," which is punched while the input code is being read. The object code is the one which will later be used to make the actual computations which are desired.

1.2. Equipment Needed with ISOPAR

ISOPAR follows its parent SOAP II in that it requires only a basic 650 plus alphabetical device, but it will assemble programs which use other optional features, such as indexing registers, floating point, tapes, printer, disk storage, etc. If the alphabetic device will accept special characters, the programmer has more latitude, but that

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feature is not essential. Other special devices are not used in the assembly, even if present. (See 6.3(c).)

1.3. Shortcomings of Previous Assembly Routines

IBM prepared a Symbolic Optimal Assembly Program, commonly known as SOAP, and later a modification called SOAP II. The present assembly routine is modified from SOAP II, but corrects two serious shortcomings in it, as well as several minor ones. On the other hand, ISOPAR still includes a number of known shortcomings, as described in 6. The two serious shortcomings of SOAP II will now be discussed.

1.3.1. Brevity of Remarks

The first shortcoming of SOAP II is largely a matter of control panels, and could have been remedied without much change in the code itself. SOAP II is inadequate in that only ten spaces are allowed for explaining a word of the code; and if the machine includes only the optional Alphabetic feature, but not the Special Character feature, these 10 columns of explanation can include no punctuation. The remarks are often so abbreviated that they suggest meaning only to the person who wrote them, and perhaps not to him after a little time has elapsed. ISOPAR allows 38 card columns for remarks, and they may include any symbols which the 407 will print.

This is accomplished by not trying to carry the remarks from input to output through the 650. Instead, a Reproducer board is permanently wired (see 3.2), and as soon as an ISOPAR code is run through the 650, the cards are run through the Reproducer to reproduce the remarks into the output cards. To simplify coding, this plan has been carried further, and all of the other information on the input cards is transferred to the output by the Reproducer; the only things punched by the 650 are the derived instruction, its location, a card number, and any punches necessary to control the 407 on the basis of defects found during assembly. Sufficient card columns for adequate remarks were obtained by giving up the quite unimportant feature that the output cards should be self-loading.

1.3.2. Deficient Optimization

The second serious shortcoming of SOAP II is one whose remedy required rewriting the entire program, although SOAP II served as a valuable guide throughout. (Since the program was being rewritten, other improvements were included; see 4.) SOAP II produces a program which is rather poorly optimized; the optimization of the output of ISOPAR is much better.

The trouble with SOAP II is that it always processes the cards and addresses in regular sequence: the cards as they reach the hopper, and the addresses in the order L, D, I. The shortcomings of this method of optimization are set forth clearly in IBM's "650 Data Processing System Bulletin: Basic Operation Codes, Program Optimizing, Program Loading," No. G24-5002-0 9/58. On pages 27-28, it is explained that for some operations the time of execution cannot be predicted, and, in order to optimize, one must go ahead to a fixed address and work back. This is just what ISOPAR does.

For example, consider the pair of words:

```
0000  14  ABC
      21  SAVE  0020
```

where 0000 and 0020 are fixed addresses; that is, either absolute values, or regional values, or symbols for which a value has already been assigned when these words are reached. Assuming that its first-choice locations are available, SOAP II would assign values that would make these words read:

```
0000  14  0003  0013
0013  21  0018  0020
```

When this code is performed, the computer wastes 49 word-times between 0018 and 0020.

If operation 14 actually required exactly 10 word-times to perform (or 60, or 110), optimization could not be improved without changing 0000 or 0020. But 14 is not that kind of operation. The time which elapses from the moment it gets the divisor from memory location ABC until it stores the remainder in SAVE is large and variable. In any particular computation, there is a certain dynamic level which ought to be assigned to SAVE to make it fit with ABC; but each time the code is performed, that level will presumably be different. Except for the question of parity (a refinement which need not bother us at this point) any dynamic level is as likely to be suitable for SAVE as any other, so far as fitting it to ABC. (The blank address could be assigned any value, since in any case the second of these words will be in the program register before the division is finished.)

Now consider how these words would be optimized manually. You look ahead until you find a fixed address, and work back. In this instance, working back from 0020, the value 0017 is assigned to SAVE. This will fit ABC as well as anything else and gives the best fit with 0020. It will be seen that, on the average over many performances of the code, the two words will be performed in 49 word-times less than

if SAVE is made equal to 0018: the time interval between ABC and SAVE will be the same, on the average, and the time interval between SAVE and 0020 will always be 49 word-times less.

This is an extreme case. When we consider optimization of many different codes by SOAP II, we see that its method wastes an average of 24 1/2 word-times per division, as compared with the manual method, if we exclude from consideration those cases in which another variable-length order is reached before we get to a fixed address.

The same argument applies to other variable-length orders, such as multiply, floating operations, read, write. For floating add, the average waste would be somewhat less, because the optimizing addends used in SOAP II are such as will usually waste a few word-times but seldom an entire turn of the drum.

Summarizing, SOAP II wastes considerable time because addresses are always processed in the order in which they are reached. When a variable-length order is reached, it assigns a more or less arbitrary length to it, regardless of what the situation may be on ahead. Since, on the average, it makes little difference in computing time what address is put there, the manual method optimizes the address with relation to later addresses, so that no time is wasted when the next fixed address is reached.

ISOPAR follows the manual method. When a variable-length order is reached, it stops processing and reads in more cards until a fixed address is reached. Then it optimizes backward; then it punches forward. This takes more processing time than SOAP II, but produces a materially better optimized code. In the example cited above, ISOPAR would give, if its first-choice locations were available:

```
0000  14  0003  1512
1512  21  1517  0020
```

2. Programmer's Guide

It is assumed that a person attempting symbolic programming, for use with ISOPAR or any other assembly routine, is already at least somewhat familiar with machine-language programming, and no attempt is made to discuss the meanings of the operations or the addresses.

2.1. Coding Form and ISOPAR Input

The ISOPAR input consists of one card for each word of code, with certain additional cards. These additional cards are headings used in listing the code, and cards which serve to guide the assembly. A complete list of the card types is given in 5.2.1.

Figures 1-2 show the coding form used for the ISOPAR input. Each line shows information that might appear in one input card. Numbers at the top show the card columns. It is to be understood that cards would never be used in the sequence and with the entries here used; this is, rather, an assembled collection of different types of cards, given in the order in which they are described in the text.

2.1.1. Column 16, Card Status

Column 16 may be used for a letter which shows the status of the card. Such letters may be omitted if desired, since they do not affect the assembly, and only K affects the 407 listing (by controlling spacing). The following letters are used:

K: The word is a constant, not an instruction. Q: A comparison constant, or the word used to restore a variable instruction after a constant has been subtracted. (Used often with the basic machine; seldom with a machine having index registers.) C: An instruction which is performed immediately after the one preceding it in the listing, and also after some other instruction. N: An instruction which is not performed after the one preceding it in the listing, but is performed after some other instruction. R: An instruction whose logical predecessor is not in the listing at all, but is built up somehow. P: A word used to preset or modify a variable instruction. J: Similar to P, in case the word appears in the code in the sequence in which it will be performed.

These letters are used in the listing of the ISOPAR code. It might be noted, however, that that code has so many interruptions to normal sequence that the value of the letters is rather limited.

2.1.2. Column 17, Card Type and Other Information

Certain of the possible card types are indicated by punches in column 17, and that column also gives some other information about certain cards.

A 1 in 17 indicates a "Comments" card. These are normally heading cards for use in listing, with one at the start of each segment of the code. The comments are written in columns 18-75. The ISOPAR assembly code passes over those cards without using them.

A 2 in 17 indicates a card of a relocatable subroutine. Each actual code-word of the subroutine has such a punch; but the subroutine's type 1 cards, if any, and its REQ and RBR cards do not use 2 in 17, nor does the associated REL card. (See 2.2.)

An X-punch (also known as 11-punch) in 17 indicates a negative word. It is normally used only with constants, including those with 2 in 17. It may be used in an ALF card, but not in a card with 1 in 17.

A Y-punch (also known as 12 or R) in 17 indicates a card of the availability table (2.3.7.). It is not part of the input, but is punched as part of the output, if a PAT card is used.

2.1.3. Columns 24-25, Operation

For every word that is to appear in the object code, there must be a line on the coding form and a card in the input code. The first two digits of the object-code word are entered in columns 24-25 (except in case of an ALF card, 2.3.1.), and are reproduced unchanged into 5-6 of the output card. If the word is an instruction, these digits show the operation; alternatively, they may be the first two digits of a constant. If the word is an instruction, these digits are also used during optimization.

2.1.4. Columns 23-25, Pseudo-Operation

The input symbolic code must also include some "pseudo-operations." A pseudo-operation is indicated by a 3-letter symbol in 23-25.

There are 13 permissible pseudo-operations, listed in 5.2.1. An illegal combination of letters will probably cause the assembly program to go astray. Actually, however, only the lower punches in columns 23 and 25 are used in identifying the pseudo-operations; for example, KAZ or SCI, or 279 would work just the same as BLR. A pseudo-operation is recognized by having blank 17 and non-blank 23.

Pseudo-operation ALF gives rise to a word of code, just as do cards showing actual operations. The other 12 do not. They are used, so to speak, to guide the assembly into correct channels.

Three of the pseudo-operations, BOP, PAT, and HED, are used with only columns 23-25 punched. All of the others require additional punching.

In case RBD cards are used, they must be at the start of the program, preceded perhaps by type 1 cards and a BOP card, but by nothing else. The other pseudo-operations may be used at any time, although normally all except HED also appear before the first card which produces a code-word of the object code.

2.1.5. Reservations

ISOPAR assigns addresses optimally, in cases in which the programmer has not specified the address. When an address is thus assigned, a note is made that that address is now "unavailable," so that it will not be reassigned.

It is always necessary, however, that certain words be in a predetermined relation to each other; e.g., the 10 words of a read band must be together. To make this possible, it is necessary at the start of a program to "reserve" certain portions of the drum, so that the assembly routine will not assign those cells to other uses.

Seven or eight of the pseudo-operations relate to reserving. Two of these are explained here, and the others are explained later.

When a pseudo-operation calls for reserving a location, it is reserved regardless of its previous status; when it is to be "unreserved," that too occurs regardless of previous status.

2.1.5.1. BLR, Block Reservation

Two varieties of BLR cards are illustrated. The first has its I address blank; the second has a four-digit number for I.

The first illustrated BLR card reserves cell 0306, making it unavailable for automatic assignment by the assembly routine. The second illustrated BLR card reserves all cells from 1296 to 1305 inclusive.

2.1.5.2. RBD, Reserve Band

RBD supplements BLR, and reserves large blocks of locations much more rapidly than does BLR.

The first RBD card shown in figure 1 reserves the entire band which starts with 0000, namely locations 0000-0049 inclusive. The second RBD card reserves 0600-1899 inclusive, and also 0000.

The number in the D-address must be a multiple of 50. If it is not, no reservation occurs.

The number in the I-address, if not blank, is normally congruent to 49 (modulo 50). If it is not, reservation extends to the end of the band in which that location lies. Should the I-address be smaller than the D-address, it reserves only one band.

RBD first reserves the initial location of each band, and then reads the next card to see if it is also an RBD card. At the end of the last RBD card, the reservations in the locations = 0 (mod 50) are extended to the following 49 locations. After that, it also reserves 0000, since that is nearly always desirable. To work correctly, all RBD cards must precede all the rest of the program except possibly type 1 cards and a BOP card.

2.1.6. Columns 18-22, 26-30, 32-36, Addresses

As in all 650 coding, three addresses must be specified for each word: L, the location into which the word is to be placed; D, the data-address in the word; and I, the instruction-address in the word.

In the input code, each of these addresses consists of five characters, and may consist of any combination of letters, digits, blanks, and special characters that is acceptable to the alphabetic input of the 650. Addresses are of four types, as explained later.

It has been found expedient to restrict the generality of the characters in an address. If, for example, an address consists of two consecutive non-blanks and three blanks, it may be hard to tell in a 407 listing which positions are non-blank, and errors have occurred from this source. It is better, therefore, for the programmer to adopt the rule that every address be either left-justified (first position punched) or right-justified (right position punched); or, of course, it may be both left- and right-justified.

The following conventions in writing addresses have been found aids to accurate key-punching. They are illustrated in figures 1-2.

Letters used in addresses are written as capital letters.

An address with fewer than 5 non-blank characters should be written crowded against the left or the right margin of the space on the form, to show left- or right-justification, respectively.

A capital O is written with a bar over it; a zero with a slash through it. The latter may be omitted if the zero is with a group of other digits.

Digit 1 is indicated by a single line; letter I has horizontal bars at the top and bottom.

A blank character within an address is indicated by a small b. Should the programmer desire to have a symbol that is blank at both ends, it should be written with b's at one end to clarify the punching requirements.

2.1.6.1. Absolute Addresses

If the first character of an address is blank and the other four are digits, it is an "absolute address." Such an address is reproduced into the corresponding output card unchanged, unless it is tagged for indexing. If it is a true address, it must of course be a valid one (e.g. for a basic 650, it must be 0000-1999, or 8000-8003). It may also, however, be part of a constant.

ISOPAR reserves an absolute drum address if it is L, since such an address always signifies a location that is being used. (To make the reservation meaningful, the word would have to appear near the start of the code. This is feasible, for example, with constants for which L is absolute.) Absolute D and I addresses are not reserved, (except in relocatable subroutines, 2.2), because such addresses are often parts of constants, or are not true addresses as in operations 80 or 30; and it would reduce available locations to reserve them.

2.1.6.2. Regional Addresses

If the first character of an address is a letter and the other four are digits, it is a "regional address." Regional addresses are used when the programmer knows that a certain group of words must be kept together in a certain sequence (e.g., a table of functions, or the 10 input words), but does not yet want to decide just where to put them. Later, before assembling the program, he will prepare a single REG card to define the region.

Any drum location may be described by a regional address referred to any region. If, for example, the region P is defined by saying that P0001 = 0177, then P0002 = 0178, P0003 = 0179, etc. Going the other direction, that same definition also implies that P0000 = 0176, P9999 = 0175, P9998 = 0174, etc.

2.1.6.2.1. REG, Regional Designator

For each region used in the program, there must be an REG card defining the region. It must appear before the first regional address of that region, and it is normally put near the start of the code.

The two varieties of REG card are shown in figure 1. Although columns 26-30 look like a regional address, the programmer must be careful to realize that they are not.

The first illustrated REG card specifies that the regional address P0001 is equivalent to 0177. It also causes location 0177 to be reserved.

The second REG card specifies that R0001 is equivalent to 0101, and it also reserves all locations from 0101 to 0110 inclusive.

Since it is rare for one to want to use a region consisting of only one word, the first type of REG card is normally used in conjunction with an RBD card. Suppose, for example, region A is to extend from 0800 to 1787, inclusive. One could use a card REG A0800 1787, to specify that A0001 = 0800, and to reserve from 0800 to 1787. This card, however, takes an annoyingly long time to assemble. Assembly may be much hastened by using two cards:

```
RBD   0800  1799
REG  A0800
```

This also reserves 1788-1799, which are not needed; if it will crowd the drum too much to leave them reserved, they can be unreserved with a BLA card.

The four digits in the D ADDR column of an REG card can be any number from 0001 to 9999 inclusive, although many of them would probably not be useful. The number 0000 cannot be used.

2.1.6.3. Blank Addresses

Addresses are normally left blank when the D or I address of one word is to be equal to the L of the next, and the programmer does not care what the address is. More generally, words for which L, D, and I are all given (e.g., constants) may intervene; also, pseudo-operations and type 1 cards may intervene. The following description will help explain the results which ensue when blanks are incorrectly used.

During forward processing, a blank D or I is filled optimally; and if both are blank, I is made equal to D. A blank L is made equal to the D or I that was last processed forward.

During backward processing, blank L is filled optimally, and blank D or I is made equal to the blank L that was last processed backwards.

Although a constant may follow a word with blank I without error in assembly, such an arrangement might impair optimization. If a constant is encountered during a forward search for a fixed address, the search will be abandoned. Usual practice is to put the constants at the end of the segment in which they are encountered, since the type 1 card at the start of the next segment will in any case cause the search to be abandoned.

When an equivalent is assigned to a blank address, the equivalent is reserved.

2.1.6.4. Symbolic Addresses

Any address that is not absolute, regional, or blank is a symbolic address. A symbolic address is assigned a drum equivalent when it is first processed; thereafter, the same equivalent is used, unless it is redefined (see EQU, SYN) or cleared out of the symbol table (see HED).

When an equivalent is assigned to a symbolic address, three things happen: (1) That location is reserved to prevent conflicting use. (2) The symbol is stored in the symbol table. (3) The equivalent of the symbol is stored at a corresponding place in the equivalence table.

By use of SYN or EQU, it is possible to preassign or reassign the equivalent of a symbol.

2.1.7. Columns 31 and 37, Indexing Tags

When a program is being prepared for a 650 equipped with indexing registers, it is not necessary to add the multiple of 2000 or 200 to the absolute address; and for best optimization, you should not do so. A "tag" is put in column 31 or 37 indicating which index register is to be used with a particular address. Permissible tags are 1,2,3, respectively, or A,B,C, respectively, or even J,K,L. The assembly uses the digit-punch only; or, if the column is blank, it uses zero.

The only types of address that could usefully be indexed are absolute or regional. Since indexing is for the purpose of access in turn to locations having a definite relation to each other, there are no circumstances under which it would be useful to index a blank or symbolic address, and ISOPAR ordinarily does not do so, even if a tag is provided in the input code.

ISOPAR decides whether the address is drum (add 2000, 4000, or 6000 for indexing) or core (add 200, 400, or 600) solely on the basis of whether the given address is less or more than $1999\frac{1}{2}$. No check is made on whether the unindexed address might erroneously be in the ranges 2000-8999 or 9060-9999.

In the tagged example shown in figure 1, if region P is as defined by the REG card above it: P0001 = 0177; P0000 = 0176; tag A causes addition of 2000, and the D address of indexed word comes out as 2176.

2.1.8. Columns 38-75, Remarks

Every card may have remarks punched in columns 38-75, explaining the purpose of the card. These remarks are not used in assembly, but show up if the cards are interpreted or listed. The remarks may be as extensive, within these limits, as suits the fancy of the programmer.

The dotted vertical line in the coding form shows where the remarks must end if they are written on an elite typewriter. In figures 1-2, the remarks overrun the line; they are not actually being punched in cards, but the space is used only to describe the card.

2.2. Relocatable Library Subroutines

A relocatable subroutine consists of a number of type-2 cards, and one or more REQ cards. At times, it also includes an RBR card and one or more type-1 cards.

The type-2 cards are written in absolute language, and are usually optimized better than can be done by any optimizing routine. This is warranted, as a rule, because the same subroutine will be used many times.

In all, three pseudo-operations pertain to relocatable subroutines.

The cards for relocatable subroutines are normally put near the beginning of the input deck, preceding all cards for which addresses are assigned optimally. This is necessary so that the locations to which addresses are relocated will not have been assigned by ISOPAR to other purposes before they are reserved during relocation. It would be possible to use a BLR card to reserve the space for the subroutine, but that is an unnecessary complication.

2.2.1. Format of Relocatable Cards

Each card is identified by a 2 in column 17. It may also have an X in 17, if the output word is to be negative.

All addresses must be absolute, and may be either drum or core.

Normally, drum and core addresses would be relocated by different amounts. Any relocatable address less than 2000 is interpreted as drum; any relocatable address exceeding 1999 is interpreted as core.

If an address is not to be relocated (e.g. the D address of operation 30 or 50, or the D or I "address" of a constant), the fact is indicated by putting some non-blank character in the left-hand position of the address. Most commonly, the letter "F" is used, signifying "fixed."

Such an address (see figure 2) resembles in form a regional address, but it is quite different. In fact, F0002 may have three quite different interpretations according to the type of card.

In an ordinary card, it signifies the second word of region F; in an REG card, it signifies that thereafter regional address F0001 = 0002; in a type 2 card, it signifies that the address is 0002 and that it is not to be relocated. In this last use, the first character may be a digit, a letter, or a special character, all of which produce exactly the same result. These three uses of F0002 are shown in figure 2.

A D or I address may be tagged for indexing, as in normal cards. An indexed drum address could not be written as, say, 2030, because it would then be relocated as a core address, not drum.

If L, D, or I is a relocated drum address, that location will be reserved. Hence, it is not necessary to reserve locations for a relocatable subroutine, provided it is assembled before the program starts assigning locations optimally.

Subroutines prepared for SOAP II may be used with ISOPAR by reproducing the cards, provided they meet the conditions mentioned in 4.1.1. In reproducing, columns 41 and 42 are combined into 17, and columns 43-72 are reproduced into 18-47. The resulting subroutine will have some superfluous cards, since in SOAP II it is necessary to reserve specifically all "temporaries."

2.2.2. REL, Relocation Indicator

In this pseudo-operation, columns 27-30 show the amount that is to be added to each drum address, whether L, D, or I: columns 33-36 show the amount to be added to each core address. For example, the first REL card of figure 2 would add 1200 to each drum address, and 0010 to each core address. If either of these fields is blank, it is interpreted as zero, as in the second illustrated REL card. These relocation amounts must be positive.

An REL card applies to all type-2 cards which follow it until another REL card is reached. Normally, the REL card will be placed immediately before the subroutine to which it applies. In any case, every subroutine must be preceded by an REL card.

If a relocated drum address exceeds 1999, or a relocated core address exceeds 9059, it will be left blank in the output. No check is made, however, on whether a relocated core address is less than 9000.

2.2.3. REQ, Relocatable Equivalence

Every relocatable subroutine must include one or more REQ cards; they do not have a 2 in 17. REQ is similar to EQU (2.3.5), but differs from it in two respects: (1) I must be an absolute address; (2) The I-address is modified by adding to it the amount indicated by the last REL card.

For example, the first REL card shown in figure 2 causes all drum locations to be relocated by 1200. If the entry to the subroutine is 0000 in the unrelocated subroutine, it must be 1200 after relocation. This is accomplished by the illustrated REQ card.

Note that the REQ cards are part of the standard subroutine. On the other hand, the REL card is prepared by the person using the subroutine on the particular job. REL must precede the entire subroutine, including the REQ cards.

2.2.4. RBR, Relocatable Block Reservation

This is like BLR, except that the reserved block is relocated by the amount indicated by the preceding REL card. This pseudo-operation was retained from SOAP II, where it had a use because relocated D and I addresses were not reserved. It is probably useless in ISOPAR.

2.3. Other Pseudo-Operations

2.3.1. ALF, Alphabetic Word

This is the only pseudo-operation which gives rise to a word of code. It is used to facilitate entering information which is to be punched alphabetically by the object code.

The quantity whose alphabetic equivalent is to go into the object code is entered under D ADDR. Under any ordinary circumstances, it will be necessary to specify the location in 18-22. An ALF card is ordinarily a constant, and is so designated in column 16.

The first ALF card in figure 2 will cause the number 00 61 87 00 00 to be put into location 0013, and the latter is reserved because it is an absolute L. The second ALF card will cause 00 00 00 00 00 to be put into the location whose symbolic address is PQ, which must already have been defined.

An ALF card may be negative. It is sometimes necessary to make an alphabetic word negative when printing with an on-line 407, the sign being used to control printing. Also, for punched output, it might be desired to have the sign punch in some non-alphabetic column.

2.3.2. BLA, Block Availability

This pseudo-operation causes a block of the drum to be made available, regardless of whether it was previously available or unavailable. Its format is identical with that of BLR.

The usual use of BLA is in connection with RBD. Suppose, for example, it is desired to reserve 0800-1698. This could be done with one card, BLR 0800 1698, but the operation will be much faster if two cards are used, namely

```
RBD 0800 1699
BLA 1699
```

Unless the drum is to be tightly packed, one would omit the second card, and let 1699 stay reserved.

A BLA card is not needed at the start of the assembly, since the entire drum is made available during initialization.

2.3.3. HED, Symbol-Table Clearer

This pseudo-operation is used to clear out of the symbol table all of the symbols which are used in just one segment of the program. This serves a triple purpose: (1) It is much easier to use a mnemonic symbol such as LOOP if it can be erased from the symbol table at the start of each segment of code. (2) It reduces assembly time by curtailing the search. (3) In some cases, it may be necessary to erase some symbols in order to have room in the symbol table.

Symbols are divided into two categories: "Long" symbols, which have a non-blank character in the right-hand position; and "short" symbols, which have the right-hand position blank. Whenever a HED card is read, all short symbols are deleted from the symbol table, but long symbols are left unchanged.

It will be noted that a "long" symbol might consist of but one letter or digit, provided it is right-justified.

It is customary to use a HED card immediately after each type 1 card (2.1.2), unless there is a specific reason for not doing so.

2.3.4. SYN, Synonym

This pseudo-operation causes the symbol written in the D ADDR position to be assigned the equivalent of the I ADDR. The latter may be absolute, regional, or symbolic; if regional or symbolic, it must previously have been defined.

Common uses of this pseudo-operation are: (1) When two different symbols are used in writing the code, and it is later decided that they ought to be the same. Use of SYN makes it unnecessary to go through and change one each time it is used. The SYN card must, for this use, appear after one of the symbols has been defined, but before the second

is used. (2) A symbol may be used for mnemonic reasons, but it is necessary to relate it to other addresses; this is done by a SYN card in which I is absolute or regional. (3) Occasionally, as in ISOPAR itself, symbolic temporaries which would otherwise have different values are given the same absolute value to conserve drum space.

If a symbol has been previously defined, it can be redefined with a SYN card, but this feature is seldom useful.

SYN works as follows: The I address is interpreted to give its absolute equivalent. The symbol in the D address is then made equal to that value. The absolute value of the I address is then reserved if (as is usually the case) it is a drum address; if not, the reserving procedure is skipped

The SYN card of figure 2 will cause right-justified X to have the value 0100, and 0100 is then reserved.

2.3.5. EQU, Equivalence

EQU produces exactly the same result as does SYN, which was just described. The reason for having two symbols is to minimize the conflict with SOAP II, where the two symbols worked differently as regards reserving. In practice, it appears that there is never any objection to reserving, although usually the location will already have been reserved. If in some rare case, the location must be left unreserved, the EQU or SYN card should be followed by a BLA card.

For example, the EQU card of figure 2 will cause the symbol ALPHA to be given the value previously determined for a left-justified BETA. This location will then be reserved, if BETA is less than 2000.

2.3.6. BOP, Beginning of Program

This pseudo-operation makes it possible to assemble two or more programs with a single reading of the ISOPAR code. A BOP card is placed between each pair of programs. In reproducing from input to output, note that, as its name implies, the BOP card is to be considered as belonging to the second code.

A BOP card at the start of the first program would be redundant, since the same presetting steps occur initially without a BOP card.

2.3.7. PAT, Punch Availability Table

The availability table, described in 5.2.3, is a 200-word table used by ISOPAR to remember which drum locations are available. The pseudo-operation PAT could be used at any time during assembly to cause

a punch-out of the table, but in practice it is not likely to be wanted except at the end of the assembly.

The output consists of 50 cards, each showing the 4 availability words of one dynamic level. Each card also contains 4 words to facilitate identification of the 4 availability words. The output has Y in column 17 (see 2.1.2), and may be listed on the same 407 control panel as is used for listing the ISOPAR input or output.

For example, the 13th card of the table shows the availability of all locations whose addresses are = 12 (mod 50). The first 10 columns are punched 00 0012 0462; the next 10 columns show the availability of locations 0012, 0062, 0112, ..., 0462, respectively, where a 1 means "available" and a 0 means "unavailable." Similarly, card columns 21-30 are punched 00 0512 0962, and columns 31-40 show the availability of 0512 (50) 0962. The rest of that level is similarly shown by the rest of the card.

2.4. 800X Instructions

Sometimes a card is inserted in which the location is an address such as 8002. Such a card will not stop the machine, but it is not used in optimizing the program.

3. ISOPAR Processing Instructions

This section discusses the actual technique of processing a symbolic code, once it has been written and punched into cards.

3.1. Assembly on the 650

3.1.1. Input Card Arrangement

ISOPAR deck: This is a 7 per card condensed deck. The cards are identified by serial numbers in columns 4-6, from 001 through 189.

Input deck which is to be assembled: Usually, but not necessarily, all of the pseudo-operations except HED are put at the start. These are followed by standard subroutines, and then the main code. Sometimes the order of the main code may be altered from the logical order, to improve optimization, for either or both of two reasons: If the parts done most frequently appear first, certain temporaries in the most-used part will be assigned locations to fit those parts, instead of to fit other places where they are used less often. Occasionally, such inversion is useful to give the most-used parts first choice of available locations.

Other input programs, if any, provided each of the latter is preceded by a BOP card.
Three blank cards, if desired, to avoid need for using End-of-File key.

3.1.2. Operation of the 650 Console

Storage Entry Switches: 70 1952 9xxx.
Control Switches: STOP RUN RUN PROGRAM STOP STOP, respectively.
COMPUTER RESET
PROGRAM START.

At the end of the assembly, it stops while trying to do operation 70.

If you wish to punch out the availability table, but have not included a PAT card, send control to 0010.

The starting point for performing the code is 0100, but transfer to that point is automatic.

Figure 3 shows the control panel to be used in the 533.

3.1.3. Programmed Stops

ISOPAR includes a number of programmed stops which would indicate defects in analyzing the different problems to be encountered. The only stops which are likely to occur are:

0111: Symbol table full. PROGRAM START will continue assembly, leaving a blank where a symbol has no equivalent. Each time an undefined symbol appears, the machine will stop again, until such time as a HED card clears part of the symbol table.

0222: Drum packed; i.e., no locations are available for blanks or new symbols. PROGRAM START will continue assembly, leaving blank any addresses which cannot be filled.

3.1.4. Other Stops

The most common stop occurs when a blank card is inadvertently put into the input deck. The minimum permissible punching is either a 1 in 17, with the other columns blank; or digits in 24-25, with the other columns blank.

If ISOPAR tries to process a blank card, the computer stops with the two middle digits of the distributor blank. The safest thing to do is to start over.

If an MDF operation (see 5.1.1.(b)) has blank D, the machine stops with 00 0404 9998 in the program register.

3.1.5. ISOPAR Output

The output of the assembly routine consists of the assembled "object code," at the rate of one word per card. The format is as follows:

1-4 Location.
5-14 Code word; X overpunched in 14 if negative.
15 Control X.
76 Possibly a number to indicate a defect in the input code which made complete assembly impossible, as follows:
3: An EQU or SYN card with blank or undefined I.
7: L-address missing.
8: D-address missing.
9: I-address missing.

The following are some of the causes of missing addresses: Availability table full (i.e., no address available as equivalent to new symbol or blank address); symbol table is full, and there is no place to store the equivalent of a new symbol (remedy: use more HED cards); an absolute L address with an impossible value (e.g., 3168).

77-80 Card number. Only even numbers are used, to permit insertion of corrections.

There is a one-to-one correspondence between input cards and output cards, except for the availability table, if any. There must, therefore, be an output card for each input card that is not a code word, as well as for those that are. To permit the output code to be read into the 650, these extra cards must be readable by it. To do this without damaging the code, it is provided that each such card have 0000 01 0000 0000 in 1-14, with an identifying X in 9.

This puts a Stop order into 0000. It is well-known that it is undesirable to have a word of the code in 0000, as a check in case the program accidentally goes to a zero word. It is necessary to reserve 0000 before assembling the code, so that it will not be used elsewhere in the code; if there is an RBD card, it automatically reserves 0000. If, perchance, the code is permitted to use 0000, the X-9 cards must be sorted out before the code is used.

3.2. Reproducing Input Into Output Cards

It is customary, after the 650 run is completed, to reproduce columns 16-75 from the input cards to the output cards, so that one listing may show both input and output. A permanently wired Reproducer board for this purpose is kept on hand.

After those columns are reproduced, either the input cards or the output cards may be used to correct the symbolic code for later re-assembly.

3.3. Listing the Code

The input or output code maybe listed on a 407 with the control panel illustrated in figure 4. The resulting lists are illustrated by the 1/card lists of the ISOPAR code.

The output is often listed three times; between lists, the cards are sorted and the Alteration Switches are changed. Switch 1 is optional, N for double spaced and T for single spaced.

3.3.1. List 1, Logical Order

This set-up is also used to list the input code.

The cards are listed in logical order; in the output code, they are in sequence by columns 77-80. Alteration switches 2-6 are on N.

A type 1 card, signifying a heading to a new segment of the code, is preceded by a wide space, caused by a program change.

An extra space is produced whenever L of one word is not equal to I of the preceding word, in the symbolic code. An exception is made when both cards have K in 16. Hence, in following an assembled code, you can be sure that the words run in sequence so long as there is no extra space.

Symbolic addresses which are left-justified are printed slightly to the left of those which are not. This makes it easier to determine from a listing which card columns are punched.

On a store operation, both the symbolic and the assembled D-addresses are printed out in special columns, under control of a 2 in column 24. These make it easy to see when something is stored, and where.

Sometimes an emitted legend prints near the right margin, as described in the following paragraphs. BYPASS and BLANK print under control of punches in column 76 (3.1.5), and appear only in the output code. NOTE prints under control of punching in columns 18-36, and appears in the input code, or in the output code if the input code has been reproduced into the output cards. (See 3.2.)

BYPASS means that a SYN or an EQU card could not be processed because its I-address had not been properly defined.

BLANK means that L, D, or I is left blank because of one of many possible defects in the symbolic code.

NOTE signifies any one of several conditions in the symbolic code, which sometimes mean that an error was made in writing the code. Such signals should be investigated. Subject to the exceptions in the next paragraph, this word prints if any one of the following conditions exists: (a) The preceding card had both blank D and blank I. (b) Preceding card had blank I, and this card has non-blank L. (c) Preceding card had non-blank D and I, and this card has blank L.

Even if one of those conditions does exist, NOTE does not print if any one of the following conditions exists: (a) Run-out, and no card is printing. (b) Card has 1 in column 17. (c) Card has blank column 25. (d) Card is punched in column 23. (e) Preceding card was punched in 23. (f) Preceding card had blank 24.

3.3.2. List 2, By D-Address

Sort the cards on 7-10, and remove X-9 cards. Set Alteration Switches 2-6 on T.

The cards are listed in sequence by D-address, with an extra space whenever the D-address changes. This list is used when it is necessary to examine the uses made of a particular temporary location. Some of the cards for which the D-address is not a true address are omitted from the listing; namely, cards with K in 16, and cards with operations 00,30,01,31,05,35,06,36. When a card is so omitted, the spacing, including the extra space for change in 7-10, is handled as if the card did not exist.

3.3.3. List 3, By Location

For this list, sort the cards on 1-4. Set Alteration Switches 2-4 on T, and Switches 5-6 on N.

This lists all cards, in sequence by location, uniformly single or double spaced. It is used for studying what was initially in each location. By comparing lists 2 and 3, it is possible to study all uses made of any location, except instances where it is reached by modifying an address (with index registers, or otherwise).

4. Relation of ISOPAR to SOAP II

4.1. How to Use ISOPAR, If Already Familiar with SOAP II

In most respects, coding for ISOPAR is done exactly as for SOAP II, and a SOAP II symbolic code could be reproduced into different columns for use with ISOPAR. The exceptions fall into two categories: First, changes in coding procedure which must be made in order for the symbolic code to work; second, changes which are permissible, and knowledge of which will facilitate coding.

To reduce programming conflicts with SOAP II, it is provided that any pseudo-operation used in SOAP II will have meaning, although in seven cases the meaning is somewhat different from the SOAP II meaning. In addition, ISOPAR uses one new pseudo-operation.

4.1.1. Necessary Changes in Programming Methods

A person familiar with SOAP II code-writing must take the following differences into account to write an ISOPAR code:

(a) All operations must be numeric.

(b) Symbolic addresses are not allowed in type 2 cards (relocatable subroutines). They are, of course, used in REQ cards.

(c) Minus signs must be X-punches. (SOAP II permits any punch.) In ISOPAR, the sign appears in the same card column as does the card type.

(d) EQU and SYN produce identical effects: They reserve the location in question if it is a drum location, but do not try to reserve otherwise.

(e) In type 2 cards, any non-blank character as the first character of an address makes the address fixed. An address is identified as core or drum solely by its magnitude before relocation.

(f) Although HED has a quite different meaning, a SOAP II code with HED cards will work with ISOPAR unless a symbol headed in one segment is referred to in another segment.

(g) On a long code, it will probably be essential to use HED cards and "short" symbols, lest the symbol table overflow. (With SOAP II, HED serves only to prevent duplication of symbols.)

(h) Location 0000 must be reserved, unless the X-9 cards are to be sorted out before the code is used. This is no hardship, because 0000 should never be used in the code anyway. (If RBD is used with ISOPAR, it automatically reserves 0000.)

(i) A card such as REG A0000, where 0001 of the region is to be location 0000, is inadmissible.

(j) ISOPAR does not now provide for loading an availability table back onto the drum. This feature was in the program for two years, but no use for it was found. (With SOAP II, some users make up availability tables and load them initially as a quick method of reserving large blocks of memory; but with ISOPAR, pseudo-operation RBD accomplishes the same thing more conveniently and expeditiously.)

4.1.2. Permissible Changes in Programming Methods

In addition to the changes listed in the preceding section, those familiar with SOAP II should note the following differences between SOAP II and ISOPAR, some of which will materially simplify programming.

(a) A new pseudo-operation, RBD, greatly shortens the time required to reserve large blocks of memory. It is explained in 2.1.5.2.

(b) BLR, REG, RBR, or BLA may have blank I-address, if only one location is to be reserved or unreserved.

(c) SYN may have a non-drum address in its I-position. With SOAP II a non-drum I causes trouble; with ISOPAR, it merely omits reserving. In ISOPAR, EQU and SYN are identical.

(d) The function of HED has been changed. In ISOPAR, it clears out of the symbol table all symbols which are not right-justified. HED cards must be used in a long code, lest the symbol table become full; they should be used rather frequently, for the reasons given in 2.3.3. Be sure that the right-hand character in any symbolic address is blank, unless the symbol is actually used in more than one segment of the code.

(e) Comments and remarks may be longer than with SOAP II. They may include any characters which the 407 will print, even those not acceptable to the alphabetic input of the 650.

(f) An address may consist of any combination of 5 characters acceptable to the alphabetic input of the 650, as explained in 2.1.6. The following examples illustrate the differences between SOAP II and ISOPAR in this respect:

Address	SOAP II Interpretation	ISOPAR Interpretation
bbbbb	Blank	Blank
C0001	Regional	Regional
C000b	Symbolic	Symbolic
b1234	Absolute	Absolute
b123b	Stops machine	Symbolic
bABCD	Absolute, namely, 1234	Symbolic
bABCT	Stops machine	Symbolic
bbbb1	Stops machine	Symbolic
1bbbb	Symbolic	Symbolic

(g) There is no need in ISOPAR to write out cards having L in the 800X series, and such cards do not affect optimization.

(h) An absolute L address is reserved. If constants or other words with absolute locations are put at the start of the code, it is unnecessary to reserve their locations separately.

(i) When a type 2 card is processed, any relocated address is reserved, whether L, D, or I. (SOAP II reserves only L.) This change probably renders RBR obsolete.

4.1.3. Some Comments on ISOPAR Which Also Apply to SOAP II

There are a few places in which ISOPAR follows SOAP II, but the SOAP II manual is obscure or even incorrect. The following remarks apply to both of these assembly routines.

A word with blank D-address or I-address is normally followed by a word with blank L, and the assembly routines put the same absolute address into the two places. It is not essential, however, that the words be consecutive: They may, without error, be separated by type 1 cards, by pseudo-operations, or by code words in which L, D, and I are all non-blank. For ISOPAR, however, better optimization may occur if constants are put at the end of a segment rather than immediately after the references to them, because a constant encountered during a forward search will initiate the QUITT routine (see 5.1).

On pseudo-operations BLR, BLA, RBR, and SYN, a location is reserved or unreserved regardless of its previous status.

With an REG card, two distinct steps are involved. E.g., with REG A0175 0225, first 0175 is recorded as the equivalent of the regional address A0001, without reference to the size of the region. Then 0175 through 0225 are reserved, just as if it were a BLR card. This makes it clear why regional addresses have significance whether or not they are within the region originally reserved by the REG card.

A regional address may be made negative, by using complements; e.g., A9936 is an address 65 smaller than A0001.

The meaning of a regional address can be changed. This is done in the SOAP II manual: on page 87, REG D0923 0923 specifies that D0001 = 0923. On page 89, D0953 0953 means that thereafter D0001 will equal 0953 instead. It is necessary that the proper reservations be made initially, as is done on page 65.

The first character of a regional address must be a letter. An address whose first character is a digit or a special character (with a 650 designed to read special characters) is interpreted as symbolic.

An REG card in which the first character of the D-address is blank, numerical, or special character, will not define a region; but it will, nevertheless, reserve the specified interval. E.g., the two cards

```
BLR   0030  0070
REG   0030  0070
```

do exactly the same thing; namely, reserve from 0030 to 0070, inclusive. BLR could be abolished entirely; but to do so would not shorten ISOPAR by even one word.

4.2. Improvements in Optimization

There are a number of features in which ISOPAR optimizes a program better than does SOAP II:

(a) The main improvement is in discontinuing forward processing when a variable-length instruction is reached, and searching for a fixed address from which to optimize backward.

(b) A defect in optimization of indexed operations has been remedied. E.g., in SOAP II the symbolic word

```
0200     69     ABC     0031 A
```

is assembled with ABC = 0003, if the first choice is available. Since, however, one word-time is spent in interpreting the indexed I-address,

before it starts to perform the instruction, ABC should be 0004 (mod 50), and that is the value which ISOPAR supplies for it. This saves 49 word-times in the performance of such very rare instructions.

(c) When an add or subtract instruction has a D-address of 8001, the time required is, on the average, one word-time less because the word is already in the distributor. ISOPAR optimizes to utilize this saving.

(d) An indexing operation (50, 51, 80, 81, etc.) takes an extra word-time when a complement cycle is required. SOAP II allows an extra word-time under all conditions; ISOPAR saves it for those cases for which the complement cycle never occurs: I.e., operations 80, 82, 88, when the D-address is 0000-1999.

4.3. Available Drum Space for ISOPAR Program

SOAP II uses 1964 locations. The remaining 36 were not enough to meet the requirements of the extra steps involved in ISOPAR.

A considerable number of locations were made available by the innovation mentioned in 3.2: transferring input to output by Reproducer, not through the 650. This saves not only the transferring instructions, but also other words from the fact that input and output did not have to be packed so tightly.

Additional words were saved by more efficient writing of the code. For example: subroutines 4,5,6,8,9 of SOAP II were combined into one subroutine. A more efficient method of getting into subroutine 7 was used. The exits from various subroutines were combined into subroutine 10.

To make additional space, two features of SOAP II were dropped:

(a) ISOPAR does not provide for symbolic addresses in relocated cards (type 2 cards). This is probably not a serious loss, although it may on rare occasions cause inconvenience.

(b) ISOPAR does not provide for symbolic operations. Since some users may regard this as a serious loss, the point will be argued briefly. Any user of the 650 must learn the numerical codes anyway, if only to interpret the signal lights on the machine, or the results of a tracing routine. The three-letter codes used in SOAP II are much less mnemonic than the variable-length letter codes originally proposed by IBM; yet the user must learn them exactly, and not err by using the wrong letters. The result is that the user must learn exactly <u>two</u> arbitrary names for each operation, namely, the numeric and the symbolic.

By using only numerical operation codes, the problem of learning to code is actually simpler than if one must learn both systems. This change saved considerably more than the 100 words omitted from the symbolic-operation table.

All of these changes, however, did not make enough drum space available. Consideration was given to reducing the symbol table from 400 to 300 words. It was found, however, that 300 would often be too small; for example, ISOPAR itself uses more than 300 symbols.

In order to make the necessary drum space available, a fundamental change was made in the method of using the symbol table, with a concomittant change in the operation of a HED card. These changes, explained in the next section, made it feasible to cut the symbol table still more, and it now contains only 210 locations. ISOPAR has been used successfully for two years, and no instance of insufficient space in the symbol table has occurred.

4.3.1. Use of the Symbol Table

In SOAP II, the spot in the symbol table where the code first looks for a given symbol is a function of the 10-digit value of the symbol, the function being so chosen that changing any one character of the symbol will give a different location. The search for that symbol starts at that point, and proceeds upward. Ordinarily, within a short distance, either the symbol is found; or a blank place is found, which then receives the symbol. If the top of the symbol table is reached, the search continues at the bottom; if it then gets back to the starting point, the symbol table is full.

One obvious fact about symbolic addresses is that most of them are used only within a short range of the program. Only a few are used at widely separated places. In recognition of this fact, SOAP II uses the pseudo-op HED, which puts a specified character into the fifth place of any symbol whose fifth place is blank; hence, different segments of the code may be written without concern for duplication of "short" symbols, provided the different segments are "headed" differently. A symbol that is needed in more than one segment has its fifth character non-blank.

In order to obtain more space for the ISOPAR code, provision is made for clearing the symbol table from time to time of symbols that are used in only one part of the code; in this way, the symbol table can be made shorter. But when this is done, the SOAP II method of storing symbols cannot be used. Suppose, for example, the "function" of a symbol is 1756. Suppose when the symbol is stored, 1756 and 1757 are occupied; it is stored in 1758. Suppose that later 1757 is cleared out. The next time this symbol comes up, the code would find a blank at 1757, and conclude that this symbol was not in the table.

Hence, ISOPAR needed a quite different method, and the following was adopted: As in SOAP II, symbols used in only one segment of the code should be "short" symbols; i.e., with their last position blank. Symbols used in more than one segment should be "long"; i.e., with the last position non-blank. In SOAP II, a short symbol is "Headed" by a HED card; in ISOPAR, all of the short symbols are cleared out of the symbol table by a HED card.

Long symbols are stored in the symbol table starting with the first cell of the table and working upwards. Short symbols are stored starting with the top and working downwards. When a symbol is sought, the code starts at the appropriate end, and checks each cell in turn until the symbol or zero is found. To guard against the possibility that the entire table become full, one cell is left vacant at each end; when the search ends in a zero, a check is made to determine that it is in the middle, and not beyond either end.

By taking care to use long symbols only when necessary, and by clearing out the short symbols at rather frequent intervals, the search-time can be kept within reasonable bounds, although it will usually be somewhat greater than with SOAP II.

4.4. Improvements in the 407 Control Panel

Although not a part of the code itself, the 407 control panel used for listing a code is also important. The ISOPAR 407 control panel is described in 3.3. Here, we mention briefly those features which are improvements over the panel shown in the SOAP II manual for that program: (a) Wide space above a type 1 card. (b) Extra space when L does not equal I of previous card. (c) D-addresses of store operations printed in separate columns. (d) Alignment-shift between addresses which are left-justified and those which are not. (e) The legend "NOTE" is printed on input code as well as on output. (With SOAP II, the legend calls attention to errors only after assembly is finished.) (f) Alteration switches provide for modifications of spacing for three different lists, and for suppression of some cards on List 2.

5. Analysis of the ISOPAR Program

Throughout this analysis, when digits of a word are mentioned, the digits are counted from left to right: The left-most digit is digit 1, and the right-most digit is digit 10. This differs from the method used in the 650 manual and on the console; but it agrees with the method used in many other IBM publications, and is much more natural than counting from the right.

5.1. The Optimizing Procedure

ISOPAR normally assembles a code by considering the addresses in the sequence in which they appear. Usually, L is known from some previous word; D is determined at an optimum distance from L; and I is determined at an optimum distance from either L or D, depending upon the operation. Then it goes on to the next word.

If, however, circumstances are such that it is impossible to optimize an address in this way, ISOPAR starts a "forward search" to find some fixed address from which it can process backwards to the point at which the search started. During the search, enough information must be stored about each card to permit reconstructing it.

The forward search may be terminated in either of two ways: (1) It may prove impossible to find a fixed address; then ISOPAR returns to where it started the search, assigns an address more or less arbitrarily, processes the stored-up cards forward, and resumes normal processing. This is the QUITF routine. (2) It may find a fixed address, whereupon the stored-up cards are processed backwards and the results stored; then these results are punched forwards. This is the BACKW routine. Thereafter, normal processing is resumed.

The different circumstances involved in these processes will now be given in some detail.

5.1.1. Circumstances Under Which ISOPAR Abandons Normal Processing

There are three conditions which cause ISOPAR to stop the normal processing and start a forward search. At the time it starts the search, it makes a note as to which condition initiated the search, because there are slight differences in the later assembly methods.

(a) When L is a symbolic address that has not been previously defined. This is the start of a wholly new series of instructions. Any assignment of this L at this stage would be wholly arbitrary. Hence, it is best to look ahead for a fixed address, and work back.

(b) When a variable-length operation (called MDF operation), such as multiply, divide, float, read, write, table look-up, is encountered. With most MDF operations, it does not matter whether the abandoning occurs after D, or after L of the next word, since I of the MDF operation may have any address whatever. However, operation 84 is different. Since L for that word is used after the table-look-up is completed, the machine cannot start looking for the I-address until after the operation is completed. Hence, for an 84 operation, normal processing should be abandoned and the forward search started between the D and I addresses. To simplify coding, the same procedure is used for all MDF operations.

(c) When a D address is indexed (for use on a 650 which has indexing registers). Since an indexed D address refers to a variable drum location, it is impossible to optimize the I of that word with respect to it. Hence, it is better to go ahead to a fixed address and work back to I. There is no need to start a forward search on indexed I, because the following L will surely be either a fixed address or a new symbol.

5.1.2. The Forward Search

When a card is examined during the search, there are three possible outcomes, which will now be discussed in detail.

5.1.2.1. Abandon Search (QUITT routine)

If it is impossible to find a fixed address to which to tie the stored-up cards, ISOPAR abandons the search, returns to the point at which the search started, assigns an initial address more or less arbitrarily, and processes the stored-up cards forward. The circumstances under which it does this are:

(i) Storage region for storing cards is full. The region holds 15 cards.

(ii) Another MDF operation is reached.

(iii) D is indexed; since its time of performance is variable, it is impossible to optimize across it.

(iv) I is indexed, meaning that the next instruction is variable.

(v) Card is of type 1 or 2, or is a pseudo-operation. Normally this is the end of a block, and will be followed by fixed L. (See 6.1 (e).)

(vi) An address is of the type designated as QUITT in 5.1.2.4.

5.1.2.2. Initiate Backward Processing (BACKW Routine)

Should a fixed address be found before any of the conditions listed in 5.1.2.1 occur, the search is successfully completed, and the code starts processing backward. Addresses considered "fixed" for this purpose are indicated in 5.1.2.4 by BACKW.

5.1.2.3. Continue the Search

If nothing occurs to terminate the search, it continues to the next card. In other words, the search continues if none of the special conditions listed in 5.1.2.1 occurs, and if the address is marked ON in 5.1.2.4.

5.1.2.4. Table of Types of Addresses

The following table shows the different types of addresses which may be encountered during the forward search, and shows, for each type, whether the address initiates the QUITT routine or the BACKW routine, or whether the search goes on. These decisions are subject to the rules in 5.1.2.1, which prescribe other conditions under which the search is abandoned.

Line	Type of Address	L	D*	I
1	Blank	ON	ON	ON
2	Regional, region defined	QUITT	BACKW	BACKW
3	Regional, region not defined	QUITT	QUITT	QUITT
4	Symbolic, symbol defined before search started	QUITT	BACKW	BACKW
5	Symbolic, not defined, but room in symbol table	ON	ON	ON
6	Symbolic, not defined, symbol table full	QUITT	QUITT	QUITT
7	Absolute, 0000-1999	QUITT	BACKW	BACKW
8	Absolute, 8000-8003, 8005-8007 (called 800X)	QUITT	ON	QUITT
9	Absolute, 9000-9059	ON	ON	ON
10	Absolute, other	QUITT	QUITT	QUITT

*D is examined only if it is an address, excluding, for example, operation 30. Specifically, it is examined only if the first digit of the optimizing addend (5.2.7) is non-zero.

In the following explanation of the items in this table, an item is identified by its line number and column heading:

For lines 1 and 5, the address is wholly undefined, and the search continues. For 8D and line 9, the address is defined, but its dynamic level is not; therefore, the search continues for an address of fixed dynamic level.

When a fixed D or I is reached (2D, 2I, 4D, 4I, 7D, 7I), the search for a fixed address is successfully terminated, and we begin backward processing.

A fixed L (2L, 4L, 7L) may be reached by the search only if the previous D and I were unfixed. This means the start of a new block of words; the previous block cannot be tied to anything, and we might as well abandon the search.

If we reach an address that cannot be processed (lines 3, 6), the job will have to be done over anyway, and the easiest way of finishing it is best.

For 8I, the location of the next order to be performed is variable, and there is little point in trying to optimize through it. Therefore, the search is abandoned.

8L would indicate a mistake. If there were a word with 800X in L, it should follow one with 800X in I, and the latter terminates the search. (ISOPAR does not encourage the use of cards with 800X in L, and makes no use of them.)

10L is a programmer's mistake, since L cannot have such a value.

10D and 10I are normally parts of a constant. ISOPAR does not attempt to optimize backward through a constant; rather, we QUITT the search upon reaching one.

5L is really two cases. If the undefined symbol is different from any symbol used up to this point, it could just as well read QUITT. More commonly, however, an undefined-symbol L would be a symbol already encountered during the forward search, but not yet put into the symbol table because it has not been processed. We might have, for example:

```
0047    19    0200
        45          Y
        46          X
        20    T1    X
X       20    0100
```

where 0100 is an address that has been fixed at the time operation 19 initiates a forward search. In this case,to QUITT and process forward from 0200 would assign to X a value that would be unsuitable with reference to 0100, and it is best to pass through the X, and then process backward from 0100. To simplify coding, it is provided that when L is an undefined symbol, the forward search always continues, irrespective of whether that symbol may have been encountered during the search. The only circumstance under which this might detract from the optimization would be if the storage area filled up before a fixed address was reached, but would not fill up had we started a new search with the symbolic L in question.

5.1.3. Some Methods of Backward Processing

During forward processing ISOPAR uses the same procedure as SOAP II: L is determined from some previous word; the optimum dynamic level of D is derived by measuring forward from that of L, and an available

location at or above that dynamic level is found; the dynamic level of I is measured from that of L or of D, according to the operation, and an available location for I is found.

The procedure is more complicated during backward processing, since there are several different cases. The program first examines the D and I addresses to determine whether they are fixed; the method of processing depends upon those two decisions, and also upon the type of operation. In explaining this procedure, we first discuss the methods of handling different types of addresses, and then consider the question of what constitutes a "fixed" address.

5.1.3.1. Sequence in Which Addresses are Processed

The operations encountered during backward processing (since MDF operations are excluded) fall into three categories:

(a) Those in which D is not an address to be optimized (including all shift and indexing operations).

(b) Those in which D is measured from L, and I is measured from D. These are considered under the name "arithmetic operations."

(c) Those in which D and I are both measured from L. These will be considered under the name "branch operations."

The first backward card (the one which initiates backward processing) and the last one (the one which initiated the forward search) require special treatment, and will not be discussed here. For the intermediate cards, the sequence of processing the addresses is as follows:

Shift or indexing operation: D forward, I backward, L backward.
Arithmetic operation, fixed I: I backward, D backward, L backward.
Arithmetic, fixed D, unfixed I: D backward, I forward from D, L backward from D.
Arithmetic, D and I unfixed (An abnormal case, but could occur if D and I are new symbols referring to some point later in the program): I backward, giving an arbitrary address, D backward, L backward.
Branch, D and I unfixed (abnormal case): I backward, L backward, D forward.
Branch, D unfixed, I fixed: I backward, L backward, D forward.
Branch, D fixed, I unfixed: D backward, L backward, I forward.
Branch, D and I fixed: Compute L backward from D and also from I, and then use whichever dynamic level is lower, where

"lower" must be interpreted with reference to a circular drum. This assures that if it branches equally often to D and to I, the time required will be a minimum.

5.1.3.2. Definition of "Fixed Address"

The definition of "fixed address" during backward processing is not the same as during the forward search.

After we have processed a blank L backwards, any blank D or I must be considered as fixed; for it will be the same as the L address of the following word, which will have been fixed by the time the given D or I is reached.

Core I is fixed under the same conditions, for an analagous reason: Its dynamic level is the same as that of the following L, which has already been determined. A core D address, with branch operation, is fixed because it is normally associated with the L of the following word if that is also core. A core D address with arithmetic operation is unfixed, for it will work equally well at any dynamic level. It would be possible to improve the optimization of segments of code involving core addresses by a considerable expansion of the code to take a larger number of conditions into account. (See 6.1 (f).)

The full schedule of fixed-unfixed addresses may be found by studying the one per card code under "Backwards Routine," lines 696-734.

5.1.3.3. Optimizing Addends and Subtrahends

Words 0800-0899, shown in the one per card listing of the program (lines 110-308), and described in 5.2.7, give the addends required for forward optimization. Two addends are given, which are often equal, and never differ by more than one. The first addend is used if the augend is even; the second if the augend is odd. The following examples illustrate how they work:

Augend	Addends	Result
0000	54	0005
0001	54	0005
0002	54	0007
0003	54	0007
0000	43	0004
0001	43	0004
0002	43	0006
0003	43	0006

Now look at this table from the point of view of backward processing. For the case where the addends are 54, if we start back from 0005 we could go to either 0000 or 0001; but since optimization now requires that the result be as large as possible, we take 0001. If we start with 0007, the result is 0003. If we start with 0006, we see that 0002 is too large, since going forward from 0002 gets us to 0007; therefore, going back from 0006 we must take 0001. I.e., in this case, the first part of the table becomes:

Minuend	Result	Subtrahends
0007	0003	54
0006	0001	54
0005	0001	54

where the subtrahends were determined to fit the result to the minuend; the first subtrahend is used if the minuend is even, and the second if it is odd.

Similarly, from the second part of the addend table, we get:

Minuend	Result	Subtrahends
0006	0003	34
0005	0001	34
0004	0001	34

Thus, when the addends for forward processing are 54, the subtrahends for backward processing are also 54; but when the addends are 43, the subtrahends are 34. By considering all cases, it is found that if the larger of the addends is odd, they are used unchanged as subtrahends; if the larger is even, they must be interchanged. For use on an automatic computer, the formula is: If the two addends be called ab, compute the remainder of $(a + b + 1)/4$. If this remainder is zero, the subtrahends are ba; otherwise, they are ab.

5.1.3.4. An Example of Backward Processing

Consider, now the example given in 5.1.2.4. In the last word, D is fixed. Since the operation is 20, L is measured backward from D, and I is measured forward from D. Assuming throughout that ISOPAR's first choice is available, X = 1545, and the last I = 0003. The five words now read, inserting values already derived:

```
0047    19    0200
        45          Y
        46          1545
        20    T1    1545
1545    20    0100  0003
```

In word 4, I is now fixed. D is measured backward from I and L is measured backward from D. Deriving optimum values, and inserting them:

```
0047    19    0200
        45          Y
        46    1537  1545
1537    20    1542  1545
1545    20    0100  0003
```

Both D and I of word 3 are now fixed. By the last rule of 5.1.3.1, we find that L measured from D would be 1534, and measured from I it would be 1541. Using the lesser value we now have:

```
0047    19    0200
        45    1534  Y
1534    46    1537  1545
1537    20    1542  1545
1545    20    0100  0003
```

Finally, word 2 is a branch operation with D fixed. Measure L backward from D, and I forward from L:

```
0047    19    0200  1531
1531    45    1534  0035
1534    46    1537  1545
1537    20    1542  1545
1545    20    0100  0003
```

5.2. Memory Allocation

The one per card listing of the ISOPAR code shows, near the beginning, the locations of various blocks of memory assigned to particular purposes. Some of these are discussed in the following sections.

5.2.1. Input Region

The following list shows the read-in schedule. The absolute addresses are 0151-0160. Words 1-3 are alphabetic; the others are not. When a card column is shown as 0, it means that a zero is emitted into that position of the word.

Regional Address	Card Columns, and Explanation
R0001	18-22. L, alphabetic.
R0002	26-30. D, alphabetic.
R0003	32-36 I, alphabetic.
R0004	Emitted 00000 00008 if X-17 (negative word). Emitted 00000 00000 otherwise.
R0005	0 31 0 0 24 25 37 0 0 0. Indexing tags, and operation. If 31 or 37 is blank, it is replaced by an emitted 0.
R0006	Unused.
R0007	0 0 0 0 0 0 19 20 21 22. L, numeric, often invalid.
R0008	0 0 0 0 0 0 27 28 29 30. D, numeric, often invalid.
R0009	0 0 0 0 0 0 33 34 35 36. I, numeric, often invalid.
R0010	0 0 0 0 0 0 0 0, followed by the 2-digit card type.

Shortly after the card is read, control goes to R0010, whereupon the card type becomes the entry to a particular segment of the routine. The 533 control panel determines this type as follows: If column 17 contains a 1 or 2, that digit preceded by 0 is the card type. If 17 lacks 1 and 2, but 23 is punched, then the digit punches (1-9) of 23 and 25 are the card type. If neither of these conditions exists, then 08 is used. The full list of card types is as follows:

01	1 in c.c. 17; i.e., comments card.
02	2 in c.c. 17; i.e., relocatable subroutine.
08	Ordinary card of the code.
16	ALF, Alphabetic word.
21	BLA, Block availability.
25	SYN, Synonym.
27	BOP, Beginning of program.
29	BLR, Block reservation.
54	EQU, Equality.
73	PAT, Punch availability table.
84	HED, Symbol-table clearer.
93	REL, Relocation indicator.
94	RBD, Reserve band.
97	REG, Regional designator.
98	REQ, Relocatable equivalence.
99	RBR, Relocatable block reservation.

5.2.2. Output Region

For most output cards, the output region is used as follows:

P0001-4	Not used for punching.
P0005	Card number. Punches into 77-80.
P0006	Location of the assembled instruction. Punches into 1-4.
P0007	OP, in positions 5-6. Punches into 5-6..
P0008	D, at right end of word. Punches into 7-10.
P0009	I, at right end of word. Punches into 11-14.
P0010	Control information, as follows:

Position 1: A card that is not part of the code; i.e., type 1, or a pseudo-operation other than ALF. Causes 0000 01 0000 0000 to punch into 1-14, with an X in 9.
Position 3: Causes a 3 to punch in column 76. (See 3.1.5.)
Position 5: Activates Punch B. (See below)
Position 7: Causes it to omit punching L, and to punch 7 in 76.
Position 8: Causes it to omit punching D, and to punch 8 in 76.
Position 9: Causes it to omit punching I, and to punch 9 in 76.
Position 10: Word is negative. Causes X to overpunch in 14.

All of the cards have a control X punched in 15.

When an ALF card is processed, words 7,8,9 may hold other digits in addition to those described above, but they are not punched and do not affect the result in any other way.

When Punch B is activated (8 in position 5 of word 10), the availability table (2.3.7) is punched. Ten columns are punched, respectively, from each of words 1,2,3,4,9,6,7,8. (Word 5 is not used, to make it possible to carry the card number through such a punch-out.)

5.2.3. Availability Table

The availability table "remembers" drum locations used by the program which is being assembled, and those still available for use. The table contains 200 words, or 2000 digits; each digit shows the status of one memory word: 0 = unavailable; 1 = available. The 10 digits of the first word of the table show the status of, respectively, 0000, 0050, 0100,...,0450. The second word shows the status of 0500, 0550,... 0950. The fifth word of the table shows the status of 0001, 0051, 0101...,0451, etc. With this arrangement, when we have determined the dynamic level which ought to be used for a blank address or a new symbol, we can tell whether any such address is available by zero-testing four words. If those four words are all zeros, we continue in the proper direction and use the nearest word that is available. In any case, when a non-zero availability word is found, the first non-zero digit of the word is used.

Suppose we need a location of dynamic level 12. If we are processing forward, the choice goes, in sequence, 0012, 0062, 0112,... 1962,0013, 0063,... 1963, 0014, etc. But if we are processing backward, the sequence of choice is more complicated: 1512, 1562,...1912, 1962,1012,1062,...1462,0512,0562,...,0962,0012,0062,...,0462,1511, 1561,...,1961,1061,etc. It is often possible to tell just by glancing at an address whether it was derived during backward or forward processing.

5.2.4. Storage Region

When a card is stored during the forward search, five of the input words are stored for later reference. Words R0001 through R0005 (described in 5.2.1) for the card which initiated the search are stored in S0001-S0005; the same words for the next card are stored in S0006-S0010; etc. Words R0006-R0010 need not be stored, because they are not used in processing a type 08 card, which is the only type that is stored up.

If the search ends with transfer to the QUITT routine, S0001-S0005 are brought back to R0001-R0005, and processed. Then each other card is brought in turn to the same place. When the card which initiated QUITT is reached, its words R0006-R0010 are still in place, never having been disturbed.

If the search ends with the BACKW routine, the last card stored is taken to R0001-R0005 for processing backwards; its assembled word is in P0006-P0010 as usual, but these words are then stored at the end of the storage region. Each card is processed in turn going backwards, and stored in the storage region; when all have been processed, they are brought back in turn to P0006-P0010, and the cards are punched at top punching speed.

5.2.5. Symbol Table

When a numerical address has been assigned to a symbol, the 10-digit representation of the symbol is stored in the symbol table. Symbols in which the last character is non-blank are stored as encountered, starting with the beginning of the table. Symbols in which the last character is blank are stored as encountered, starting with the end of the table. These latter are cleared from the table whenever there is a pseudo-operation HED. Care is taken that the two series of symbols do not overlap. The symbol table is cleared during initialization.

5.2.6. Equivalence Table

Whenever a symbol is stored in the symbol table, its numerical equivalent is stored in the equivalence table. The equivalent of the first symbol in the symbol table is stored in the D-position of the first word of the equivalence table; the equivalent of the second symbol goes into the I-position of the same word. The equivalents of the next two symbols are similarly stored in the second equivalence word.

The equivalence table need not be cleared initially or by a HED card, because it is never consulted except to store or find the equivalent of a symbol that is in the symbol table. Storing is done in such a way that only the four digits are disturbed, leaving the rest of the digits and the sign unchanged. The values are used in such a way that the other digits and the sign do not affect what we take from the table.

5.2.7. Optimizing Addends and Tags

Information needed to optimize the instructions is stored in 0800-0899. For example, the information for operation 17 is in location 0817. The digits of one of these words have the following meanings:

1: Optimum dynamic level of D minus given level of L, when L is even.
2: Same, when L is odd.
3-4: Optimum dynamic level of I, measured from given level of L or of D according to the operation, when latter is even.
5-6: Same, when reference address is odd.
7: 8 for an operation whose execution requires a variable length of time (MDF operation).
9 for an operation requiring a fixed length of time.
8-9: 88, operation 31.
98, other shift operations; namely, 30, 35, 36.
89, indexing operations; namely, 50-53, 58-59, 80-83, 88-89.
99, any other operation.
10: 8 if I is measured from L (e.g., branch, shift, indexing).
9 if I is measured from D (e.g., add, subtract, store).

The following represent slight modifications in the above:

(a) When digit 1 is zero, D is not an address; it may have other meaning, as in shift operations; or it may be meaningless, as in operations 00,01.

(b) For shift operations, where the optimizing addends come from analysis of D, the first 6 digits of 0830 etc. are zero. The optimizing addends are given in 1250-1259.

(c) For indexing operations, D is not a drum address. For these operations, digits 5-6 are zeros, but digits 1-4 have a special meaning. They have the values 0101 for operations 80,82,88, and 0000 for the other indexing operations.

(d) For an MDF operation, optimizing addends cannot be given reliably; but digits 1-6 are the quantities that are used in case the forward search ends in QUITT.

5.2.8. Region Table

Locations G0001-G0029 (excepting G0010, G0020, G0021) are used for interpreting regional addresses. Suppose an REG card shows X1369, meaning that thereafter regional address X0001 = 1369. The numerical equivalent of X is 87, and 87-60=27. The number 1369 is then stored in G0027.

The region table is cleared during initialization; a non-zero in any cell of the table shows that there has been an REG card for that region. It will be noted that a card such as REG X0000 is invalid, since it would be impossible to tell that there had been an REG card for that region.

G0012 and G0020 are assigned by SYN cards to particular temporaries. G0021 is used as a zero constant.

5.3. Description of the Program

The main routine is quite short — in fact, it may be said to consist of only 4 words. From the last of these, it branches to any of 16 different exits, namely the card types given in 5.2.1.

On a card type 01, the branch is directly to Subroutine 10. On type 02 or a pseudo-operation, the branch is to a short segment of routine which appears near the end of the list.

On an ordinary card (type 08), the branch is to the segment which immediately follows the main routine. Thence, in turn, the code may branch to any of several subroutines, or to the forward search. The latter uses various subroutines, and eventually goes to either the QUITT routine or to the backward processing (BACKW) routine. It will be noted that under one set of circumstances it goes to BACKW and almost immediately resumes the forward search. This is the case where the search starts with an MDF operation, but I of that word is fixed.

There are three entries to the forward search, because it is necessary to make note of the reason for the search. The third entry is from Subroutine 19.

5.3.1. Right-Justified Temporaries

A number of quantities are stored in temporaries with absolute addresses, or with 5-letter symbolic addresses, because they are used in various parts of the program. Most of these will now be briefly described; for some, the derivation of the 5-letter symbol will be indicated.

ALOPT (all optimizing tags) is developed in Subroutine 14, and is sometimes modified elsewhere. It is developed for each word that is processed. Its digits have the following significance:

1: 9, Subroutine 11 is to reserve any location which it selects. This is the initial and usual value for this digit.
8, Subroutine 11 is not to reserve any location. This value is used when both D and I are fixed during backward processing of a branch instruction. (5.1.3.1.)

2: 8 is initial value. Changed to 9 during backward processing, if it is found that D is not a fixed address. (5.1.3.2.)

3: Same, for I.

4-5: Unused.

6: 8, the operation is one for which D is not an address, or at least not a drum address. (E.g., 30, 80.)
9, the operation is one for which D is an address. (E.g., 10, 69.)
The determination is made on the basis of whether the first digit of OPTIM is zero.

7-10: Identical with digits 7-10 of OPTIM.

BLANB holds the equivalent found for a blank L during backward processing.

BLANK holds the equivalent of a blank D or I during forward processing.

CDIFF holds the amount by which an REL card says to relocate core addresses.

COUNT shows the number of addresses in an instruction which are tagged for indexing. It is either 0, 1, or 2.

DDIFF holds the amount by which an REL card says to relocate a drum address.

DRUMT is initially 80 0000 0000. It is changed to 90 0000 0000 if the availability table shows that there is no space on the drum to which a blank or symbolic address can be assigned. It is changed to 80 0000 0000 during processing of a BLA card.

EQUIV holds, at its right end, the absolute equivalent of any address that has been processed, as soon as the equivalent has been determined.

HSYMB holds the alphabetic address that is being worked on, excepting that if the address is blank, it is not stored in HSYMB. (The symbol was carried over from SOAP II, where it stood for "headed symbol.")

LSYMB (location of symbol) shows either (1) the location in the symbol table where the symbol given in HSYMB may be found, or (2) an unused location, into which that symbol may be stored. LSYMB is in the D-position of the word.

OPTIM shows the word taken from 0800-0899 (see 5.2.7) that is appropriate to the operation involved in the card now being worked on.

OPREG (operating register) shows the dynamic level of an address which we have just finished using. If it is a drum address, the address itself (perhaps indexed) is put into OPREG, except sometimes for the addition of COUNT on an L-address. If it is a core address or an 800X D address, the dynamic level (never less than -0001 nor more than +0050) is computed and stored in OPREG.

ORCEB, ORCEQ, and SAVOR are used for storing various quantities used in attempting to optimize through core addresses. A core address itself is always optimized.

SAVEL and SAVED are used for saving addresses already derived for L and D, respectively, at the start of a forward search.

1030 and 1050 hold various distributor-branch tags, used to select different cases. The determination of the proper circumstances for changing these tags proved one of the most troublesome features of writing ISOPAR.

1030 holds the QUITT tag. Digit 1 is set to 8 when processing a card of type 08 (ordinary). It is changed to 9 at start of a forward search. It is used in Subroutine 19: A new-symbol L, when processing forward, starts a forward search if this digit is 8; but not if it is 9, for then we are on QUITT routine, and a search has been proven fruitless.

1030 holds other tags, in digits 5 and 6, which are used to tell the circumstances which started the forward search, and which are used at various places in the processing.

1050 holds the First-Card Tag. Its first digit is set to 8 when a card of the main routine is read. It is changed to 9 at the end of the study of a card during the forward search; so if the first card searched initiates QUITT or BACKW, the tag is still 8. During QUITT, it is changed to 8 at the end of the first card; hence, during QUITT, it is 9 for the first stored card if there are more than one; it is 8 in other cases. On BACKW, if there is more than one stored card, 1050 is changed to 8 when a blank L is processed backwards, whereafter it is used to indicate that blank D or I is to be made equal to BLANB. On BACKW with only one stored card, 1050 starts with 8, but changes to 9 if it is determined that the forward search started with L, so that this one card can be processed on the same basis as the first backward card in the more general case.

5.3.2. Subroutines

In addition to the 16 segments of code entered from the 16 different card types, there are 19 subroutines. Although many of these are usually entered from card type 08, some of them can be reached from other portions of the code. The subroutines are numbered 1 through 22, omitting 12, 15, and 16. The salient facts about each subroutine will now be listed, including a statement as to whence it is entered.

The symbolic entry word to a subroutine is of the form SUBR1, SUB19, SB10A, SUB2R, etc., excepting for subroutine 18, the entry word to which is INDEX. At the time of entry, the exit word is in the Distributor unless otherwise noted. Normally, this is stored soon after the subroutine is entered. To conserve drum space, the exits are stored in only three different locations, called EXITX, EXITY, and EXITZ, and these are put into otherwise unused locations of the punch region.

1: Initialize the drum at the start of a program. This is entered either from the first word of the main routine, or from BOP. It clears the region and symbol tables; clears card number; sets DRUMT to 80 0000 0000; and makes the availability table all 1's, since the entire drum is initially available.

2: Double-entry. If entered at SUB2R, it reserves all locations from FWA to FWA+N, inclusive. If entered at SUB2U, it unreserves similarly. At time of entry, FWA is in Upper, and N is in

Lower. Before reserving is attempted, checks are made so that no reservation will be attempted beyond location 1999. It is entered from Subroutines 4, 8, and 19, and from BLR, BLA, EQU. (Reserving of optimally assigned locations is done by Subroutine 11, without use of Subroutine 2.)

3 is used during the forward search to determine whether an address is fixed. At entry, the address in question, alphabetic, is in upper. At time of exit, type of address is indicated by contents of accumulator, as follows:

Blank, new symbol, core: 00000 00000 00000 00008

Drum, regional, old symbol: 00000 00000 00000 00000

800X: 00000 00000 0800X 00000

Absolute, not in those ranges; undefined symbol with table full; regional with region undefined: 00000 00008 00000 00000

4, 5, 6: Used to process L, D, or I, respectively, backwards. This is done principally by appropriate use of other subroutines.

7: This stores a new symbol in the symbol table, and its absolute equivalent in the equivalence table. Makes use of the contents of EQUIV, HSYMB, and LSYMB, which were stored by Subroutines 11, 9, and 9, respectively. Entered from Subroutines 4,5,6,19, 20,21.

8: This is used to process addresses in type 2 cards (relocatable subroutines). At entry time, the Upper contains the alphabetic address, used only to determine whether the address is to be fixed; the Lower contains the numeric address. At exit, the relocated address is in the Lower; or, if the relocation gives too high a value, the Upper will contain 00 0000 8000.

9: This subroutine, which may be entered from Backward Processing or from Subroutines 3, 4, 5, 6, 19, 20, or 21, examines an address to determine its character. At entry, the alphabetic address is in the Upper. Although the basic exit instruction is, as usual, in the Distributor at time of entry, it may be modified by the subroutine according to the type of address. If the I-position at time of entry shows K, the I-position of the actual exit instruction is as follows:

K-2: Address is regional with region undefined; or is a new symbol but symbol table is full.
K-1: Address is blank.
K: Absolute drum address; or symbolic or regional address equivalent to a drum address.
K+1: Undefined symbol, but there is room for it in symbol table.
K+2: 800X address.
K+3: Core address; i.e., absolute, in range 9000-9059.
K+4: Some other absolute address (or possibly a symbolic or regional address equivalent to an "other" address). Normally, part of a constant.

Subroutine 9 also stores the following:

HSYMB: The alphabetical symbol, unless it is a blank.
EQUIV: The absolute equivalent of the address, in cases K, K+2, K+3, and K+4. (Should an undefined symbol happen to consist of four digits preceded by a digit or a special character, the four digits will be stored in EQUIV, but will not be used.)
LSYMB: If the address is an old symbol, D-position of LSYMB receives the location of the symbol in the symbol table, less the location of the first word of that table. Similarly, if the address is a new symbol, LSYMB receives the location into which the symbol ought to be stored.

10: This so-called subroutine is a collection of short bits of code, namely the common endings of various subroutines and segments.

11: This subroutine is used for finding the optimum address, when the given address is blank or is a new symbol. It uses Subroutine 13 to find the optimum dynamic level; then 11 examines the availability table to find the available location which most nearly fits the prescribed level. The selected location is stored in EQUIV, and also is in the Lower at time of exit. The location is reserved, except when the first digit of ALOPT is 8. (See 5.3.1.)

Subroutine 11 is entered from Subroutines 4,5,6,19,20,21. At entry time, the exit instruction is in the Lower, and includes various branch-distributor tags. If the Lower is of the form 00 0abc KKKK, abc shows where we came from, as follows:

From Subroutine 4 (backward L): 989
From Subroutine 5 (backward D): 988
From Subroutine 6 (backward I): 990
From Subroutine 19 (forward L): 890
From Subroutine 20 (forward D): 888
From Subroutine 21 (forward I): 889

Should the drum be packed, so that no location is available, the exit instruction is changed from 00 0abc KKKK to 00 0abc KKKK+1. Also the drum tag is changed from 80 0000 0000 to 90 0000 0000, so that it will thereafter be unnecessary to go through a search of the availability table.

13: This subroutine is usually entered from Subroutine 11, but possibly from 4, 5, 20, or 21. The data it uses are found in OPREG, OPTIM, and ALOPT, described in 5.3.1. At entry time, the Distributor contains 00 0axc KKKK, where x is irrelevant, KKKK is the location of the next instruction, and ac have the values given under Subroutine 11.

At the end, the computed optimum dynamic level is shown at the right end of the Accumulator, with a value between 00 and +49, inclusive.

To explain the classification of cases within the subroutine, note that we never get to 13 when processing the D address of an indexing or shift operation, or when processing backward D of a branch operation.

14: This is entered from many different places and is used before much else can be done with a word. It transfers the control information and the operation to the output region, and separates the indexing tags and counts them (See COUNT, 5.3.1.). It moves the optimizing addends and tags from 0800-0899 to OPTIM, and develops the initial form of ALOPT. At exit time, ALOPT remains in the Distributor.

17: This subroutine is entered from 5 or 20. At entry, the Lower still contains P, the optimum dynamic level determined by Subroutine 13. 17 computes a slight correction to the dynamic level of D in certain cases: If D is 8002 and P is odd, or if D is 8003 and P is even, the correction is +1; if D is 8001, the correction is -1. This amount will later be added to P in Subroutine 20, or subtracted from P in 5.

18: This modifies a drum or core address if the address was tagged for indexing. At entry, the Lower contains the absolute value of the address to be indexed, in the I position. The D position of the Distributor is 0 if a D-address is being indexed, and 1 if an I-address is being indexed.

19, 20, 21: Used to process L, D, or I, respectively, forward.

22: This is a short subroutine used to preserve ORCEQ at the start of backward processing, for possible use when we go forward again. At time of entry, exit word is in Lower instead of Distributor.

6. Desirable Changes in ISOPAR

ISOPAR was prepared in the Spring of 1958, and has been in constant use since that Fall. It was probably effectively debugged for the features which exist on the 650 used by the National Bureau of Standards. On the other hand, it has never assembled a complete program for a 650 equipped with core, tapes, or disks. (If features involving operations 25-29 are used, the 407 plugboard should be slightly modified.)

Some work has been done toward incorporating certain desirable revisions. However, the National Bureau of Standards will soon stop using the 650, and since the existing ISOPAR represents considerable improvement over SOAP, it seems best to publish ISOPAR now, and indicate possible further improvements.

In preparation for publication, a few minor improvements were made. Most of the changes suggested in the following sections would involve major modifications of the code.

6.1. Changes to Improve Optimization

(a) If the forward search ends with the fixed D address of an MDF operation, it processes backward from that fixed address, but then does not start another forward search; instead, it uses the normal processing procedure from that fixed D. This defect was discovered in debugging the code, but it would require very extensive modification to remedy, and it has not been corrected.

(b) An indexed D with an operation such as 80 should not initiate a forward search, since there is no uncertainty as to the length of time required to perform the operation.

(c) For the same reason, an indexed D with operation 80, encountered during the forward search, should not initiate QUITT, but the search should continue.

(d) When operation 69 has blank D (the usual entrance to a subroutine), the L of the following instruction is correctly made equal to that D; but then a forward search ought to be initiated, since the latter instruction is not performed in the place indicated by its L. This would probably be a major revision: At present, a forward search always starts with either L or I, but this would require one to start with D.

(e) A forward search is terminated by QUITT when the search reaches any type of card other than type 08 (ordinary card); and even by a type 08 card if it is a constant. Present programming custom

often puts together at the end of one segment and the start of another the following cards: Card with blank I, constants, type 01 card, HED card, card with blank L. It would be desirable to carry the search through this group, and optimize backward through them. This would require a substantial increase in the capabilities for storing cards and for processing stored cards.

(f) In ISOPAR, the optimization through core addresses is not very good. In this it resembles SOAP II, although the methods are different. Suppose, for example, that during normal processing the following pair of instructions is reached:

```
1000  60  1003 9002
9003  15  ABC
```

Both assembly routines derive 07 as the dynamic level of 9002, and then use 07 as the dynamic level of 9003 in optimizing ABC. Other cases involve more complicated rules; but essentially they all assume that some nearby core addresses are the same.

Perhaps optimization could be improved by making a record of the dynamic level last assigned to each core address, for use when that address shows up again as L. Or if, as above, a core L is not equal to the preceding I (or D in case of a branch order), a forward search might be initiated on the grounds that we probably have the start of a loop. Such changes would substantially increase the length of the code.

(g) In deciding whether to terminate a forward search, ISOPAR erroneously treats an indexed D as fixed, and initiates backward processing. It would probably be more logical to initiate QUITT although it would apparently make little actual difference in the result.

6.2. Changes to Improve Usability

Although the method of transferring the input symbolic code to the output cards through a Reproducer has been reasonably satisfactory, it is of course more troublesome than if the 533 would punch the entire information. This is impossible (1.3.1), but one of the changes which has been considered is to have columns 17-37 transferred to the output through the 533, so that the symbolic and assembled codes could be listed together for immediate check-out without waiting for reproducing. Normally, the remarks would be reproduced at a later time, unless the immediate check-out uncovered errors which warranted discarding the output code at this stage.

6.3. Changes to Speed Assembly And/Or Make More Drum Space Available

Most of the changes suggested in 6.1 and 6.2 require more drum space. There are several ways in which more space can be made available.

(a) ISOPAR uses 1900-1999 only during the read-in. Those cells are also used for tracing routines to hunt errors in ISOPAR, and for a punch-out routine to punch the code at the rate of 7 words per card. Those locations could not be used for instructions, but they could be used for part of the symbol table after the need for tracing is past.

(b) The sizes of the symbol table and of the storage region are flexible, and after any other changes they should be modified to fill the drum. If any change is made in the size or location of the storage region, note the following precautions, unless other revisions make them obsolete: The length of the storage region is a multiple of 5. The SYN cards for SMAXM and SMAX1 must be corrected.

If a change is made in the size or location of the symbol table, note the following: The equivalence table is exactly half as long as the symbol table. The region table should immediately precede the symbol table, so that both can be cleared with one set-up, in Subroutine 1. Somewhere in the drum, there must be a zero word preceding the symbol table, and one following it; at present, these are in G0021 and ZMAX1. The SYN cards for ZMAXM and ZMAX1 must be kept up to date. The constant ZTABL, which shows the length of the symbol table and appears at the end of the program, must be correct. The SYN card for HSYMB is used only to improve optimization, and only the dynamic level is significant; its dynamic level is at present 4 higher than that of ZMAXM.

(c) ISOPAR follows SOAP II in providing that the assembly routine uses only the basic 650 plus alphabetic feature; but that it will assemble programs involving other optional features. It would be better to prepare two different versions: Version A, which will assemble programs involving all optional features, but which uses index registers in the assembly; Version B, which omits all reference to index registers. Both of these would be considerably shorter than the present version; in fact, Version A would be several hundred words shorter. It seems very unlikely that a 650 without index registers would have to assemble a program that used them; if that should happen, the present version of ISOPAR could be used for the purpose.

(d) Another way of getting additional drum space (not over 60 locations) would be to provide that the instructions for handling core addresses be in locations 9000-9059, or as many of them as would be useful. This would not require separate codes for machines lacking

core memory, except for omitting the reading of the instructions that go into core; but it would mean that ISOPAR could process programs involving core only on a machine equipped with core memory.

650 ISOPAR PROGRAM SHEET PAGE____

	TP	LOC	PS	OP	D ADDR	IA	I ADDR	IA	REMARKS, OR END COMMENTS *
16	17	18-22	23	24 25	26-30	31	32-36	37	38-75
K		0160		00	0000		0006		A constant, namely 6
Q		Q4		20	END		XXX		A comparison constant, to test for end of a loop
	1	COMME	N	TS	CARD	-			A heading (comment) card
	2	0050		30	F 0002		0007		Card of a relocatable subroutine, with fixed D
K	-	0160		00	0000		0300		A negative constant, namely -300
			B	LR	0306				To reserve 0306
			B	LR	1296		1305		To reserve 1296-1305, inclusive
			R	BD	0000				To reserve 0000-0049
			R	BD	0600		1899		To reserve 0000 and 0600-1899
				60	X		AB		Blank L, left-justified symbolic D, right-justified symbolic I
		OI		24	ϕ1 bAC				Letter O, letter I, digit 0, digit 1, blank character
				21	0130				Absolute address
K		0350		10	1000		0051		Constant, namely 1010000051. 0350 is reserved, but not 1000 nor 0051
				20	X 0002				Store from Lower into word 2 of Region X
			R	EG	P 0177				Designate that P0001 = 0177, and reserve 0177
			R	EG	R 0101		0110		Designate that R0001 = 0101, and reserve 0101-0110
				20	P 0000	A			Store Lower into (P0000 + contents of index register A)

*On type I card, comments start in column 18.

FIGURE 1. Samples of ISOPAR input program cards

650 ISOPAR PROGRAM SHEET PAGE____

	TP	LOC	PS	OP	D ADDR	IA	I ADDR	IA	REMARKS, OR END COMMENTS *
16	17	18-22	23	24 25	26-30	31	32-36	37	38-75
				20	F0002				F0002 denotes second word of region F
				REG	F0002				F0002 denotes that region F starts in location 0002
	2			30	F0002		0007		F0002 denotes that 0002 is not to be modified in relocation
				REL	1200		0010		Type-2 addresses are relocated: Drum by 1200 and core by 0010
				REL			0020		Type-2 addresses are relocated: Drum unchanged and core by 0020
				REQ	SINEX		0000		Symbol SINEX = (0000 + amount of relocation shown by last REL card)
				RBR	0000		0051		Reserve 0000-0051 augmented by amount shown on last REL card
K		0013	A	LF	bAX				Reserve 0013 and put 00 61 87 00 00 into it
K		PQ	A	LF					Put positive zero into symbolic location PQ
K	-	0014	A	LF					Reserve 0014 and put negative zero into it
			B	LA	1699				Make 1699 available
			B	LA	0169		0183		Make 0169-0183 available
			H	ED					Clear from symbol table all symbols which are not right-justified
			S	YN	X		0100		Make right-justified symbolic X = 0100, and reserve 0100
			E	QU	ALPHA		BETA		Make symbol ALPHA equal to value of symbol BETA, and reserve
			B	ŌP					To assemble a second input program without rereading ISOPAR
			P	AT					Punch availability table. Normally, used only at end of program
		8003		60	0100				A card with 800X in L can be used but is not useful

*On type I card, comments start in column 18. FIGURE 2. Samples of ISOPAR input program cards

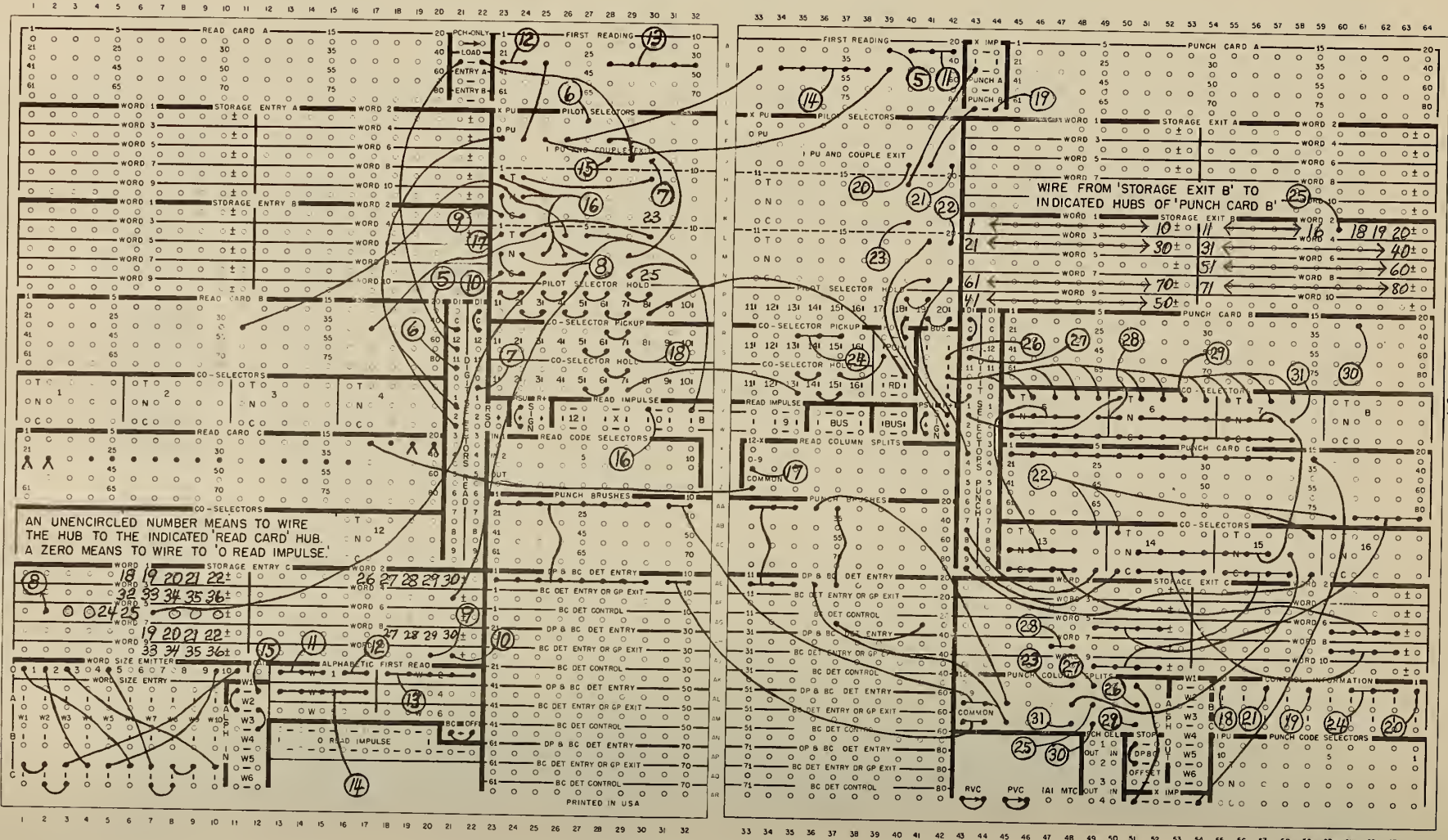
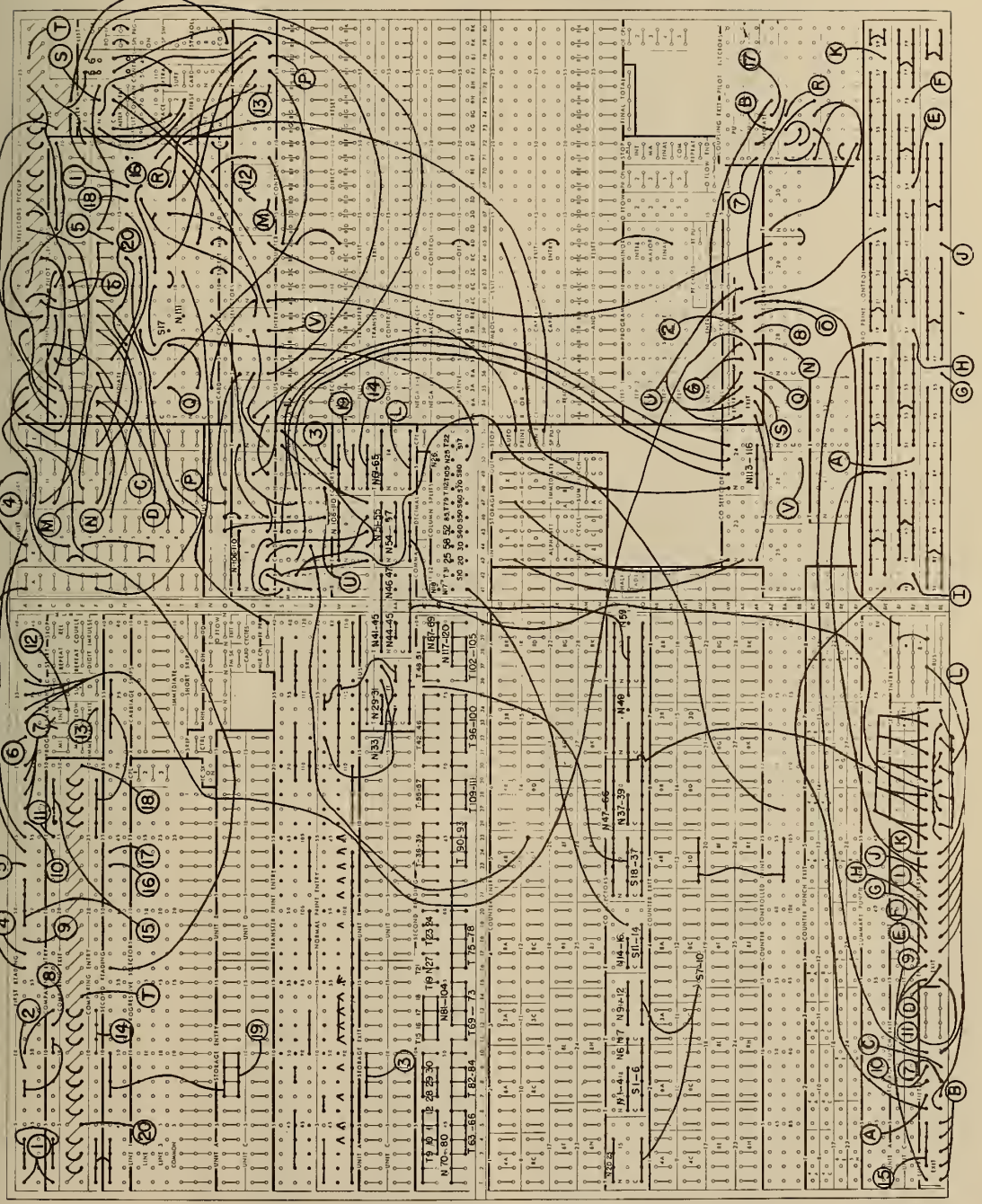


FIG. 3 TYPE 533 ISOPAR CONTROL PANEL

S: WIRE TO INDICATED SECOND READING HUB
N: WIRE TO INDICATED NORMAL PRINT ENTRY HUB
T: WIRE TO INDICATED TRANSFER PRINT ENTRY HUB



INTERNATIONAL BUSINESS MACHINES CORPORATION
ACCOUNTING MACHINE, TYPE 407, CONTROL PANEL DIAGRAM

IBM

Form 22-5806-5
Printed in U.S.A.

FIG. 4 TYPE 407 ISOPAR CONTROL PANEL

8

```
RBD    1150                RESERVE PART OF REGION S                    10
RBO    1350      1999                                                  12
BLR    0002                TYPE 2 ROUTINE                              14
BLR    0008                ORDINARY CARD                               16
BLR    0010                MANUAL PAT                                  18
BLR    0016                ALF ROUTINE                                 20
BLR    0021                BLA ROUTINE                                 22
BLR    0025                SYN ROUTINE                                 24
BLR    0027                BOP ROUTINE                                 26
BLR    0029                BLR ROUTINE                                 28
BLR    0054                EQU ROUTINE                                 30
BLR    0073                PAT ROUTINE                                 32
BLR    0084                HEO ROUTINE                                 34
BLR    0093      0094      REL AND RBD ROUTINE                         36
BLR    0097      0099      REG, REQ, RBR ROUTINES                      38
REG Q0118        0131      BRANCH ENTRIES IN EQU, SYN, AND REQ         40
REG R0151        0160      READ REGION                                 42
REG T0168        0172      ENTRIES IN PAT                              44
REG P0177        0186      PUNCH REGION                                46
REG F0218        0224      BRANCH ENTRIES IN SUBROUTINE 3              48
REG M0268        0277      BRANCH ENTRIES IN SUBROUTINE 4              50
REG J0368        0375      BRANCH ENTRIES IN SUBROUTINE 6              52
REG L0418        0425      BRANCH ENTRIES IN SUBROUTINE 19             54
REG 00469        0478      BRANCH ENTRIES IN SUBROUTINE 20             56
REG X0518        0531      BRANCH ENTRIES IN BACKWARD PROCESSING       58
REG I0572        0581      BRANCH ENTRIES IN SUBROUTINE 21             60
REG U0608        0609      USED IN HED ROUTINE                         62
BLR    0900      0903      CERTAIN TEMPORARIES                         64
REG C0918        0927      BRANCH ENTRIES IN SUBROUTINE 5              66
BLR    1030                SEARCH-START TAG                            68
BLR    1050                FIRST-CARD TAG                              70
REG S1125        1149      STORAGE REGION, 1125-1199                   72
BLA    1350      1354      RESERVED BY RBD, BUT NOT NEEDED             74
REG A1355                  AVAILABILITY TABLE, 1355-1554               76
REG E1555                  EQUIVALENCE TABLE, 1555-1659                78
REG G1660                  LIST OF REGIONS, 1660-1688                  80
REG Z1689                  SYMBOL TABLE, 1689-1898                     82
SYN SETCC          0001      TYPE 1                                    84
SYN HSYMB          0108    OPTIMIZE MAIN ITERATION OF SUBR 9           86
SYN EXITX        P0001     TO CONSERVE DRUM SPACE                      88
SYN EXITY        P0002     TO CONSERVE DRUM SPACE                      90
SYN EXITZ        P0003     TO CONSERVE DRUM SPACE                      92
SYN DRUMT        G0010     TO CONSERVE DRUM SPACE                      94
SYN BLANB        G0020     TO CONSERVE DRUM SPACE                      96
SYN ZEROX        G0021     DOUBLE USE OF ZERO                          98
SYN SMAXM          1199    LAST CELL OF STORAGE AREA                  100
SYN SMAX1          1200    CELL BEYOND END OF STORAGE AREA            102
SYN ZMAXM          1898                                               104
SYN ZMAX1          1899    FOR CLEARING CELL BEYOND Z REGION          106
```

OPTIMIZING ADDENDS AND TAGS 108

```
0800 00 0404 9998    K  0800  00  0404  9998   FOR OPERATION = LOCATION - 0800   110
0801 00 0404 9998    K  0801  00  0404  9998   FOR OPERATION = LOCATION - 0800   112
0802 33 2322 8999    K  0802  33  2322  8999   FOR OPERATION = LOCATION - 0800   114
0803 00 0505 8998    K  0803  00  0505  8998   FOR OPERATION = LOCATION - 0800   116
0804 00 0505 8998    K  0804  00  0505  8998   FOR OPERATION = LOCATION - 0800   118
0805 00 0505 8998    K  0805  00  0505  8998   FOR OPERATION = LOCATION - 0800   120
0806 00 0505 8998    K  0806  00  0505  8998   FOR OPERATION = LOCATION - 0800   122
0807 00 0505 8998    K  0807  00  0505  8998   FOR OPERATION = LOCATION - 0800   124
0808 33 1212 9999    K  0808  33  1212  9999   FOR OPERATION = LOCATION - 0800   126
0809 33 0202 9999    K  0809  33  0202  9999   FOR OPERATION = LOCATION - 0800   128
0810 33 0504 9999    K  0810  33  0504  9999   FOR OPERATION = LOCATION - 0800   130
0811 33 0504 9999    K  0811  33  0504  9999   FOR OPERATION = LOCATION - 0800   132
0812 99 9999 8999    K  0812  99  9999  8999   FOR OPERATION = LOCATION - 0800   134
0813 99 9999 8999    K  0813  99  9999  8999   FOR OPERATION = LOCATION - 0800   136
0814 33 1110 8999    K  0814  33  1110  8999   FOR OPERATION = LOCATION - 0800   138
0815 33 0504 9999    K  0815  33  0504  9999   FOR OPERATION = LOCATION - 0800   140
0816 33 0504 9999    K  0816  33  0504  9999   FOR OPERATION = LOCATION - 0800   142
0817 33 0504 9999    K  0817  33  0504  9999   FOR OPERATION = LOCATION - 0800   144
0818 33 0504 9999    K  0818  33  0504  9999   FOR OPERATION = LOCATION - 0800   146
0819 33 2120 8999    K  0819  33  2120  8999   FOR OPERATION = LOCATION - 0800   148
0820 54 0303 9999    K  0820  54  0303  9999   FOR OPERATION = LOCATION - 0800   150
0821 45 0303 9999    K  0821  45  0303  9999   FOR OPERATION = LOCATION - 0800   152
0822 34 0303 9999    K  0822  34  0303  9999   FOR OPERATION = LOCATION - 0800   154
0823 34 0303 9999    K  0823  34  0303  9999   FOR OPERATION = LOCATION - 0800   156
```

```
0824 33 0303 9999       K  0824 33 0303 9999       FOR OPERATION = LOCATION - 0800                158
0825 44 0505 9999       K  0825 44 0505 9999       FOR OPERATION = LOCATION - 0800                160
0826 00 0505 9998       K  0826 00 0505 9998       FOR OPERATION = LOCATION - 0800                162
0827 00 0505 9998       K  0827 00 0505 9998       FOR OPERATION = LOCATION - 0800                164
0828 33 1212 9999       K  0828 33 1212 9999       FOR OPERATION = LOCATION - 0800                166
0829 33 0202 9999       K  0829 33 0202 9999       FOR OPERATION = LOCATION - 0800                168
0830 00 0000 9988       K  0830 00 0000 9988       FOR OPERATION = LOCATION - 0800                170
0831 00 0000 9888       K  0831 00 0000 9888       FOR OPERATION = LOCATION - 0800                172
0832 33 2726 8999       K  0832 33 2726 8999       FOR OPERATION = LOCATION - 0800                174
0833 33 2726 8999       K  0833 33 2726 8999       FOR OPERATION = LOCATION - 0800                176
0834 33 2726 8999       K  0834 33 2726 8999       FOR OPERATION = LOCATION - 0800                178
0835 00 0000 9988       K  0835 00 0000 9988       FOR OPERATION = LOCATION - 0800                180
0836 00 0000 9988       K  0836 00 0000 9988       FOR OPERATION = LOCATION - 0800                182
0837 33 2726 8999       K  0837 33 2726 8999       FOR OPERATION = LOCATION - 0800                184
0838 33 2726 8999       K  0838 33 2726 8999       FOR OPERATION = LOCATION - 0800                186
0839 33 2726 8999       K  0839 33 2726 8999       FOR OPERATION = LOCATION - 0800                188
0840 33 0404 9998       K  0840 33 0404 9998       FOR OPERATION = LOCATION - 0800                190
0841 33 0404 9998       K  0841 33 0404 9998       FOR OPERATION = LOCATION - 0800                192
0842 33 0404 9998       K  0842 33 0404 9998       FOR OPERATION = LOCATION - 0800                194
0843 33 0404 9998       K  0843 33 0404 9998       FOR OPERATION = LOCATION - 0800                196
0844 34 0405 9998       K  0844 34 0405 9998       FOR OPERATION = LOCATION - 0800                198
0845 43 0504 9998       K  0845 43 0504 9998       FOR OPERATION = LOCATION - 0800                200
0846 33 0404 9998       K  0846 33 0404 9998       FOR OPERATION = LOCATION - 0800                202
0847 33 0505 9998       K  0847 33 0505 9998       FOR OPERATION = LOCATION - 0800                204
0848 33 0404 9998       K  0848 33 0404 9998       FOR OPERATION = LOCATION - 0800                206
0849 33 0404 9998       K  0849 33 0404 9998       FOR OPERATION = LOCATION - 0800                208
0850 00 0000 9898       K  0850 00 0000 9898       FOR OPERATION = LOCATION - 0800                210
0851 00 0000 9898       K  0851 00 0000 9898       FOR OPERATION = LOCATION - 0800                212
0852 00 0000 9898       K  0852 00 0000 9898       FOR OPERATION = LOCATION - 0800                214
0853 00 0000 9898       K  0853 00 0000 9898       FOR OPERATION = LOCATION - 0800                216
0854 44 0505 9999       K  0854 44 0505 9999       FOR OPERATION = LOCATION - 0800                218
0855 00 0505 8998       K  0855 00 0505 8998       FOR OPERATION = LOCATION - 0800                220
0856 00 0505 8998       K  0856 00 0505 8998       FOR OPERATION = LOCATION - 0800                222
0857 00 0505 8998       K  0857 00 0505 8998       FOR OPERATION = LOCATION - 0800                224
0858 00 0000 9898       K  0858 00 0000 9898       FOR OPERATION = LOCATION - 0800                226
0859 00 0000 9898       K  0859 00 0000 9898       FOR OPERATION = LOCATION - 0800                228
0860 33 0504 9999       K  0860 33 0504 9999       FOR OPERATION = LOCATION - 0800                230
0861 33 0504 9999       K  0861 33 0504 9999       FOR OPERATION = LOCATION - 0800                232
0862 99 9999 8999       K  0862 99 9999 8999       FOR OPERATION = LOCATION - 0800                234
0863 99 9999 8999       K  0863 99 9999 8999       FOR OPERATION = LOCATION - 0800                236
0864 33 1110 8999       K  0864 33 1110 8999       FOR OPERATION = LOCATION - 0800                238
0865 33 0504 9999       K  0865 33 0504 9999       FOR OPERATION = LOCATION - 0800                240
0866 33 0504 9999       K  0866 33 0504 9999       FOR OPERATION = LOCATION - 0800                242
0867 33 0504 9999       K  0867 33 0504 9999       FOR OPERATION = LOCATION - 0800                244
0868 33 0504 9999       K  0868 33 0504 9999       FOR OPERATION = LOCATION - 0800                246
0869 33 0303 9999       K  0869 33 0303 9999       FOR OPERATION = LOCATION - 0800                248
0870 00 0504 8999       K  0870 00 0504 8999       FOR OPERATION = LOCATION - 0800                250
0871 00 0504 8999       K  0871 00 0504 8999       FOR OPERATION = LOCATION - 0800                252
0872 00 0504 8999       K  0872 00 0504 8999       FOR OPERATION = LOCATION - 0800                254
0873 00 0504 8999       K  0873 00 0504 8999       FOR OPERATION = LOCATION - 0800                256
0874 00 0504 8999       K  0874 00 0504 8999       FOR OPERATION = LOCATION - 0800                258
0875 00 0504 8999       K  0875 00 0504 8999       FOR OPERATION = LOCATION - 0800                260
0876 00 0504 8999       K  0876 00 0504 8999       FOR OPERATION = LOCATION - 0800                262
0877 00 0504 8999       K  0877 00 0504 8999       FOR OPERATION = LOCATION - 0800                264
0878 00 0504 8999       K  0878 00 0504 8999       FOR OPERATION = LOCATION - 0800                266
0879 00 0505 9999       K  0879 00 0505 9999       FOR OPERATION = LOCATION - 0800                268
0880 01 0100 9898       K  0880 01 0100 9898       FOR OPERATION = LOCATION - 0800                270
0881 00 0000 9898       K  0881 00 0000 9898       FOR OPERATION = LOCATION - 0800                272
0882 01 0100 9898       K  0882 01 0100 9898       FOR OPERATION = LOCATION - 0800                274
0883 00 0000 9898       K  0883 00 0000 9898       FOR OPERATION = LOCATION - 0800                276
0884 33 2526 8999       K  0884 33 2526 8999       FOR OPERATION = LOCATION - 0800                278
0885 00 0606 8998       K  0885 00 0606 8998       FOR OPERATION = LOCATION - 0800                280
0886 00 0606 8998       K  0886 00 0606 8998       FOR OPERATION = LOCATION - 0800                282
0887 00 0606 8998       K  0887 00 0606 8998       FOR OPERATION = LOCATION - 0800                284
0888 01 0100 9898       K  0888 01 0100 9898       FOR OPERATION = LOCATION - 0800                286
0889 00 0000 9898       K  0889 00 0000 9898       FOR OPERATION = LOCATION - 0800                288
0890 44 0505 9998       K  0890 44 0505 9998       FOR OPERATION = LOCATION - 0800                290
0891 33 0505 9998       K  0891 33 0505 9998       FOR OPERATION = LOCATION - 0800                292
0892 33 0505 9998       K  0892 33 0505 9998       FOR OPERATION = LOCATION - 0800                294
0893 33 0505 9998       K  0893 33 0505 9998       FOR OPERATION = LOCATION - 0800                296
0894 33 0505 9998       K  0894 33 0505 9998       FOR OPERATION = LOCATION - 0800                298
0895 33 0505 9998       K  0895 33 0505 9998       FOR OPERATION = LOCATION - 0800                300
0896 33 0505 9998       K  0896 33 0505 9998       FOR OPERATION = LOCATION - 0800                302
0897 33 0505 9998       K  0897 33 0505 9998       FOR OPERATION = LOCATION - 0800                304
0898 33 0505 9998       K  0898 33 0505 9998       FOR OPERATION = LOCATION - 0800                306
0899 44 0505 9998       K  0899 44 0505 9998       FOR OPERATION = LOCATION - 0800                308
1250 23 2225 2400  2225 K  1250 23 2225 2400  2225 TABLE TO OPTIMIZE SHIFT OPERATIONS           310
1251 07 0607 0600       K  1251 07 0607 0600       TABLE TO OPTIMIZE SHIFT OPERATIONS             312
1252 07 0609 0800       K  1252 07 0609 0800       TABLE TO OPTIMIZE SHIFT OPERATIONS             314
1253 09 0811 1000       K  1253 09 0811 1000       TABLE TO OPTIMIZE SHIFT OPERATIONS             316
1254 11 1013 1200       K  1254 11 1013 1200       TABLE TO OPTIMIZE SHIFT OPERATIONS             318
1255 13 1215 1400       K  1255 13 1215 1400       TABLE TO OPTIMIZE SHIFT OPERATIONS             320
1256 15 1417 1600       K  1256 15 1417 1600       TABLE TO OPTIMIZE SHIFT OPERATIONS             322
1257 17 1619 1800       K  1257 17 1619 1800       TABLE TO OPTIMIZE SHIFT OPERATIONS             324
1258 19 1821 2000       K  1258 19 1821 2000       TABLE TO OPTIMIZE SHIFT OPERATIONS             326
1259 21 2023 2200  2023 K  1259 21 2023 2200  2023 TABLE TO OPTIMIZE SHIFT OPERATIONS             328
1300 19 9906 0690       K  1300 19 9906 0690       TABLE TO OPTIMIZE INDEX1NG OPERATIONS          330
1301 80 0008 0880       K  1301 80 0008 0880       TABLE TO OPTIMIZE INDEXING OPERATIONS          332
1302 80 0106 0680       K  1302 80 0106 0680       TABLE TO OPTIMIZE INDEXING OPERATIONS          334
1303 80 0209 0880       K  1303 80 0209 0880       TABLE TO OPTIMIZE INDEX1NG OPERATIONS          336
1304 80 0308 0980       K  1304 80 0308 0980       TABLE TO OPTIMIZE INOEXING OPERATIONS          338
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1305 99 9908 0880          K    1305  99    9908      0880          TABLE TO OPTIMIZE INOEXING OPERATIONS                    340



                                                  OTHER CONSTANTS WITH ABSOLUTE LOCATIONS                                  342

1200 19 9900 0000          K    1200  19    9900      0000          IF DRUM AOORESS, USE REGULAR EXIT                        344
1201 79 9900 0004          K    1201  79    9900      0004          IF NOT AN ADDRESS, ADD 4                                 346
1202 80 0300 0002          K    1202  80    0300      0002          IF 800X ADORESS, AOO 2                                   348
1203 80 0400 0004          K    1203  80    0400      0004          IF NOT AN AODRESS, ADD 4                                 350
1204 80 0700 0002          K    1204  80    0700      0002          IF 800X AODRESS, ADO 2                                   352
1205 89 9900 0004          K    1205  89    9900      0004          IF NOT AN AODRESS, ADO 4                                 354
1206 90 5900 0003          K    1206  90    5900      0003          IF CORE ADDRESS, AOD 3                                   356
1207 99 9999 0004          K    1207  99    9999      0004          IF NOT AN ADDRESS, ADD 4                                 358



                                                  MAIN ROUTINE                                                             360

0100 69 0003 0006          N    0100  69 READC     SUBR1           INITIALIZE AT START OF ASSEMBLY                          362

0003 70 0161 1041            READC    70 R0011                     READ ONE CARO                                            364
1041 69 1044 1047                     69 81STX                    RESTORE FIRST CARD TAG )                                 366
1047 24 1050 0160  1050               24    1050   R0010    1050 RESTORE FIRST CARD TAG )  MULTIBRANCH                      368



                                                  ORDINARY CARO                                                            370

0008 69 1044 0047          N    0008  69 81STX                    DELETE QUITT TAG )                                       372
0047 24 1030 0033  1030               24    1030              1030 DELETE QUITT TAG )                                       374
0033 69 0036 0039                     69          SUB14           OP, C.I., OPTIM, ALOPT, ETC.                             376

0036 69 0089 0042          J          69          SUB19           PROCESS L                                                378

0089 69 0092 0045          J          69          SUB20           PROCESS O                                                380

0092 69 0095 0048          J          69 OPTIM                    IS IT AN MOF OPERATION )                                 382
0048 94 0051 0053                     94 MDFLP                    D, YES                                                   384
0053 60 0902 0007                     60    0902                  IS O INOEXED                                             386
0007 44 0011 0012                     44 MDFL1    ABCDE           IF SO, START FORWARD SEARCH                              388
0012 69 0015 0018          C ABCDE    69          SUB21           PROCESS I                                                390

0015 60 0003 0057          J          60 READC    SB10A           PREPARE TO PUNCH CARD                                    392



                                                  FORWARD SEARCH                                                           394
                                        HED                                                                                396

0051 69 0004 0107          N MOFLP    69 P        A               STARTED SEARCH WITH MOF OPERATION                        398

0011 69 0014 0107          N MOFL1    69 I        A               STARTED SEARACH WITH INOEXED O                           400

1001 69 1004 0107          N MDFLL    69 L        A               STARTED WITH NEW-SYMBOL L                                402
0107 24 1030 0083  1030    C A        24    1030              1030 STORE TAG TELLING HOW SEARCH STARTED                      404
0083 65 0086 0041                     65 SENO     LOOP            STORE SET OF DATA )                                      406
0041 10 0044 8003          C LOOP     10             8003         STORE SET OF DATA )                                      408

0044 69 0151 8002          J          69 R0001       8002         STORE SET OF DATA )                                      410

0086 24 1125 0028  1125    J SEND     24 S0001    X          S0001 STORE SET OF DATA )                                      412
0028 11 0031 0035            X        11 Q                        STORE SET OF DATA )                                      414
0035 15 0038 0043                     15 16THX                    STORE SET OF DATA )                                      416
0043 44 0147 0148                     44          OUT             STORE SET OF DATA )                                      418

0147 10 0050 8003                     10 QS          8003         STORE SET OF DATA )                                      420

0148 20 0103 0056  0103    N OUT      20 FINAL                FINAL STORE VARIABLE ORDER                                   422
0056 69 1050 0203                     69    1050                  IS THIS FIRST SET OF SEARCH )                            424
0203 90 0207 0058                     90          NO              IS THIS FIRST SET OF SEARCH )                            426

0207 69 1030 0133                     69    1030                  IF SO, WHERE DIO SEARCH START                            428
0133 96 0136 0088                     96 B        C               WITH I OR L, RESPECTIVELY                                430

0058 65 0160 0065          N NO       65 R0010                    IS CARO OF TYPE 08 )                                     432
0065 16 0068 0023                     16 810TH                    IS CARD OF TYPE 08 )                                     434
0023 45 0026 0077                     45 QUITT                    D, IT IS NOT, AND WE QUIT                                436
0077 60 0151 0005                     60 R0001                    ALPHABETIC L                                             438
0005 69 0208 0061                     69          SUBR3           IS L FIXED AOORESS )                                     440

0208 35 0005 0071          J          35    0005                  IS L FIXED AOORESS )                                     442
0071 44 0026 0076                     44 QUITT                    IF SO, QUIT SEARCH )                                     444
0076 45 0088 0026                     45 C        QUITT           IF SO, QUIT SEARCH )                                     446

0088 69 0091 0039          C C        69          SUB14           GET Op, C.I., TAGS, OPTIM, ALOPT.                        448
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0091 95 0144 0046          J          95 K                          IS O ACTUALLY AN AOORESS                          450
0046 60 0152 0257                     60 R0002                      IF SO, IS IT FIXEO )                              452
0257 69 0060 0061                     69          SUBR3             IF SO, IS IT FIXEO )                              454

0060 44 0026 0064          J          44 QUITT                      IF N G, QUIT SEARCH                               456
0064 45 0144 0019                     45 K          BACKW           IF FIXEO, START BACKWARD PROCESSING               458

0144 69 0197 0150          C K        69 ALOPT                      IS IT AN MOF OPERATION                            460
0150 94 0026 0055                     94 QUITT                      IF SO, QUIT SEARCH                                462
0055 60 0902 0307                     60    0902                    IS O INOEXED                                      464
0307 45 0026 0136                     45 OUITT      B               IF SO, QUIT SEARCH                                466
0136 60 0153 0357          C B        60 R0003                      IS I A FIXEO AOORESS )                            468
0357 69 0110 0061                     69          SUBR3             IS I A FIXEO ADDRESS )                            470

0110 35 0005 0173          J          35    0005                    IS I A FIXEO AOORESS )                            472
0173 44 0026 0078                     44 QUITT                      IF I IS N G, QUIT SEARCH                          474
0078 45 0032 0019                     45 BCOEF      BACKW           IF I IS FIXEO, START BACKWARO                     476

0032 65 0103 0407          N BCDEF    65 FINAL                      IS STORAGE AREA FULL )                            478
0407 16 0210 0115                     16 MAX                        IS STORAGE AREA FULL )                            480
0115 45 0318 0026                     45          OUITT             IFSO, OUIT SEARCH                                 482

0318 65 0903 0457                     65    0903                    IS I INOEXEO                                      484
0457 45 0026 0111                     45 QUITT                      IF SO, OUIT SEARCH                                486
0111 69 0114 0017                     69 91STX                      CHANGE FIRST-CARO INDICATOR TO 2ND )              488
0017 24 1050 0253  1050               24    1050              1050 CHANGE FIRST-CARO INOICATOR TO 2NO )               490
0253 70 0151 1007                     70 R0001                      REAO ANOTHER CARO                                 492
1007 65 0160 0165                     65 R0010                      IS IT TYPE 08)                                    494
0165 16 0068 0323                     16 810TH                      IS IT TYPE 08)                                    496
0323 45 0176 0227                     45          LP                O, IT IS NOT.  I, IT IS,                          498

0176 15 0079 0233                     15 710                        IS TYPE 01                                        500
0233 45 0236 0037                     45 YYY                        O, NO,  I, YES.                                   502
0037 24 0151 0104  0151               24 R0001              R0001 IF SO, PUT IN OUMMY MOVEABLE WORDS )              504
0104 24 0152 0105  0152               24 R0002              R0002 IF SO, PUT IN OUMMY MOVEABLE WORDS )              506
0105 24 0153 0236  0153               24 R0003    YYY       R0003 IF SO, PUT IN OUMMY MOVEABLE WORDS )              508
0236 24 0155 0227  0155    C YYY      24 R0005    LP        R0005 EITHER CASE, SOMETHING INTO R0005                 510
0227 65 0103 0041          C LP       65 FINAL    LOOP            ALL CASES, BACK TO START OF LOOP                  512

0031 69 0155 8002          O O        69 R0005      8002          COMPARISON CONSTANT FOR STORING                   514

0050 69 0156 8002          O OS       69 R0006      8002          TO RESTORE COMPARISON CONST + AOVANCE             516

0210 24 1200 0028  1200    Q MAX      24 SMAX1    X         SMAX1 CONSTANT FOR WHETHER STORAGE IS FULL              518

0004 90 0088 0000          K P        90    0088    0000          TAG FOR SEARCH STARTED BY MOF                     520
0014 90 0089 0000          K I        90    0089    0000          TAG FOR SEARCH STARTEO BY INOEXED O               522
1004 90 0090 0000          K L        90    0090    0000          TAG, SEARCH STARTED BY NEW-SYMBOL L               524
0079 00 0000 0007          K 710      00    0000    0007                                                            526


                                        QUIT WITHOUT FIXEO ADORESS                                                  528
                                HED                                                                                 530

0026 69 1050 0303          N OUITT    69    1050                    WAS THERE ONLY ONE SEARCHEO CARO                  532
0303 90 0507 0258                     90          SKP               O, ONLY ONE.                                      534

0507 69 1030 0283                     69    1030                    WHERE OID SEARCH START                            536
0283 96 0012 0138                     96 ABCDE                      IF WITH I, PROCESS LIKE 08                        538
0138 69 0141 0042                     69          SUB19             PROCESS L                                         540

0141 69 0012 0045          J          69 ABCDE    SUB20             PROCESS O, AND TO 08 ROUTINE                      542

0258 65 0103 0557          N SKP      65 FINAL                      NOT 1ST CARO.  MAKE COMP. CONST. )                544
0557 10 0260 0215                     10 BRNG                       NOT 1ST CARD.  MAKE COMP. CONST. )                546
0215 22 0069 0022  0069               22 OC                   OC    NOT 1ST CARO.  MAKE COMP, CONST. )                548
0022 65 8003 0229                     65    8003    LOOP            BRING BACK A SET )                                550
0229 10 0082 8002          C LOOP     10 SEN0       8002          BRING BACK A SET )                                552

0260 69 1125 8003          J BRNG     69 S0001      8003          BRING BACK A SET )                                554

0082 24 0151 0204  0151    J SEN0     24 R0001    X         R0001 BRING BACK A SET )                                556
0204 11 0607 0161            X        11 O                        BRING BACK A SET )                                558
0161 15 0038 0143                     15 16THX                    BRING BACK A SET )                                560
0143 44 0247 0198                     44          OUT             BRING BACK A SET )                                562

0247 10 0200 8002                     10 QS         8002          BRING BACK A SET )                                564

0198 20 0353 0106  0353    N OUT      20 VAR                  VAR   STORE VARIABLE ORDER                            566
0106 16 0069 0623                     16 QC                       IS THIS LAST SET                                  568
0623 45 0226 0160                     45          R0010           IF SO, MULTIBRANCH + EXIT FROM OUITT              570

0226 69 0279 0039                     69          SUB14           GET OP, C.I.. TAGS, OPTIM, ALOPT.                 572

0279 69 1050 0403          J          69    1050                    IS THIS FIRST QUITT SET                           574
0403 90 0657 0308                     90 NO                         O, IT IS NOT                                      576
0308 69 1030 0333                     69    1030                    IF SO, WHERE OIO WE START                         578
0333 96 0286 0657                     96 JUMP     NO                D, STARTEO WITH I.  I, WITH L.                    580
0657 69 0310 0042          C NO       69          SUB19           STARTEO WITH L, OR NOT FIRST. PROC. L             582
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D310 69 0286 0045          J          69 JUMP      SUB20          PROCESS D                                  584

D286 69 D139 0018          J JUMP     69           SUB21          PROCESS I                                  586

0139 69 1044 0297          J          69 81STX                    CHANGE TAG TO SECOND-CARD TAG )            588
0297 24 1050 0453  1050               24    1D5D              1D50 CHANGE TAG TO  SECOND-CARD TAG )           590
D453 60 0206 0057                     60          SB10A           PUNCH CARD                                 592

0206 65 0353 0229          J          65 VAR       LOOP           BRING VARIABLE ORDER, AND REPEAT           594

D6D7 24 D155 02D4  D155    Q Q        24 RDD05     X         RDD05 COMPARISON CONSTANT FOR BRINGING SET      596

0200 24 0156 02D4  D156    Q QS       24 RD006     X         RD006 TO RESTORE AND ADVANCE                    598


                                                BACKWARDS ROUTINE                                          60D
                                      HEO                                                                  602

0019 69 1050 0503          N BACKW    69    105D                    WAS THERE JUST ONE SEARCH CARD           604
0503 90 07D7 D358                     9D          A                 IF NOT, JUMP AHEAD                       606

0707 69 103D 0383                     69    103D                    IF SO, WHERE DID SEARCH START            608
0383 96 D336 0188                     96          B                 D, WITH I.  I, WITH L.                   610

0336 95 0032 0012                     95 BCDEF     ABCDE           WITH I.  EXIT ACCORDING TO WHY SEARCH      612

0188 69 0114 0067          N B        69 91STX                    START ON L.  FIRST-CARD TAG )            614
0D67 24 1D5D 0358  1D50               24    1D5D    A           105D START ON L.  FIRST-CARD TAG )           616
0358 69 0211 0164          C A        69 SEN                      PRESET TO STORE AFTER PROCESSING )       618
0164 24 0117 0D20  D117               24 VAR2X               VAR2X PRESET TO STORE AFTER PROCESSING )      620
0D2D 69 0182 D085                     69 PDD06                    SAVE L FROM CARD THAT STARTED SRCH )     622
0D85 24 D238 0191  D238               24 SAVEL               SAVEL SAVE L FROM CARD THAT STARTED SRCH )    624
D191 69 0184 0D87                     69 P0008                    SAVE D  FROM CARD THAT STARTED SRCH )    626
0D87 24 004D 0193  DD40               24 SAVED               SAVED SAVE D  FROM CARD THAT STARTED SRCH )   628
D193 69 0D96 0D49                     69 DN1                      PRESET EXIT FROM BACKWARDS ROUTINE )     63D
0D49 24 0D52 02D5  DD52               24 DONE                DONE PRESET EXIT FROM BACKWARDS ROUTINE )     632
D205 65 0103 0757                     65 FINAL                    BRING BACK A SET )                       634
0757 69 D36D 0D13                     69 BRNG                     BRING BACK A SET )                       636
0013 22 0167 DD70  D167               22 XXXX1               XXXX1 BRING BACK A SET )                      638
0070 65 80D1 0327                     65    8DD1                  BRING BACK A SET )                       64D
0327 16 DD38 0243                     16 16THX     LOOP           BRING BACK A SET )                       642

0360 69 9999 8DD3          J BRNG     69    9999      80D3        BRING BACK A SET )                       644

D243 10 D146 8DD2          N LOOP     1D              8D02        BRING BACK A SET )                       646

D146 24 D155 D408  D155    J          24 R00D5     X         RD005 BRING BACK A SET )                      648
D4D8 11 D261 0265            X        11 Q                        BRING BACK A SET )                       65D
D265 16 0038 D293                     16 16THX                    BRING BACK A SET )                       652
D293 44 0347 D248                     44          OUT             BRING BACK A SET )                       654

D347 10 0250 80D2                     10 QS            8002       BRING BACK A SET )                       656

0248 2D 0553 0256  D553    N OUT      2D VAR                 VAR   STORE VARIABLE ORDER                     658
D256 69 0D09 0D39                     69          SUB14           GET OP. C.I., TAGS, OPTIM, ALOPT.        66D

0009 65 0553 09D7          J          65 VAR                      IS THIS LAST SET )                       662
D907 16 041D 0315                     16 QF                       IS THIS LAST SET )                       664
0315 45 0468 0319                     45 NO                       D, NO.  I, YES.                          666
D319 69 1D3D D433                     69    1D3D                  IF SO, WHERE DID SEARCH START            668
D433 96 0386 0288                     96          L               D, WITH I.  I, WITH L.                   67D

D386 69 D189 D142                     69          SUBR6           PROCESS I BACKWARD                       672

0189 69 0238 0241          J          69 SAVEL                    BRING BACK L AND D )                     674
0241 24 0182 0135  D182               24 PODD6               P0006 BRING BACK L AND D )                    676
0135 69 DD40 0343                     69 SAVED                    BRING BACK L AND D )                     678
D343 24 0184 0137  D184               24 PDDD8     ENDED     PD008 BRING BACK L AND D )                    68D

D288 69 0137 0D9D          N L        69 ENDED                    WITH L.  ALTER EXIT )                    682
D090 24 0052 0468  D052               24 DONE      NO        DONE  WITH L.  ALTER EXIT )                   684
D468 69 D197 030D          C NO       69 ALOPT                    IS D AN ACTUAL ADDRESS                   686
D300 95 0603 0255                     95 SHX                      D, NO.  I, YES.                          688
D255 6D D153 0957                     6D RDD03                    BRING ALPHABETIC I                       69D
D957 69 046D D063                     69          SUBR9           ANALYZE I, FOR TYPE OF ADDRESS           692

D46D 65 D197 0520          J          65 ALOPT     XDDD3           MULTIPLE EXIT, ACCORDING TO KIND         694

D522 15 D075 0329          R X0005    15 13RD      X1              8DDX.  CALL IT UNFIXED                   696

0518 15 D075 D329          R XDDD1    15 13RD      X1              ADDRESS N G.  CALL UNFIXED               698

D519 69 1D50 D653          R X0002    69    1D50                  BLANK ADDRESS. IS THIS FIRST CARD        7D0
0653 9D 0329 0521                     90 X1        XDD04            FIRST, UNFIXED.  OTHER, FIXED.          7D2

D52D DD DD0D D329          R XDDD3    DD    DDDD   X1              DRUM, OLD SYMB, REG. FIXED               704

D521 15 0D75 0329          R XD0D4    15 13RD      X1              NEW SYMBOL. UNFIXED                      706

0523 0D 0DD0 0519          R XD0D6    D0    DDDD   X0002           CORE.  TREAT SAME AS BLANK               7D8
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0524 00 0000 0329          R X0007    00    0000    X1            OTHER ADDRESS.  FIXED                                  710
0329 20 0197 0350  0197    C X1       20 ALOPT                  ALOPT STORE MODIFIED ALOPT                             712
0350 60 0152 1057                     60 R0002                        ALPHABETIC D. TO SEE WHETHER FIXED               714
1057 69 0510 0063                     69          SUBR9               ANALYZE D                                        716

0510 65 0197 0527          J          65 ALOPT    X0010               MULTIPLE EXIT                                    718

0529 15 0132 0187          R X0012    15 12NDX    X2                  800X ADDRESS.  UNFIXED                           720

0525 15 0132 0187          R X0008    15 12NDX    X2                  D IS N G.  CALL UNFIXED                          722

0526 69 1050 0703          R X0009    69    1050                      BLANK.  IS THIS FIRST CARD                       724
0703 90 0187 0528                     90 X2       X0011               NO. FIXED.  YES. UNFIXED.                        726

0527 00 0000 0081          R X0010    00    0000    F                 OLD SYMBOL. DRUM. REGION.  FIXED                 728

0528 15 0132 0187          R X0011    15 12NDX    X2                  NEW SYMBOL.  UNFIXED                             730

0530 91 0526 0525          R X0013    91 X0009    X0008               CORE.  BRANCH. LIKE BLANK. ARITH. UNF            732

0531 01 0666 0531          R X0014    01    0666  X0014               OTHER.  ERROR.  SHOULD NOT BE HERE.             734

0187 20 0197 0081  0197    N X2       20 ALOPT    F             ALOPT STORE MODIFIED ALOPT                             736
0081 91 0034 0436          C F        91 XX8                          MULTIPLE BRANCH ACCORDING TO TAGS )              738
0436 99 0140 0291                     99          MISC                MULTIPLE BRANCH ACCORDING TO TAGS )              740

0140 98 0291 0145                     98 MISC     899                 MULTIPLE BRANCH ACCORDING TO TAGS )              742

0034 99 0338 0239          N XX8      99          9X8                 MULTIPLE BRANCH ACCORDING TO TAGS )              744

0338 98 0341 0393                     98 888      898                 MULTIPLE BRANCH ACCORDING TO TAGS )              746

0261 20 0151 0408  0151    Q Q        24 R0001    X             R0001 COMPARISON CONSTANT FOR END OF SET               748

0250 20 0150 0408  0150    Q QS       24 R0000    X             R0000 RESTORE COMPARISON CONSTANT AND MODIFY           750

0410 69 1124 8003          Q QF       69 S0000        8003                                                             752

0075 00 1000 0000          K 13RD     00    1000      0000                                                           754


                                      FIXED I. OR BOTH UNFIXED. ARITHMETIC                                            756

0291 69 0194 0142          N MISC     69          SUBR6               PROCESS I BACKWARDS                              758

0194 69 0397 0400          J          69 LNM      SUBR5               PROCESS D BACKWARDS                              760

0397 69 0052 0305          J LNM      69 DONE     SUBR4               PROCESS L BACKWARDS                              762


                                      SHIFT OR INDEXING OPERATION                                                     764

0603 69 0306 0045          N SHX      69          SUB20               PROCESS D FORWARDS                               766

0306 69 0397 0142          J          69 LNM      SUBR6               PROCESS I BACKWARDS                              768


                                      UNFIXED I. FIXED D. ARITHMETIC                                                  770

0145 69 0298 0400          N 899      69          SUBR5               PROCESS D BACKWARDS                              772

0298 69 0101 0018          J          69          SUB21               PROCESS I FORWARDS                               774

0101 65 0397 0201          J          65 LNM      SUB22                  SAVE ORCEQ                                    776


                                      UNFIXED I. FIXED D. BRANCH OPERATION                                            778

0393 69 0196 0400          N 898      69          SUBR5               PROCESS D BACKWARDS                              780

0196 69 0149 0305          J          69          SUBR4               PROCESS L BACKWARDS                              782

0149 69 0102 0018          J          69 LN       SUB21               PROCESS I FORWARDS                               784

0102 65 0052 0201          J LN       65 DONE     SUB22                  SAVE ORCEQ                                    786


                                      UNFIXED D. BRANCH OPERATION                                                     788

0239 69 0192 0142          N 9X8      69          SUBR6               PROCESS I BACKWARDS                              790
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0192 69 0195 0305          J          69            SUBR4           PROCESS L BACKWARDS                                  792

0195 69 0102 0045          J          69 LN         SUB20           PROCESS D FORWARDS                                   794



                                                FIXED D AND I, BRANCH OPERATION                                         796

0341 69 1679 0232          N 888      69 BLANB                                SAVE IN CASE I IS BLANK                  798
0232 24 0235 0388  0235               24 T1                         T1        SAVE IN CASE I IS BLANK                  800
0388 69 0391 0244                     69 ORCEB                                SAVE IN CASE I IS CORE )                 802
0244 24 0447 0450  0447               24 T2                         T2        SAVE IN CASE I IS CORE )                 804
0450 65 0197 0251                     65 ALOPT                                ALOPT TO LOWER                           806
0251 16 0254 0059                     16 11STX                                CHANGE ITS FIRST DIGIT TO 8              808
0059 20 0197 0500  0197               20 ALOPT                      ALOPT     STORE MODIFIED ALOPT                     810
0500 69 0753 0400                     69            SUBR5                     PROCESS D BACKWARDS                      812

0753 69 0356 0305          J          69            SUBR4           PROCESS L BACKWARDS FROM O                       814

0356 65 0109 0113          J          65            SSB             BRING BACK BLANB AND ORCEB                       816

0109 65 0062 0217          J          65 OPREG                                SAVE DYNAMIC LEVEL OF L FROM O )         818
0217 14 0320 1036                     14 50IXX                                SAVE DYNAMIC LEVEL OF L FROM D )         820
1036 21 1091 1094  1091               21 OLO                        OLO       SAVE DYNAMIC LEVEL OF L FROM O )         822
1094 65 0197 0301                     65 ALOPT                                MODIFY TO USE ROUTINE FOR UNFIXED O )    824
0301 15 0132 0237                     15 12NOX                                MODIFY TO USE ROUTINE FOR UNFIXED D )    826
0237 20 0197 0550  0197               20 ALOPT                      ALOPT     MODIFY TO USE ROUTINE FOR UNFIXED D )    828
0550 69 0953 0142                     69            SUBR6                     PROCESS I BACKWARDS                      830

0953 69 0406 0305          J          69            SUBR4           PROCESS L BACKWARDS FROM I                       832

0406 65 0062 0267          J          65 OPREG                                WHICH L IS LESS, MEASURED ON CIRCLE )    834
0267 14 0320 1080                     14 50IXX                                WHICH L IS LESS, MEASURED ON CIRCLE )    836
1080 65 8003 1038                     65    8003                              WHICH L IS LESS, MEASURED ON CIRCLE )    838
1038 16 1091 0245                     16 DLO                                  WHICH L IS LESS, MEASURED ON CIRCLE )    840
0245 46 0348 0199                     46 AEB                                  WHICH L IS LESS, MEASURED ON CIRCLE )    842
0199 16 0202 1107                     16 25IXX      BOT                       WHICH L IS LESS, MEASURED ON CIRCLE )    844

0348 15 0202 1107          N AEB      15 25IXX      BOT             WHICH L IS LESS, MEASURED ON CIRCLE )            846
1107 46 0560 0311          C BOT      46            2NO             D, WE WILL USE ONE MEASURED FROM D               848

0560 65 0163 0113                     65            SSB             BRING BACK BLANB AND ALOPT ONCE MORE             850

0163 69 0066 0400          J          69            SUBR5           PROCESS BACKWARDS O ONCE MORE                    852

0066 65 0197 0351          J          65 ALOPT                                MODIFY ALOPT AGAIN )                     854
0351 16 0132 0287                     16 12NOX      XY                        MODIFY ALOPT AGAIN )                     856
0287 15 0254 0209          C XY       15 11STX                                MODIFY ALOPT AGAIN )                     858
0209 20 0197 0397  0197               20 ALOPT      LNM             ALOPT     STORE NEW ALOPT, AND JUMP BACK           860

0311 65 0214 0113          N 2ND      65            SSB             USE I-COMP.  BRING BLANB AND ORCEB               862

0214 69 0317 0142          J          69            SUBR6           PROCESS I BACKWARDS AGAIN                        864

0317 65 0197 0287          J          65 ALOPT      XY              BRING ALOPT, AND JUMP BACK                       866

0113 69 0235 0438          N SSB      69 T1                                   SPEC. SUBR.  BRING BACK BLANB + ORCEB    868
0438 24 1679 0282  1679               24 BLANB                      BLANB     SPEC. SUBR.  BRING BACK BLANB + ORCEB    870
0282 69 0447 0600                     69 T2                                   SPEC. SUBR.  BRING BACK BLANB + ORCEB    872
0600 24 0391 8002  0391               24 ORCEB         8002         ORCEB     SPEC. SUBR.  BRING BACK BLANB + ORCEB    874

0096 65 0117 0321          J ONI      65 VAR2X                                ALL CASES.  STORE PROCESSED CARD )       876
0321 10 0024 8003                     10                8003                  STORE PROCESSED CARD )                   878

0024 69 0186 8002          J          69 P0010          8002                  STORE PROCESSED CARD )                   880

0211 24 1199 0252  1199    J SEN      24 SMAXM                      SMAXM     STORE PROCESSED CARD )                   882
0252 11 0355 0259                     11 O2                                   STORE PROCESSED CARD )                   884
0259 16 0038 0443                     16 16THX                                STORE PROCESSED CARD )                   886
0443 44 0497 0398                     44            OUT2                      STORE PROCESSED CARD )                   888

0497 10 0650 8003                     10 QS2            8003                  STORE PROCESSED CARD )                   890

0398 20 0117 0570  0117    N OUT2     20 VAR2X                      VAR2X     STORE PROCESSED CARD )                   892
0570 65 0553 0243                     65 VAR        LOOP                      BRINGING ORDER.  BACK FOR ANOTHER CARD   894

0355 69 0182 8002          Q O2       69 P0006          8002                  COMPARISON CONSTANT FOR END OF SET        896

0650 69 0181 8002          Q QS2      69 P0005          8002                  RESTORE CONSTANT AND MODIFY              898



                                                BACKWARDS PUNCH                                                         900
                                   HED                                                                                  902

0137 65 0117 0571          J ENDED    65 VAR2X                                MAKE NEW BRINGING ORDER )                904
0571 69 0074 0377                     69 BRNG                                 MAKE NEW BRINGING ORDER )                906
0377 22 0167 0620  0167               22 XXXX1      LOOP            XXXX1     MAKE NEW BRINGING ORDER )                908
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0620 60 0673 0057          C LOOP     60           SB10A          TO SUB 10A TO PUNCH ONE CARD                    910

0673 65 0167 0621          J          65 XXXX1                    BRING BACK A SET OF RESUTTS )                   912
0621 16 0174 0379                     16 OL                       BRING BACK A SET OF RESULTS )                   914
0379 45 0332 0483                     45           OVR            BRING BACK A SET OF RESULTS )                   916

0332 15 8001 0289                     15    8001                  BRING BACK A SET OF RESULTS )                   918
0289 10 0242 0547                     10 SEND      A              BRING BACK A SET OF RESULTS )                   920
0547 15 0038 8002          C A        15 16THX         8002       BRING BACK A SET OF RESULTS )                   922

0074 69 9999 8003          J BRNG     69    9999       8003      BRING BACK A SET OF RESULTS )                   924

0242 24 0182 0285  0182    J SEND     24 P0006     X        P0006 BRING BACK A SET OF RESULTS )                   926
0285 11 0488 0493            X        11 O                        BRING BACK A SET OF RESULTS )                   928
0493 44 0597 0448                     44           OUT            BRING BACK A SET OF RESULTS )                   930

0597 10 0700 0547                     10 OS        A              BRING BACK A SET OF RESULTS )                   932

0448 20 0167 0620  0167    N OUT      20 XXXX1     LOOP     XXXX1 STORE MODIFIED BRINGING ORDER + REPEAT          934

0483 69 0486 0339          N OVR      69 SAVOR                    FINISHED.  SAVE SAVOR AS ORCED )                936
0339 24 0292 0003  0292               24 ORCED     READC    ORCED FINISHED.  SAVE SAVOR AS ORCED )                938

0488 24 0186 0285  0186    O O        24 P0010     X        P0010                                                  940

0700 24 0187 0285  0187    O OS       24 P0011     X        P0011                                                  942

0174 69 1199 8003          O QL       69 SMAXM         8003                                                       944



                                                SUBROUTINE 1.  INITIALIZE AT START OF A PROGRAM                 946
                                   HED                                                                          948

0006 24 0178 0231  0178    N SUBR1    24 EXITY                 EXITY STORE EXIT                               950
0231 61 0134 8003                     61               8003          CLEAR REGION AND SYMBOL TABLES )            952

0134 20 1897 0302  1899    J          20 ZMAX1                 ZMAX1 CLEAR REGION AND SYMBOL TABLES )         954
0302 10 0405 0309                     10 QA                         CLEAR REGION AND SYMBOL TABLES )            956
0309 46 0112 0213                     46           OUT              CLEAR REGION AND SYMBOL TABLES )            958

0112 11 0365 8003                     11 QSA           8003         CLEAR REGION AND SYMBOL TABLES )            960

0213 20 0181 0234  0181    N OUT      20 P0005                 P0005 CLEAR CARD NUMBER                          962
0234 69 1044 0647                     69 81STX                      PRESET DRUM TAG )                           964
0647 24 1669 0072  1669               24 DRUMT                 DRUMT PRESET DRUM TAG )                        966
0072 65 0175 0429                     65 AVAL                       MAKE DRUM AVAILABLE )                       968
0429 10 0382 8003                     10               8003         MAKE DRUM AVAILABLE )                       970

0382 20 1554 1307  1554    J          20 A0200                 A0200 MAKE DRUM AVAILABLE )                      972
1307 11 0610 0415                     11 QB                         MAKE DRUM AVAILABLE )                       974
0415 46 0178 0569                     46 EXITY                      MAKE DRUM AVAILABLE )                       976
0569 10 0322 8003                     10 QSB           8003         MAKE DRUM AVAILABLE )                       978

0405 20 1661 0000  1661    Q QA       20 G0002         0000 G0002 COMPARISON CONSTANT                            980

0365 20 1660 0000  1660    Q QSA      20 G0001         0000 G0001 RESTORE COMPARISON CONSTANT AND MODIFY         982

0610 20 1356 0000  1356    Q QB       20 A0002         0000 A0002 COMPARISON CONSTANT                            984

0322 20 1355 0000  1355    Q QSB      20 A0001         0000 A0001 RESTORE COMPARISON CONSTANT AND MODIFY         986

0175 11 1111 1111          K AVAL     11    1111       1111       AVAILABILITY WORD                              988



                                                SUBROUTINE 2.  RESERVE OR UNRESERVE A BLOCK OF DRUM             990
                                   HED                                                                          992
                                   EQU SA           HSYMB         DOUBLE-PURPOSE TO CONSERVE DRUM SPACE          994

0750 21 0304 0458  0304    R XX       21 UH                UH     REPLACE DIGIT OF AVAIL. WORD BY W )            998
0458 35 0001 0465                     35    0001                 REPLACE DIGIT OF AVAIL. WORD BY W )            1000
0465 65 8002 0723                     65    8002                 REPLACE DIGIT OF AVAIL. WORD BY W )            1002
0723 10 0326 0281                     10 W                       REPLACE DIGIT OF AVAIL. WORD BY W )            1004
0281 30 0001 0337                     30    0001                 REPLACE DIGIT OF AVAIL. WORD BY W )            1006
0337 10 0304 0359                     10 UH          SPR         REPLACE DIGIT OF AVAIL. WORD BY W )            1008

0900 65 1003 0508          R    0900  65 N                       HAVE WE FINISHED                               1010
0508 45 0162 0178                     45           EXITY          D, WE HAVE NOT FINISHED.  I, WE HAVE.          1012

0162 16 0515 0619                     16 110TH                   REDUCE NUMBER YET TO BE DONE )                 1014
0619 20 1003 0456  1003               20 N                  N    REDUCE NUMBER YET TO BE DONE )                 1016
0456 60 0108 0263                     60 SA                      ARE WE TO LAST LINE OF TABLE )                 1018
0263 11 0116 0671                     11 796                     ARE WE TO LAST LINE OF TABLE )                 1020
0671 46 0324 0225                     46           TP            D, NOT LAST LINE.                              1022

0324 10 0427 0331                     10 800         SU          RESTORE, AND TAKE WORD FROM NEXT LINE          1024
0331 21 0108 0361  0108    C SU       21 SA                  SA  STORE VARIABLE STORING ORDER                   1026
0361 10 0264 8003                     10 C4            8003      MAKE VARIABLE BRINGING ORDER                   1028
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1025 24 0178 0381  0178   N SUB2R    24 EXITY                EXITY ENTRY TO RESERVE.  STORE EXIT.                    1030
0381 69 1680 0533                     69 ZEROX      RU              BRING ZERO TO INOICATE RESERVATION              1032

1075 24 0178 0431  0178   N SUB2U    24 EXITY                EXITY ENTRY TO UNRESERVE.  STORE EXIT.                  1034
0431 69 0515 0533                     69 110TH      RU              BRING UNITY TO INOICATE UNRESERVATION           1036
0533 24 0326 0479  0326   C RU       24 W                    W     STORE 0 OR 1                                    1038
0479 21 0284 0387  0284              21 XXXXA                XXXXA STORE INITIAL AOORESS TO BE RESERVEO            1040
0387 20 1003 0506  1003              20 N                    N     STORE N-1                                       1042
0506 11 0409 0313                    11 2000I                      IS INITIAL AOORESS LESS THAN 2000               1044
0313 46 0166 0178                    46           EXITY            I, OVER 1999.  WE RESERVE NOTHING               1046

0166 10 1003 0558                    10 N                          UPPER, LAST AOORESS - 2000                      1048
0558 46 0411 0212                    46 OK                         I, LAST ONE WOULO BE OVER 1999                  1050
0212 16 8003 0669                    16    8003                    MOOIFY TO ENO WITH 1999 )                       1052
0669 16 0515 0719                    16 110TH                      MOOIFY TO ENO WITH 1999 )                       1054
0719 20 1003 0411  1003              20 N          OK        N     MOOIFY TO ENO WITH 1999 )                       1056
0411 60 0284 0389         C OK       60 XXXXA                      MAKE SEVERALVARIABLE OROERS )                   1058
0389 10 8001 0295                    10    8001                    MAKE SEVERAL VARIABLE OROERS )                  1060
0295 30 0003 1053                    30    0003                    MAKE SEVERAL VARIABLE OROERS )                  1062
1053 21 0658 0461  0658              21 X                    X     MAKE SEVERAL VARIABLE OROERS )                  1064
0461 11 8001 0367                    11    8001                    MAKE SEVERAL VARIABLE OROERS )                  1066
0367 35 0001 0773                    35    0001                    MAKE SEVERAL VARIABLE OROERS )                  1068
0773 21 0228 0481  0228              21 P                    P     MAKE SEVERAL VARIABLE OROERS )                  1070
0481 11 8001 0437                    11    8001                    MAKE SEVERAL VARIABLE OROERS )                  1072
0437 35 0002 0543                    35    0002                    MAKE SEVERAL VARIABLE OROERS )                  1074
0543 10 8003 0401                    10    8003                    MAKE SEVERAL VARIABLE OROERS )                  1076
0401 10 0658 0363                    10 X                          MAKE SEVERAL VARIABLE OROERS )                  1078
0363 15 0228 0583                    15 P                          MAKE SEVERAL VARIABLE OROERS )                  1080
0583 35 0004 0593                    35    0004                    MAKE SEVERAL VARIABLE OROERS )                  1082
0593 69 0246 0249                    69 C1                         MAKE SEVERAL VARIABLE OROERS )                  1084
0249 22 0901 0354  0901              22    0901            0901    MAKE SEVERAL VARIABLE OROERS )                  1086
0354 69 0708 0511                    69 C2                         MAKE SEVERAL VARIABLE OROERS )                  1088
0511 22 0359 0262  0359              22 SPR                  SPR   MAKE SEVERAL VARIABLE OROERS )                  1090
0262 10 0565 0331                    10 C3         SU              MAKE SEVERAL VARIABLE OROERS )                  1092

0225 65 0359 0413         N TP       65 SPR                        BOTTOM LINE OF TABLE                            1094
0413 16 0708 0463                    16 C2                         IS IT ALSO RIGHT ENO OF WORO                    1096
0463 45 0216 0417                    45           ZP               0, NO                                           1098

0216 15 0769 0973                    15 C5                         MOOIFY TO TAKE NEXT COLUMN OF TABLE )           1100
0973 69 0246 0299                    69 C1                         MOOIFY TO TAKE NEXT COLUMN OF TABLE )           1102
0299 22 0901 0404  0901              22    0901            0901    MOOIFY TO TAKE NEXT COLUMN OF TABLE )           1104
0404 20 0359 0312  0359              20 SPR                  SPR   MOOIFY TO TAKE NEXT COLUMN OF TABLE )           1106
0312 60 0108 0513                    60 SA                         MOOIFY TO TAKE FIRST LINE, SAME COLUMN          1108
0513 11 0266 0331                    11 C6         SU              MOOIFY TO TAKE FIRST LINE, SAME COLUMN          1110

0417 69 0246 0349         N ZP       69 C1                         LAST LINE ANO ENO OF WORO.  MOOIFY )            1112
0349 24 0901 0454  0901              24    0901            0901    LAST LINE ANO ENO OF WORO.  MOOIFY )            1114
0454 69 0758 0561                    69 C7                         LAST LINE ANO ENO OF WORO.  MOOIFY )            1116
0561 24 0359 0362  0359              24 SPR                  SPR   LAST LINE ANO ENO OF WORO.  MOOIFY )            1118
0362 60 0108 0563                    60 SA                         LAST LINE ANO ENO OF WORO.  MOOIFY )            1120
0563 11 0316 0331                    11 C8         SU              LAST LINE ANO ENO OF WORO.  MOOIFY )            1122

0246 35 0000 0750         P C1       35    0000    XX              TO PRESET LEFT SHIFT OROER                      1124

0708 30 0009 0108         P C2       30    0009    SA              PRESETTER ANO ALSO COMPARISON CONSTANT          1126

0565 20 1355 0900  1355   P C3       20 A0001        0900  A0001   INITIAL OF STORING OROER                        1128

0264 45 0000 0001         P C4       45    0000      0001          OIFFERENCE OF BRINGING ANO STORING ORO          1130

0116 20 1551 0900  1551   Q 796      20 A0197        0900  A0197   COMPARISON CONSTANT FOR LAST LINE               1132

0427 20 1555 0900  1555   Q 800      20 A0201        0900  A0201   TO RESTORE FOR NEXT LINE OF TABLE               1134

0769 30 0010 0108         O C5       30    0010    SA              TO RESTORE AFTER SUBTRACTING C2                 1136

0266 00 0196 0000         P C6       00    0196      0000          TO MOOIFY BRINGING OROER FOR NEXT COL           1138

0758 30 0000 0108         P C7       30    0000    SA              PRESETTER FOR START OF NEW COLUMN               1140

0316 00 0195 0000         P C8       00    0195      0000          MOOIFY BRINGING OROER TO START NEW COL          1142



                                        SUBR 3  FINO WHETHER AOOR IN UPPER IS FIXEO                               1144
                                  HEO                                                                             1146

0061 24 0177 0030  0177   N SUBR3    24 EXITX                EXITX STORE EXIT                                      1148
0030 69 0633 0063                     69           SUBR9            TO SUBROUTINE 9 TO ANALYZE THE AOORESS          1150

0633 65 0536 0220         J          65 EQUIV      F0003           BRING EQUIV ANO MULTIBRANCH                     1152

0218 60 0068 0177         R F0001    60 810TH      EXITX           AOORESS IS N G                                  1154

0219 65 0068 0177         R F0002    65 810TH      EXITX           BLANK AOORESS                                   1156

0220 65 1680 0177         N F0003    65 ZEROX      EXITX           ORUM AOORESS, OR EQUIVALENT TO ORUM             1158

0221 65 0068 0177         R F0004    65 810TH      EXITX           SYMBOLIC AOORESS, WITH UNOEFINEO SYMB           1160
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0222 35 0005 0177          R F0005    35    0005   EXITX          800X ADDRESS                                          1162

0223 65 0068 0177          R F0006    65 810TH     EXITX          CDRE ADDRESS                                          1164

0224 60 0068 0177          R F0007    60 810TH     EXITX          OTHER ADDRESS.  USUALLY PART DF CONST.                1166


                                                 SUBR 4  PRDCESS BACKWARDS L                                         1168
                                          HED                                                                        1170.

0305 24 0177 0080  0177    N SUBR4    24 EXITX              EXITX STDRE EXIT                                         1172
0080 60 0151 0455                     60 R0001                    ALPHABETICAL L INTD UPPER                        1174
0455 69 0908 0063                     69 PRE       SUBR9          ANALYZE THE ADDRESS                              1176

0908 65 0536 0271          J PRE      65 EDUIV     M0004          EQUIVALENT TD LDWER.  MULTIBRANCH                1178

0268 20 1679 0271  1679    N M0001    20 BLANB     M0004    BLANB STORE EDUIVALENT DF BLANK ADDRESS                1180

0269 60 0622 0627          R M0002    60 87THX     SB10B          N. G.  DMIT PUNCHING                             1182

0270 69 1044 0697          R M0003    69 81STX                    BLANK.  CHANGE FIRST-CARD TAG )                  1184
0697 24 1050 1103  1050               24    1050            1050        CHANGE FIRST-CARD TAG )                    1186
1103 65 0556 0611                     65           SUB11          FIND BEST EQUIVALENT TD BLANK                    1188

0556 00 0989 0268                     00    0989   M0001          TAGS AND EXIT FOR SUBRDUTINE 11                  1190

0271 20 018' 0335  0182    N M0004    20 P0006     SB10C    P0006 DRUM ADDRESS.  STDRE FDR PUNCHING                1192

0272 65 0325 0611          R M0005    65           SUB11          NEW SYMBDL.  FIND BEST EDUIVALENT                1194

0325 00 0989 0276          J          00    0989   M0009          TAGS AND EXIT FOR USE IN SUBROUTINE 11           1196

0273 01 0555 0273          R M0006    01    0555   M0006          800X ADDRESS.  STDP THE MACHINE                  1198

0274 20 0182 0385  0182    R M0007    20 P0006              P0006 CORE ADDRESS.  STDRE FDR PUNCHING                1200
0385 69 0538 0441                     69           SUB13          FIND DYNAMIC LEVEL DF CDRE ADDRESS               1202

0538 00 0909 0342          J          00    0909                  TAGS AND EXIT FDR USE IN SUBR 13                 1204
0342 20 0391 0335  0391               20 ORCEB     SB10C    DRCEB STORE DYNAMIC LEVEL OF CORE ADDRESS              1206

0275 01 0555 0275          R M0008    01    0555   M0008          DTHER ADDRESS.  STDP MACHINE                     1208

0276 69 0197 0950          N M0009    69 ALOPT                    EDUIV OF NEW SYMBDL.                             1210
0950 90 0271 0505                     90 M0004                    D, CASE WHERE WE DUPLICATE COMPUTATION           1212
0505 69 0908 0661                     69 PRE       SUBR7          USUAL CASE.  STORE SYMBOL AND EQUIV              1214

0277 00 0000 0269          R M0010    00    0000   M0002          NEW SYMBOL, BUT SYMBOL TABLE FULL                1216


                                                 SUBROUTINE 5   PROCESS BACKWARDS D                                 1218
                                          HED                                                                        1220

0400 24 0177 0230  0177    N SUBR5    24 EXITX              EXITX STORE EXIT                                         1222
0230 60 0152 0958                     60 R0002                    ALPHABETIC D INTO UPPER                          1224
0958 69 0711 0063                     69 PRE       SUBR9          ANALYZE THE ALPHABETIC D ADDRESS                 1226

0711 65 0536 0921          J PRE      65 EQUIV     C0004          BRING EQUIVALENT.  MULTIBRANCH                   1228

0918 20 1023 0376  1023    N C0D01    20 BLANK     A        BLANK STORE EQUIV OF BLANK FOR FORWARD L               1230

0919 60 0672 0627          R C0002    60 88THX     SB10B          N G.  OMIT PUNCHING                              1232

0920 69 1050 1353          R C0003    69    1050                  BLANK ADDRESS. WAS THERE BLANK BACK L            1234
1353 90 1008 1058                     90           BB1            D, THERE WAS A BLANK BACKWARDS L                 1236

1008 65 1679 0376                     65 BLANB     A              BRING EDUIVALENT OF BLANK BACKWARD L             1238

1058 65 0761 0611          N BB1      65           SUB11          GET BLANK D DYNAMICALLY FROM I                   1240

0761 00 0988 0918          J          00    0988   C0001          TAGS AND EXIT FOR SUBROUTINE 11                  1242

0921 69 0624 0677          N C0004    69           INDEX          DRUM OR EDUIVALENT.  INDEX IF TAGGED             1244

0624 00 0000 0376          J          00    0000   A              TAG-IDENTIFICATIDN, AND EXIT FRDM 18             1246

0922 65 0625 0611          R C0005    65           SUB11          NEW SYMBOL.  FIND BEST EQUIVALENT                1248

0625 00 0988 0926          J          00    0988   C0009          EXIT AND TAGS FOR SUBROUTINE 11                  1250

0923 69 0426 0441          R C0006    69           SUB13          800X ADDRESS.  GET DYNAMIC LEVEL                 1252

0426 00 0908 0280          J          00    0908                  TAGS AND EXIT FOR SUBROUTINE 13                  1254
0280 69 0683 0586                     69           SUB17          CORRECTION TO DYNAMIC LEVEL                      1256

0683 66 8002 0491          J          66    8002                  CHANGE SIGN OF CORRECTION                        1258
0491 15 0294 0335                     15 XXXX2     SB10C          ADD TO GIVE MODIFIED DYNAMIC LEFEL               1260

0924 69 0727 0677          R C0007    69           INDEX          CORE ADDRESS.  INDEX IT                          1262
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0727 00 0000 0631          J          00    0000                    ADDEND AND EXIT FOR SUBROUTINE 18                    1264
0631 20 0184 0487  0184               20 P0008                P0008 STORE CORE ADDRESS FOR PUNCHING                      1266
0487 69 0190 0441                     69          SUB13             GET DYNAMIC LEVEL OF CORE ADDRESS                    1268

0190 00 0908 0344          J          00    0908                    TAGS AND EXIT FOR SUBROUTINE 13                      1270
0344 69 1050 0504                     69    1050                    FIRST-CARD TAG                                       1272
0504 90 0335 0459                     90 SB10C                      D, WE SHOULD STORE THIS DYNAMIC LEVEL                1274
0459 20 0486 0335  0486               20 SAVOR      SB10C     SAVOR STORE DYN LEV OF CORE, AND FINISH UP                 1276

0376 20 0062 0925  0062    N A        20 OPREG      C0008     OPREG STORE ADDRESS FOR OPTIMIZING NEXT ADDR               1278
0925 20 0184 0177  0184    R C0008    20 P0008      EXITX     P0008 MISC ADDR.  STORE FOR PUNCHING.  EXIT              1280

0926 69 0711 0661          N C0009    69 PRE        SUBR7           STORE EQUIVALENT OF NEW SYMBOL                       1282

0927 00 0000 0919          R C0010    00    0000    C0002           NEW SYMBOL, BUT TABLE FULL.  N.G.                    1284


                                                SUBROUTINE 6   PROCESS BACKWARDS I                                      1286
                                      HED                                                                            1288

0142 24 0177 0330  0177    N SUBR6    24 EXITX                    EXITX STORE EXIT                                     1290
0330 60 0153 1108                     60 R0003                          ALPHABETIC I TO UPPER                        1292
1108 69 0911 0063                     69 PRE        SUBR9               ANALYZE ALPHABETIC I                         1294

0911 65 0536 0371          J PRE      65 EQUIV      J0004               BRING EQUIVALENT.  MULTIBRANCH               1296

0368 69 0911 0661          N J0001    69 PRE        SUBR7               STORE EQUIVALENT OF NEW SYMBOL               1298

0369 60 0722 0627          R J0002    60 89THX      SB10B               N.G.  OMIT PUNCHING                          1300

0370 69 1669 0772          R J0003    69 DRUMT                          BLANK I, IS DRUM FULL                        1302
0772 90 0626 0369                     90            J0002               D, DRUM IS NOT FULL                          1304

0626 65 1679 0371                     65 BLANB      J0004               BRING EQUIVALENT OF BLANK BACKWARD L          1306
0371 24 0062 0615  0062    N J0004    24 OPREG                  OPREG DRUM OR DRUM EQUIVALENT                        1308
0615 69 0568 0677                     69            INDEX               TO SUBROUTINE 18 TO INDEX                    1310

0568 00 0001 0375          J          00    0001    J0008               ADDEND AND EXIT FOR SUBROUTINE 18            1312

0372 65 0675 0611          R J0005    65            SUB11               NEW SYMBOL.  FIND BEST VALUE                 1314

0675 00 0990 0368          J          00    0990    J0001               TAGS AND EXIT FOR SUBROUTINE 11              1316

0373 01 0000 0373          R J0006    01    0000    J0006               800X RANGE.  ERROR.                          1318

0374 69 0391 0371          R J0007    69 ORCEB      J0004               CORE.  BRING DYNAMIC LEVEL                   1320

0375 20 0185 0177  0185    R J0008    20 P0009      EXITX     P0009 OTHER ADDRESS, USUALLY A CONSTANT                    1322


                                                SUBROUTINE 7  STORE SYMBOL AND ITS EQUIVALENT                          1324
                                      HED                                                                            1326

0661 24 0179 0432  0179    N SUBR7    24 EXITZ                    EXITZ STORE EXIT                                     1328
0432 65 0435 0439                     65 LSYMB                          SYMBOL-STORING ORDER )                       1330
0439 15 0392 0747                     15 SS                             SYMBOL-STORING ORDER )                       1332
0747 69 0108 8002                     69 HSYMB          8002            STORE SYMBOL )                               1334

0392 24 1689 0442  1689    J SS       24 Z0001                    Z0001 STORE SYMBOL )                               1336
0442 65 0435 0489                     65 LSYMB                          LOCATION OF EQUIVALENT RELATIVE TO E1        1338
0489 14 0492 1029                     14 2DXXX                          LOCATION OF EQUIVALENT RELATIVE TO E1        1340
1029 35 0004 1039                     35    0004                        LOCATION OF EQUIVALENT RELATIVE TO E1        1342
1039 20 0294 0797  0294               20 XXXX2                  XXXX2 LOCATION OF EQUIVALENT RELATIVE TO E1         1344
0797 15 1000 0555                     15 P1                             MAKE BRINGING ORDER )                        1346
0555 20 0167 0670  0167               20 XXXX1                  XXXX1 MAKE BRINGING ORDER )                         1348
0670 44 1073 0674                     44 IPOS                           D, USE I-POSITION.  I, USE D-POSITION.       1350
0674 65 0536 0541                     65 EQUIV                          BRING EQUIVALENT                             1352
0541 35 0004 0451                     35    0004                        SHIFT TO D POSITION                          1354
0451 10 0554 0509                     10 P2         A                   MAKE STORING ORDER )                         1356
0509 10 0294 0167          C A        10 XXXX2      XXXX1               MAKE STORING ORDER )                         1358

1073 65 0536 0591          N IPOS     65 EQUIV                          USE I-POSITION.  BRING EQUIVALENT            1360
0591 10 0394 0509                     10 P3         A                   MAKE STORING ORDER                           1362

1000 69 1555 8003          P P1       69 E0001          8003            INITIAL OF BRINGING ORDER                    1364

0554 22 1555 0179  1555    P P2       22 E0001      EXITZ     E0001 INITIAL OF ORDER TO STORE D-POSITION                1366

0394 23 1555 0179  1555    P P3       23 E0001      EXITZ     E0001 INITIAL OF ORDER TO STORE I-POSITION                1368


                                                SUBR 8  PROCESS TYPE 2 ADDR.  ALPH IN UPPER, NUMERIC, LOWR             1370
                                      HED                                                                            1372

1024 24 0177 0380  0177    N SUBR8    24 EXITX                    EXITX STORE EXIT                                     1374
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```
0380 11 0254 0559                    11 11STX                        IS FIRST POSITION BLANK                          1376
0559 46 0412 0613                    46          FXT                 I, FIRST IS NON-BLANK.  FIXED AOORESS.           1378

0412 10 8001 0969                    10    8001                      RESTORE TO POSITIVE                              1380
0969 60 8002 0777                    60    8002                      NUMERIC AOORESS ALONE IN UPPER                   1382
0777 11 0409 0663                    11 2000I                        SUBTRACT 2000                                    1384
0663 46 0366 0467                    46          RC                  0, ORUM.  I, CORE.                               1386

0366 10 1019 1123                    10 OOIFF                        ORUM.  AOO RELOCATION AMOUNT                     1388
1123 46 0676 0977                    46          BAO                 I, RELOCATEO ORUM WILL EXCEEO 1999               1390

0676 10 0409 0713                    10 2000I    RES                 RESTORE RELOCATEO DRUM AOORESS                   1392

0467 10 8001 1223          N RC      10    8001                      CORE AOORESS.  RESTORE THE 2000                  1394
1223 10 0726 0681                    10 COIFF                        ADD RELOCATION AMOUNT                            1396
0681 11 0334 0539                    11 9060                         SUBTRACT 9060                                    1398
0539 46 0542 0977                    46          BAO                 I, RELOCATEO CORE ADORESS TOO HIGH               1400

0542 10 8001 0713                    10    8001  RES                 RESTORE THE 9060                                 1402
0713 21 0167 0720  0167   C RES      21 XXXX1                  XXXX1 STORE AOORESS TEMPORARILY                        1404
0720 69 1273 1025                    69          SUB2R               RESERVE IF ORUM ADORESS                          1406

1273 65 0167 0177          J         65 XXXX1    EXITX               EQUIVALENT BACK TO LOWER ANO EXIT                1408

0613 65 8002 0177          N FXT     65    8002  EXITX               FIXED ADDRESS.  CLEAR UPPER ANO EXIT.            1410

0977 60 0622 0177          N BAD     60 87THX    EXITX               MOOIFIEO AOOR TOO HIGH.  8000 TO UPPER           1412

0334 00 0000 9060          K 9060    00    0000      9060                                                             1414
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SUBROUTINE 9. ANALYZE AN AOORESS 1416

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                                     HEO                                                                             1418

1002 44 1005 0606          C LOOP    44          UND                 I, SYMBOL IS NOT IN THE TABLE                    1420

1005 11 0108 0763                    11 HSYMB                        SOME SYMBOL WAS FOUNO.  SUBTRACT OURS            1422
0763 44 0517 0618                    44 NZ                           0, IT WAS NOT RIGHT ONE                          1424
0618 46 0517 0972                    46 NZ       DEF                 0, IT WAS NOT RIGHT ONE . I, IT AS.              1426

0517 10 8001 1323          C NZ      10    8001                      WRONG SYMBOL.  RESTORE UPPER TO PLUS             1428
1323 65 8002 0731                    65    8002                      CLEAR UPPER                                      1430
0731 15 0384 8002                    15 T              8002          AOVANCE LOWER AND BRING ANOTHER                  1432

0063 24 0179 0482  0179    N SUBR9   24 EXITZ                EXITZ STORE EXIT                                       1434
0482 45 0636 0537                    45 ABC                          I, THE ADORESS IS BLANK                          1436
0537 61 0515 1069                    61 110TH    OON                 MOOIFY EXIT ANO PREPARE TO OUIT                  1438

0636 21 0108 0961  0108    N ABC     21 HSYMB                HSYMB AOORESS NOT BLANK.  STORE SYMBOL                   1440
0961 30 0008 0629                    30    0008                      ALSO STORE FIRST LETTER OF AOORESS )             1442
0629 21 0294 0947  0294              21 XXXX2                XXXX2 ALSO STORE FIRST LETTER OF ADORESS )             1444
0947 11 8001 0604                    11    8001                      CLEAR FIRST LETTER                               1446
0604 16 1208 0913                    16 909                          SUBTRACT 9090908995                              1448
0913 46 0416 0567                    46 SYM      LOO                 0, ADORESS IS SYMBOLIC.                          1450
0567 11 8003 0725          C LOO     11    8003                      ARE LAST FOUR CHARACTERS OIGITS )                1452
0725 45 0278 0679                    45          OUT                 ARE LAST FOUR CHARACTERS DIGITS )                1454

0278 35 0001 0485                    35    0001                      ARE LAST FOUR CHARACTERS OIGITS )                1456
0485 44 0416 0240                    44 SYM                          ARE LAST FOUR CHARACTERS OIGITS )                1458
0240 10 8001 0997                    10    8001                      ARE LAST FOUR CHARACTERS OIGITS )                1460
0997 35 0001 0567                    35    0001  LOO                 ARE LAST FOUR CHARACTERS OIGITS )                1462

0679 65 8001 0535          N OUT     65    8001                      THEY ARE OIGITS.  GET VALUE )                    1464
0535 30 0001 0641                    30    0001                      THEY ARE DIGITS.  GET VALUE )                    1466
0641 20 0536 0589  0536              20 EOUIV                EOUIV STORE THESE 4 OIGITS                             1468
0589 10 0294 0399                    10 XXXX2                        FIRST CHARACTER INTO UPPER                       1470
0399 44 0654 0704                    44          ABS                 I, ZERO.  AOORESS WAS ABSOLUTE                   1472

0654 11 1308 0963                    11 99THX                        NON-ZERO.  SUBTRACT 90                           1474
0963 46 0466 0416                    46          SYM                 I, FIRST CHAR IS OIGIT.  AOOR SYMBOLIC           1476

0466 10 1119 0724                    10 29IXX                        ADD 29                                           1478
0724 46 0416 0328                    46 SYM                          0, FIRST IS SPEC. CHAR.  SYMBOLIC                1480
0328 35 0004 0639                    35    0004                      MAKE BRINGING ORDER )                            1482
0639 10 0592 8003                    10              8003            MAKE BRINGING ORDER )                            1484

0592 65 1660 0665          J         65 G0001                        BRING EQUIVALENT OF REGION                       1486
0665 45 0668 1219                    45          NG                  I, REGION IS UNDEFINED                           1488

0668 15 0536 0691                    15 EQUIV                        GET EQUIVALENT OF REGIONAL ADDRESS )             1490
0691 16 0515 1269                    16 110TH                        GET EQUIVALENT OF REGIONAL AOORESS )             1492
1269 23 0536 0704  0536              23 EQUIV    ABS         EQUIV   STORE EQUIVALENT                                 1494

0416 60 0108 1013          N SYM     60 HSYMB                        SYMBOLIC ADORESS.  BRING SYMBOL                  1496
1013 35 0008 0781                    35    0008                      CLEAR ALL BUT LAST CHARACTER                     1498
0781 44 0585 0686                    44          SHRT                0, LONG SYMBOL                                   1500

0585 69 0038 0741                    69 16THX                        PRESET T AS POSITIVE 1 )                         1502
0741 24 0384 0587  0384              24 T                    T       PRESET T AS POSITIVE 1 )                         1504
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0727 00 0000 0631          J          00    0000                        ADDEND AND EXIT FOR SUBROUTINE 18                    1264
0631 20 0184 0487  0184                20 P0008                  P0008 STORE CORE ADDRESS FOR PUNCHING                      1266
0487 69 0190 0441                      69          SUB13               GET DYNAMIC LEVEL OF CORE ADDRESS                    1268

0190 00 0908 0344          J          00    0908                        TAGS AND EXIT FOR SUBROUTINE 13                      1270
0344 69 1050 0504                      69    1050                        FIRST-CARD TAG                                       1272
0504 90 0335 0459                      90 SB10C                          D, WE SHOULD STORE THIS DYNAMIC LEVEL                1274
0459 20 0486 0335  0486                20 SAVOR      SB10C         SAVOR STORE DYN LEV OF CORE, AND FINISH UP                 1276

0376 20 0062 0925  0062  N A           20 OPREG      C0008         OPREG STORE ADDRESS FOR OPTIMIZING NEXT ADDR               1278
0925 20 0184 0177  0184  R C0008       20 P0008      EXITX         P0008 MISC ADDR.  STORE FOR PUNCHING.  EXIT                1280

0926 69 0711 0661        N C0009       69 PRE        SUBR7               STORE EQUIVALENT OF NEW SYMBOL                       1282

0927 00 0000 0919        R C0010       00    0000    C0002               NEW SYMBOL, BUT TABLE FULL.  N.G.                    1284


                                                SUBROUTINE 6   PROCESS BACKWARDS I                                          1286
                                       HED                                                                                 1288

0142 24 0177 0330  0177  N SUBR6       24 EXITX                  EXITX STORE EXIT                                           1290
0330 60 0153 1108                      60 R0003                        ALPHABETIC I TO UPPER                                1292
1108 69 0911 0063                      69 PRE        SUBR9             ANALYZE ALPHABETIC I                                 1294

0911 65 0536 0371          J PRE       65 EQUIV      J0004             BRING EQUIVALENT.  MULTIBRANCH                       1296

0368 69 0911 0661        N J0001       69 PRE        SUBR7               STORE EQUIVALENT OF NEW SYMBOL                       1298

0369 60 0722 0627        R J0002       60 89THX      SB10B               N.G.  OMIT PUNCHING                                  1300

0370 69 1669 0772        R J0003       69 DRUMT                          BLANK I, IS DRUM FULL                                1302
0772 90 0626 0369                      90          J0002               D, DRUM IS NOT FULL                                  1304

0626 65 1679 0371                      65 BLANB      J0004             BRING EQUIVALENT OF BLANK BACKWARD L                 1306
0371 24 0062 0615  0062  N J0004       24 OPREG                  OPREG DRUM OR DRUM EQUIVALENT                              1308
0615 69 0568 0677                      69          INDEX               TO SUBROUTINE 18 TO INDEX                            1310

0568 00 0001 0375          J          00    0001    J0008               ADDEND AND EXIT FOR SUBROUTINE 18                    1312

0372 65 0675 0611        R J0005       65          SUB11               NEW SYMBOL.  FIND BEST VALUE                         1314

0675 00 0990 0368          J          00    0990    J0001               TAGS AND EXIT FOR SUBROUTINE 11                      1316

0373 01 0000 0373        R J0006       01    0000    J0006               800X RANGE.  ERROR.                                  1318

0374 69 0391 0371        R J0007       69 ORCEB      J0004               CORE.  BRING DYNAMIC LEVEL                           1320

0375 20 0185 0177  0185  R J0008       20 P0009      EXITX         P0009 OTHER ADDRESS, USUALLY A CONSTANT                    1322


                                                SUBROUTINE 7   STORE SYMBOL AND ITS EQUIVALENT                             1324
                                       HED                                                                                 1326

0661 24 0179 0432  0179  N SUBR7       24 EXITZ                  EXITZ STORE EXIT                                           1328
0432 65 0435 0439                      65 LSYMB                        SYMBOL-STORING ORDER )                               1330
0439 15 0392 0747                      15 SS                           SYMBOL-STORING ORDER )                               1332
0747 69 0108 8002                      69 HSYMB         8002           STORE SYMBOL )                                       1334

0392 24 1689 0442  1689  J SS          24 Z0001                  Z0001 STORE SYMBOL )                                       1336
0442 65 0435 0489                      65 LSYMB                        LOCATION OF EQUIVALENT RELATIVE TO E1                1338
0489 14 0492 1029                      14 2DXXX                        LOCATION OF EQUIVALENT RELATIVE TO E1                1340
1029 35 0004 1039                      35    0004                      LOCATION OF EQUIVALENT RELATIVE TO E1                1342
1039 20 0294 0797  0294                20 XXXX2                  XXXX2 LOCATION OF EQUIVALENT RELATIVE TO E1                1344
0797 15 1000 0555                      15 P1                           MAKE BRINGING ORDER )                                1346
0555 20 0167 0670  0167                20 XXXX1                  XXXX1 MAKE BRINGING ORDER )                                1348
0670 44 1073 0674                      44 IPOS                         D, USE I-POSITION.  I, USE D-POSITION.               1350
0674 65 0536 0541                      65 EQUIV                        BRING EQUIVALENT                                     1352
0541 35 0004 0451                      35    0004                      SHIFT TO D POSITION                                  1354
0451 10 0554 0509                      10 P2         A                 MAKE STORING ORDER )                                 1356
0509 10 0294 0167          C A         10 XXXX2      XXXX1             MAKE STORING ORDER )                                 1358

1073 65 0536 0591        N IPOS        65 EQUIV                        USE I-POSITION.  BRING EQUIVALENT                    1360
0591 10 0394 0509                      10 P3         A                 MAKE STORING ORDER                                   1362

1000 69 1555 8003          P P1        69 E0001         8003           INITIAL OF BRINGING ORDER                            1364

0554 22 1555 0179  1555    P P2        22 E0001      EXITZ       E0001 INITIAL OF ORDER TO STORE D-POSITION                 1366

0394 23 1555 0179  1555    P P3        23 E0001      EXITZ       E0001 INITIAL OF ORDER TO STORE I-POSITION                 1368


                                                SUBR 8  PROCESS TYPE 2 ADDR.  ALPH IN UPPER, NUMERIC, LOWR                 1370
                                       HED                                                                                 1372

1024 24 0177 0380  0177  N SUBR8       24 EXITX                  EXITX STORE EXIT                                           1374
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0380 11 0254 0559                    11 11STX                    IS FIRST POSITION BLANK                                  1376
0559 46 0412 0613                    46          FXT             I, FIRST IS NON-BLANK.  FIXED ADDRESS.                   1378

0412 10 8001 0969                    10    8001                  RESTORE TO POSITIVE                                      1380
0969 60 8002 0777                    60    8002                  NUMERIC ADDRESS ALONE IN UPPER                           1382
0777 11 0409 0663                    11 2000I                    SUBTRACT 2000                                            1384
0663 46 0366 0467                    46          RC              0, DRUM.  I, CORE.                                       1386

0366 10 1019 1123                    10 00IFF                    DRUM.  ADD RELOCATION AMOUNT                             1388
1123 46 0676 0977                    46          BAD             I, RELOCATED DRUM WILL EXCEED 1999                       1390

0676 10 0409 0713                    10 2000I    RES             RESTORE RELOCATED DRUM ADDRESS                           1392

0467 10 8001 1223          N RC      10    8001                  CORE ADDRESS.  RESTORE THE 2000                          1394
1223 10 0726 0681                    10 CDIFF                    ADD RELOCATION AMOUNT                                    1396
0681 11 0334 0539                    11 9060                     SUBTRACT 9060                                            1398
0539 46 0542 0977                    46          BAD             I, RELOCATED CORE ADDRESS TOO HIGH                       1400

0542 10 8001 0713                    10    8001  RES             RESTORE THE 9060                                         1402
0713 21 0167 0720  0167   C RES      21 XXXX1                XXXX1 STORE ADDRESS TEMPORARILY                                1404
0720 69 1273 1025                    69          SUB2R           RESERVE IF DRUM ADDRESS                                  1406

1273 65 0167 0177          J         65 XXXX1    EXITX           EQUIVALENT BACK TO LOWER AND EXIT                        1408

0613 65 8002 0177          N FXT     65    8002  EXITX           FIXED ADDRESS.  CLEAR UPPER AND EXIT.                    1410

0977 60 0622 0177          N BAD     60 87THX    EXITX           MODIFIED ADDR TOO HIGH.  8000 TO UPPER                   1412

0334 00 0000 9060          K 9060    00    0000      9060                                                                 1414


                                     SUBROUTINE 9.  ANALYZE AN ADDRESS                                                    1416
                                HED                                                                                       1418

1002 44 1005 0606          C LOOP    44          UND             I, SYMBOL IS NOT IN THE TABLE                            1420

1005 11 0108 0763                    11 HSYMB                    SOME SYMBOL WAS FOUND.  SUBTRACT OURS                    1422
0763 44 0517 0618                    44 NZ                       0, IT WAS NOT RIGHT ONE                                  1424
0618 46 0517 0972                    46 NZ       DEF             D, IT WAS NOT RIGHT ONE . I, IT AS.                      1426

0517 10 8001 1323          C NZ      10    8001                  WRONG SYMBOL.  RESTORE UPPER TO PLUS                     1428
1323 65 8002 0731                    65    8002                  CLEAR UPPER                                              1430
0731 15 0384 8002                    15 T          8002          ADVANCE LOWER AND BRING ANOTHER                          1432

0063 24 0179 0482  0179    N SUBR9   24 EXITZ                EXITZ STORE EXIT                                           1434
0482 45 0636 0537                    45 ABC                      I, THE ADDRESS IS BLANK                                  1436
0537 61 0515 1069                    61 110TH    OON             MODIFY EXIT AND PREPARE TO QUIT                          1438

0636 21 0108 0961  0108    N ABC     21 HSYMB                HSYMB ADDRESS NOT BLANK.  STORE SYMBOL                     1440
0961 30 0008 0629                    30    0008                  ALSO STORE FIRST LETTER OF ADDRESS )                     1442
0629 21 0294 0947  0294              21 XXXX2                XXXX2 ALSO STORE FIRST LETTER OF ADDRESS )                     1444
0947 11 8001 0604                    11    8001                  CLEAR FIRST LETTER                                       1446
0604 16 1208 0913                    16 909                      SUBTRACT 9090908995                                      1448
0913 46 0416 0567                    46 SYM      LOO             0, ADDRESS IS SYMBOLIC.                                  1450
0567 11 8003 0725          C LOO     11    8003                  ARE LAST FOUR CHARACTERS DIGITS )                        1452
0725 45 0278 0679                    45          OUT             ARE LAST FOUR CHARACTERS DIGITS )                        1454

0278 35 0001 0485                    35    0001                  ARE LAST FOUR CHARACTERS DIGITS )                        1456
0485 44 0416 0240                    44 SYM                      ARE LAST FOUR CHARACTERS DIGITS )                        1458
0240 10 8001 0997                    10    8001                  ARE LAST FOUR CHARACTERS DIGITS )                        1460
0997 35 0001 0567                    35    0001  LOO             ARE LAST FOUR CHARACTERS DIGITS )                        1462

0679 65 8001 0535          N OUT     65    8001                  THEY ARE DIGITS.  GET VALUE )                            1464
0535 30 0001 0641                    30    0001                  THEY ARE DIGITS.  GET VALUE )                            1466
0641 20 0536 0589  0536              20 EQUIV                EQUIV STORE THESE 4 DIGITS                                     1468
0589 10 0294 0399                    10 XXXX2                    FIRST CHARACTER INTO UPPER                               1470
0399 44 0654 0704                    44          ABS             I, ZERO.  ADDRESS WAS ABSOLUTE                           1472

0654 11 1308 0963                    11 99THX                    NON-ZERO.  SUBTRACT 90                                   1474
0963 46 0466 0416                    46          SYM             I, FIRST CHAR IS DIGIT.  ADDR SYMBOLIC                   1476

0466 10 1119 0724                    10 29IXX                    ADD 29                                                   1478
0724 46 0416 0328                    46 SYM                      0, FIRST IS SPEC. CHAR.  SYMBOLIC                        1480
0328 35 0004 0639                    35    0004                  MAKE BRINGING ORDER )                                    1482
0639 10 0592 8003                    10          8003            MAKE BRINGING ORDER )                                    1484

0592 65 1660 0665          J         65 G0001                    BRING EQUIVALENT OF REGION                               1486
0665 45 0668 1219                    45          NG              I, REGION IS UNDEFINED                                   1488

0668 15 0536 0691                    15 EQUIV                    GET EQUIVALENT OF REGIONAL ADDRESS )                     1490
0691 16 0515 1269                    16 110TH                    GET EQUIVALENT OF REGIONAL ADDRESS )                     1492
1269 23 0536 0704  0536              23 EQUIV    ABS         EQUIV STORE EQUIVALENT                                         1494

0416 60 0108 1013          N SYM     60 HSYMB                    SYMBOLIC ADDRESS.  BRING SYMBOL                          1496
1013 35 0008 0781                    35    0008                  CLEAR ALL BUT LAST CHARACTER                             1498
0781 44 0585 0686                    44          SHRT            0, LONG SYMBOL                                           1500

0585 69 0038 0741                    69 16THX                    PRESET T AS POSITIVE 1 )                                 1502
0741 24 0384 0587  0384              24 T                    T   PRESET T AS POSITIVE 1 )                                 1504
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0587 65 0290 8001                    65 Y            8001        BRINGING ORDER INTO LOWER                          1506

0290 10 1689 1002          J Y       10 Z0001      LOOP          ADD A SYMBOL INTO UPPER, FROM BOTTOM               1508

0686 66 0038 0643          N SHRT    66 16THX                    SHORT.  PRESET T AS -1 )                           1510
0643 20 0384 0637  0384               20 T                  T     SHORT.  PRESET T AS -1 )                           1512
0637 65 0340 8001                    65              8001        BRINGING ORDER INTO LOWER                          1514

0340 10 1898 1002          J         10 ZMAXM      LOOP          ADD A SYMBOL, STARTING AT TOP                      1516

0606 16 0290 0345          N UND     16 Y                        SYMB NOT IN TABLE.  SUBTRACT Y                     1518
0345 20 0435 0588  0435               20 LSYMB              LSYMB STORE ADDR OF SPACE RELATIVE TO START              1520
0588 46 0791 0642                    46 FULL                     0, TABLE IS FULL                                   1522
0642 16 0395 0449                    16 ZTABL                                                                       1524
0449 46 0352 0791                    46              FULL        1, TABLE IS FULL                                   1526

0352 60 0515 1069                    60 110TH      DON           MODIFY EXIT, AND PREPARE TO QUIT                   1528

0972 16 0290 0445          N DEF     16 Y                        DEFINED SYMBOL.  SUBTRACT Y                        1530
0445 16 0498 0754                    16 JBRL                     SUBTRACT INITIAL BRINGING ORDER                    1532
0754 20 0435 0638  0435               20 LSYMB              LSYMB ADDRESS OF SYMBOL RELATIVE TO START                1534
0638 14 0492 0904                    14 2DXXX                    DIVIDE BY 2                                        1536
0904 35 0004 0715                    35    0004                  QUOTIENT INTO D OF LOWER                           1538
0715 15 0718 8002                    15              8002        MAKE BRINGING ORDER                                1540

0718 69 1555 0659          J         69 E0001                    BRING WORD SHOWING EQUIVALENT                      1542
0659 44 1063 0314                    44              LH          0, ADDR IS ODD.  EQUIV IN RIGHT END                1544

1063 67 8001 1319                    67    8001      LR          EQUIVALENT IS IN I POSITION OF LOWER               1546

0314 67 8001 0721          N LH      67    8001                  EQUIVALENT IN 0 POSITION OF LOWER                  1548
0721 30 0004 1319                    30    0004      LR          EQUIVALENT IN I POSITION OF LOWER                  1550
1319 69 8003 0776          C LR      69    8003                  CLEAR DISTRIBUTOR                                  1552
0776 23 0536 0704  0536               23 EQUIV      ABS   EQUIV STORE EQUIVALENT OF SYMBOL                         1554

0791 01 0111 1219          J FULL    01    0111      NG          STOP IF SYMBOL TABLE IS FULL                       1556
1219 61 1022 1069          C NG      61 2IXXX      DON           MODIFY EXIT FOR N G SYMBOL                         1558

0704 35 0006 0770          N ABS     35    0006                  ABSOLUTE ADDRESS OR EQUIVALENT                     1560
0770 16 8002 0729                    16    8002                  ADDRESS INTO LEFT END DISTRIBUTOR                  1562
0729 84 1200 0775                    84    1200                  SEARCH TABLE ACCORDING TO SIZE OF ADDR             1564
0775 15 0378 8002                    15              8002        MAKE BRINGING ORDER                                1566

0378 60 0000 0605                    60    0000                  BRING APPROPRIATE TABULAR VALUE                    1568
0605 35 0006 0970                    35    0006                  SHIFT TO REMOVE TABULAR ADDRESS )                  1570
0970 30 0006 1069                    30    0006      DON         SHIFT TO REMOVE TABULAR ADDRESS )                  1572
1069 10 0179 8003          C DON     10 EXITZ        8003        FROM MANY PLACES.  MULTIBRANCH                     1574

1208 90 9090 8995          K 909     90    9090      8995                                                           1576
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SUBROUTINE 10. MISCELLANEOUS EXITS 1578

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0001 60 0003 0709          N SETCC   60 READC      SUB10         SEQUEL TO MANY PSEUDO-OPS.                         1580
0709 15 1044 0499          C SUB10   15 B1STX                    C.I. TO PUNCH X-9 )                                1582
0499 20 0186 0689  0186               20 P0010              P0010 C.I. TO PUNCH X-9 )                                1584
0689 60 8003 0057                    60    8003      SB10A       CLEAR LOWER                                        1586
0057 15 0181 0635          C SB10A   15 P0005                    ADVANCE CARD NUMBER )                              1588
0635 15 1022 1027                    15 2IXXX                    ADVANCE CARD NUMBER )                              1590
1027 20 0181 0434  0181               20 P0005              P0005 ADVANCE CARD NUMBER )                              1592
0434 71 0177 8003                    71 P0001        8003        PUNCH CARD.  PERFORM UPPER.                        1594

0627 10 0186 0941          N SB10B   10 P0010                    FROM 4-6,19-21.  TO SUPPRESS )                     1596
0941 21 0154 0759  0154               21 R0004              R0004 TO SUPPRESS IN CASE WE SEARCH                      1598
0759 21 0186 0177  0186               21 P0010      EXITX   P0010 FROM 4-6,19-21.  TO SUPPRESS )                     1600

0335 20 0062 0177  0062    N SB10C    20 OPREG      EXITX   OPREG FROM 4-5, 19-20.  STORE DYNAMIC LEVEL              1602
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SUBROUTINE 11. FIND BEST LOCATION AND RESERVE IT 1604

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                                HED                                                                                1606

0611 69 1669 1072          N SUB11   69 DRUMT                    IS THE DRUM FULL                                   1608
1072 90 0976 1077                    90              PAKT        I, YES.                                            1610

0976 20 0178 0931  0178               20 EXITY              EXITY STORE EXIT OUT OF LOWER                            1612
0931 96 0484 0736                    96 DI                       I,  ADDRESS IS BACKWARD I OR FORWARD L             1614
0736 65 8003 0693                    65    8003      SSW         CLEAR ACCUMULATOR AND JUMP                         1616

0484 69 0687 0390          N DI      69 F                        PREPARE EXIT AND GO TO SUBROUTINE 13 )             1618
0390 22 0167 0441  0167               22 XXXX1      SUB13   XXXX1 PREPARE EXIT AND GO TO SUBROUTINE 13 )             1620

0687 00 0000 0991          J F       00    0000                  TO BUILD EXIT FROM SUBROUTINE 13                   1622
0991 35 0004 0501                    35    0004                  4 TIMES DYNAMIC ADDRESS IN 0 POSITION              1624
0501 15 8002 0909                    15    8002                  4 TIMES DYNAMIC ADDRESS IN 0 POSITION              1626
0909 15 8002 0693                    15    8002      SSW         4 TIMES DYNAMIC ADDRESS IN D POSITION              1628
0693 69 0178 0981          C SSW     69 EXITY                    ALL CASES.  GOING WHICH DIRECTION                  1630
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0981 97 0534 0786                      97          BAK             0, FORWARD.  1, BACKWARD.                          1632

0534 69 0737 0440                      69 OFF                      FORWARD.  SET SWITCH OFF FOR 1ST PART              1634
0440 24 0743 0296  0743                24 SW                SW     FORWARD.  SET SWITCH OFF FOR 1ST PART              1636
0296 15 0549 0954                      15 601                      INITIAL OF VARIABLE BRINGING ORDER                 1638
0954 20 0959 0462  0959                20 BP1               BP1    STORE VARIABLE BRINGING ORDER                      1640
0462 16 0038 0793                      16 16THX     ST             COMPARISON CONSTANT FOR LAST PART                  1642

1088 44 1241 0743          R TA        44 YES       SW             IS A LOCATION AVAILABLE IN THIS GROUP              1644
0743 65 0346 0551            SW        65 AI        SWOF           NOT PERFORMED--JUST FOR OPTIMIZING                 1646

0737 65 0346 0551          J OFF       65 AI        SWOF           HAVE WE REACHED TOP OF TABLE                       1648
0551 16 1054 1009            SWOF      16 799                      SUBTRACT END OF TABLE                              1650
1009 45 0512 1113                      45           MAX            1, WE HAVE REACHED TOP OF TABLE                    1652

0512 15 0765 1020                      15 800       SAI            ADVANCE VARIABLE BRINGING ORDER                    1654
1020 20 0346 8001  0346    C SAI       20 AI           8001  AI     STORE BRINGING ORDER, AND DO IT                    1656

0786 69 0739 0692          N BAK       69 OFB                      GOING BACKWARD.  SET SWITCH OFF )                  1658
0692 24 0743 0396  0743                24 SW                SW     GOING BACKWARD.  SET SWITCH OFF )                  1660
0396 15 0599 1104                      15 602                      INITIAL BRINGING ORDER )                           1662
1104 20 0959 0562  0959                20 BP1               BP1    INITIAL BRINGING ORDER )                           1664
0562 15 0038 0793                      15 16THX     ST             COMPARISON CONSTANT FOR LAST PART                  1666
0793 20 1097 1020  1097    C ST        20 A0        SAI    A0      STORE COMPARISON CONSTANT                          1668

0739 65 0346 0601          J OFB       65 AI                       START BACKWARDS SEARCH.  HOW FAR                   1670
0601 16 1354 1059                      16 600                      SUBTRACT COMPARISON CONSTANT                       1672
1059 45 0612 1213                      45           MIN            0, WE ARE NOT BACK TO START YET                    1674

0612 15 0915 1020                      15 599       SAI            RESTORE AND MODIFY                                 1676

1113 69 0516 1070          N MAX       69 ON                       AT TOP.  SET SWITCH ON )                           1678
1070 24 0743 0446  0743                24 SW                SW     AT TOP.  SET SWITCH ON )                           1680
0446 65 1354 1020                      65 600       SAI            RESET BRINGING ORDER, AND SEARCH MORE              1682

0516 65 0346 0651          J ON        65 AI                       AFTER RESTART.  BRING BRINGING ORDER               1684
0651 16 1097 0701                      16 A0                       COMPARISON CONSTANT, SUBTRACTED                    1686
0701 45 0655 0705                      45           FULL           1, THERE IS NO AVAILABLE LOCATION.                 1688

0655 15 0959 1020                      15 BP1       SAI            RESTORE AND MODIFY                                 1690

1213 69 0516 1120          N MIN       69 ON                       SECOND PART, BACKWARDS.  CHANGE SWITCH             1692
1120 24 0743 0496  0743                24 SW                SW     SECOND PART, BACKWARDS.  CHANGE SWITCH             1694
0496 65 1054 1020                      65 799       SAI            START BACK FROM TOP OF TABLE                       1696

0705 01 0222 1109          N FULL      01    0222                  STOP BECAUSE ORUM IS PACKED                        1698
1109 69 0114 0617                      69 91STX                    CHANGE ORUM TAG TO 9 )                             1700
0617 24 1669 1122  1669                24 ORUMT             ORUMT  CHANGE ORUM TAG TO 9 )                             1702
1122 65 0178 1077                      65 EXITY     PAKT           MODIFY EXIT )                                      1704
1077 15 0515 8002          C PAKT      15 110TH        8002        MODIFY EXIT )                                      1706

1241 36 0000 1263          N YES       36    0000                  WE FOUND A CELL.  SHIFT AND COUNT                  1708
1263 20 0294 1247  0294                20 XXXX2             XXXX2  STORE THE COUNT                                    1710
1247 69 0197 1100                      69 ALOPT                    SHOULD WE RESERVE                                  1712
1100 90 0755 0905                      90 SKP                      0, SKIP BECAUSE COMP IS DOUBLE                     1714
0905 35 0001 1011                      35    0001                  RESERVE )                                          1716
1011 30 0001 0667                      30    0001                  RESERVE )                                          1718
0667 11 8003 0975                      11    8003                  PUT INTO DISTRIBUTOR                               1720
0975 35 0004 0685                      35    0004                  MOVE AMOUNT OF SHIFT INTO D                        1722
0685 10 8001 1291                      10    8001                  AVAILABILITY WORD BACK INTO UPPER                  1724
1291 15 0444 8002                      15          8002            MAKE SHIFTING ORDER                                1726

0444 30 0000 0717          J           30    0000                  SHIFT MODIFIED WORD BACK INTO PLACE                1728
0717 60 8003 1225                      60    8003                  CLEAR LOWER                                        1730
1225 15 0346 0751                      15 AI                       NEW AVAILABILITY WORD INTO ORUM )                  1732
0751 69 0955 1209                      69 STR                      NEW AVAILABILITY WORD INTO ORUM )                  1734
1209 22 0167 8001  0167                22 XXXX1             XXXX1  NEW AVAILABILITY WORD INTO ORUM )                  1736

0955 21 9972 0755  9972    J STR       21    9972    SKP    9972  NEW AVAILABILITY WORD INTO ORUM )                  1738
0755 65 0346 0951          C SKP       65 AI                       ALL CASES.  WHAT DID WE RESERVE )                  1740
0951 16 1354 1309                      16 600                      WHAT CELL DID WE RESERVE )                         1742
1309 30 0004 1220                      30    0004                  WHAT CELL DID WE RESERVE )                         1744
1220 14 0774 1021                      14 4IXXX                    WHAT CELL DID WE RESERVE )                         1746
1021 16 8002 1079                      16    8002                  WHAT CELL DID WE RESERVE )                         1748
1079 35 0001 1035                      35    0001                  WHAT CELL DID WE RESERVE )                         1750
1035 15 8001 1341                      15    8001                  WHAT CELL DID WE RESERVE )                         1752
1341 10 0294 0649                      10 XXXX2                    WHAT CELL DID WE RESERVE )                         1754
0649 19 0320 1074                      19 90IXX                    WHAT CELL DID WE RESERVE )                         1756
1074 15 8003 1031                      15    8003                  WHAT CELL DID WE RESERVE )                         1758
1031 20 0536 0178  0536                20 EQUIV     EXITY  EQUIV   STORE THIS ADDRESS IN EQUIV                         1760

0915 60 1354 1088          Q 599       60 A0000     TA                                                                1762

1354 60 1355 1088          O 600       60 A0001     TA                                                                1764

0549 60 1356 1088          P 601       60 A0002     TA                                                                1766

0599 60 1357 1088          P 602       60 A0003     TA                                                                1768

1054 60 1554 1088          Q 799       60 A0200     TA                                                                1770

0765 60 1555 1088          Q 800       60 A0201     TA                                                                1772
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                                        SUBROUTINE 13.  CALCULATE OPTIMUM DYNAMIC LEVEL                    1774
                                   HEO                                                                     1776

0441 24 0179 0532  0179   N SUB13   24 EXITZ                    EXITZ STORE EXIT                           1778
0532 95 0735 0787                   95          9                    D, O AOORESS.  I, FORWARO I OR BACKW L  1780

0735 97 0688 0490                   97 FD       FIBO                 D, FORWARO D.   I, BACKWARO D.        1782

0787 97 0490 0742         N 9       97 FIBD     BL                   O, FORWARO I.  I, BACKWARD L.          1784

0688 65 0095 0699         N FO      65 OPTIM                         FORWARO O.  L-D ADDENDS, LEFT ENO LOWE 1786
0699 35 0001 1055                   35    0001                            L-O AOOENOS TO LEFT ENO LOWER )    1788
1055 16 8002 1313                   16    8002                            L-O ADDENOS TO LEFT END LOWER )    1790
1313 35 0001 1270                   35    0001                            L-O ADOENOS TO LEFT END LOWER )    1792
1270 15 8001 1227                   15    8001                            L-D AOOENOS TO LEFT END LOWER )    1794
1227 30 0003 0785                   30    0003  SEO                       L-O ADDENDS TO LEFT END LOWER )    1796

0490 65 0095 0749         N FIBD    65 OPTIM                         FORWARO I OR BACKWARD O.  GET ADDENOS  1798
0749 92 0402 1105                   92 SHOP                             O, IT IS A SHIFT OPERATION          1800
1105 93 0660 0710                   93 XAS                              O, IT IS AN INOEXING OPERATION      1802
0710 35 0002 0785                   35    0002  SEO                     OTHER.  I-ADOENOS TO LEFT ENO LOWER 1804

0742 65 0197 1051         N BL      65 ALOPT                         BACKWARO L.  GET ALOPT                 1806
1051 92 0402 0656                   92 SHOP                             D, IT IS A SHIFT OPERATION          1808
0656 93 0660 1061                   93 XAS                              O, IT IS AN INOEXING OPERATION      1810
1061 91 0364 0688                   91          FD                      O, IT IS A BRANCH OPERATION         1812

0364 99 0688 0490                   99 FO       F1BD                 I, BACKWARD L, BRANCH, UNFIXED O       1814

0402 60 0184 0789         N SHOP    60 P0008                         SHIFT OPERATION.  FORWARD I, BACKW L.  1816
0789 35 0009 0760                   35    0009                       ISOLATE LAST DIGIT OF D-AODRESS )      1818
0760 30 0005 0974                   30    0005                       ISOLATE LAST DIGIT OF O-ADORESS )      1820
0974 10 1277 8003                   10             8003              MAKE BRINGING OROER                    1822

1277 65 1250 0706         J         65    1250                       BRING SHIFT ADOENOS                    1824
0706 69 0095 0548                   69 OPTIM                         OPTIMIZING TAGS                        1826
0548 93 1101 0785                   93          SEO                  D, OPERATION 31.  I, 30,35,36.         1828

1101 35 0004 0785                   35    0004  SEO                  OPERATION 31.  TAKE LARGER ADDENDS.    1830

0660 60 0184 0939         N XAS     60 P0008                         INDEXING OP,  FORWARO I, BACKWARD L.   1832
0939 30 0004 0799                   30    0004                       O-AOORESS TO LEFT ENO OF OISTR )       1834
0799 16 8002 0910                   16    8002                       O-ADORESS TO LEFT ENO OF DISTR )       1836
0910 84 1300 1275                   84    1300                       LOOK UP IN TABLE                       1838
1275 15 0428 8002                   15             8002              MAKE BRINGING OROER                    1840

0428 65 0000 0756         J         65    0000                       BRING ADOENDS                          1842
0756 35 0004 0767                   35    0004                       SHIFT AOOENOS TO LEFT ENO              1844
0767 92 0785 1222                   92 SEO                           JUMP UNLESS OPERATION 80,82, OR 88     1846
1222 16 0095 0785                   16 OPTIM    SEO                  REOUCE AOOENOS BY 1 FOR 80,82, OR 88   1848
0785 69 0179 0582         C SEO     69 EXITZ                         ALL CASES.  WHICH OIRECTION            1850
0582 97 0935 0937                   97 P                             O, FORWARD.  I, BACKWARD.              1852
0937 20 0792 0495  0792             20 IND                   IND     BACKWARO.  SHOULO WE INTERCHANGE AOONO 1854
0495 30 0006 0960                   30    0006                          SHOULD WE INTERCHANGE AOOENOS )    1856
0960 35 0008 0779                   35    0008                          SHOULO WE INTERCHANGE AOOENOS )    1858
0779 20 0733 0936  0733             20 B                     B          SHOULD WE INTERCHANGE ADOENOS )    1860
0936 60 8003 0943                   60    8003                          SHOULO WE INTERCHANGE AOOENDS )    1862
0943 30 0002 0949                   30    0002                          SHOULO WE INTERCHANGE AOOENDS )    1864
0949 20 0906 1010  0906             20 A                     A          SHOULD WE INTERCHANGE AOOENOS )    1866
1010 15 0733 0987                   15 B                               SHOULO WE INTERCHANGE ADOENOS )    1868
0987 15 0132 1037                   15 12NOX                           SHOULD WE INTERCHANGE AODENOS )    1870
1037 14 0540 1048                   14 42NO                            SHOULO WE INTERCHANGE AOOENOS )    1872
1048 44 1351 1052                   44 OK                            I, WE SHOULO INTERCHANGE             1874
1052 66 0906 1111                   66 A                             INTERCHANGE ANO MAKE NEGATIVE )      1876
1111 30 0002 0917                   30    0002                       INTERCHANGE ANO MAKE NEGATIVE )      1878
0917 16 0733 0935                   16 B        P                    INTERCHANGE ANO MAKE NEGATIVE )      1880

1351 66 0792 0935         N OK      66 IND      P                    MAKE NEGATIVE, BUT OO NOT INTERCHANGE  1882
0935 20 0167 1320  0167   C P       20 XXXX1                 XXXX1   ALL CASES.  STORE AOOENOS              1884
1320 65 0062 0967                   65 OPREG                         WHICH ONE OO WE USE )                  1886
0967 14 1022 1060                   14 21XXX                         WHICH ONE OO WE USE )                  1888
1060 44 1014 0414                   44          EVN                  O, OPREG WAS OOD.  I, EVEN.            1890

1014 65 0167 0771                   65 XXXX1                         ODD.  SEPARATE LAST AODENO )           1892
0771 35 0002 1327                   35    0002                       OOO.  SEPARATE LAST AODEND.            1894
1327 65 8002 0985                   65    8002  BOTH                 OOO.  SEPARATE LAST AOOENO.            1896

0414 65 0167 0985         N EVN     65 XXXX1    BOTH                 EVEN.  WE SHOULO USE FIRST AOOEND       1898
0985 30 0008 0956         C BOTH    30    0008                       BOTH.  RIGHT AOOENO TO RIGHT ENO       1900
0956 15 0062 1017                   15 OPREG                         ADD OLO DYNAMIC LEVEL                  1902
1017 15 0320 1325                   15 501XX                         ADO 50 TO MAKE SURELY POSITIVE         1904
1325 69 0179 0632                   69 EXITZ                         IF BACKWARO L, SUBTRACT TAG-COUNT )    1906
0632 95 1085 1087                   95 CP                            IF BACKWARO L, SUBTRACT TAG-COUNT )    1908
1087 97 1085 0942                   97 CP                            IF BACKWARO L, SUBTRACT TAG-COUNT )    1910
0942 16 0545 1085                   16 COUNT    CP                   IF BACKWARO L, SUBTRACT TAG-COUNT )    1912
1085 14 0320 1272         C CP      14 501XX                         NEW LEVEL, MOOULO 50 IN UPPER          1914
1272 65 8003 0179                   65    8003  EXITZ                NEW OYNAMIC LEVEL INTO LOWER           1916

0540 04 0000 0000         K 42ND    04    0000       0000                                                   1918
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                                        SUBROUTINE 14.  CONTROL INFO, OP, OPTIM, ALOPT.                 1920
                                    HED                                                                 1922

0039 24 0177 0430  0177   N SUB14    24 EXITX                EXITX STORE EXIT                            1924
0430 69 0154 1110                    69 R0004                      CONTROL INFORMATION FOR PUNCHING )    1926
1110 24 0186 0989  0186              24 P0010                P0010 CONTROL INFORMATION FOR PUNCHING )    1928
0989 65 0155 1210                    65 R0005                      BRING TAGS AND OPERATION              1930
1210 69 8003 0566                    69    8003                    CLEAR DISTRIBUTOR                     1932
0566 22 0183 0986  0183              22 P0007                P0007 STORE OPERATION FOR PUNCHING          1934
0986 16 8001 0993                    16    8001                    CLEAR OP FROM ACCUMULATOR             1936
0993 35 0005 1006                    35    0005                    D TAG INTO UPPER                      1938
1006 21 0902 1056  0902              21    0902                0902 STORE D TAG                          1940
1056 65 8002 0965                    65    8002                    DELETE D TAG                          1942
0965 30 0005 0628                    30    0005                    I TAG TO RIGHT END LOWER              1944
0628 20 0903 1106  0903              20    0903                0903 STORE I TAG                          1946
1106 45 1260 1211                    45          BT                D, I TAG IS NON-ZERO                  1948

1260 65 0515 1211                    65 110TH    BT                COUNT OF I TAGS IN LOWER              1950
1211 10 0902 1310          C BT      10    0902                    D TAG INTO UPPER                      1952
1310 44 0464 0514                    44          UM                0, D TAG IS NON-ZERO                  1954

0464 15 0515 0514                    15 110TH    UM                COUNT OF TAGS IN LOWER                1956
0514 20 0545 0598  0545   C UM       20 COUNT                COUNT STORE TAG-COUNT                       1958
0598 60 0183 1237                    60 P0007                      OPERATION IN D OF UPPER               1960
1237 10 0590 8003                    10             8003           MAKE BRINGING ORDER                   1962

0590 65 0800 1306          J         65    0800                    BRING OPTIMIZING ADOENOS AND TAGS     1964
1306 24 0095 0648  0095              24 OPTIM                OPTIM STORE OPTIMIZING AODENDS AND TAGS     1966
0648 69 8003 1261                    69    8003                    CLEAR DISTRIBUTOR                     1968
1261 23 0167 0971  0167              23 XXXX1                XXXX1 STORE LAST 4 DIGITS OF OPTIM          1970
0971 35 0001 0678                    35    0001                    ONE DIGIT INTO UPPER                  1972
0678 44 1081 0682                    44 YES                        I, 0 IS NOT TRUE ADDRESS              1974
0682 60 1235 1089                    60 8          AX              MORE TAGS INTO UPPER                  1976

1081 60 0584 1089          N YES     60 9          AX              MORE TAGS INTO UPPER                  1978
1089 10 0167 1071          C AX      10 XXXX1                      AOD IN TAGS FROM OPTIM                1980
1071 21 0197 0177  0197              21 ALOPT    EXITX     ALOPT STORE ALL OPTIMIZING TAGS               1982

1235 98 8008 0000          K 8       98    8008      0000                                              1984
0584 98 8009 0000          K 9       98    8009      0000                                              1986


                                        SUBROUTINE 17.  MOOIFY DYN LEV IF D = 8001,8002,8003            1988
                                    HED                                                                 1990

0586 24 0178 1231  0178   N SUB17    24 EXITY                EXITY STORE EXIT INSTRUCTION                1992
1231 20 0294 1297  0294              20 XXXX2                XXXX2 STORE DYNAMIC LEVEL, RIGHT END WORD   1994
1297 14 1022 1322                    14 21XXX                      DIVIDE DYNAMIC LEVEL BY 2             1996
1322 44 1076 1026                    44          EVN               D, DYNAMIC LEVEL IS ODD.              1998

1076 65 1279 1033                    65 8002     E0                ODD.  PUT 8002 AT RIGHT END OF LOWER  2000

1026 65 1229 1033          N EVN     65 8003     E0                EVEN.  PUT 8003 AT RIGHT END OF LOWER 2002
1033 16 0536 0992          C EO      16 EQUIV                      BOTH.  SUBTRACT  THE 800X ADDRESS    2004
0992 24 0184 1287  0184              24 P0008                P0008 STORE THE ADDRESS FOR PUNCHING        2006
1287 45 0640 1042                    45 XY                         I, 8002-8003 + WRONG PARITY           2008
1042 65 0515 0178                    65 110TH    EXITY             UNIT CORRECTION TO DYNAMIC LEVEL      2010

0640 65 1043 1347          N XY      65 8001                       8001 INTO RIGHT END LOWER             2012
1347 16 0536 1092                    16 EQUIV                      SUBTRACT THE AODRESS IN QUESTION      2014
1092 45 0546 0698                    45 NZ                         D, AODRESS IS NOT 8001                2016
0698 66 0515 0178                    66 110TH    EXITY             IF 8001, CORRECTION IS -1             2018

0546 67 8003 0178          N NZ      67    8003  EXITY             IF NOT 8001, CORRECTION IS ZERO       2020

1043 00 0000 8001          K 8001    00    0000      8001                                              2022
1279 00 0000 8002          K 8002    00    0000      8002                                              2024
1229 00 0000 8003          K 8003    00    0000      8003                                              2026


                                        SUBROUTINE 18.  INOEX FOR USE WITH INDEXING REGISTER            2028
                                    HED                                                                 2030

0677 24 0178 1281  0178   N INDEX    24 EXITY                EXITY STORE EXIT                            2032
1281 20 0167 1121  0167              20 XXXX1                XXXX1 STORE ADORESS                         2034
1121 65 0178 0783                    65 EXITY                      D-POSITION HOLDS 0 FOR O, 1 FOR I )   2036
0783 30 0004 1093                    30    0004                    D-POSITION HOLOS O FOR D, 1 FOR I )   2038
1093 35 0004 1311                    35    0004                    D-POSITION HOLOS 0 FOR D, 1 FOR I )   2040
1311 15 0564 8002                    15             8002           BRINGING ORDER                        2042

0564 65 0902 0662          J         65    0902                    BRING APPROPRIATE TAG                 2044
0662 15 8002 1221                    15    8002                    DOUBLE IT                             2046
1221 10 0167 1271                    10 XXXX1                      INOEXABLE AODRESS INTO UPPER          2048
1271 11 1124 0929                    11 27TH                       SUBTRACT 2000, TO OETERMINE RANGE     2050
0929 46 0732 0933                    46 DRM                        I,  CORE.  D, DRUM.                   2052
0933 11 8003 1242                    11    8003                    CORE.  CLEAR UPPER                    2054
1242 30 0001 0999                    30    0001    A               SHIFT RIGHT FOR CORE ADDENO           2056
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0732 10 8001 0999          N DRM      10    8001   A              DRUM.  MAKE POSITIVE AGAIN                    2058
0999 15 0167 0178          C A        15 XXXX1    EXITY          ADD ADDRESS BEING INDEXED.  EXIT.              2060

1124 00 0000 2000          K 27TH     00    0000     2000         FOR TELLING WHETHER DRUM OR CORE               2062


                                                SUBROUTINE 19.  PROCESS L FORWARD                              2064
                                    HED                                                                        2066

0042 24 0177 0480  0177    N SUB19    24 EXITX                EXITX STORE EXIT                               2068
0480 60 0151 0712                     60 R0001                      ALPHABETICAL L TO UPPER                  2070
0712 69 1015 0063                     69 PRE        SUBR9           ANALYZE L-ADDRESS                        2072

1015 65 0536 0421          J PRE      65 EQUIV      L0004           BRING EQUIVALENT.  MULTIBRANCH           2074

0418 69 1015 0661          N L0001    69 PRE        SUBR7           SUB 11 FOUND EQU OF SYMB.  RESERVE       2076

0419 60 0622 0627          R L0002    60 87THX      SB10B           N.G.  FIX TO OMIT PUNCHING               2078

0420 69 1669 1224          R L0003    69 DRUMT                      BLANK ADDRESS.  IS DRUM FULL             2080
1224 90 0728 0419                     90            L0002           D, DRUM NOT FULL.  I, DRUM IS FULL.      2082

0728 65 1023 0421                     65 BLANK      L0004           USE PROPER VALUE FOR BLANK ADDRESS       2084
0421 20 0182 1285  0182    N L0004    20 P0006                P0006 DRUM.  STORE ADDRESS FOR PUNCHING        2086
1285 60 8001 1292                     60    8001                    PUT IT INTO UPPER                        2088
1292 69 0595 1025                     69            SUB2R           RESERVE ADDRESS                          2090

0595 65 0182 1337                     65 P0006      MW              BRING BACK NUMERICAL ADDRESS             2092

0422 69 1030 0983          R L0005    69    1030                    NEW SYMBOL.  WHERE ARE WE                2094
0983 90 1001 0738                     90 MDFLL                      D, START SEARCH.  I, WE ARE ON OUITT     2096
0738 65 1342 0611                     65            SUB11           FIND AN EQUIVALENT                       2098

1342 00 0890 0418          J          00    0890    L0001           TAGS AND EXIT FOR USE IN SUBR 11         2100

0423 00 0000 0001          R L0006    00    0000    SETCC           800X ADDRESS.  OUIT IMMEDIATELY          2102

0424 20 0182 1335  0182    R L0007    20 P0006                P0006 CORE ADDRESS.  STORE FOR PUNCHING        2104
1335 65 0292 1337                     65 ORCEO      MW              DYNAMIC LEVEL OF LAST CORE ADDRESS       2106
1337 15 0545 0335          C MW       15 COUNT      SB10C           CORE OR DRUM.  ADD TAG-COUNT TO DYN LV   2108

0425 00 0000 0419          R L0008    00    0000    L0002           MISCELLANEOUS ADDRESS.  OUIT AND OMIT     2110


                                                SUBROUTINE 20.  PROCESS D FORWARD                              2112
                                    HED                                                                        2114

0045 24 0177 0630  0177    N SUB20    24 EXITX                EXITX STORE EXIT                               2116
0630 60 0152 0762                     60 R0002                      ALPHABETICAL D INTO UPPER                2118
0762 69 1065 0063                     69 PRE        SUBR9           ANALYZE D-ADDRESS                        2120

1065 65 0536 0472          J PRE      65 EQUIV      D0004           BRING EQUIVALENT.  MULTIBRANCH           2122

0469 20 1023 0476  1023    N D0001    20 BLANK      D0008     BLANK STORE EQUIV OF BLANK FOR REFERENCE       2124

0470 60 0672 0627          R D0002    60 88THX      SB10B           N.G.  OUIT AND OMIT PUNCHING              2126

0471 69 0095 0748          R D0003    69 OPTIM                      BLANK D.  IS IT MDF OPERATION            2128
0748 94 0800 0912                     94    0800                    IF BLANK D AND MDF,  STOP MACHINE        2130
0912 65 1115 0611                     65            SUB11           BLANK D, BUT NOT MDF.  FIND VALUE OF D   2132

1115 00 0888 0469          J          00    0888    D0001           TAGS AND EXIT FOR SUBROUTINE 11          2134

0472 69 1226 0677          N D0004    69            INDEX           DRUM ADDRESS.  INDEX IF TAGGED           2136

1226 00 0000 0476          J          00    0000    D0008           ADDEND AND EXIT FOR USE IN SUBR 18       2138

0473 65 1276 0611          R D0005    65            SUB11           NEW SYMBOL.  FIND EQUIVALENT             2140

1276 00 0888 0477          J          00    0888    D0009           TAGS AND EXIT FOR USE IN SUBR 11         2142

0474 69 0778 0441          R D0006    69            SUB13           800X ADDRESS.  FIND DYNAMIC LEVEL        2144

0778 00 0808 0782          J          00    0808                    TAGS AND EXIT FOR USE IN SUBR 11         2146
0782 69 1086 0586                     69            SUB17           PERHAPS MODIFY DYNAMIC LEVEL )           2148

1086 15 0294 1049          J          15 XXXX2      B               PERHAPS MODIFY DYNAMIC LEVEL )           2150

0475 69 0928 0677          R D0007    69            INDEX           CORE ADDRESS.  INDEX IF TAGGED           2152

0928 00 0000 0932          J          00    0000                    ADDEND AND EXIT FOR SUBROUTINE 18        2154
0932 20 0184 0788  0184              20 P0008                P0008 STORE THE CORE ADDRESS FOR PUNCHING       2156
0788 69 1243 0441                     69            SUB13           FIND DYNAMIC LEVEL                       2158

1243 00 0808 0798          J          00    0808                    TAGS AND EXIT FOR SUBROUTINE 13          2160
0798 20 0292 1049  0292              20 ORCEO      B         ORCEO STORE DYNAMIC LEVEL FOR REFERENCE        2162

0476 20 0184 1049  0184    R D0008    20 P0008      B         P0008 MISC ADDRESS, USUALLY A CONSTANT         2164
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1049 69 0095 0948          C B        69 OPTIM                        SEVERAL CASES. WHAT KINO OF OP                    2166
0948 91 0177 0335                     91 EXITX     SB10C              O, BRANCH. I, ARITHMETIC.                         2168

0477 69 1065 0661          N 00009    69 PRE       SUBR7              STORE EQUIVALENT OF NEW SYMBOL                    2170

0478 00 0000 0470          R D0010    00    0000   00002              SYMB TABLE FULL OR ORUM PACKEO. OUIT              2172



                                                SUBROUTINE 21. PROCESS I FORWARO                                     2174
                                   HEO                                                                               2176

0018 24 0177 0680  0177    N SUB21    24 EXITX                  EXITX STORE EXIT                                    2178
0680 60 0153 0962                     60 R0003                        ALPHABETIC I TO UPPER                         2180
0962 69 1215 0063                     69           SUBR9              ANALYZE I-AOORESS                             2182

1215 65 0536 0575          J          65 EQUIV     I0004              BRING EQUIVALENT. MULTIBRANCH                     2184

0572 20 1023 0577  1023    N I0001    20 BLANK     I0006        BLANK STORE EQUIVALENT OF BLANK FOR REFERENC            2186

0573 60 0722 0627          R I0002    60 89THX     SB10B              N.G. OUIT ANO OMIT PUNCHING                   2188

0574 60 0152 1012          R I0003    60 R0002                        BLANK I. IS D ALSO BLANK                      2190
1012 44 1265 0616                     44 DNB                          O, O IS NOT BLANK.                            2192
0616 69 1669 1274                     69 ORUMT                        BLANK O ANO I. CHECK DRUM TAG                 2194
1274 90 0978 0573                     90           I0002              I, DRUM IS FULL                               2196

0978 65 1023 0579                     65 BLANK     I0008              MAKE BLANK I EOUAL TO BLANK O                 2198

1265 65 0768 0611          N DNB      65           SUB11              USUAL CASE, I BLANK AND NOT O.                2200

0768 00 0889 0572          J          00    0889   I0001              TAGS ANO EXIT FOR SUBROUTINE 11               2202

0575 69 1028 0677          N I0004    69           INOEX              ORUM AOORESS. INOEX IF TAGGEO                 2204

1028 00 0001 0577          J          00    0001   I0006              AOOENDS AND EXIT FOR USE IN SUBR 18.          2206

0576 65 0979 0611          R I0005    65           SUB11              NEW SYMBOL. FIND BEST VALUE.                  2208

0979 00 0889 0580          J          00    0889   I0009              TAGS ANO EXIT FOR SUBR 11.                    2210

0577 20 0185 0177  0185    R I0006    20 P0009     EXITX        P0009 800X AODRESS. STORE AND EXIT                  2212

0578 69 1331 0677          R I0007    69           INOEX              CORE ADORESS. INOEX IF TAGGEO                 2214

1331 00 0001 1236          J          00    0001                     AOOENO AND EXIT FOR SUBROUTINE 18.            2216
1236 20 0185 0938  0185               20 P0009                  P0009 STORE CORE AOORESS FOR PUNCHING               2218
0938 69 1293 0441                     69           SUB13              FINO OYNAMIC LEVEL                            2220

1293 00 0809 0998          J          00    0809                     TAGS AND EXIT FOR SUBROUTINE 13               2222
0998 20 0292 0177  0292               20 ORCEO     EXITX       ORCEO STORE OYNAMIC LEVEL FOR REFERENCE             2224

0579 20 0185 0177  0185    R I0008    20 P0009     EXITX        P0009 OTHER ADORESS. STORE ANO EXIT.                2226

0580 20 0185 0988  0185    N I0009    20 P0009                  P0009 STORE EQUIVALENT OF NEW SYMBOL                2228
0988 69 0177 0661                     69 EXITX     SUBR7              STORE SYMBOL AND ITS EQUIVALENT               2230

0581 00 0000 0573          R I0010    00    0000   I0002              SYMBOL TABLE FULL. OMIT PUNCHING ADOR         2232



                                                SUBROUTINE 22. SAVE ORCEO ON FIRST BACKWARD CARO                     2234

0201 69 1050 1062          N SUB22    69    1050                     FIRST-CARD TAG                                2236
1062 90 8002 1067                     90    8002                     O, WE ARE NOT ON FIRST BACKWARD CARO           2238
1067 69 0292 0645                     69 ORCEO                       STORE ORCEO FOR USE WHEN WE START FORW        2240
0645 24 0486 8002  0486               24 SAVOR           8002  SAVOR STORE ORCEQ FOR USE WHEN WE START FORW        2242



                                                ROUTINE FOR TYPE 2 CARO, NAMELY RELOCATABLE SUBROUTINE               2244
                                   HED                                                                               2246

0002 69 1112 0039          R     0002 69           SUB14              OP, C,I,, TAGS. OPTIM, ALOPT                  2248

1112 65 0157 1212          J          65 R0007                        NUMERICAL L                                   2250
1212 10 0151 1262                     10 R0001                        ALPHABETIC L                                  2252
1262 69 1315 1024                     69           SUBR8              PROCESS L                                     2254

1315 44 1321 1324          J          44 NGL                          O, RELOCATEO L IS EXCESSIVE                   2256
1324 20 0182 1286  0182               20 P0006     PROD         P0006 STORE L FOR PUNCHING                          2258

1321 10 0186 1343          N NGL      10 P0010                        FIX C,I. SO THAT L WILL NOT PUNCH )           2260
1343 21 0186 1286  0186               21 P0010     PROO         P0010 FIX C,I. SO THAT L WILL NOT PUNCH )           2262
1286 65 0158 0614          C PROD     65 R0008                        NUMERICAL D                                   2264
0614 10 0152 1312                     10 R0002                        ALPHABETIC O                                  2266
1312 69 0666 1024                     69           SUBR8              PROCESS D                                     2268

0666 44 1326 1078          J          44 NGD                          D, RELOCATED D IS EXCESSIVE                   2270
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1078 69 0982 0677                    69          INDEX          INDEX D                                  2272

0982 00 0000 1336         J          00    0000                 ADDEND AND EXIT FDR INDEXING             2274
1336 20 0184 1238  0184              20 P0008    PRDI      P0008 STORE D FDR PUNCHING                     2276

1326 30 0001 1083         N NGD      30    0001                 FIX C.I. SD THAT D WILL NOT PUNCH )      2278
1083 10 0186 0494                    10 P0010                   FIX C.I. SD THAT D WILL NOT PUNCH )      2280
0494 21 0186 1238  0186              21 P0010    PRDI      P0010 FIX C.I. SD THAT D WILL NOT PUNCH )      2282
1238 65 0159 0664         C PRQI     65 R0009                   NUMERICAL I                              2284
0664 10 0153 0714                    10 R0003                   ALPHABETIC I                             2286
0714 69 1117 1024                    69          SUBR8          PROCESS I                                2288

1117 44 1228 1278         J          44 NGI                     D.RELOCATED I IS EXCESSIVE               2290
1278 69 1032 0677                    69          INDEX          INDEX I                                  2292

1032 00 0001 1288         J          00    0001                 ADDEND AND EXIT FDR INDEXING             2294
1288 20 0185 1338  0185              20 P0009    ALL       P0009 STORE I FDR PUNCHING                     2296

1228 30 0002 1239         N NGI      30    0002                 FIX C.I. SD THAT I WILL NOT PUNCH )      2298
1239 10 0186 0544                    10 P0010                   FIX C.I. SD THAT I WILL NOT PUNCH )      2300
0544 21 0186 1338  0186              21 P0010    ALL       P0010 FIX C.I. SD THAT I WILL NOT PUNCH )      2302
1338 60 0003 0057         C ALL      60 READC    SB10A          PREPARE TO PUNCH AND READ NEXT CARD      2304
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EQU, SYN, AND RED RDUTINES 2306

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                                     HED                                                                  2308
                                     EDU E       DPTIM          DDUBLE-PURPOSE TO CONSERVE DRUM SPACE    2310

0054 60 0153 0764         R    0054  60 R0003    BDTH           EDU ENTRY.  ALPHABETIC I                 2312

0025 60 0153 0764         R    0025  60 R0003    BDTH           SYN ENTRY.  ALPHABETIC I                 2314
0764 69 1217 0063         C BDTH     69          SUBR9          ANALYZE I                                2316

1217 65 0536 0120         J          65 EDUIV    D0003          BRING EDUIVALENT.  MULTIBRANCH.          2318

0118 65 1328 1233         R D0001    65 83RD     BP             INVALID ADDRESS                          2320

0119 65 1328 1233         R D0002    65 83RD     BP             BLANK I.  CARD IS UNUSABLE               2322

0120 20 0095 1098  0095   N D0003    20 E        X         E    DRUM.  PUT I-EDUIVALENT INTO E           2324

0121 65 1328 1233         R D0004    65 83RD     BP             NEW SYMBOL I.  CARD IS UNUSABLE          2326

0122 20 0095 1098  0095   R D0005    20 E        X         E    800X ADDRESS                             2328

0123 20 0095 1098  0095   R D0006    20 E        X         E    CORE ADDRESS                             2330

0124 20 0095 1098  0095   R Q0007    20 E        X         E    OTHER ADDRESS                            2332
1098 60 0152 0914         C X        60 R0002                   ALPHABETIC D                             2334
0914 69 1267 0063                    69          SUBR9          ANALYZE D                                2336

1267 65 0095 0127         J          65 E        D0010          BRING VALUE OF I INTO LOWER              2338

0125 65 1328 1233         R Q0008    65 83RO     BP             N G D.  CARD IS UNUSABLE                 2340

0126 65 1328 1233         R D0009    65 83RD     BP             BLANK D.  CARD IS UNUSABLE               2342

0127 20 0536 1289  0536   N D0010    20 EQUIV    SD        EDUIV OLD SYMBOL.  STORE I AS NEW EDUIV        2344

0128 20 0536 1289  0536   R D0011    20 EDUIV    SD        EDUIV NEW SYMBOL.  STORE I AS ITS EDUIVALENT   2346

0129 20 0536 1289  0536   R D0012    20 EQUIV    SD        EDUIV 800X.  STORE ITS EDUIVALENT.           2348

0130 20 0536 1289  0536   R D0013    20 EQUIV    SD        EDUIV CORE.  STORE I AS ITS EDUIVALENT.      2350

0131 20 0536 1289  0536   R D0014    20 EQUIV    SD        EDUIV OTHER.  STORE I AS THE EQUIVALENT.     2352
1289 69 0594 0661         C SD       69          SUBR7          STORE SYMBOL AND EDUIVALENT IN TABLE     2354

0594 60 0095 1099         J          60 E                       BRING SYMBOL-EQUIVALENT TO UPPER         2356
1099 69 0001 1025                    69 SETCC    SUB2R          RESERVE AND PUNCH CARD                   2358

1233 10 0003 0709         N BP       10 READC    SUB10          BY-PASS INVALID CARD                     2360

0098 65 0159 0964         R    0098  65 R0009                   RED ENTRY.  NUMERICAL I                  2362
0964 16 0409 1064                    16 2000I                   CORE OR DRUM                             2364
1064 46 1317 0968                    46 D                       D, DRUM.  I, CORE.                       2366
0968 15 0726 1082                    15 CDIFF    CD             ADD CORE RELOCATION AMOUNT               2368

1317 15 1019 1082         N D        15 DDIFF    CD             ADD DRUM RELOCATION AMOUNT               2370
1082 15 0409 0124         C CD       15 2000I    D0007          RESTORE THE 2000 AND JUMP BACK           2372

1328 00 8000 0000         K 83RD     00    8000      0000                                               2374
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RBD ROUTINE 2376

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                                     HED                                                                  2378

0094 60 0158 1114         R    0094  60 R0008                   BEGINNING OF REGION TO BE RESERVED       2380
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1114 69 1018 1025                    69          SUB2R          RESERVE FIRST CELL IN BANO                              2382

1018 60 0153 1214          J         60 R0003                   IS THE I-AOORESS BLANK                                  2384
1214 45 1068 1329                    45          OUT            O, NOT BLANK.  I, IT IS BLANK.                          2386

1068 60 0158 1264                    60 R0008                   BRING FIRST AOORESS AGAIN                               2388
1264 10 0320 0730                    10 50IXX                   AOVANCE IT                                              2390
0730 21 0158 1314  0158              21 R0008              R0008 STORE AOVANCEO O AOORESS                                2392
1314 11 0159 0716                    11 R0009                   SUBTRACT ENO OF AREA TO BE RESERVEO                     2394
0716 61 8003 0780                    61    8003                 CHANGE ITS SIGN                                         2396
0780 46 1329 0094                    46 OUT          0094       O, WE HAVE FINISHEO                                     2398

1329 70 0151 1102          N OUT     70 R0001                   WHEN OONE, REAO NEXT CARO                               2400
1102 65 0160 0766                    65 R0010                   IS THIS ANOTHER RBO CARO )                              2402
0766 16 0930 1339                    16 94I                     IS THIS ANOTHER RBO CARO )                              2404
1339 45 0644 0694                    45 ALL                     I, IT IS ANOTHER RBO CARO                               2406
0694 60 8001 0709                    60    8001    SUB10        PUNCH A CARO, ANO REPEAT RBO                            2408

1034 16 0038 0744            A       16 16THX                   OUPLICATE INTO AVAILABILITY TABLE )                     2410
0744 11 8001 0452                    11    8001                 OUPLICATE INTO AVAILABILITY TABLE )                     2412
0452 10 0916 0980                    10 Q                       OUPLICATE INTO AVAILABILITY TABLE )                     2414
0980 46 1283 0634                    46 OONE                    OUPLICATE INTO AVAILABILITY TABLE )                     2416
0634 11 8001 8002                    11    8001      8002       OUPLICATE INTO AVAILABILITY TABLE )                     2418

0644 61 1248 0966          N ALL     61 SENO                    OUPLICATE INTO AVAILABILITY TABLE )                     2420
0966 16 1230 8002                    16                8002     OUPLICATE INTO AVAILABILITY TABLE )                     2422

1230 69 1355 8003          J         69 A0001          8003     OUPLICATE INTO AVAILABILITY TABLE )                     2424

1248 2[illegible] 1359 1034  1359    J SENO    24 A0005  A       A0005 OUPLICATE INTO AVAILABILITY TABLE )                 2426

1283 65 1680 0690          N OONE    65 ZEROX                   CLEAR ACCUMULATOR                                       2428
0690 69 0794 1025                    69          SUB2R          RESERVE 0000                                            2430

0794 60 0160 0709                    60 R0010    SUB10          PUNCH CARO ANO PROCEEO                                  2432

0916 24 1555 0000  1555    Q Q       24 A0201        0000  A0201                                                        2434

0930 00 0000 0094          K 94I     00    0000      0094                                                              2436
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BLR, BLA, ANO RBR ROUTINES 2438

HEO 2440

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0029 69 1232 0740          R    0029 69 ZQ         SUB            BLR ENTRY.  TO SUBROUTINE                               2442

1232 69 0001 1025          J ZQ      69 SETCC      SUB2R          TO RESERVING SUBROUTINE                                 2444

0021 69 1044 1298          R    0021 69 81STX                    BLA ENTRY.  CHANGE ORUM TAG                             2446
1298 24 1669 1280  1669              24 ORUMT                ORUMT CHANGE ORUM TAG.  ORUM CANNOT BE FULL.                2448
1280 69 1333 0740                    69          SUB            TO SUBROUTINE                                           2450

1333 69 0001 1075          J         69 SETCC      SUB2U          TO UNRESERVING SUBROUTINE                               2452

0099 69 0502 0740          R    0099 69          SUB            RBR ENTRY.  TO SUBROUTINE                               2454

0502 10 1019 1232          J         10 00IFF      ZQ             AOO RELOCATION AMOUNT                                   2456

0740 24 0179 1282  0179    N SUB     24 EXITZ                EXITZ STORE EXIT                                          2458
1282 65 0153 1016                    65 R0003                   ALPHABETICAL I                                          2460
1016 45 1330 1332                    45          BL             I, I IS UNPUNCHEO                                       2462

1330 65 0159 1066                    65 R0009                   NUMERICAL I INTO LOWER                                  2464
1066 16 0158 1332                    16 R0008    BL             SUBTRACT NUMERICAL O FROM LOWER                         2466
1332 10 0158 0179          C BL      10 R0008    EXITZ          NUMERICAL O INTO UPPER                                  2468
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REG ROUTINE 2470

HEO 2472

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0097 65 0152 1116          R    0097 65 R0002                   REGION OESIGNATOR TO RIGHT ENO )                        2474
1116 30 0008 0790                    30    0008                 REGION OESIGNATOR TO RIGHT ENO )                        2476
0790 16 1308 1216                    16 99THX                   SUBTRACT 90                                             2478
1216 46 0684 0029                    46                0029     IF A DIGIT, TO BLR WITHOUT OESIGNATING                  2480

0684 15 1119 0734                    15 29IXX                   ADD 29                                                  2482
0734 46 0029 0940                    46    0029                 IF SPEC CHAR, TO BLR DIRECTLY                           2484
0940 35 0004 0552                    35    0004                 SHIFT TO O POSITION                                     2486
0552 15 1266 0784                    15 ST                      MAKE STORING ORDER                                      2488
0784 69 0158 8002                    69 R0008          8002     ADDRESS OF 0001 OF REGION                               2490

1266 2[illegible] 1660 0029  1660    J ST      24 G0001  0029  G0001 STORE ADDRESS OF 0001 OF REGION                     2492
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HEO ROUTINE 2494

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                                         HEO                                                                          2496
0084 65 0990 8002         R     0084  65               8002        AOOING OROER TO LOWER                              2498

0990 10 1898 0608         J           10 ZMAXM     U0001           AOO A SYMBOL TO UPPER                              2500
0608 44 1316 0001         R U0001     44           SETCC           I, IT IS ZERO ANO WE HAVE FINISHEO                 2502

1316 35 0008 1040                     35     0008                  CLEAR ALL EXCEPT LAST CHARACTER )                  2504
1040 30 0008 1118                     30     0008                  CLEAR ALL EXCEPT LAST CHARACTER )                  2506
1118 44 0001 0934                     44 SETCC                     O, QUIT BECAUSE WE HAVE FOUND LONG SYM             2508
0934 15 1090 8002                     15 K                     8002        MAKE STORING OROER, ANO STORE ZERO         2510

0609 16 1218 8002         R U0002     16 KA                    8002        RESTORE LOWER, ANO AOO NEXT SYMBOL         2512

1090 11 0000 0001         P K         11     0000      0001        TO CHANGE AOOING OROER TO STORING ONE              2514

1218 11 0001 0001         P KA        11     0001      0001        TO CHANGE STORING OROER TO AOOING ONE              2516


                                                  ALF ROUTINE                                                         2518
                                         HEO                                                                          2520

0016 65 0114 0984         R     0016  65 91STX                     TAG IN CASE L IS UNOEFINEO SYMBOL )                2522
0984 24 1030 1084   1030              24     1030            1030  TAG IN CASE L IS UNDEFINEO SYMBOL )                2524
1084 24 0197 1350   0197              24 ALOPT              ALOPT  TAG IN CASE L IS UNOEFINEO SYMBOL )                2526
1350 69 0154 1268                     69 R0004                     CONTROL INFORMATION )                              2528
1268 24 0186 1240   0186              24 P0010              P0010  CONTROL INFORMATION )                              2530
1240 69 0944 0042                     69           SUB19           PROCESS L, IF REGIONAL OR SYMBOLIC                 2532

0944 65 0152 1318         J           65 R0002                     ALPHABETIC SYMBOL                                  2534
1318 24 0185 1290   0185              24 P0009              P0009  STORE LAST 4 OIGITS OF CONSTANT IN I               2536
1290 30 0004 0602                     30     0004                                                                     2538
0602 20 0184 1340   0184              20 P0008              P0008  STORE NEXT 4 OIGITS IN O POSITION                  2540
1340 24 0183 0994   0183              24 P0007              P0007  STORE FIRST 2 OIGITS IN OP POSITION                2542
0994 60 0003 0057                     60 REAOC     SB10A              PUNCH                                           2544


                                                  PAT ROUTINE                                                         2546
                                         HEO                                                                          2548

0073 60 0010 0709         R     0073  60     0010  SUB10           PUNCH USUAL OUMMY OUTPUT CARO                      2550

0010 69 1234 1244         J     0010  69 85TH                      C.I. FOR AVAILABILITY TABLE )                      2552
1244 24 0186 1294   0186              24 P0010              P0010  C.I. FOR AVAILABILITY TABLE )                      2554
1294 60 1348 1284                     60 A1                        VARIABLE BRINGING OROER INTO UPPER                 2556
1284 15 1344 1249                     15 RS1       LOOP            INITIAL WORO SHOWING LOCATION OF TABLE             2558
1249 20 0177 1334   0177  C LOOP      20 P0001              P0001  STORE LOCATION OF AVAILABILITY WORO                2560
1334 15 0695 1299                     15 C3                        MOOIFY IOENTIFICATION OF WORO                      2562
1299 20 0179 0745   0179              20 P0003              P0003  STORE LOCATION OF AVAILABILITY WORO                2564
0745 15 0695 1349                     15 C3                        MODIFY IOENTIFICATION OF WORD                      2566
1349 20 0185 0795   0185              20 P0009              P0009  STORE LOCATION OF AVAILABILITY WORO                2568
0795 15 0695 0652                     15 C3                        MODIFY IDENTIFICATION OF WORO                      2570
0652 20 0183 8003   0183              20 P0007         8003 P0007  STORE LOCATION OF AVAILABILITY WORO                2572

0168 24 0178 0945   0178  R T0001     24 P0002              P0002  STORE AVAILABILITY WORO                            2574
0945 10 0702 8003                     10 C6            8003        MOOIFY BRINGING ORDER, ANO BRING                   2576

0169 24 0180 0995   0180  R T0002     24 P0004              P0004  STORE AVAILABILITY WORO                            2578
0995 10 0702 8003                     10 C6            8003        MOOIFY BRINGING ORDER, ANO BRING                   2580

0170 24 0182 1045   0182  R T0003     24 P0006              P0006  STORE AVAILABILITY WORO                            2582
1045 10 0702 8003                     10 C6            8003        MOOIFY BRINGING OROER, ANO BRING                   2584

0171 24 0184 1095   0184  R T0004     24 P0008              P0008  STORE AVAILABILITY WORO                            2586
1095 10 0702 8003                     10 C6            8003        MODIFY BRINGING OROER, ANO BRING                   2588

0172 71 0177 1096         R T0005     71 P0001                     PUNCH A CARO OF THE TABLE                          2590
1096 11 1352 1046                     11 O                         ARE WE OONE                                        2592
1046 44 0752 0003                     44           REAOC           O, WE ARE NOT OONE.                                2594

0752 10 1245 0952                     10 OS                        RESTORE VARIABLE BRINGING OROER                    2596
0952 16 1295 1249                     16 C7        LOOP            MOOIFY IOENTIFICATION FOR NEXT CARO                2598

1348 69 1355 0168         P A1        69 A0001     T0001           INITIAL VARIABLE BRINGING OROER                    2600

0702 00 0001 0001         P C6        00     0001      0001        TO MODIFY VARIABLE BRINGING OROER                  2602

1352 69 1555 0172         O O         69 A0201     T0005           COMPARISON CONSTANT FOR ENO OF JOB                 2604

1245 69 1555 0168         O OS        69 A0201     T0001           TO RESTORE BEFORE ENO OF JOB                       2606

1344 00 0000 0450         K RS1       00     0000      0450        INITIAL IOENTIFICATION OF WORO                     2608
0695 00 0500 0500         K C3        00     0500      0500        TO MODIFY IDENTIFICATION                           2610
1295 00 1499 1499         K C7        00     1499      1499        TO MOOIFY INOENTIFICATION AT ENO OF LI             2612
1234 00 0080 0000         K 85TH      00     0080      0000                                                           2614
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                                        REL ROUTINE                                                                 2616
                                    HED                                                                             2618

0093 65 0152 1345          R    0093  65 R0002                        ALPHAbETIC D                                 2620
1345 45 0596 0646                     45          S00                 IF 0 IS BLANK, WE SHOULD STORE ZERO          2622

0596 65 0158 0646                     65 R0008    SD0                 BRING NUMERICAL 0                            2624
0646 20 1019 0696  1019    C S00      20 00IFF                  00IFF STORE DRUM RELOCATION AMOUNT                 2626
0696 65 0153 0746                     65 R0003                        ALPHAbETIC I                                 2628
0746 45 0796 0946                     45          SC0                 JUMP IF I IS BLANK                           2630

0796 65 0159 0946                     65 R0009    SC0                 BRING NUMERICAL I                            2632
0946 20 0726 0001  0726    C SC0      20 C0IFF    SETCC         C0IFF STORE CORE RELOCATION AMOUNT                 2634



                                        BOP ROUTINE                                                                 2636

0027 69 0001 0006          R    0027  69 SETCC    SUBR1               TO INITIALIZING SUBROUTINE                   2638



                                        GENERAL CONSTANTS                                                           2640

0515 00 0000 0001          K 110TH     00   0000      0001                                                         2644
1022 00 0000 0002          K 2IXXX     00   0000      0002                                                         2646
0774 00 0000 0004          K 4IXXX     00   0000      0004                                                         2648
0068 00 0000 0008          K 810TH     00   0000      000P                                                         2650
0202 00 0000 0025          K 25IXX     00   0000      0025                                                         2652
1119 00 0000 0029          K 29IXX     00   0000      0029                                                         2654
0320 00 0000 0050          K 50IXX     00   0000      0050                                                         2656
0722 00 0000 0080          K 89THX     00   0000      0080                                                         2658
1308 00 0000 0090          K 99THX     00   0000      0090                                                         2660
0672 00 0000 0800          K 88THX     00   0000      0800                                                         2662
0409 00 0000 2000          K 2000I     00   0000      2000                                                         2664
0622 00 0000 8000          K 87THX     00   0000      8000                                                         2666
0038 00 0001 0000          K 16THX     00   0001      0000                                                         2668
0492 00 0002 0000          K 20XXX     00   0002      0000                                                         2670
0132 01 0000 0000          K 12NOX     01   0000      0000                                                         2672
0254 10 0000 0000          K 11STX     10   0000      0000                                                         2674
1044 80 0000 0000          K 81STX     80   0000      0000                                                         2676
0114 90 0000 0000          K 91STX     90   0000      0000                                                         2678
0395 00 0210 0000          K ZTABL     00   0210      0000               LENGTH OF SYMBOL TABLE                    2680
                                    PAT                                                                         2682
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0520 00 0000 0329        R X0003     00    0000   X1          DRUM, OLD SYMB, REG. FIXED                          704
0523 00 0000 0519        R X0006     00    0000   X0002       CORE.  TREAT SAME AS BLANK                          708
0524 00 0000 0329        R X0007     00    0000   X1          OTHER ADDRESS.  FIXED                               710
0527 00 0000 0081        R X0010     00    0000   F           OLD SYMBOL, DRUM, REGION.  FIXED                    728
0264 45 0000 0001        P C4        45    0000      0001     DIFFERENCE OF BRINGING AND STORING ORD              1130
0277 00 0000 0269        R M0010     00    0000   M0002       NEW SYMBOL, BUT SYMBOL TABLE FULL                   1216
0624 00 0000 0376        J           00    0000   A           TAG-IDENTIFICATION, AND EXIT FROM 18                1246
0727 00 0000 0631        J           00    0000               ADDEND AND EXIT FOR SUBROUTINE 18                   1264
0927 00 0000 0919        R C0010     00    0000   C0002       NEW SYMBOL, BUT TABLE FULL.  N.G.                   1284
0373 01 0000 0373        R J0006     01    0000   J0006       8OOX RANGE.  ERROR.                                 1318
0378 60 0000 0605                    60    0000               BRING APPROPRIATE TABULAR VALUE                     1568
0687 00 0000 0991        J F         00    0000               TO BUILD EXIT FROM SUBROUTINE 13                    1622
0428 65 0000 0756        J           65    0000               BRING ADDENDS                                       1842
0423 00 0000 0001        R L0006     00    0000   SETCC       8OOX ADDRESS.  QUIT IMMEDIATELY                     2102
0425 00 0000 0419        R L0008     00    0000   L0002       MISCELLANEOUS ADDRESS.  QUIT AND OMIT               2110
1226 00 0000 0476        J           00    0000   00008       ADDEND AND EXIT FOR USE IN SUBR 18                  2138
0928 00 0000 0932        J           00    0000               ADDEND AND EXIT FOR SUBROUTINE 18                   2154
0478 00 0000 0470        R 00010     00    0000   00002       SYMB TABLE FULL OR DRUM PACKED. QUIT                2172
0581 00 0000 0573        R I0010     00    0000   I0002       SYMBOL TABLE FULL.  OMIT PUNCHING ADDR              2232
0982 00 0000 1336        J           00    0000               ADDEND AND EXIT FOR INDEXING                        2274
1090 11 0000 0001        P K         11    0000      0001     TO CHANGE ADDING ORDER TO STORING ONE               2514

1232 69 0001 1025        J ZQ        69 SETCC    SUB2R       TO RESERVING SUBROUTINE                             2444
1333 69 0001 1075        J           69 SETCC    SUB2U       TO UNRESERVING SUBROUTINE                           2452
1118 44 0001 0934                    44 SETCC                0, QUIT BECAUSE WE HAVE FOUND LONG SYM              2508
1218 11 0001 0001        P KA        11    0001      0001     TO CHANGE STORING ORDER TO ADDING ONE               2516
0702 00 0001 0001        P C6        00    0001      0001     TO MODIFY VARIABLE BRINGING ORDER                   2602
0027 69 0001 0006        R    0027   69 SETCC    SUBR1       TO INITIALIZING SUBROUTINE                          2638
0568 00 0001 0375        J           00    0001   J0008       ADDEND AND EXIT FOR SUBROUTINE 18                   1312
1028 00 0001 0577        J           00    0001   I0006       ADDENDS AND EXIT FOR USE IN SUBR 18.                2206
1331 00 0001 1236        J           00    0001               ADDEND AND EXIT FOR SUBROUTINE 18.                  2216
1032 00 0001 1288        J           00    0001               ADDEND AND EXIT FOR INDEXING                        2294
1099 69 0001 1025                    69 SETCC    SUB2R       RESERVE AND PUNCH CARD                              2358

0994 60 0003 0057                    60 READC    SB10A          PUNCH                                            2544
0100 69 0003 0006        N    0100   69 READC    SUBR1       INITIALIZE AT START OF ASSEMBLY                     362
0015 60 0003 0057        J           60 READC    SB10A       PREPARE TO PUNCH CARD                               392
0001 60 0003 0709        N SETCC     60 READC    SUB10       SEQUEL TO MANY PSEUDO-OPS.                          1580
1338 60 0003 0057        C ALL       60 READC    SB10A       PREPARE TO PUNCH AND READ NEXT CARD                 2304
1233 10 0003 0709        N BP        10 READC    SUB10       BY-PASS INVALID CARD                                2360

0051 69 0004 0107        N MOFLP     69 P        A           STARTED SEARCH WITH MOF OPERATION                   398

0256 69 0009 0039                    69          SUB14       GET OP, C.I., TAGS, OPTIM, ALOPT.                   660

0073 60 0010 0709        R    0073   60    0010  SUB10       PUNCH USUAL DUMMY OUTPUT CARD                       2550

0007 44 0011 0012                    44 MDFLI    ABCDE       IF SO, START FORWARD SEARCH                         388

0283 96 0012 0138                    96 ABCDE                IF WITH I, PROCESS LIKE 08                          538
0141 69 0012 0045        J           69 ABCDE    SUB20       PROCESS D, AND TO 08 ROUTINE                        542

0011 69 0014 0107        N MDFLI     69 I        A           STARTED SEARACH WITH INDEXED D                      400

0012 69 0015 0018        C ABCDE     69          SUB21       PROCESS I                                           390

0321 10 0024 8003                    10             8003     STORE PROCESSED CARD )                              878

0023 45 0026 0077                    45 OUITT                0, IT IS NOT, AND WE QUIT                           436
0071 44 0026 0076                    44 QUITT                IF SO, QUIT SEARCH )                                444
0060 44 0026 0064        J           44 QUITT                IF N G, QUIT SEARCH                                 456
0150 94 0026 0055                    94 QUITT                IF SO, QUIT SEARCH                                  462
0307 45 0026 0136                    45 QUITT    B           IF SO, QUIT SEARCH                                  466
0173 44 0026 0078                    44 QUITT                IF I IS N G, QUIT SEARCH                            474
0457 45 0026 0111                    45 QUITT                IF SO, QUIT SEARCH                                  486

0734 46 0029 0940                    46    0029              IF SPEC CHAR, TO BLR DIRECTLY                       2484

0028 11 0031 0035          X         11 0                    STORE SET OF DATA )                                 414

0078 45 0032 0019                    45 BCOEF    BACKW       IF I IS FIXED, START BACKWARD                       476
0336 95 0032 0012                    95 BCDEF    ABCDE       WITH I.  EXIT ACCORDING TO WHY SEARCH               612

0081 91 0034 0436        C F         91 XX8                  MULTIPLE BRANCH ACCORDING TO TAGS )                 738

0033 69 0036 0039                    69          SUB14       OP, C.I., OPTIM, ALOPT, ETC.                        376

0585 69 0038 0741                    69 16THX                PRESET T AS POSITIVE 1 )                            1502
0686 66 0038 0643        N SHRT      66 16THX                SHORT.  PRESET T AS -1 )                            1510
0462 16 0038 0793                    16 16THX    ST          COMPARISON CONSTANT FOR LAST PART                   1642
0562 15 0038 0793                    15 16THX    ST          COMPARISON CONSTANT FOR LAST PART                   1666
1034 16 0038 0744          A         16 16THX                DUPLICATE INTO AVAILABILITY TABLE )                 2410
0035 15 0038 0043                    15 16THX                STORE SET OF DATA )                                 416
0161 15 0038 0143                    15 16THX                BRING BACK A SET )                                  560
0327 16 0038 0243                    16 16THX    LOOP        BRING BACK A SET )                                  642
0265 16 0038 0293                    16 16THX                BRING BACK A SET )                                  652
0259 16 0038 0443                    16 16THX                STORE PROCESSED CARD )                              886
0547 15 0038 8002        C A         15 16THX       8002     BRING BACK A SET OF RESULTS )                       922

0087 24 0040 0193  0040              24 SAVED             SAVED SAVE D  FROM CARD THAT STARTED SRCH )             628
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0135 69 0040 0343                      69 SAVEO                        8RING BACK L AND D )                                    678

0041 10 0044 8003          C LOOP      10              8003            STORE SET OF DATA )                                     408

0147 10 0050 8003                      10 QS            8003            STORE SET OF DATA )                                     420

0048 94 0051 0053                      94 MDFLP                         D, YES                                                  384

0049 24 0052 0205  0052                24 DONE                  DONE    PRESET EXIT FROM 8ACKWARDS ROUTINE )                    632
0090 24 0052 0468  0052                24 DONE          NO      OONE    WITH L.  ALTER EXIT )                                   684
0397 69 0052 0305          J LNM       69 DONE          SU8R4           PROCESS L BACKWAROS                                     762
0102 65 0052 0201          J LN        65 OONE          SU822              SAVE ORCEQ                                           786

0257 69 0060 0061                      69               SU8R3           IF SO, IS IT FIXEO )                                    454

0109 65 0062 0217          J           65 OPREG                         SAVE DYNAMIC LEVEL OF L FROM D )                        818
0406 65 0062 0267          J           65 OPREG                         WHICH L IS LESS, MEASURED ON CIRCLE )                   834
0376 20 0062 0925  0062    N A         20 OPREG         C0008   OPREG   STORE ADDRESS FOR OPTIMIZING NEXT ADDR                  1278
0371 24 0062 0615  0062    N J0004     24 OPREG                 OPREG   ORUM OR ORUM EQUIVALENT                                 1308
0335 20 0062 0177  0062    N S810C     20 OPREG         EXITX   OPREG   FROM 4-5, 19-20.  STORE DYNAMIC LEVEL                   1602
1320 65 0062 0967                      65 OPREG                         WHICH ONE OO WE USE )                                   1886
0956 15 0062 1017                      15 OPREG                         AOD OLD OYNAMIC LEVEL                                   1902

0163 69 0066 0400          J           69               SU8R5           PROCESS 8ACKWAROS D ONCE MORE                           852

0065 16 0068 0023                      16 810TH                         IS CARO OF TYPE 08 )                                    434
0165 16 0068 0323                      16 810TH                         IS IT TYPE 08)                                          496
0218 60 0068 0177          R F0001     60 810TH         EXITX           AOORESS IS N G                                          1154
0219 65 0068 0177          R F0002     65 810TH         EXITX           8LANK ADDRESS                                           1156
0221 65 0068 0177          R F0004     65 810TH         EXITX           SYM8OLIC ADDRESS, WITH UNDEFINED SYM8                   1160
0223 65 0068 0177          R F0006     65 810TH         EXITX           CORE AODRESS                                            1164
0224 60 0068 0177          R F0007     60 810TH         EXITX           OTHER ADDRESS.  USUALLY PART OF CONST.                  1166

0215 22 0069 0022  0069                22 OC                    OC      NOT 1ST CARD.  MAKE COMP. CONST. )                      548
0106 16 0069 0623                      16 QC                            IS THIS LAST SET                                        568

0571 69 0074 0377                      69 8RNG                          MAKE NEW 8RINGING ORDER )                               906

0522 15 0075 0329          R X0005     15 13RD          X1              800X.  CALL IT UNFIXED                                  696
0518 15 0075 0329          R X0001     15 13RD          X1              ADDRESS N G.  CALL UNFIXED                              698
0521 15 0075 0329          R X0004     15 13RD          X1              NEW SYMBOL. UNFIXED                                     706

0176 15 0079 0233                      15 710                           IS TYPE 01                                              500

0229 10 0082 8002          C LOOP      10 SEND             8002         8RING 8ACK A SET )                                      552

0083 65 0086 0041                      65 SEND          LOOP            STORE SET OF DATA )                                     406

0076 45 0088 0026                      45 C             OUITT           IF SO, QUIT SEARCH )                                    446

0036 69 0089 0042          J           69               SU819           PROCESS L                                               378

0088 69 0091 0039          C C         69               SU814           GET OP, C.I., TAGS, OPTIM, ALOPT.                       448

0089 69 0092 0045          J           69               SUB20           PROCESS O                                               380

0092 69 D095 0048          J           69 OPTIM                         IS IT AN MOF OPERATION )                                382
0688 65 0095 0699          N FD        65 OPTIM                         FORWARO D.  L-D ADDENDS, LEFT END LOWE                  1786
0490 65 0095 0749          N FI8D      65 OPTIM                         FORWARD I OR 8ACKWARD D.  GET ADDENDS                   1798
0706 69 0095 0548                      69 OPTIM                         OPTIMIZING TAGS                                         1826
1222 16 0095 0785                      16 OPTIM         SEO             REDUCE ADDENDS 8Y 1 FOR 80,82, OR 88                    1848
1306 2A 0095 0648  0095                24 OPTIM                 OPTIM   STORE OPTIMIZING AODENDS AND TAGS                       1966
0471 69 0095 0748          R D0003     69 OPTIM                         8LANK D.  IS IT MDF OPERATION                           2128
1049 69 0095 0948          C 8         69 OPTIM                         SEVERAL CASES.  WHAT KIND OF OP                         2166
0120 20 0095 1098  0095    N Q0003     20 E             X       E       DRUM.  PUT I-EQUIVALENT INTO E                          2324
0122 20 0095 1098  0095    R Q0005     20 E             X       E       800X ADDRESS                                            2328
0123 20 0095 1098  0095    R Q0006     20 E             X       E       CORE ADDRESS                                            2330
0124 20 0095 1098  0095    R Q0007     20 E             X       E       OTHER ADDRESS                                           2332
1267 65 0095 0127          J           65 E             Q0010           BRING VALUE OF I INTO LOWER                             2338
0594 60 0095 1099          J           60 E                             8RING SYMBOL-EQUIVALENT TO UPPER                        2356

0193 69 0096 0049                      69 DN1                           PRESET EXIT FROM 8ACKWARDS ROUTINE )                    630

0298 69 0101 0018          J           69               SU821           PROCESS I FORWARDS                                      774

0149 69 0102 0018          J           69 LN            SUB21           PROCESS I FORWARDS                                      784
0195 69 0102 0045          J           69 LN            SU820           PROCESS D FORWARDS                                      794

0148 20 0103 0D56  D1D3    N OUT       20 FINAL                 FINAL   STORE VARIABLE ORDER                                    422
DD32 65 0103 D4D7          N BCDEF     65 FINAL                         IS STORAGE AREA FULL )                                  478
D227 65 0103 D041          C LP        65 FINAL         LOOP            ALL CASES, BACK TO START OF LOOP                        512
0258 65 0103 D557          N SKP       65 FINAL                         NOT 1ST CARD.  MAKE COMP. CONST. )                      544
0205 65 D103 0757                      65 FINAL                         BRING BACK A SET )                                      634

0456 60 0108 0263                      60 SA                            ARE WE TO LAST LINE OF TABLE )                          1018
D331 21 0108 0361  D108    C SU        21 SA                    SA      STORE VARIABLE STORING ORDER                            1026
0312 60 D108 D513                      6D SA                            MODIFY TO TAKE FIRST LINE, SAME COLUMN                  11D8
0362 6D 0108 D563                      6D SA                            LAST LINE AND END OF WORD.  MODIFY )                    112D
0747 69 0108 8DD2                      69 HSYMB            8002         STORE SYM8OL )                                          1334
1D05 11 D108 0763                      11 HSYMB                         SOME SYMBOL WAS FOUND.  SUBTRACT OURS                   1422
0636 21 0108 D961  D108    N ABC       21 HSYMB                 HSYMB   ADDRESS NOT BLANK.  STORE SYMBOL                        1440
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0416 60 0108 1013          N SYM       60 HSYMB                    SYMBOLIC ADDRESS.  BRING SYMBOL                1496

0356 65 0109 0113          J           65          SSB             BRING BACK BLANB AND ORCEB                       816

0357 69 0110 0061                      69          SUBR3           IS I A FIXED ADDRESS )                           470

0791 01 0111 1219          J FULL      01    0111  NG              STOP IF SYMBOL TABLE IS FULL                     1556

0309 46 0112 0213                      46          OUT             CLEAR REGION AND SYMBOL TABLES )                 958

0111 69 0114 0017                      69 91STX                    CHANGE FIRST-CARD INDICATOR TO 2ND )             488
0188 69 0114 0067          N B         69 91STX                    START ON L.  FIRST-CARD TAG )                    614
1109 69 0114 0617                      69 91STX                    CHANGE DRUM TAG TO 9 )                           1700
0016 65 0114 0984          R    0016   65 91STX                    TAG IN CASE L IS UNDEFINED SYMBOL )              2522

0263 11 0116 0671                      11 796                      ARE WE TO LAST LINE OF TABLE )                   1020

0164 24 0117 0020  0117                24 VAR2X            VAR2X   PRESET TO STORE AFTER PROCESSING )               620
0096 65 0117 0321          J DN1       65 VAR2X                    ALL CASES.  STORE PROCESSED CARD )               876
0398 20 0117 0570  0117    N OUT2      20 VAR2X            VAR2X   STORE PROCESSED CARD )                           892
0137 65 0117 0571          J ENDED     65 VAR2X                    MAKE NEW BRINGING ORDER )                        904

0987 15 0132 1037                      15 12NOX                       SHOULD WE INTERCHANGE ADDENDS )               1870
0529 15 0132 0187          R X0012     15 12NOX    X2              BOOX ADDRESS.  UNFIXED                           720
0525 15 0132 0187          R X0008     15 12NDX    X2              D IS N G.  CALL UNFIXED                          722
0528 15 0132 0187          R X0011     15 12NOX    X2              NEW SYMBOL.  UNFIXED                             730
0301 15 0132 0237                      15 12NOX                    MODIFY TO USE ROUTINE FOR UNFIXED D )            826
0351 16 0132 0287                      16 12NDX    XY              MODIFY ALOPT AGAIN )                             856

0231 61 0134 8003                      61             8003         CLEAR REGION AND SYMBOL TABLES )                 952

0133 96 0136 0088                      96 B        C               WITH I OR L, RESPECTIVELY                        430

0288 69 0137 0090          N L         69 ENDED                    WITH L.  ALTER EXIT )                            682

0286 69 0139 0018          J JUMP      69          SUB21           PROCESS I                                        586

0436 99 0140 0291                      99          MISC            MULTIPLE BRANCH ACCORDING TO TAGS )              740

0138 69 0141 0042                      69          SUB19           PROCESS L                                        540

0091 95 0144 0046          J           95 K                        IS D ACTUALLY AN ADDRESS                         450
0064 45 0144 0019                      45 K        BACKW           IF FIXED, START BACKWARD PROCESSING              458

0243 10 0146 8002          N LOOP      10             8002         BRING BACK A SET )                               646

0043 44 0147 0148                      44          OUT             STORE SET OF DATA )                              418

0196 69 0149 0305          J           69          SUBR4           PROCESS L BACKWARDS                              782

0037 24 0151 0104  0151                24 R0001            R0001   IF SO, PUT IN DUMMY MOVEABLE WORDS )             504

0250 24 0150 0408  0150    Q QS        24 R0000    X       R0000   RESTORE COMPARISON CONSTANT AND MODIFY           750

0044 69 0151 8002          J           69 R0001       8002         STORE SET OF DATA )                              410
0077 60 0151 0005                      60 R0001                    ALPHABETIC L                                     438
0253 70 0151 1007                      70 R0001                    READ ANOTHER CARD                                492
0082 24 0151 0204  0151    J SEND      24 R0001    X       R0001   BRING BACK A SET )                               556
0261 24 0151 0408  0151    Q Q         24 R0001    X       R0001   COMPARISON CONSTANT FOR END OF SET               748
0080 60 0151 0455                      60 R0001                    ALPHABETICAL L INTO UPPER                        1174
0480 60 0151 0712                      60 R0001                    ALPHABETICAL L TO UPPER                          2070
1212 10 0151 1262                      10 R0001                    ALPHABETIC L                                     2252
1329 70 0151 1102          N OUT       70 R0001                    WHEN DONE, READ NEXT CARD                        2400

0046 60 0152 0257                      60 R0002                    IF SO, IS IT FIXED )                             452
0104 24 0152 0105  0152                24 R0002            R0002   IF SO, PUT IN DUMMY MOVEABLE WORDS )             506
0350 60 0152 1057                      60 R0002                    ALPHABETIC D, TO SEE WHETHER FIXED               714
0230 60 0152 0958                      60 R0002                    ALPHABETIC D INTO UPPER                          1224
0630 60 0152 0762                      60 R0002                    ALPHABETICAL D INTO UPPER                        2118
0574 60 0152 1012          R I0003     60 R0002                    BLANK I.  IS D ALSO BLANK                        2190
0614 10 0152 1312                      10 R0002                    ALPHABETIC D                                     2266
1098 60 0152 0914          C X         60 R0002                    ALPHABETIC D                                     2334
0097 65 0152 1116          R    0097   65 R0002                    REGION DESIGNATOR TO RIGHT END )                 2474
0944 65 0152 1318          J           65 R0002                    ALPHABETIC SYMBOL                                2534
0093 65 0152 1345          R    0093   65 R0002                    ALPHABETIC D                                     2620

0136 60 0153 0357          C B         60 R0003                    IS I A FIXED ADDRESS )                           468
0105 20 0153 0236  0153                24 R0003    YYY     R0003   IF SO, PUT IN DUMMY MOVEABLE WORDS )             508
0255 60 0153 0957                      60 R0003                    BRING ALPHABETIC I                               690
0330 60 0153 1108                      60 R0003                    ALPHABETIC I TO UPPER                            1292
0680 60 0153 0962                      60 R0003                    ALPHABETIC I TO UPPER                            2180
0664 10 0153 0714                      10 R0003                    ALPHABETIC I                                     2286
0054 60 0153 0764          R    0054   60 R0003    BOTH            END ENTRY.  ALPHABETIC I                         2312
0025 60 0153 0764          R    0025   60 R0003    BOTH            SYN ENTRY.  ALPHABETIC I                         2314
1018 60 0153 1214          J           60 R0003                    IS THE I-ADDRESS BLANK                           2384
1282 65 0153 1016                      65 R0003                    ALPHABETICAL I                                   2460
0696 65 0153 0746                      65 R0003                    ALPHABETIC I                                     2628

0941 21 0154 0759  0154                21 R0004            R0004   TO SUPPRESS IN CASE WE SEARCH                    1998
0430 69 0154 1110                      69 R0004                    CONTROL INFORMATION FOR PUNCHING )               1926
1350 69 0154 1268                      69 R0004                    CONTROL INFORMATION )                            2528
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0236 24 0155 0227  0155    C YYY       24 R0005     LP          R0005 EITHER CASE. SOMETHING INTO R0005                    510
0031 69 0155 8002          O O         69 R0005        8002           COMPARISON CONSTANT FOR STORING                     514
0607 24 0155 0204  0155    O O         24 R0005     X           R0005 COMPARISON CONSTANT FOR BRINGING SET                 596
0146 24 0155 0408  0155    J           24 R0005     X           R0005 BRING BACK A SET )                                   648
0989 65 0155 1210                      65 R0005                       BRING TAGS AND OPERATION                          1930

0050 69 0156 8002          O OS        69 R0006        8002           TO RESTORE COMPARISON CONST + ADVANCE               516
0200 24 0156 0204  0156    O OS        24 R0006     X           R0006 TO RESTORE AND ADVANCE                               598

1112 65 0157 1212          J           65 R0007                       NUMERICAL L                                       2250

1286 65 0158 0614          C PROO      65 R0008                       NUMERICAL O                                       2264
0094 60 0158 1114          R    0094   60 R0008                       BEGINNING OF REGION TO BE RESERVED                2380
1068 60 0158 1264                      60 R0008                       BRING FIRST ADDRESS AGAIN                         2388
0730 21 0158 1314  0158                21 R0008                 R0008 STORE ADVANCED O ADDRESS                          2392
1066 16 0158 1332                      16 R0008     BL            R0008 SUBTRACT NUMERICAL O FROM LOWER                   2466
1332 10 0158 0179          C BL        10 R0008     EXITZ         R0008 NUMERICAL O INTO UPPER                            2468
0784 69 0158 8002                      69 R0008        8002           ADDRESS OF 0001 OF REGION                         2490
0596 65 0158 0646                      65 R0008     SDO           R0008 BRING NUMERICAL O                                 2624

1238 65 0159 0664          C PROI      65 R0009                       NUMERICAL I                                       2284
0098 65 0159 0964          R    0098   65 R0009                       REO ENTRY.  NUMERICAL I                           2362
1314 11 0159 0716                      11 R0009                       SUBTRACT ENO OF AREA TO BE RESERVED               2394
1330 65 0159 1066                      65 R0009                       NUMERICAL I INTO LOWER                            2464
0796 65 0159 0946                      65 R0009     SCO           R0009 BRING NUMERICAL I                                 2632

0058 65 0160 0065          N NO        65 R0010                       IS CARD OF TYPE 08 )                               432
1007 65 0160 0165                      65 R0010                       IS IT TYPE 08)                                     494
1102 65 0160 0766                      65 R0010                       IS THIS ANOTHER RBD CARD )                        2402
0794 60 0160 0709                      60 R0010     SUB10         R0010 PUNCH CARD AND PROCEED                            2432

0003 70 0161 1041            READC     70 R0011                       READ ONE CARD                                      364

0508 45 0162 0178                      45           EXITY         R0010 O, WE HAVE NOT FINISHED.  I, WE HAVE.           1012

0560 65 0163 0113                      65           SSB           R0010 BRING BACK BLANB AND ALOPT ONCE MORE              850

0313 46 0166 0178                      46           EXITY         R0010 I, OVER 1999.  WE RESERVE NOTHING                1046

0013 22 0167 0070  0167                22 XXXX1                   XXXX1 BRING BACK A SET )                               638
0377 22 0167 0620  0167                22 XXXX1     LOOP          XXXX1 MAKE NEW BRINGING ORDER )                        908
0673 65 0167 0621          J '         65 XXXX1                   XXXX1 BRING BACK A SET OF RESUTTS )                    912
0448 20 0167 0620  0167    N OUT       20 XXXX1     LOOP          XXXX1 STORE MODIFIED BRINGING ORDER + REPEAT           934
0555 20 0167 0670  0167                20 XXXX1                   XXXX1 MAKE BRINGING ORDER )                           1348
0713 21 0167 0720  0167    C RES       21 XXXX1                   XXXX1 STORE ADDRESS TEMPORARILY                       1404
1273 65 0167 0177          J           65 XXXX1     EXITX         R0010 EQUIVALENT BACK TO LOWER AND EXIT               1408
0390 22 0167 0441  0167                22 XXXX1     SUB13         XXXX1 PREPARE EXIT AND GO TO SUBROUTINE 13 )          1620
1209 22 0167 8001  0167                22 XXXX1        8001       XXXX1 NEW AVAILABILITY WORD INTO DRUM )               1736
0935 20 0167 1320  0167    C P '       20 XXXX1                   XXXX1 ALL CASES.  STORE ADDENDS                       1884
1014 65 0167 0771                      65 XXXX1                         000.  SEPARATE LAST ADDEND )                    1892
0414 65 0167 0985          N EVN       65 XXXX1     BOTH          R0010 EVEN.  WE SHOULD USE FIRST ADDEND               1898
1261 23 0167 0971  0167                23 XXXX1                   XXXX1 STORE LAST 4 DIGITS OF OPTIM                    1970
1089 10 0167 1071          C AX        10 XXXX1                         ADD IN TAGS FROM OPTIM                          1980
1281 20 0167 1121  0167                20 XXXX1                   XXXX1 STORE ADDRESS                                   2034
1221 10 0167 1271                      10 XXXX1                         INDEXABLE ADDRESS INTO UPPER                    2048
0999 15 0167 0178          C A         15 XXXX1     EXITY         R0010 ADD ADDRESS BEING INDEXED.  EXIT.               2060

0621 16 0174 0379                      16 OL                          BRING BACK A SET OF RESULTS )                      914

0072 65 0175 0429                      65 AVAL                        MAKE DRUM AVAILABLE )                              968

0323 45 0176 0227                      45           LP            R0010 O, IT IS NOT.  I, IT IS.                         498

0061 24 0177 0030  0177    N SUBR3     24 EXITX                   EXITX STORE EXIT                                      1148
0305 24 0177 0080  0177    N SUBR4     24 EXITX                   EXITX STORE EXIT                                      1172
0400 24 0177 0230  0177    N SUBR5     24 EXITX                   EXITX STORE EXIT                                      1222
0142 24 0177 0330  0177    N SUBR6     24 EXITX                   EXITX STORE EXIT                                      1290
1024 24 0177 0380  0177    N SUBR8     24 EXITX                   EXITX STORE EXIT                                      1374
0434 71 0177 8003                      71 P0001        8003           PUNCH CARD.  PERFORM UPPER.                       1594
0039 24 0177 0430  0177    N SUB14     24 EXITX                   EXITX STORE EXIT                                      1924
0042 24 0177 0480  0177    N SUB19     24 EXITX                   EXITX STORE EXIT                                      2068
0045 24 0177 0630  0177    N SUB20     24 EXITX                   EXITX STORE EXIT                                      2116
0948 91 0177 0335                      91 EXITX     SB10C         R0010 O, BRANCH.  I, ARITHMETIC.                      2168
0018 24 0177 0680  0177    N SUB21     24 EXITX                   EXITX STORE EXIT                                      2178
0988 69 0177 0661                      69 EXITX     SUBR7              STORE SYMBOL AND ITS EQUIVALENT                  2230
1249 20 0177 1334  0177    C LOOP      20 P0001                   P0001 STORE LOCATION OF AVAILABILITY WORD             2560
0172 71 0177 1096          R T0005     71 P0001                         PUNCH A CARD OF THE TABLE                       2590

0006 24 0178 0231  0178    N SUBR1     24 EXITY                   EXITY STORE EXIT                                       950
0415 46 0178 0569                      46 EXITY                         MAKE DRUM AVAILABLE )                           976
1025 24 0178 0381  0178    N SUB2R     24 EXITY                   EXITY ENTRY TO RESERVE.  STORE EXIT.                  1030
1075 24 0178 0431  0178    N SUB2U     24 EXITY                   EXITY ENTRY TO UNRESERVE.  STORE EXIT.                1034
0976 20 0178 0931  0178                20 EXITY                   EXITY STORE EXIT OUT OF LOWER                         1612
0693 69 0178 0981          C SSW       69 EXITY                         ALL CASES.  GOING WHICH DIRECTION               1630
1122 65 0178 1077                      65 EXITY     PAKT          R0010 MODIFY EXIT )                                   1704
0586 24 0178 1231  0178    N SUB17     24 EXITY                   EXITY STORE EXIT INSTRUCTION                          1992
0677 24 0178 1281  0178    N INDEX     24 EXITY                   EXITY STORE EXIT                                      2032
1121 65 0178 0783                      65 EXITY                         O-POSITION HOLDS O FOR O, 1 FOR I )             2036
0168 24 0178 0945  0178    R T0001     24 P0002                   P0002 STORE AVAILABILITY WORD                         2574

0661 24 0179 0432  0179    N SUBR7     24 EXITZ                   EXITZ STORE EXIT                                      1328
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0063 24 0179 0482  0179    N SUBR9     24 EXITZ                EXITZ STORE EXIT                                          1434
1069 10 0179 8003          C DON       10 EXITZ       8003         FROM MANY PLACES.  MULTIBRANCH                        1574
0441 24 0179 0532  0179    N SUB13     24 EXITZ                EXITZ STORE EXIT                                          1778
0785 69 0179 0582          C SEO       69 EXITZ                     ALL CASES.  WHICH DIRECTION                          1850
1325 69 0179 0632                      69 EXITZ                     IF BACKWARD L, SUBTRACT TAG-COUNT )                  1906
0740 24 0179 1282  0179    N SUB       24 EXITZ                EXITZ STORE EXIT                                          2458
1299 20 0179 0745  0179                20 P0003                P0003 STORE LOCATION OF AVAILABILITY WORD                  2564

0169 24 0180 0995  0180    R T0002     24 P0004                P0004 STORE AVAILABILITY WORD                              2578

0057 15 0181 0635          C SB10A     15 P0005                     ADVANCE CARD NUMBER )                                1588
1027 20 0181 0434  0181                20 P0005                P0005 ADVANCE CARD NUMBER )                               1592
0650 69 0181 8002          O OS2       69 P0005       8002         RESTORE CONSTANT AND MODIFY                           898
0213 20 0181 0234  0181    N OUT       20 P0005                P0005 CLEAR CARD NUMBER                                   962

0274 20 0182 0385  0182    R M0007     20 P0006                P0006 CORE ADDRESS.  STORE FOR PUNCHING                   1200
0421 20 0182 1285  0182    N L0004     20 P0006                P0006 ORUM.  STORE ADDRESS FOR PUNCHING                   2086
0595 65 0182 1337                      65 P0006       MW           BRING BACK NUMERICAL ADDRESS                         2092
0424 20 0182 1335  0182    R L0007     20 P0006                P0006 CORE ADDRESS.  STORE FOR PUNCHING                   2104
1324 20 0182 1286  0182                20 P0006       PROD     P0006 STORE L FOR PUNCHING                                2258
0170 20 0182 1045  0182    R T0003     24 P0006                P0006 STORE AVAILABILITY WORD                             2582
0020 69 0182 0085                      69 P0006                     SAVE L FROM CARD THAT STARTED SRCH )                  622
0241 24 0182 0135  0182                24 P0006                P0006 BRING BACK L AND D )                                676
0355 69 0182 8002          O O2        69 P0006          8002       COMPARISON CONSTANT FOR END OF SET                    896
0242 24 0182 0285  0182    J SEND      24 P0006       X        P0006 BRING BACK A SET OF RESULTS )                       926
0271 20 0182 0335  0182    N M0004     20 P0006       SB10C    P0006 ORUM ADDRESS.  STORE FOR PUNCHING                   1192

0566 22 0183 0986  0183                22 P0007                P0007 STORE OPERATION FOR PUNCHING                        1934
0598 60 0183 1237                      60 P0007                     OPERATION IN O OF UPPER                              1960
1340 24 0183 0994  0183                24 P0007                P0007 STORE FIRST 2 DIGITS IN OP POSITION                 2542
0652 20 0183 8003  0183                20 P0007          8003  P0007 STORE LOCATION OF AVAILABILITY WORD                  2572

0631 20 0184 0487  0184                20 P0008                P0008 STORE CORE ADDRESS FOR PUNCHING                     1266
0925 20 0184 0177  0184    R C0008     20 P0008       EXITX    P0008 MISC ADDR.  STORE FOR PUNCHING.  EXIT               1280
0402 60 0184 0789          N SHOP      60 P0008                     SHIFT OPERATION.  FORWARD I, BACKW L.                1816
0660 60 0184 0939          N XAS       60 P0008                     INDEXING OP.  FORWARD I, BACKWARD L.                 1832
0992 24 0184 1287  0184                24 P0008                P0008 STORE THE ADDRESS FOR PUNCHING                      2006
0932 20 0184 0788  0184                20 P0008                P0008 STORE THE CORE ADDRESS FOR PUNCHING                 2156
0476 20 0184 1049  0184    R D0008     20 P0008       B        P0008 MISC ADDRESS, USUALLY A CONSTANT                    2164
1336 20 0184 1238  0184                20 P0008       PROI     P0008 STORE D FOR PUNCHING                                2276
0602 20 0184 1340  0184                20 P0008                P0008 STORE NEXT 4 DIGITS IN D POSITION                   2540
0171 24 0184 1095  0184    R T0004     24 P0008                P0008 STORE AVAILABILITY WORD                             2586
0191 69 0184 0087                      69 P0008                     SAVE D  FROM CARD THAT STARTED SRCH )                 626
0343 24 0184 0137  0184                24 P0008       ENDED    P0008 BRING BACK L AND D )                                680

0375 20 0185 0177  0185    R J0008     20 P0009       EXITX    P0009 OTHER ADDRESS, USUALLY A CONSTANT                   1322
0577 20 0185 0177  0185    R I0006     20 P0009       EXITX    P0009 800X ADDRESS.  STORE AND EXIT                       2212
1236 20 0185 0938  0185                20 P0009                P0009 STORE CORE ADDRESS FOR PUNCHING                     2218
0579 20 0185 0177  0185    R I0008     20 P0009       EXITX    P0009 OTHER ADDRESS.  STORE AND EXIT.                     2226
0580 20 0185 0988  0185    N I0009     20 P0009                P0009 STORE EQUIVALENT OF NEW SYMBOL                      2228
1288 20 0185 1338  0185                20 P0009       ALL      P0009 STORE I FOR PUNCHING                                2296
1318 24 0185 1290  0185                24 P0009                P0009 STORE LAST 4 DIGITS OF CONSTANT IN I                2536
1349 20 0185 0795  0185                20 P0009                P0009 STORE LOCATION OF AVAILABILITY WORD                 2568

0499 20 0186 0689  0186                20 P0010                P001C C.I. TO PUNCH X-9 )                                 1584
0627 10 0186 0941          N SB10B     10 P0010                     FROM 4-6,19-21.  TO SUPPRESS )                       1596
0759 21 0186 0177  0186                21 P0010       EXITX    P0010 FROM 4-6,19-21.  TO SUPPRESS )                      1600
1110 24 0186 0989  0186                24 P0010                P0010 CONTROL INFORMATION FOR PUNCHING )                  1928
1321 10 0186 1343          N NGL       10 P0010                     FIX C.I. SO THAT L WILL NOT PUNCH )                  2260
1343 21 0186 1286  0186                21 P0010       PROD     P0010 FIX C.I. SO THAT L WILL NOT PUNCH )                 2262
1083 10 0186 0494                      10 P0010                     FIX C.I. SO THAT D WILL NOT PUNCH )                  2280
0494 21 0186 1238  0186                21 P0010       PROI     P0010 FIX C.I. SO THAT D WILL NOT PUNCH )                 2282
1239 10 0186 0544                      10 P0010                     FIX C.I. SO THAT I WILL NOT PUNCH )                  2300
0544 21 0186 1338  0186                21 P0010       ALL      P0010 FIX C.I. SO THAT I WILL NOT PUNCH )                 2302
1268 24 0186 1240  0186                24 P0010                P0010 CONTROL INFORMATION )                               2530
1244 24 0186 1294  0186                24 P0010                P0010 C.I. FOR AVAILABILITY TABLE )                       2554
0024 69 0186 8002          J           69 P0010          8002       STORE PROCESSED CARD )                               880
0488 24 0186 0285  0186    O O         24 P0010       X        P0010                                                     940

0703 90 0187 0528                      90 X2          X0011            NO, FIXED.  YES, UNFIXED.                       726
0700 24 0187 0285  0187    O OS        24 P0011       X        P0011                                                     942

0386 69 0189 0142                      69             SUBR6            PROCESS I BACKWARD                               672

0487 69 0190 0441                      69             SUB13            GET DYNAMIC LEVEL OF CORE ADDRESS                1268

0239 69 0192 0142          N 9X8       69             SUBR6            PROCESS I BACKWARDS                              790

0291 69 0194 0142          N MISC      69             SUBR6            PROCESS I BACKWARDS                              758

0192 69 0195 0305          J           69             SUBR4            PROCESS L BACKWARDS                              792
0316 00 0195 0000          P C8        00     0195      0000          MODIFY BRINGING ORDER TO START NEW COL           1142

0393 69 0196 0400          N 898       69             SUBR5            PROCESS D BACKWARDS                              780
0266 00 0196 0000          P C6        00     0196      0000          TO MODIFY BRINGING ORDER FOR NEXT COL            1138

0144 69 0197 0150          C K         69 ALOPT                      IS IT AN MDF OPERATION                           460
0468 69 0197 0300          C NO        69 ALOPT                      IS D AN ACTUAL ADDRESS                           686
0460 65 0197 0520          J           65 ALOPT       X0003           MULTIPLE EXIT, ACCORDING TO KIND                694
0329 20 0197 0350  0197    C X1        20 ALOPT                ALOPT STORE MODIFIED ALOPT                             712
0510 65 0197 0527          J           65 ALOPT       X0010         MULTIPLE EXIT                                     718
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D187 20 D197 D081  D197    N X2        2D ALOPT     F          ALDPT STORE MODIFIED ALOPT                                  736
D450 65 D197 0251                      65 ALDPT                ALOPT TO LDWER                                              8D6
0D59 20 D197 D500  D197                2D ALOPT                ALOPT STORE MODIFIED ALOPT                                  810
1D94 65 D197 D301                      65 ALDPT                     MDDIFY TO USE RDUTINE FOR UNFIXED D )                  824
D237 20 D197 055D  0197                2D ALOPT                ALOPT MDDIFY TO USE RDUTINE FOR UNFIXED D )                 828
DD66 65 D197 D351          J           65 ALOPT                     MDDIFY ALOPT AGAIN )                                   854
D209 20 D197 D397  D197                20 ALOPT     LNM        ALOPT STORE NEW ALOPT, AND JUMP BACK                        86D
0317 65 D197 0287          J           65 ALOPT     XY              BRING ALDPT, AND JUMP BACK                             866
D276 69 D197 095D          N MDD09     69 ALDPT                     EQUIV DF NEW SYMBOL,                                   1210
1247 69 0197 11DD                      69 ALOPT                     SHDULD WE RESERVE                                      1712
0742 65 D197 1D51          N BL        65 ALOPT                     BACKWARD L.  GET ALOPT                                 18D6
1D71 21 D197 D177  0197                21 ALOPT     EXITX      ALOPT STORE ALL OPTIMIZING TAGS                             1982
1084 24 D197 135D  D197                24 ALDPT                ALOPT TAG IN CASE L IS UNDEFINED SYMBOL )                   2526

D247 1D D20D 8DD2                      1D QS           8D02         BRING BACK A SET )                                     564

0199 16 D2D2 1107                      16 25IXX     BDT             WHICH L IS LESS, MEASURED DN CIRCLE )                  844
D348 15 D202 11D7          N AEB       15 25IXX     BDT             WHICH L IS LESS, MEASURED DN CIRCLE )                  846

D453 6D D206 DD57                      6D           SB1DA           PUNCH CARD                                             592

D2D3 90 D2D7 DD58                      9D           ND              IS THIS FIRST SET DF SEARCH )                          426

DDD5 69 D2D8 DD61                      69           SUBR3           IS L FIXED ADDRESS )                                   44D

04D7 16 D210 D115                      16 MAX                       IS STORAGE AREA FULL )                                 48D

0358 69 D211 0164          C A         69 SEN                       PRESET TD STORE AFTER PROCESSING )                     618

D311 65 D214 0113          N 2ND       65           SSB             USE I-CDMP.  BRING BLANB AND ORCEB                     862

D463 45 0216 0417                      45           ZP              D, ND                                                  1D98

D7D5 D1 D222 11D9          N FULL      01    D222                   STOP RECAUSE DRUM IS PACKED                            1698

D623 45 D226 016D                      45           RODID           IF SO, MULTIBRANCH + EXIT FRDM OUITT                   57D

D773 21 D228 D481  D228                21 P                 P       MAKE SEVERAL VARIABLE ORDERS )                         1D7D
0363 15 D228 D583                      15 P                         MAKE SEVERAL VARIABLE ORDERS )                         1080

0232 24 D235 D388  D235                24 T1                T1      SAVE IN CASE I IS BLANK                                8D0
D113 69 D235 0438          N SSB       69 T1                        SPEC. SUBR.  BRING BACK BLANB + ORCEB                  868

D233 45 0236 DD37                      45 YYY                       D, NO,  I, YES.                                        5D2

DD85 24 0238 0191  D238                24 SAVEL             SAVEL   SAVE L FROM CARD THAT STARTED SRCH )                   624
D189 69 0238 0241          J           69 SAVEL                     BRING BACK L ANO D )                                   674

0289 1D 0242 0547                      1D SEND      A               BRING BACK A SET OF RESULTS )                          92D

0593 69 D246 0249                      69 C1                        MAKE SEVERAL VARIABLE ORDERS )                         1D84
0973 69 D246 0299                      69 C1                        MODIFY TO TAKE NEXT COLUMN OF TABLE )                  11D2
D417 69 D246 D349          N ZP        69 C1                        LAST LINE AND END OF WORD.  MODIFY )                   1112

D143 44 D247 D198                      44           OUT             BRING BACK A SET )                                     562

D347 1D D25D 8002                      10 OS           80D2         BRING BACK A SET )                                     656

D251 16 D254 D059                      16 11STX                     CHANGE ITS FIRST DIGIT TO 8                            8D8
0287 15 0254 D209          C XY        15 11STX                     MODIFY ALOPT AGAIN )                                   858
038D 11 0254 D559                      11 11STX                     IS FIRST POSITION BLANK                                1376

D557 1D D26D D215                      10 BRNG                      NOT 1ST CARD.  MAKE COMP. CONST, )                     546

D4D8 11 D261 D265            X         11 O                         BRING BACK A SET )                                     65D

D361 10 D264 80D3                      1D C4           80D3         MAKE VARIABLE BRINGING ORDER                           1D28

0513 11 0266 D331                      11 C6        SU              MOOIFY TO TAKE FIRST LINE, SAME COLUMN                 111D

D95O 9D D271 0505                      9D MDDD4                     O, CASE WHERE WE OUPLICATE COMPUTATION                 1212

D725 45 D278 0679                      45           OUT             ARE LAST FOUR CHARACTERS OIGITS )                      1454

D226 69 D279 DO39                      69           SUB14           GET OP, C.I., TAGS, OPTIM, ALOPT.                      572

0479 21 0284 0387  0284                21 XXXXA             XXXXA   STORE INITIAL ADORESS TO BE RESERVEO                   1D40
D411 60 D284 D389          C OK        6D XXXXA                     MAKE SEVERALVARIABLE OROERS )                          1D58

0333 96 0286 0657                      96 JUMP      NO              D, STARTEO WITH I.  I, WITH L.                         58D
D310 69 D286 0045          J           69 JUMP      SUB20           PROCESS O                                              584

0587 65 029D 80D1                      65 Y            80D1         BRINGING OROER INTO LOWER                              1506
D6D6 16 D29D D345          N UND       16 Y                         SYMB NOT IN TABLE.  SUBTRACT Y                         1518
D972 16 029D D445          N OEF       16 Y                         DEFINED SYMBOL.  SUBTRACT Y                            153D

014D 98 D291 D145                      98 MISC      899             MULTIPLE BRANCH ACCOROING TO TAGS )                    742

0339 24 D292 ODD3  0292                24 ORCEO     REAOC      ORCEO FINISHED.  SAVE SAVOR AS ORCEQ )                      938
1335 65 0292 1337                      65 ORCEO     MW              DYNAMIC LEVEL OF LAST CORE AOORESS                     21D6
0798 2D 0292 1049  0292                2D ORCEQ     B          ORCEO STORE DYNAMIC LEVEL FOR REFERENCE                     2162
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0998 20 0292 0177  0292                20 ORCEQ     EXITX      ORCEQ STORE DYNAMIC LEVEL FOR REFERENCE                    2224
1067 69 0292 0645                      69 ORCEO                       STORE ORCEO FOR USE WHEN WE START FORW             2240

0491 15 0294 0335                      15 XXXX2     SB10C             ADD TO GIVE MODIFIED DYNAMIC LEFEL                 1260
1039 20 0294 0797  0294                20 XXXX2                 XXXX2 LOCATION OF EQUIVALENT RELATIVE TO E1              1344
0509 10 0294 0167        C A           10 XXXX2     XXXX1             MAKE STORING ORDER )                               1358
0629 21 0294 0947  0294                21 XXXX2                 XXXX2 ALSO STORE FIRST LETTER OF ADDRESS )               1444
0589 10 0294 0399                      10 XXXX2                       FIRST CHARACTER INTO UPPER                         1470
1263 20 0294 1247  0294                20 XXXX2                 XXXX2 STORE THE COUNT                                    1710
1341 10 0294 0649                      10 XXXX2                       WHAT CELL DID WE RESERVE )                         1754
1231 20 0294 1297  0294                20 XXXX2                 XXXX2 STORE DYNAMIC LEVEL, RIGHT END WORD                1994
1086 15 0294 1049        J             15 XXXX2     B                 PERHAPS MODIFY DYNAMIC LEVEL )                     2150

0145 69 0298 0400        N 899         69           SUBR5             PROCESS D BACKWARDS                                772

0750 21 0304 0458  0304  R XX          21 UH                    UH    REPLACE DIGIT OF AVAIL. WORD BY W )                998
0337 10 0304 0359                      10 UH        SPR               REPLACE DIGIT OF AVAIL. WORD BY W )                1008

0603 69 0306 0045        N SHX         69           SUB20             PROCESS D FORWARDS                                 766

0657 69 0310 0042        C NO          69           SUB19             STARTED WITH L, OR NOT FIRST. PROC. L              582

0563 11 0316 0331                      11 C8        SU                LAST LINE AND END OF WORD.  MODIFY )               1122

0214 69 0317 0142        J             69           SUBR6             PROCESS I BACKWARDS AGAIN                          864

0115 45 0318 0026                      45           QUITT             IFSO, QUIT SEARCH                                  482

0217 14 0320 1036                      14 501XX                       SAVE DYNAMIC LEVEL OF L FROM D )                   820
0267 14 0320 1080                      14 501XX                       WHICH L IS LESS, MEASURED ON CIRCLE )              836
0649 19 0320 1074                      19 501XX                       WHAT CELL OID WE RESERVE )                         1756
1017 15 0320 1325                      15 501XX                       ADD 50 TO MAKE SURELY POSITIVE                     1904
1085 14 0320 1272        C CP          14 501XX                       NEW LEVEL, MODULO 50 IN UPPER                      1914
1264 10 0320 0730                      10 501XX                       ADVANCE IT                                         2390

0569 10 0322 8003                      10 QSB          8003           MAKE DRUM AVAILABLE )                              978

0671 46 0324 0225                      46           TP                D, NOT LAST LINE.                                  1022

0272 65 0325 0611        R M0005       65           SUB11             NEW SYMBOL.  FIND BEST EQUIVALENT                  1194

0723 10 0326 0281                      10 W                           REPLACE DIGIT OF AVAIL. WORD BY W )                1004
0533 24 0326 0479  0326  C RU          24 W                     W     STORE 0 OR 1                                       1038

0653 90 0329 0521                      90 X1        X0004               FIRST, UNFIXED.  OTHER, FIXED.                   702

0379 45 0332 0483                      45           OVR               BRING BACK A SET OF RESULTS )                      916

0681 11 0334 0539                      11 9060                        SUBTRACT 9060                                      1398

0504 90 0335 0459                      90 SB10C                       D, WE SHOULD STORE THIS DYNAMIC LEVEL              1274

0383 96 0336 0188                      96           B                 D, WITH I.  I, WITH L.                             610

0034 99 0338 0239        N XX8         99           9X8               MULTIPLE BRANCH ACCORDING TO TAGS )                744

0637 65 0340 8001                      65              8001           BRINGING ORDER INTO LOWER                          1514

0338 98 0341 0393                      98 888       898               MULTIPLE BRANCH ACCORDING TO TAGS )                746

0743 65 0346 0551          SW          65 AI        SWOF              NOT PERFORMED--JUST FOR OPTIMIZING                 1646
0737 65 0346 0551        J OFF         65 AI        SWOF              HAVE WE REACHED TOP OF TABLE                       1648
1020 20 0346 8001  0346  C SAI         20 AI           8001     AI     STORE BRINGING ORDER, AND DO IT                    1656
0739 65 0346 0601        J OFB         65 AI                          START BACKWARDS SEARCH.  HOW FAR                   1670
0516 65 0346 0651        J ON          65 AI                          AFTER RESTART.  BRING BRINGING ORDER               1684
1225 15 0346 0751                      15 AI                          NEW AVAILABILITY WORD INTO DRUM )                  1732
0755 65 0346 0951        C SKP         65 AI                          ALL CASES.  WHAT OID WE RESERVE )                  1740

0293 44 0347 0248                      44           OUT               BRING BACK A SET )                                 654

0245 46 0348 0199                      46 AEB                         WHICH L IS LESS, MEASURED ON CIRCLE )              842

0449 46 0352 0791                      46           FULL              I, TABLE IS FULL                                   1526

0198 20 0353 0106  0353  N OUT         20 VAR                   VAR   STORE VARIABLE ORDER                               566
0206 65 0353 0229        J             65 VAR       LOOP              BRING VARIABLE ORDER, AND REPEAT                   594

0252 11 0355 0259                      11 02                          STORE PROCESSED CARD )                             884

0753 69 0356 0305        J             69           SUBR4             PROCESS L BACKWARDS FROM D                         814

0511 22 0359 0262  0359                22 SPR                   SPR   MAKE SEVERAL VARIABLE ORDERS )                     1090
0225 65 0359 0413        N TP          65 SPR                         BOTTOM LINE OF TABLE                               1094
0404 20 0359 0312  0359                20 SPR                   SPR   MODIFY TO TAKE NEXT COLUMN OF TABLE )              1106
0561 24 0359 0362  0359                24 SPR                   SPR   LAST LINE AND END OF WORD.  MODIFY )               1118

0757 69 0360 0013                      69 BRNG                        BRING BACK A SET )                                 636

1061 91 0364 0688                      91           F0                   D, IT IS A BRANCH OPERATION                     1812

0112 11 0365 8003                      11 OSA          8003           CLEAR REGION AND SYMBOL TABLES )                   960
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0663 46 0366 0467                    46          RC              0, ORUM.  I, CORE.                          1386

0775 15 0378 8002                    15              8002        MAKE BRINGING OROER                         1566

0429 10 0382 8003                    10              8003        MAKE ORUM AVAILABLE )                        970

0731 15 0384 8002                    15 T            8002        ADVANCE LOWER AND BRING ANOTHER             1432
0741 24 0384 0587  0384              24 T                    T   PRESET T AS POSITIVE 1 )                    1504
0643 20 0384 0637  0384              20 T                    T   SHORT.  PRESET T AS -1 )                    1512

0433 96 0386 0288                    96          L               0, WITH I.  I, WITH L.                       670

0388 69 0391 0244                    69 ORCEB                    SAVE IN CASE I IS CORE )                     802
0600 28 0391 8002  0391              24 ORCEB        8002  ORCEB SPEC. SUBR.  BRING BACK BLANB + ORCEB        874
0342 20 0391 0335  0391              20 ORCEB        SB10C ORCEB STORE DYNAMIC LEVEL OF CORE ADDRESS           1206
0374 69 0391 0371        R J0007     69 ORCEB        J0004       CORE.  BRING DYNAMIC LEVEL                   1320

0439 15 0392 0747                    15 SS                       SYMBOL-STORING ORDER )                       1332

0591 10 0394 0509                    10 P3           A           MAKE STORING ORDER                           1362

0642 16 0395 0449                    16 ZTABL                                                                 1524

0194 69 0397 0400        J           69 LNM          SUBR5       PROCESS O BACKWARDS                          760
0306 69 0397 0142        J           69 LNM          SUBR6       PROCESS I BACKWARDS                          768
0101 65 0397 0201        J           65 LNM          SUB22          SAVE ORCEQ                                776

0749 92 0402 1105                    92 SHOP                        0, IT IS A SHIFT OPERATION               1800
1051 92 0402 0656                    92 SHOP                        0, IT IS A SHIFT OPERATION               1808

0302 10 0405 0309                    10 QA                       CLEAR REGION AND SYMBOL TABLES )             956

0953 69 0406 0305        J           69              SUBR4       PROCESS L BACKWARDS FROM I                   832

0506 11 0409 0313                    11 2000I                    IS INITIAL ADDRESS LESS THAN 2000           1044
0777 11 0409 0663                    11 2000I                    SUBTRACT 2000                               1384
0676 10 0409 0713                    10 2000I        RES         RESTORE RELOCATED ORUM ADDRESS              1392
0964 16 0409 1064                    16 2000I                    CORE OR ORUM                                2364
1082 15 0409 0124        C C0        15 2000I        Q0007       RESTORE THE 2000 AND JUMP BACK              2372

0907 16 0410 0315                    16 QF                       IS THIS LAST SET )                           664

0558 46 0411 0212                    46 OK                       I, LAST ONE WOULD BE OVER 1999              1050

0559 46 0412 0613                    46              FXT         I, FIRST IS NON-BLANK.  FIXED ADDRESS.      1378

0913 46 0416 0567                    46 SYM          LOO         D, ADDRESS IS SYMBOLIC.                     1450
0485 44 0416 0240                    44 SYM                      ARE LAST FOUR CHARACTERS DIGITS )           1458
0724 46 0416 0328                    46 SYM                      0, FIRST IS SPEC. CHAR.  SYMBOLIC           1480

0923 69 0426 0441        R C0006     69              SUB13       800X ADDRESS.  GET DYNAMIC LEVEL            1252

0324 10 0427 0331                    10 800          SU          RESTORE, AND TAKE WORD FROM NEXT LINE       1024

1275 15 0428 8002                    15              8002        MAKE BRINGING ORDER                         1840

0432 65 0435 0439                    65 LSYMB                    SYMBOL-STORING ORDER )                      1330
0442 65 0435 0489                    65 LSYMB                    LOCATION OF EQUIVALENT RELATIVE TO E1       1338
0345 20 0435 0588  0435              20 LSYMB                LSYMB STORE ADDR OF SPACE RELATIVE TO START     1520
0754 20 0435 0638  0435              20 LSYMB                LSYMB ADDRESS OF SYMBOL RELATIVE TO START       1534

1291 15 0444 8002                    15              8002        MAKE SHIFTING ORDER                         1726

0244 24 0447 0450  0447              24 T2                   T2  SAVE IN CASE I IS CORE )                    804
0282 69 0447 0600                    69 T2                       SPEC. SUBR.  BRING BACK BLANB + ORCEB        872

0957 69 0460 0063                    69              SUBR9       ANALYZE I, FOR TYPE OF ADDRESS               692

1310 44 0464 0514                    44              UM          0, 0 TAG IS NON-ZERO                        1954

0963 46 0466 0416                    46              SYM         I, FIRST CHAR IS DIGIT.  ADDR SYMBOLIC      1476

0315 45 0468 0319                    45 NO                       0, NO, I, YES.                               666

0931 96 0484 0736                    96 DI                       I,  ADDRESS IS BACKWARD I OR FORWARD L      1614

0459 20 0486 0335  0486              20 SAVOR        SB10C SAVOR STORE DYN LEV OF CORE, AND FINISH UP        1276
0645 28 0486 8002  0486              24 SAVOR            8002  SAVOR STORE ORCEQ FOR USE WHEN WE START FORW  2242
0483 69 0486 0339        N OVR       69 SAVOR                    FINISHED.  SAVE SAVOR AS ORCEQ )             936

0285 11 0488 0493          X         11 Q                        BRING BACK A SET OF RESULTS )                928

0787 97 0490 0742        N 9         97 FIBO         BL          0, FORWARD I.  I, BACKWARD L.               1784

0489 14 0492 1029                    14 20XXX                    LOCATION OF EQUIVALENT RELATIVE TO E1       1340
0638 14 0492 0904                    14 2DXXX                    DIVIDE BY 2                                 1536

0443 44 0497 0398                    44              OUT2        STORE PROCESSED CARD )                       888

0445 16 0498 0754                    16 JBRL                     SUBTRACT INITIAL BRINGING ORDER             1532

0099 69 0502 0740        R    0099   69              SUB         RBR ENTRY.  TO SUBROUTINE                   2454
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0303 90 0507 0258                      90          SKP          D, ONLY ONE.                                  534

1057 69 0510 0063                      69          SUBR9        ANALYZE 0                                     716

1009 45 0512 1113                      45          MAX          I, WE HAVE REACHED TOP OF TABLE              1652

0162 16 0515 0619                      16 110TH                 REDUCE NUMBER YET TO BE DONE )               1014
0431 69 0515 0533                      69 110TH     RU          BRING UNITY TO INDICATE UNRESERVATION        1036
0669 16 0515 0719                      16 110TH                 MODIFY TO END WITH 1999 )                    1054
0537 61 0515 1069                      61 110TH     OON         MODIFY EXIT AND PREPARE TO QUIT              1438
0691 16 0515 1269                      16 110TH                 GET EQUIVALENT OF REGIONAL ADDRESS )         1492
0352 60 0515 1069                      60 110TH     DON         MODIFY EXIT, AND PREPARE TO QUIT             1528
1077 15 0515 8002          C PAKT      15 110TH        8002     MODIFY EXIT )                                1706
1260 65 0515 1211                      65 110TH     BT          COUNT OF I TAGS IN LOWER                     1950
0464 15 0515 0514                      15 110TH     UM          COUNT OF TAGS IN LOWER                       1956
1042 65 0515 0178                      65 110TH     EXITY       UNIT CORRECTION TO DYNAMIC LEVEL             2010
0698 66 0515 0178                      66 110TH     EXITY       IF 8001, CORRECTION IS -1                    2018

1113 69 0516 1070          N MAX       69 ON                    AT TOP.  SET SWITCH ON )                     1678
1213 69 0516 1120          N MIN       69 ON                    SECOND PART, BACKWARDS.  CHANGE SWITCH       1692

0763 44 0517 0618                      44 NZ                    0, IT WAS NOT RIGHT ONE                      1424
0618 46 0517 0972                      46 NZ        DEF         0, IT WAS NOT RIGHT ONE . I, IT AS.          1426

0530 91 0526 0525          R X0013     91 X0009     X0008       CORE.  BRANCH, LIKE BLANK. ARITH, UNF         732

0981 97 0534 0786                      97           BAK         D, FORWARD.  I, BACKWARD.                    1632

0633 65 0536 0220          J           65 EQUIV     F0003       BRING EQUIV AND MULTIBRANCH                  1152
0908 65 0536 0271          J PRE       65 EQUIV     M0004       EQUIVALENT TO LOWER.  MULTIBRANCH            1178
0711 65 0536 0921          J PRE       65 EQUIV     C0004       BRING EQUIVALENT.  MULTIBRANCH               1228
0911 65 0536 0371          J PRE       65 EQUIV     J0004       BRING EQUIVALENT.  MULTIBRANCH               1296
0674 65 0536 0541                      65 EQUIV                 BRING EQUIVALENT                             1352
1073 65 0536 0591          N IPOS      65 EQUIV                 USE I-POSITION.  BRING EQUIVALENT            1360
0641 20 0536 0589  0536                20 EQUIV                 EQUIV STORE THESE 4 DIGITS                   1468
0668 15 0536 0691                      15 EQUIV                 GET EQUIVALENT OF REGIONAL ADDRESS )         1490
1269 23 0536 0704  0536                23 EQUIV     ABS         EQUIV STORE EQUIVALENT                       1494
0776 23 0536 0704  0536                23 EQUIV     ABS         EQUIV STORE EQUIVALENT OF SYMBOL             1554
1031 20 0536 0178  0536                20 EQUIV     EXITY       EQUIV STORE THIS ADDRESS IN EQUIV            1760
1033 16 0536 0992          C EQ        16 EQUIV                 BOTH.  SUBTRACT  THE 800X ADDRESS           2004
1347 16 0536 1092                      16 EQUIV                 SUBTRACT THE ADDRESS IN QUESTION             2014
1015 65 0536 0421          J PRE       65 EQUIV     L0004       BRING EQUIVALENT.  MULTIBRANCH               2074
1065 65 0536 0472          J PRE       65 EQUIV     00004       BRING EQUIVALENT.  MULTIBRANCH               2122
1215 65 0536 0575          J           65 EQUIV     I0004       BRING EQUIVALENT.  MULTIBRANCH               2184
1217 65 0536 0120          J           65 EQUIV     00003       BRING EQUIVALENT.  MULTIBRANCH.              2318
0127 20 0536 1289  0536    N 00010     20 EQUIV     S0          EQUIV OLD SYMBOL.  STORE I AS NEW EQUIV      2344
0128 20 0536 1289  0536    R 00011     20 EQUIV     SD          EQUIV NEW SYMBOL.  STORE I AS ITS EQUIVALENT 2346
0129 20 0536 1289  0536    R 00012     20 EQUIV     SD          EQUIV 800X.  STORE ITS EQUIVALENT.           2348
0130 20 0536 1289  0536    R 00013     20 EQUIV     SD          EQUIV CORE.  STORE I AS ITS EQUIVALENT.      2350
0131 20 0536 1289  0536    R 00014     20 EQUIV     SD          EQUIV OTHER.  STORE I AS THE EQUIVALENT.     2352

0385 69 0538 0441                      69           SUB13       FIND DYNAMIC LEVEL OF CORE ADDRESS           1202

1037 14 0540 1048                      14 42NO                     SHOULD WE INTERCHANGE ADDENDS )          1872

0539 46 0542 0977                      46           BAD         I, RELOCATED CORE ADDRESS TOO HIGH           1400

0942 16 0545 1085                      16 COUNT     CP          IF BACKWARD L, SUBTRACT TAG-COUNT )          1912
0514 20 0545 0598  0545    C UM        20 COUNT                 COUNT STORE TAG-COUNT                        1958
1337 15 0545 0335          C MW        15 COUNT     SB10C       CORE OR DRUM.  ADD TAG-COUNT TO DYN LV       2108

1092 45 0546 0698                      45 NZ                    0, ADDRESS IS NOT 8001                       2016

0296 15 0549 0954                      15 601                   INITIAL OF VARIABLE BRINGING ORDER           1638

0248 20 0553 0256  0553    N OUT       20 VAR                   VAR  STORE VARIABLE ORDER                     658
0009 65 0553 0907          J           65 VAR                   IS THIS LAST SET )                            662
0570 65 0553 0243                      65 VAR       LOOP        BRINGING ORDER.  BACK FOR ANOTHER CARD        894

0451 10 0554 0509                      10 P2        A           MAKE STORING ORDER )                         1356

0273 01 0555 0273          R M0006     01    0555   M0006       800X ADDRESS.  STOP THE MACHINE              1198
0275 01 0555 0275          R M0008     01    0555   M0008       OTHER ADDRESS.  STOP MACHINE                 1208

1103 65 0556 0611                      65           SUB11       FIND BEST EQUIVALENT TO BLANK                1188

1107 46 0560 0311          C BOT       46           2NO         0, WE WILL USE ONE MEASURED FROM 0            848

1311 15 0564 8002                      15              8002     BRINGING ORDER                               2042

0262 10 0565 0331                      10 C3        SU          MAKE SEVERAL VARIABLE ORDERS )               1092

0615 69 0568 0677                      69           INDEX       TO SUBROUTINE 18 TO INDEX                    1310

1081 60 0584 1089          N YES       60 9         AX          MORE TAGS INTO UPPER                         1978

0781 44 0585 0686                      44           SHRT        0, LONG SYMBOL                               1500

1237 10 0590 8003                      10              8003     MAKE BRINGING ORDER                          1962
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0639 10 0592 8003                    10              8003        MAKE BRINGING DRDER )                                  1484

1289 69 0594 0661          C SD      69              SUBR7       STORE SYMBOL AND EDUIVALENT IN TABLE                   2354

1292 69 0595 1025                    69              SUB2R       RESERVE ADDRESS                                        2090

1345 45 0596 0646                    45              SDD         IF D IS BLANK, WE SHDULD STDRE ZERD                    2622

0493 44 0597 0448                    44              DUT         BRING BACK A SET OF RESULTS )                           930

0396 15 0599 1104                    15 602                      INITIAL BRINGING DRDER )                               1662

0300 95 0603 0255                    95 SHX                      D, ND.  I, YES.                                         688

0204 11 0607 0161            X       11 D                        BRING BACK A SET )                                      558

1307 11 0610 0415                    11 DB                       MAKE DRUM AVAILABLE )                                   974

1059 45 0612 1213                    45              MIN         D, WE ARE NDT BACK TO START YET                        1674

0269 60 0622 0627          R M0002   60 87THX        SB10B       N. G.  DMIT PUNCHING                                   1182
0977 60 0622 0177          N BAD     60 87THX        EXITX       MDDIFIED ADDR TOO HIGH.  8000 TD UPPER                 1412
0419 60 0622 0627          R L0002   60 87THX        SB10B       N.G.  FIX TD OMIT PUNCHING                             2078

0921 69 0624 0677          N C0004   69              INDEX       DRUM DR EQUIVALENT.  INDEX IF TAGGED                   1244

0922 65 0625 0611          R C0005   65              SUB11       NEW SYMBOL.  FIND BEST EQUIVALENT                      1248

0772 90 0626 0369                    90              J0002       D, DRUM IS NDT FULL                                    1304

0030 69 0633 0063                    69              SUBR9       TD SUBRDUTINE 9 TD ANALYZE THE ADDRESS                 1150

0482 45 0636 0537                    45 ABC                      I, THE ADDRESS IS BLANK                                1436

1287 45 0640 1042                    45 XY                       I, 8002-8003 + WRONG PARITY                            2008

1339 45 0644 0694                    45 ALL                      I, IT IS ANDTHER RBD CARD                              2406

0497 10 0650 8003                    10 QS2          8003        STDRE PROCESSED CARD )                                  890

0399 44 0654 0704                    44              ABS         I, ZERD.  ADDRESS WAS ABSOLUTE                         1472

0701 45 0655 0705                    45              FULL        I, THERE IS ND AVAILABLE LDCATIDN.                     1688

0403 90 0657 0308                    90 NO                       D, IT IS NDT                                            576

1053 21 0658 0461  0658              21 X                    X   MAKE SEVERAL VARIABLE DRDERS )                         1064
0401 10 0658 0363                    10 X                        MAKE SEVERAL VARIABLE ORDERS )                         1078

1105 93 0660 0710                    93 XAS                          D, IT IS AN INDEXING DPERATIDN                     1802
0656 93 0660 1061                    93 XAS                          D, IT IS AN INDEXING DPERATIDN                     1810

0531 01 0666 0531          R X0014   01    0666      X0014       DTHER.  ERROR.  SHDULD NDT BE HERE.                   734
1312 69 0666 1024                    69              SUBR8       PRDCESS D                                              2268

0665 45 0668 1219                    45              NG          I, REGIDN IS UNDEFINED                                 1488

0919 60 0672 0627          R C0002   60 88THX        SB10B       N G.  OMIT PUNCHING                                    1232
0470 60 0672 0627          R D0002   60 88THX        SB10B       N.G.  DUIT AND DMIT PUNCHING                           2126

0620 60 0673 0057          C LOOP    60              SB10A       TD SUB 10A TD PUNCH DNE CARD                            910

0372 65 0675 0611          R JD005   65              SUB11       NEW SYMBDL.  FIND BEST VALUE                           1314

1123 46 0676 0977                    46              BAD         I, RELDCATED DRUM WILL EXCEED 1999                     1390

0280 69 0683 0586                    69              SUB17       CDRRECTIDN TD DYNAMIC LEVEL                            1256

1216 46 0684 0029                    46                  0029    IF A DIGIT, TD BLR WITHDUT DESIGNATING                 2480

0484 69 0687 0390          N DI      69 F                        PREPARE EXIT AND GD TO SUBROUTINE 13 )                 1618

0735 97 0688 0490                    97 FD           FIBD        D, FDRWARD D.   I, BACKWARD D.                         1782
0364 99 0688 0490                    99 FD           FIBD        I, BACKWARD L, BRANCH, UNFIXED D                       1814

1334 15 0695 1299                    15 C3                       MDDIFY IDENTIFICATIDN OF WORD                          2562
0745 15 0695 1349                    15 C3                       MDDIFY IDENTIFICATIDN OF WORD                          2566
0795 15 0695 0652                    15 C3                       MDDIFY IDENTIFICATIDN OF WDRD                          2570

0597 10 0700 0547                    10 QS           A           BRING BACK A SET DF RESULTS )                           932

0945 10 0702 8003                    10 C6               8003    MDDIFY BRINGING ORDER, AND BRING                       2576
0995 10 0702 8003                    10 C6               8003    MDDIFY BRINGING DRDER, AND BRING                       2580
1045 10 0702 8003                    10 C6               8003    MDDIFY BRINGING DRDER, AND BRING                       2584
1095 10 0702 8003                    10 C6               8003    MODIFY BRINGING DRDER, AND BRING                       2588

0503 90 0707 0358                    90              A           IF NDT, JUMP AHEAD                                      606

0354 69 0708 0511                    69 C2                       MAKE SEVERAL VARIABLE DRDERS )                         1088
0413 16 0708 0463                    16 C2                       IS IT ALSD RIGHT END DF WDRD                           1096

0958 69 0711 0063                    69 PRE          SUBR9       ANALYZE THE ALPHABETIC D ADDRESS                       1226
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0926 69 0711 0661          N C0009    69 PRE       SUBR7          STORE EQUIVALENT OF NEW SYMBOL                    1282

0715 15 0718 8002                     15              8002       MAKE BRINGING ORDER                               1540

0369 60 0722 0627          R J0002    60 89THX     SB10B          N.G.  OMIT PUNCHING                               1300
0573 60 0722 0627          R I0002    60 89THX     SB10B          N.G.  QUIT AND OMIT PUNCHING                      2188

1223 10 0726 0681                     10 COIFF                    ADD RELOCATION AMOUNT                             1396
0968 15 0726 1082                     15 CDIFF     CD             ADD CORE RELOCATION AMOUNT                        2368
0946 20 0726 0001  0726    C SCD      20 CDIFF     SETCC     CDIFF STORE CORE RELOCATION AMOUNT                     2634

0924 69 0727 0677          R C0007    69           INOEX          CORE ADDRESS.  INOEX IT                           1262

1224 90 0728 0419                     90           L0002          0, DRUM NOT FULL.  1, DRUM IS FULL.               2082

0929 46 0732 0933                     46 DRM                      1, CORE.  D, DRUM.                                2052

0779 20 0733 0936  0733               20 B                   B       SHOULD WE INTERCHANGE ADDENDS )                1860
1010 15 0733 0987                     15 B                           SHOULD WE INTERCHANGE ADDENDS )                1868
0917 16 0733 0935                     16 B         P              INTERCHANGE AND MAKE NEGATIVE )                   1880

0532 95 0735 0787                     95           9              D, D ADDRESS.  I, FORWARD I OR BACKW L            1780

0534 69 0737 0440                     69 OFF                      FORWARD.  SET SWITCH OFF FOR 1ST PART             1634

0786 69 0739 0692          N BAK      69 OFB                      GOING BACKWARD.  SET SWITCH OFF )                 1658

0440 24 0743 0296  0743               24 SW                  SW   FORWARD.  SET SWITCH OFF FOR 1ST PART           1636
0692 24 0743 0396  0743               24 SW                  SW   GOING BACKWARD.  SET SWITCH OFF )               1660
1070 24 0743 0446  0743               24 SW                  SW   AT TOP.  SET SWITCH ON )                        1680
1120 24 0743 0496  0743               24 SW                  SW   SECOND PART, BACKWARDS.  CHANGE SWITCH           1694

1046 44 0752 0003                     44           READC          D, WE ARE NOT DONE.                               2594

0500 69 0753 0400                     69           SUBR5          PROCESS 0 BACKWARDS                               812

1100 90 0755 0905                     90 SKP                      D, SKIP BECAUSE COMP IS DOUBLE                    1714

0454 69 0758 0561                     69 C7                       LAST LINE AND END OF WORD.  MODIFY )              1116

1058 65 0761 0611          N BB1      65           SUB11          GET BLANK 0 DYNAMICALLY FROM I                    1240

0512 15 0765 1020                     15 800       SAI            ADVANCE VARIABLE BRINGING ORDER                   1654

1265 65 0768 0611          N DNB      65           SUB11          USUAL CASE, I BLANK AND NOT D.                    2200

0216 15 0769 0973                     15 C5                       MODIFY TO TAKE NEXT COLUMN OF TABLE )             1100

1220 14 0774 1021                     14 4IXXX                    WHAT CELL DID WE RESERVE )                        1746

0474 69 0778 0441          R D0006    69           SUB13          800X ADDRESS.  FIND DYNAMIC LEVEL                 2144

0767 92 0785 1222                     92 SED                      JUMP UNLESS OPERATION 80,82, OR 88                1846

0588 46 0791 0642                     46 FULL                     0, TABLE IS FULL                                  1522

0937 20 0792 0495  0792               20 INO                 INO  BACKWARD.  SHOULD WE INTERCHANGE ADDND            1854
1351 66 0792 0935          N OK       66 INO       P              MAKE NEGATIVE, BUT DO NOT INTERCHANGE             1882

0690 69 0794 1025                     69           SUB2R          RESERVE 0000                                      2430

0746 45 0796 0946                     45           SCD            JUMP IF I IS BLANK                                2630

0590 65 0800 1306          J          65    0800                  BRING OPTIMIZING ADDENDS AND TAGS                 1964
0748 94 0800 0912                     94    0800                  IF BLANK 0 AND MDF, STOP MACHINE                  2130

0778 00 0808 0782          J          00    0808                  TAGS AND EXIT FOR USE IN SUBR 11                  2146
1243 00 0808 0798          J          00    0808                  TAGS AND EXIT FOR SUBROUTINE 13                   2160

1293 00 0809 0998          J          00    0809                  TAGS AND EXIT FOR SUBROUTINE 13                   2222

1115 00 0888 0469          J          00    0888  00001           TAGS AND EXIT FOR SUBROUTINE 11                   2134
1276 00 0888 0477          J          00    0888  D0009           TAGS AND EXIT FOR USE IN SUBR 11                  2142

0768 00 0889 0572          J          00    0889  I0001           TAGS AND EXIT FOR SUBROUTINE 11                   2202
0979 00 0889 0580          J          00    0889  I0009           TAGS AND EXIT FOR SUBR 11.                        2210

1342 00 0890 0418          J          00    0890  L0001           TAGS AND EXIT FOR USE IN SUBR 11                  2100

0249 22 0901 0354  0901               22    0901             0901 MAKE SEVERAL VARIABLE ORDERS )                    1086
0299 22 0901 0404  0901               22    0901             0901 MODIFY TO TAKE NEXT COLUMN OF TABLE )             1104
0349 24 0901 0454  0901               24    0901             0901 LAST LINE AND END OF WORD.  MODIFY )              1114

0053 60 0902 0007                     60    0902                  IS 0 INDEXED                                      386
0055 60 0902 0307                     60    0902                  IS 0 INDEXED                                      464
1006 21 0902 1056  0902               21    0902             0902 STORE 0 TAG                                       1940
1211 10 0902 1310          C BT       10    0902                  0 TAG INTO UPPER                                  1952
0564 65 0902 0662          J          65    0902                  BRING APPROPRIATE TAG                             2044

0318 65 0903 0457                     65    0903                  IS I INDEXED                                      484
0628 20 0903 1106  0903               20    0903             0903 STORE I TAG                                       1946
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0949 20 0906 1010  0906              20 A                    A       SHOULD WE INTERCHANGE ADDENDS )                    1866
1052 66 0906 1111                    66 A                            INTERCHANGE AND MAKE NEGATIVE )                    1876

0455 69 0908 0063                    69 PRE        SUBR9             ANALYZE THE ADDRESS                                1176
0505 69 0908 0661                    69 PRE        SUBR7             USUAL CASE.  STORE SYMBOL AND EQUIV                1214
0426 00 0908 0280          J         00    0908                      TAGS AND EXIT FOR SUBROUTINE 13                    1254
0190 00 0908 0344          J         00    0908                      TAGS AND EXIT FOR SUBROUTINE 13                    1270

0538 00 0909 0342          J         00    0909                      TAGS AND EXIT FOR USE IN SUBR 13                   1204

1108 69 0911 0063                    69 PRE        SUBR9             ANALYZE ALPHABETIC I                               1294
0368 69 0911 0661          N J0001   69 PRE        SUBR7             STORE EQUIVALENT OF NEW SYMBOL                     1298

0612 15 0915 1020                    15 599        SAI               RESTORE AND MODIFY                                 1676

0452 10 0916 0980                    10 Q                            DUPLICATE INTO AVAILABILITY TABLE )                2414

0475 69 0928 0677          R 00007   69            INDEX             CORE ADDRESS.  INDEX IF TAGGED                     2152

0766 16 0930 1339                    16 94I                          IS THIS ANOTHER RBD CARD )                         2404

0582 97 0935 0937                    97 P                            0, FORWARD.  1, BACKWARD.                          1852

1240 69 0944 0042                    69            SUB19             PROCESS L, IF REGIONAL OR SYMBOLIC                 2532

0550 69 0953 0142                    69            SUBR6             PROCESS I BACKWARDS                                 830

0751 69 0955 1209                    69 STR                          NEW AVAILABILITY WORD INTO DRUM )                  1734

0954 20 0959 0462  0959              20 BP1                BP1       STORE VARIABLE BRINGING ORDER                      1640
1104 20 0959 0562  0959              20 BP1                BP1       INITIAL BRINGING ORDER )                           1664
0655 15 0959 1020                    15 BP1        SAI               RESTORE AND MODIFY                                 1690

1072 90 0976 1077                    90            PAKT              1, YES.                                            1610

1274 90 0978 0573                    90            I0002             1, DRUM IS FULL                                    2196

0576 65 0979 0611          R I0005   65            SUB11             NEW SYMBOL.  FIND BEST VALUE.                      2208

1078 69 0982 0677                    69            INDEX             INDEX 0                                            2272

0761 00 0988 0918          J         00    0988    C0001             TAGS AND EXIT FOR SUBROUTINE 11                    1242
0625 00 0988 0926          J         00    0988    CD009             EXIT AND TAGS FOR SUBROUTINE 11                    1250

0556 00 0989 0268                    00    0989    M0D01             TAGS AND EXIT FOR SUBROUTINE 11                    1190
0325 00 0989 0276          J         00    0989    M0009             TAGS AND EXIT FOR USE IN SUBROUTINE 11             1196

0675 00 0990 0368          J         00    0990    J0001             TAGS AND EXIT FOR SUBROUTINE 11                    1316
0084 65 0990 8002          R    0084 65          8002              ADDING ORDER TO LOWER                              2498

0797 15 1000 0555                    15 P1                           MAKE BRINGING ORDER )                              1346

0983 90 1001 0738                    90 MOFLL                        0, START SEARCH.  1, WE ARE DN QUITT               2096

09D0 65 1003 0508          R    0900 65 N                            HAVE WE FINISHED                                   1010
0619 20 1003 0456  1003              20 N                  N         REDUCE NUMBER YET TO BE DONE )                     1016
0387 20 1003 0506  1003              20 N                  N         STORE N-1                                          1042
0166 10 1003 0558                    10 N                            UPPER, LAST ADDRESS - 2000                         1048
0719 20 1D03 0411  1D03              20 N          DK      N         MODIFY TO END WITH 1999 )                          1056

1D01 69 1004 0107          N MDFLL   69 L          A               STARTED WITH NEW-SYMBOL L                           402

1002 44 10D5 0606          C LDDP    44            UNO               1, SYMBOL IS NOT IN THE TABLE                      1420

1353 90 1008 1058                    90            BB1               D, THERE WAS A BLANK BACKWARDS L                   1236

1060 44 1014 0414                    44            EVN               0, DPREG WAS 000.  1, EVEN.                        1890

0712 69 1015 0063                    69 PRE        SUBR9             ANALYZE L-ADDRESS                                  2072
0418 69 1015 0661          N L0001   69 PRE        SUBR7             SUB 11 FOUND OUT OF SYMB.  RESERVE                 2076

1114 69 1018 1025                    69            SUB2R             RESERVE FIRST CELL IN BAND                         2382

0366 10 1019 1123                    10 DDIFF                        DRUM.  ADD RELOCATION AMOUNT                       1388
1317 15 1019 1082          N D       15 DDIFF      CD                ADD DRUM RELOCATION AMOUNT                         2370
0502 10 1019 1232          J         10 DDIFF      ZQ                ADD RELOCATION AMOUNT                              2456
0646 20 1019 0696  1019    C S00     20 DDIFF                DDIFF   STORE DRUM RELOCATION AMOUNT                       2626

1219 61 1022 1069          C NG      61 2IXXX      DDN               MODIFY EXIT FOR N G SYMBOL                         1558
0635 15 1022 1027                    15 2IXXX                        ADVANCE CARD NUMBER )                              1590
0967 14 1022 1060                    14 2IXXX                        WHICH ONE OD WE USE )                              1888
1297 14 1022 1322                    14 2IXXX                        DIVIDE DYNAMIC LEVEL BY 2                          1996

0918 20 1023 0376  1023    N C0D01   20 BLANK      A       BLANK   STORE EQUIV OF BLANK FOR FORWARD L                 1230
0728 65 1023 0421                    65 BLANK      L0D04           USE PROPER VALUE FOR BLANK ADDRESS                 2084
0469 20 1023 0476  1023    N D0001   20 BLANK      00008   BLANK   STORE EQUIV OF BLANK FOR REFERENCE                 2124
0572 20 1023 0577  1023    N I0001   20 BLANK      I0006   BLANK   STORE EQUIVALENT OF BLANK FOR REFERENC             2186
0978 65 1023 0579                    65 BLANK      I0008           MAKE BLANK I EQUAL TO BLANK 0                      2198

0575 69 1028 0677          N I0004   69            INDEX             DRUM ADDRESS.  INDEX IF TAGGED                     2204

0422 69 1030 0983          R L00D5   69    1030                      NEW SYMBOL.  WHERE ARE WE                          2094
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0984 24 1030 1084  1030                24    1030                1030 TAG IN CASE L IS UNDEFINED SYM80L )                          2524
0047 24 1030 0033  1030                24    1030                1030 DELETE OUITT TAG )                                           374
0107 24 1030 0083  1030   C A         24    1030                1030 STORE TAG TELLING HOW SEARCH STARTED                          404
0207 69 1030 0133                      69    1030                     IF SD, WHERE OID SEARCH START                                428
0507 69 1030 0283                      69    1030                     WHERE DID SEARCH START                                       536
0308 69 1030 0333                      69    1030                     IF SD, WHERE DID WE START                                    578
0707 69 1030 0383                      69    1030                     IF SD, WHERE DIO SEARCH START                                608
0319 69 1030 0433                      69    1030                     IF SO, WHERE OIO SEARCH START                                668

1278 69 1032 0677                      69          INDEX               INDEX I                                                    2292

0640 65 1043 1347         N XY         65 8001                         8001 INTO RIGHT END LOWER                                  2012

1041 69 1044 1047                      69 81STX                        RESTORE FIRST CARD TAG )                                    366
0008 69 1044 0047         N    0008    69 81STX                        DELETE OUITT TAG )                                          372
0139 69 1044 0297         J            69 81STX                        CHANGE TAG TO SECOND-CARO TAG )                             588
0234 69 1044 0647                      69 81STX                        PRESET DRUM TAG )                                           964
0270 69 1044 0697         R M0003      69 81STX                        8LANK,  CHANGE FIRST-CARD TAG )                            1184
0709 15 1044 0499         C SU810      15 81STX                        C.I. TO PUNCH X-9 )                                        1582
0021 69 1044 1298         R    0021    69 81STX                        BLA ENTRY.  CHANGE DRUM TAG                                2446

1047 24 1050 0160  1050                24    1050  R0010         1050 RESTORE FIRST CARD TAG )  MULTI8RANCH                        368
0056 69 1050 0203                      69    1050                     IS THIS FIRST SET OF SEARCH )                                424
0017 24 1050 0253  1050                24    1050                1050 CHANGE FIRST-CARD INDICATOR TO 2NO )                         490
0026 69 1050 0303         N OUITT      69    1050                     WAS THERE ONLY ONE SEARCHED CARD                             532
0279 69 1050 0403         J            69    1050                     IS THIS FIRST OUITT SET                                      574
0297 24 1050 0453  1050                24    1050                1050 CHANGE TAG TO  SECOND-CARD TAG )                             590
0019 69 1050 0503         N 8ACKW      69    1050                     WAS THERE JUST ONE SEARCH CARD                               604
0067 24 1050 0358  1050                24    1050  A             1050 START DN L.  FIRST-CARD TAG )                                616
0519 69 1050 0653         R X0002      69    1050                     8LANK ADDRESS. IS THIS FIRST CARD                            700
0526 69 1050 0703         R X0009      69    1050                     8LANK.  IS THIS FIRST CARD                                   724
0697 24 1050 1103  1050                24    1050                1050          CHANGE FIRST-CARD TAG )                            1186
0920 69 1050 1353         R C0003      69    1050                     8LANK AOORESS. WAS THERE BLANK BACK L                       1234
0344 69 1050 0504                      69    1050                     FIRST-CARD TAG                                              1272
0201 69 1050 1062         N SU822      69    1050                     FIRST-CARD TAG                                              2236

0551 16 1054 1009           SWOF       16 799                          SUBTRACT END OF TABLE                                      1650
0496 65 1054 1020                      65 799          SAI             START BACK FROM TOP OF TABLE                               1696

0659 44 1063 0314                      44              LH              O, ADOR IS DOD.  EQUIV IN RIGHT END                        1544

0762 69 1065 0063                      69 PRE          SU8R9           ANALYZE D-ADORESS                                          2120
0477 69 1065 0661         N D0009      69 PRE          SU8R7           STORE EQUIVALENT OF NEW SYM80L                             2170

1214 45 1068 1329                      45              OUT             D, NOT 8LANK.  I, IT IS 8LANK.                             2386

0670 44 1073 0674                      44 IPOS                         D, USE I-POSITION.  I, USE D-POSITION.                     1350

1322 44 1076 1026                      44              EVN             D, DYNAMIC LEVEL IS ODD.                                   1998

0678 44 1081 0682                      44 YES                          I, D IS NOT TRUE ADDRESS                                   1974

0632 95 1085 1087                      95 CP                           IF BACKWARD L, SUBTRACT TAG-COUNT )                        1908
1087 97 1085 0942                      97 CP                           IF BACKWARD L, SUBTRACT TAG-COUNT )                        1910

0782 69 1086 0586                      69              SU817           PERHAPS MODIFY DYNAMIC LEVEL )                             2148

0934 15 1090 8002                      15 K               8002         MAKE STORING ORDER, AND STORE ZERO                         2510

1036 21 1091 1094  1091                21 OLO                  OLO    SAVE DYNAMIC LEVEL OF L FROM O )                            822
1038 16 1091 0245                      16 OLO                          WHICH L IS LESS, MEASURED ON CIRCLE )                      840

0793 20 1097 1020  1097   C ST         20 AO           SAI        AO   STORE COMPARISON CONSTANT                                  1668
0651 16 1097 0701                      16 AO                          COMPARISON CONSTANT, SUBTRACTED                            1686

0548 93 1101 0785                      93              SEO             O, OPERATION 31.  I, 30,35,36.                             1828

0002 69 1112 0039         R    0002    69              SUB14           DP, C.I., TAGS, OPTIM, ALDPT                               2248

0912 65 1115 0611                      65              SUB11           8LANK O, BUT NOT MOF.  FIND VALUE OF O                     2132

0714 69 1117 1024                      69              SUBR8           PROCESS I                                                  2288

0466 10 1119 0724                      10 29IXX                        ADD 29                                                     1478
0684 15 1119 0734                      15 29IXX                        ADD 29                                                     2482

0410 69 1124 8003         O DF         69 S0000           8003                                                                     752
1271 11 1124 0929                      11 27TH                         SUBTRACT 2000, TO DETERMINE RANGE                          2050

0086 24 1125 0028  1125   J SEND       24 S0001        X          S0001 STORE SET OF DATA )                                        412
0260 69 1125 8003         J BRNG       69 S0001           8003         8RING BACK A SET )                                         554

0211 24 1199 0252  1199   J SEN        24 SMAXM                   SMAXM STORE PROCESSED CARD )                                   882
0174 69 1199 8003         O DL         69 SMAXM           8003                                                                     944

0210 24 1200 0028  1200   D MAX        24 SMAX1        X          SMAX1 CONSTANT FOR WHETHER STORAGE IS FULL                     518
0729 84 1200 0775                      84    1200                     SEARCH TABLE ACCDRDING TO SIZE OF ADDR                     1564

0604 16 1208 0913                      16 909                          SUBTRACT 9090908995                                        1448

0962 69 1215 0063                      69              SUBR9           ANALYZE I-ADDRESS                                          2182
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0764 69 1217 0063        C BOTH     69           SUBR9        ANALYZE I                                  2316
0609 16 1218 8002        R U0002    16 KA           8002      RESTORE LOWER, AND AOO NEXT SYMBOL         2512
0472 69 1226 0677        N 00004    69           INOEX        ORUM AOORESS.  INOEX IF TAGGEO             2136
1117 44 1228 1278        J          44 NGI                    O,RELOCATEO I IS EXCESSIVE                 2290
1026 65 1229 1033        N EVN      65 8003      EO           EVEN.  PUT 8003 AT RIGHT ENO OF LOWER      2002
0966 16 1230 8002                   16              8002      OUPLICATE INTO AVAILABILITY TABLE )        2422
0029 69 1232 0740        R    0029  69 ZO        SUB          BLR ENTRY.  TO SUBROUTINE                  2442
0010 69 1234 1244        J    0010  69 85TH                   C.I. FOR AVAILABILITY TABLE )              2552
0682 60 1235 1089                   60 8         AX           MORE TAGS INTO UPPER                       1976
1088 44 1241 0743        R TA       44 YES       SW           IS A LOCATION AVAILABLE IN THIS GROUP      1644
0788 69 1243 0441                   69           SUB13        FINO OYNAMIC LEVEL                         2158
0752 10 1245 0952                   10 OS                     RESTORE VARIABLE BRINGING ORDER            2596
0644 61 1248 0966        N ALL      61 SENO                   OUPLICATE INTO AVAILABILITY TABLE )        2420
1277 65 1250 0706        J          65    1250                BRING SHIFT AOOENOS                        1824
1106 45 1260 1211                   45           BT           O, I TAG IS NON-ZERO                       1948
1012 44 1265 0616                   44 DNB                    O, O IS NOT BLANK.                         2192
0552 15 1266 0784                   15 ST                     MAKE STORING ORDER                         2488
0914 69 1267 0063                   69           SUBR9        ANALYZE O                                  2336
0720 69 1273 1025                   69           SUB2R        RESERVE IF ORUM AOORESS                    1406
0473 65 1276 0611        R 00005    65           SUB11        NEW SYMBOL.  FINO EQUIVALENT               2140
0974 10 1277 8003                   10              8003      MAKE BRINGING ORDER                        1822
1076 65 1279 1033                   65 8002      EO           000.  PUT 8002 AT RIGHT ENO OF LOWER       2000
0980 46 1283 0634                   46 DONE                   OUPLICATE INTO AVAILABILITY TABLE )        2416
0938 69 1293 0441                   69           SUB13        FINO OYNAMIC LEVEL                         2220
0952 16 1295 1249                   16 C7        LOOP         MODIFY IDENTIFICATION FOR NEXT CARO        2598
0910 84 1300 1275                   84    1300                LOOK UP IN TABLE                           1838
0790 16 1308 1216                   16 99THX                  SUBTRACT 90                                2478
0654 11 1308 0963                   11 99THX                  NON-ZERO.  SUBTRACT 90                     1474
1262 69 1315 1024                   69           SUBR8        PROCESS L                                  2254
0608 44 1316 0001        R U0001    44           SETCC        I, IT IS ZERO AND WE HAVE FINISHED         2502
1064 46 1317 0968                   46 O                      O, ORUM.  I, CORE.                         2366
1315 44 1321 1324        J          44 NGL                    O, RELOCATED L IS EXCESSIVE                2256
0666 44 1326 1078        J          44 NGO                    O, RELOCATED O IS EXCESSIVE                2270
0118 65 1328 1233        R 00001    65 83RD      BP           INVALID AOORESS                            2320
0119 65 1328 1233        R Q0002    65 83RO      BP           BLANK I.  CARO IS UNUSABLE                 2322
0121 65 1328 1233        R Q0004    65 83RO      BP           NEW SYMBOL I.  CARO IS UNUSABLE            2326
0125 65 1328 1233        R 00008    65 83RO      BP           N G O.  CARO IS UNUSABLE                   2340
0126 65 1328 1233        R 00009    65 83RO      BP           BLANK O.  CARO IS UNUSABLE                 2342
0780 46 1329 0094                   46 OUT          0094      O, WE HAVE FINISHED                        2398
1016 45 1330 1332                   45           BL           I, I IS UNPUNCHED                          2462
0578 69 1331 0677        R I0007    69           INOEX        CORE AOORESS.  INOEX IF TAGGED             2214
1280 69 1333 0740                   69           SUB          TO SUBROUTINE                              2450
0738 65 1342 0611                   65           SUB11        FINO AN EQUIVALENT                         2098
1284 15 1344 1249                   15 RS1       LOOP         INITIAL WORD SHOWING LOCATION OF TABLE     2558
1294 60 1348 1284                   60 A1                     VARIABLE BRINGING ORDER INTO UPPER         2556
1048 44 1351 1052                   44 OK                     I, WE SHOULD INTERCHANGE                   1874
1096 11 1352 1046                   11 O                      ARE WE DONE                                2592
0601 16 1354 1059                   16 600                    SUBTRACT COMPARISON CONSTANT               1672
0446 65 1354 1020                   65 600       SAI          RESET BRINGING ORDER, AND SEARCH MORE      1682
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0951 16 1354 1309                    16 600                        WHAT CELL OID WE RESERVE )                    1742
0915 60 1354 1088          0 599     60 A0000      TA                                                          1762

0322 20 1355 0000  1355    0 OSB     20 A0001         0000       A0001 RESTORE COMPARISON CONSTANT ANO MOOIFY     986
0565 20 1355 0900  1355    P C3      20 A0001         0900       A0001 INITIAL OF STORING ORDER                  1128
1354 60 1355 1088          0 600     60 A0001      TA                                                          1764
1230 69 1355 8003          J         69 A0001         8003            OUPLICATE INTO AVAILABILITY TABLE )      2424
1348 69 1355 0168          P A1      69 A0001      T0001              INITIAL VARIABLE BRINGING ORDER           2600

0610 20 1356 0000  1356    0 0B      20 A0002         0000       A0002 COMPARISON CONSTANT                        984
0549 60 1356 1088          P 601     60 A0002      TA                                                          1766

0599 60 1357 1088          P 602     60 A0003      TA                                                          1768

1248 24 1359 1034  1359    J SEND    24 A0005      A             A0005 DUPLICATE INTO AVAILABILITY TABLE )     2426

0116 20 1551 0900  1551    0 796     20 A0197         0900       A0197 COMPARISON CONSTANT FOR LAST LINE         1132

0382 20 1554 1307  1554    J         20 A0200                    A0200 MAKE ORUM AVAILABLE )                      972
1054 60 1554 1088          0 799     60 A0200      TA                                                          1770

0427 20 1555 0900  1555    Q 800     20 A0201         0900       A0201 TO RESTORE FOR NEXT LINE OF TABLE         1134
1000 69 1555 8003          P P1      69 E0001         8003            INITIAL OF BRINGING ORDER                1364
0554 22 1555 0179  1555    P P2      22 E0001      EXITZ         E0001 INITIAL OF ORDER TO STORE 0-POSITION      1366
0394 23 1555 0179  1555    P P3      23 E0001      EXITZ         E0001 INITIAL OF ORDER TO STORE 1-POSITION      1368
0718 69 1555 0659          J         69 E0001                         BRING WORD SHOWING EQUIVALENT            1542
0765 60 1555 1088          0 800     60 A0201      TA                                                          1772
0916 24 1555 0000  1555    0 0       24 A0201         0000       A0201                                        2434
1352 69 1555 0172          0 0       69 A0201      T0005              COMPARISON CONSTANT FOR END OF JOB        2604
1245 69 1555 0168          0 0S      69 A0201      T0001              TO RESTORE BEFORE END OF JOB              2606

0365 20 1660 0000  1660    0 OSA     20 G0001         0000       G0001 RESTORE COMPARISON CONSTANT ANO MOOIFY     982
0592 65 1660 0665          J         65 G0001                         BRING EQUIVALENT OF REGION               1486
1266 24 1660 0029  1660    J ST      24 G0001         0029       G0001 STORE ADDRESS OF 0001 OF REGION           2492

0405 20 1661 0000  1661    0 0A      20 G0002         0000       G0002 COMPARISON CONSTANT                        980

0647 24 1669 0072  1669                24 ORUMT                    ORUMT PRESET DRUM TAG )                      966
0370 69 1669 0772          R J0003   69 ORUMT                          BLANK I, IS ORUM FULL                  1302
0611 69 1669 1072          N SUB11   69 ORUMT                          IS THE DRUM FULL                       1608
0617 24 1669 1122  1669                24 DRUMT                    ORUMT CHANGE ORUM TAG TO 9 )                 1702
0420 69 1669 1224          R L0003   69 ORUMT                          BLANK ADDRESS.  IS ORUM FULL           2080
0616 69 1669 1274                    69 ORUMT                          BLANK 0 AND I.  CHECK DRUM TAG         2194
1298 24 1669 1280  1669                24 ORUMT                    ORUMT CHANGE ORUM TAG.  ORUM CANNOT BE FULL.  2448

0341 69 1679 0232          N 888     69 BLANB                          SAVE IN CASE I IS BLANK                  798
0438 24 1679 0282  1679                24 BLANB                    BLANB SPEC. SUBR.  BRING BACK BLANB + ORCEB     870
0268 20 1679 0271  1679    N M0001   20 BLANB      M0004         BLANB STORE EQUIVALENT OF BLANK ADDRESS         1180
1008 65 1679 0376                    65 BLANB      A                   BRING EQUIVALENT OF BLANK BACKWARD L     1238
0626 65 1679 0371                    65 BLANB      J0004               BRING EQUIVALENT OF BLANK BACKWARD L     1306

1283 65 1680 0690          N OONE    65 ZEROX                          CLEAR ACCUMULATOR                        2428
0381 69 1680 0533                    69 ZEROX      RU                  BRING ZERO TO INDICATE RESERVATION       1032
0220 65 1680 0177          N F0003   65 ZEROX      EXITX               ORUM ADDRESS, OR EQUIVALENT TO ORUM      1158

0392 24 1689 0442  1689    J SS      24 Z0001                    Z0001 STORE SYMBOL )                         1336
0290 10 1689 1002          J Y       10 Z0001      LOOP                AOO A SYMBOL INTO UPPER, FROM BOTTOM     1508

0340 10 1898 1002          J         10 ZMAXM      LOOP                AOO A SYMBOL, STARTING AT TOP            1516
0990 10 1898 0608          J         10 ZMAXM      U0001               AOO A SYMBOL TO UPPER                    2500

0134 20 1899 0302  1899    J         20 ZMAX1                    ZMAX1 CLEAR REGION AND SYMBOL TABLES )        954

0744 11 8001 0452                    11    8001                        OUPLICATE INTO AVAILABILITY TABLE )      2412
0634 11 8001 8002                    11    8001      8002              OUPLICATE INTO AVAILABILITY TABLE )      2418
0070 65 8001 0327                    65    8001                        BRING BACK A SET )                       640
0332 15 8001 0289                    15    8001                        BRING BACK A SET OF RESULTS )            918
0389 10 8001 0295                    10    8001                        MAKE SEVERAL VARIABLE ORDERS )           1060
0461 11 8001 0367                    11    8001                        MAKE SEVERAL VARIABLE ORDERS )           1066
0481 11 8001 0437                    11    8001                        MAKE SEVERAL VARIABLE ORDERS )           1072
0412 10 8001 0969                    10    8001                        RESTORE TO POSITIVE                      1380
0467 10 8001 1223          N RC      10    8001                        CORE ADDRESS.  RESTORE THE 2000          1394
0542 10 8001 0713                    10    8001      RES               RESTORE THE 9060                         1402
0517 10 8001 1323          C NZ      10    8001                        WRONG SYMBOL.  RESTORE UPPER TO PLUS     1428
0947 11 8001 0604                    11    8001                        CLEAR FIRST LETTER                       1446
0240 10 8001 0997                    10    8001                        ARE LAST FOUR CHARACTERS DIGITS )        1460
0679 65 8001 0535          N OUT     65    8001                        THEY ARE DIGITS.  GET VALUE )            1464
1063 67 8001 1319                    67    8001      LR                EQUIVALENT IS IN I POSITION OF LOWER     1546
0314 67 8001 0721          N LH      67    8001                        EQUIVALENT IN 0 POSITION OF LOWER        1548
0685 10 8001 1291                    10    8001                        AVAILABILITY WORD BACK INTO UPPER        1724
1035 15 8001 1341                    15    8001                        WHAT CELL OIO WE RESERVE )               1752
1270 15 8001 1227                    15    8001                             L-0 ADDENDS TO LEFT END LOWER )     1794
0986 16 8001 0993                    16    8001                        CLEAR OP FROM ACCUMULATOR                1936
0732 10 8001 0999          N ORM     10    8001      A                 ORUM.   MAKE POSITIVE AGAIN             2058
1285 60 8001 1292                    60    8001                        PUT IT INTO UPPER                        2088
0694 60 8001 0709                    60    8001      SUB10             PUNCH A CARD, AND REPEAT RBD             2408

0465 65 8002 0723                    65    8002                        REPLACE DIGIT OF AVAIL. WORD BY W )      1002
0683 66 8002 0491          J         66    8002                        CHANGE SIGN OF CORRECTION                1258
0969 60 8002 0777                    60    8002                        NUMERIC ADDRESS ALONE IN UPPER           1382
0613 65 8002 0177          N FXT     65    8002      EXITX             FIXED ADDRESS.  CLEAR UPPER AND EXIT.    1410
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1323 65 8002 0731                    65   8002                 CLEAR UPPER                                          1430
D77D 16 8D02 D729                    16   80D2                 AOORESS INTO LEFT ENO OISTRIBUTOR                    1562
D501 15 8002 09D9                    15   8D02                 4 TIMES DYNAMIC ADDRESS IN O POSITION                1626
D909 15 8002 0693                    15   8DD2   SSW           4 TIMES OYNAMIC AODRESS IN O POSITION                1628
1021 16 8002 1079                    16   8002                 WHAT CELL OIO WE RESERVE )                           1748
1055 16 8002 1313                    16   8D02                      L-O AODENOS TO LEFT END LOWER )                 179D
0799 16 8002 D910                    16   80D2                 O-ADORESS TO LEFT END OF DISTR )                     1836
1327 65 8002 D985                    65   8D02   BOTH          ODO.  SEPARATE LAST AOOEND.                          1896
1D56 65 8D02 0965                    65   8002                 OELETE O TAG                                         1942
D662 15 8002 1221                    15   8002                 OOUBLE IT                                            2D46
1D62 9D 8002 1067                    90   8DD2                 O, WE ARE NOT ON FIRST BACKWARD CARO                 2238

0022 65 8003 0229                    65   8003   LOOP          BRING BACK A SET )                                    55D
1080 65 8003 1038                    65   8D03                 WHICH L IS LESS, MEASUREO ON CIRCLE )                 838
0212 16 8003 0669                    16   8003                 MOOIFY TO ENO WITH 1999 )                            1052
0543 10 8003 0401                    10   8003                 MAKE SEVERAL VARIABLE OROERS )                       1076
D567 11 8003 0725          C LOO     11   8D03                 ARE LAST FOUR CHARACTERS DIGITS )                    1452
1319 69 8003 0776          C LR      69   8003                 CLEAR DISTRIBUTOR                                    1552
0689 60 8003 0D57                    60   80D3   SB10A         CLEAR LOWER                                          1586
0736 65 8003 0693                    65   80D3   SSW           CLEAR ACCUMULATOR AND JUMP                           1616
0667 11 8003 0975                    11   8D03                 PUT INTO DISTRIBUTOR                                 1720
0717 60 8003 1225                    60   8003                 CLEAR LOWER                                          1730
1074 15 8D03 1031                    15   8003                 WHAT CELL OIO WE RESERVE )                           1758
0936 6D 8003 0943                    6D   8003                    SHOULD WE INTERCHANGE ADDENOS )                   1862
1272 65 8003 0179                    65   8003   EXITZ         NEW DYNAMIC LEVEL INTO LOWER                         1916
121D 69 8003 0566                    69   8003                 CLEAR OISTRIBUTOR                                    1932
0648 69 8003 1261                    69   80D3                 CLEAR OISTRIBUTOR                                    1968
0546 67 8003 0178          N NZ      67   8003   EXITY         IF NOT 8001, CORRECTION IS ZERO                      2020
0933 11 8003 1242                    11   80D3                 CORE.  CLEAR UPPER                                   2054
0716 61 8003 0780                    61   8003                 CHANGF ITS SIGN                                      2396

D955 21 9972 0755  9972    J STR     21   9972   SKP    9972   NEW AVAILABILITY WORO INTO ORUM )                    1738

0360 69 9999 8003          J BRNG    69   9999       8003       BRING BACK A SET )                                  644
0D74 69 9999 8003          J BRNG    69   9999       8003       BRING BACK A SET OF RESULTS )                       924
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0001 60 0003 0709          N SETCC    60 READC     SUB10          SEQUEL TO MANY PSEUDO-OPS.                          1580
0002 69 1112 0039          R    0002  69           SUB14          OP, C.I., TAGS, OPTIM, ALOPT                        2248
0003 70 0161 1041            READC    70 R0011                    READ ONE CARD                                       364
0004 90 0088 0000          K P        90    0088     0000        TAG FOR SEARCH STARTED BY MOF                       520
0005 69 0208 0061                     69             SUBR3       IS L FIXED ADDRESS )                                440
0006 24 0178 0231  0178    N SUBR1    24 EXITY               EXITY STORE EXIT                                         950
0007 44 0011 0012                     44 MOFLI     ABCDE           IF SO, START FORWARD SEARCH                         388
0008 69 1044 0047          N    0008  69 81STX                      DELETE QUITT TAG )                              372
0009 65 0553 0907          J          65 VAR                        IS THIS LAST SET )                                  662
0010 69 1234 1244          J    0010  69 85TH                       C.I. FOR AVAILABILITY TABLE )                   2552
0011 69 0014 0107          N MOFLI    69 I         A               STARTED SEARACH WITH INDEXED 0                      400
0012 69 0015 0018          C ABCDE    69           SUB21           PROCESS I                                           390
0013 22 0167 0070  0167               22 XXXX1               XXXX1 BRING BACK A SET )                                  638
0014 90 0089 0000          K I        90    0089     0000        TAG FOR SEARCH STARTED BY INDEXED 0                 522
0015 60 0003 0057          J          60 READC     SB10A           PREPARE TO PUNCH CARD                               392
0016 65 0114 0984          R    0016  65 91STX                      TAG IN CASE L IS UNDEFINED SYMBOL )             2522
0017 24 1050 0253  1050               24    1050              1050 CHANGE FIRST-CARD INDICATOR TO 2ND )                490
0018 24 0177 0680  0177    N SUB21    24 EXITX               EXITX STORE EXIT                                         2178
0019 69 1050 0503          N BACKW    69    1050                   WAS THERE JUST ONE SEARCH CARD                      604
0020 69 0182 0085                     69 P0006                     SAVE L FROM CARD THAT STARTED SRCH )                622
0021 69 1044 1298          R    0021  69 81STX                      BLA ENTRY.  CHANGE DRUM TAG                     2446
0022 65 8003 0229                     65    8003     LOOP          BRING BACK A SET )                                  550
0023 45 0026 0077                     45 QUITT                     O, IT IS NOT, AND WE QUIT                           436
0024 69 0186 8002          J          69 P0010           8002      STORE PROCESSED CARD )                              880
0025 60 0153 0764          R    0025  60 R0003     BOTH            SYN ENTRY.  ALPHABETIC I                        2314
0026 69 1050 0303          N QUITT    69    1050                   WAS THERE ONLY ONE SEARCHED CARD                    532
0027 69 0001 0006          R    0027  69 SETCC     SUBR1           TO INITIALIZING SUBROUTINE                      2638
0028 11 0031 0035            X        11 O                        STORE SET OF DATA )                                 414
0029 69 1232 0740          R    0029  69 ZO          SUB             BLR ENTRY.  TO SUBROUTINE                       2442
0030 69 0633 0063                     69           SUBR9           TO SUBROUTINE 9 TO ANALYZE THE ADDRESS          1150
0031 69 0155 8002          Q O        69 R0005           8002      COMPARISON CONSTANT FOR STORING                     514
0032 65 0103 0407          N BCDEF    65 FINAL                     IS STORAGE AREA FULL )                              478
0033 69 0036 0039                     69           SUB14           OP, C.I., OPTIM, ALOPT, ETC.                        376
0034 99 0338 0239          N XX8      99           9X8             MULTIPLE BRANCH ACCORDING TO TAGS )                 744
0035 15 0038 0043                     15 16THX                     STORE SET OF DATA )                                 416
0036 69 0089 0042          J          69           SUB19           PROCESS L                                           378
0037 24 0151 0104  0151               24 R0001               R0001 IF SO, PUT IN DUMMY MOVEABLE WORDS )                504
0038 00 0001 0000          K 16THX    00    0001     0000                                                             2668
0039 24 0177 0430  0177    N SUB14    24 EXITX               EXITX STORE EXIT                                         1924
0041 10 0044 8003          C LOOP     10                8003      STORE SET OF DATA )                                 408
0042 24 0177 0480  0177    N SUB19    24 EXITX               EXITX STORE EXIT                                         2068
0043 44 0147 0148                     44           OUT             STORE SET OF DATA )                                 418
0044 69 0151 8002          J          69 R0001           8002      STORE SET OF DATA )                                 410
0045 24 0177 0630  0177    N SUB20    24 EXITX               EXITX STORE EXIT                                         2116
0046 60 0152 0257                     60 R0002                     IF SO, IS IT FIXED )                                452
0047 24 1030 0033  1030               24    1030              1030 DELETE QUITT TAG )                                  374
0048 94 0051 0053                     94 MOFLP                     O, YES                                              384
0049 24 0052 0205  0052               24 DONE                ODNE  PRESET EXIT FROM BACKWARDS ROUTINE )                632
0050 69 0156 8002          O QS       69 R0006           8002      TO RESTORE COMPARISON CONST + ADVANCE               516
0051 69 0004 0107          N MOFLP    69 P         A               STARTED SEARCH WITH MOF OPERATION                   398
0053 60 0902 0007                     60    0902                   IS O INDEXED                                        386
0054 60 0153 0764          R    0054  60 R0003     BOTH            EOU ENTRY.  ALPHABETIC I                        2312
0055 60 0902 0307                     60    0902                   IS O INDEXED                                        464
0056 69 1050 0203                     69    1050                   IS THIS FIRST SET OF SEARCH )                       424
0057 15 0181 0635          C SB10A    15 P0005                     ADVANCE CARD NUMBER )                           1588
0058 65 0160 0065          N NO       65 R0010                     IS CARD OF TYPE 08 )                                432
0059 20 0197 0500  0197               20 ALOPT               ALOPT STORE MODIFIED ALOPT                               810
0060 44 0026 0064          J          44 QUITT                     IF N G, QUIT SEARCH                                 456
0061 24 0177 0030  0177    N SUBR3    24 EXITX               EXITX STORE EXIT                                         1148
0063 24 0179 0482  0179    N SUBR9    24 EXITZ               EXITZ STORE EXIT                                         1434
0064 45 0144 0019                     45 K         BACKW           IF FIXED, START BACKWARD PROCESSING                 458
0065 16 0068 0023                     16 810TH                     IS CARD OF TYPE 08 )                                434
0066 65 0197 0351          J          65 ALOPT                     MODIFY ALOPT AGAIN )                                854
0067 24 1050 0358  1050               24    1050     A         1050 START ON L.  FIRST-CARD TAG )                       616
0068 00 0000 0008          K 810TH    00    0000     0008                                                             2650
0070 65 8001 0327                     65    8001                   BRING BACK A SET )                                  640
0071 44 0026 0076                     44 QUITT                     IF SO, QUIT SEARCH )                                444
0072 65 0175 0429                     65 AVAL                      MAKE DRUM AVAILABLE )                               968
0073 60 0010 0709          R    0073  60    0010     SUB10           PUNCH USUAL DUMMY OUTPUT CARD                   2550
0074 69 9999 8003          J BRNG     69    9999           8003      BRING BACK A SET OF RESULTS )                       924
0075 00 1000 0000          K 13RD     00    1000           0000                                                         754
0076 45 0088 0026                     45 C         QUITT           IF SO, QUIT SEARCH )                                446
0077 60 0151 0005                     60 R0001                     ALPHARETIC L                                        438
0078 45 0032 0019                     45 BCDEF     BACKW           IF I IS FIXED, START BACKWARD                       476
0079 00 0000 0007          K 710      00    0000     0007                                                             526
0080 60 0151 0455                     60 R0001                     ALPHARETICAL L INTO UPPER                       1174
0081 91 0034 0436          C F        91 XX8                       MULTIPLE BRANCH ACCORDING TO TAGS )                 738
0082 24 0151 0204  0151    J SEND     24 R0001     X         R0001 BRING BACK A SET )                                  556
0083 65 0086 0041                     65 SEND      LOOP            STORE SET OF DATA )                                 406
0084 65 0990 8002          R    0084  65                8002      ADDING ORDER TO LOWER                               2498
0085 24 0238 0191  0238               24 SAVEL               SAVEL SAVE L FROM CARD THAT STARTED SRCH )                624
0086 24 1125 0028  1125    J SEND     24 S0001     X         S0001 STORE SET OF DATA )                                 412
0087 24 0040 0193  0040               24 SAVEO               SAVEO SAVE O  FROM CARD THAT STARTED SRCH )              628
0088 69 0091 0039          C C        69           SUB14           GET OP, C.I., TAGS, OPTIM, ALOPT.                   448
0089 69 0092 0045          J          69           SUB20           PROCESS O                                           380
0090 24 0052 0468  0052               24 ODNE      NO        ODNE  WITH L.  ALTER EXIT )                              684
0091 95 0144 0046          J          95 K                         IS O ACTUALLY AN ADDRESS                            450
0092 69 0095 0048          J          69 OPTIM                     IS IT AN MOF OPERATION )                            382
0093 65 0152 1345          R    0093  65 R0002                     ALPHARETIC O                                    2620
0094 60 0158 1114          R    0094  60 R0008                     BEGINNING OF REGION TO BE RESERVED              2380
0096 65 0117 0321          J DN1      65 VAR2X                     ALL CASES.  STORE PROCESSED CARD )                  876
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0097 65 0152 1116          R     0097    65 R0002                        REGION DESIGNATOR TO RIGHT END )                    2474
0098 65 0159 0964          R     0098    65 R0009                        REQ ENTRY.  NUMERICAL I                             2362
0099 69 0502 0740          R     0099    69          SUB                 RBR ENTRY.  TO SUBROUTINE                           2454
0100 69 0003 0006          N     0100    69 READC    SUBR1               INITIALIZE AT START OF ASSEMBLY                      362
0101 65 0397 0201          J             65 LNM      SUB22                  SAVE ORGEO                                        776
0102 65 0052 0201          J LN          65 OONE     SUB22                  SAVE ORGEO                                        786
0104 24 0152 0105  0152                  24 R0002                    R0002 IF SO, PUT IN DUMMY MOVEABLE WORDS )                506
0105 24 0153 0236  0153                  24 R0003    YYY             R0003 IF SO, PUT IN DUMMY MOVEABLE WORDS )                508
0106 16 0069 0623                        16 0C                             IS THIS LAST SET                                  568
0107 24 1030 0083  1030    C A           24    1030                  1030 STORE TAG TELLING HOW SEARCH STARTED                404
0109 65 0062 0217          J             65 OPREG                          SAVE DYNAMIC LEVEL OF L FROM 0 )                  818
0110 35 0005 0173          J             35    0005                        IS I A FIXED ADDRESS )                            472
0111 69 0114 0017                        69 91STX                          CHANGE FIRST-CARD INDICATOR TO 2NO )              488
0112 11 0365 8003                        11 OSA         8003               CLEAR REGION AND SYMBOL TABLES )                  960
0113 69 0235 0438          N SSB         69 T1                             SPEC. SUBR.  BRING BACK BLANB + ORGEB             868
0114 90 0000 0000          K 91STX       90    0000     0000                                                                 2678
0115 45 0318 0026                        45          QUITT                 IFSO, QUIT SEARCH                                 482
0116 20 1551 0900  1551    Q 796         20 A0197       0900       A0197 COMPARISON CONSTANT FOR LAST LINE                  1132
0118 65 1328 1233          R 00001       65 83RD     BP                    INVALID ADDRESS                                  2320
0119 65 1328 1233          R Q0002       65 83RD     BP                    BLANK I.  CARD IS UNUSABLE                       2322
0120 20 0095 1098  0095    N 00003       20 E        X               E     DRUM.  PUT I-EQUIVALENT INTO E                   2324
0121 65 1328 1233          R 00004       65 83RD     BP                    NEW SYMBOL I.  CARD IS UNUSABLE                  2326
0122 20 0095 1098  0095    R Q0005       20 E        X               E     800X ADDRESS                                     2328
0123 20 0095 1098  0095    R Q0006       20 E        X               E     CORE ADDRESS                                     2330
0124 20 0095 1098  0095    R 00007       20 E        X               E     OTHER ADDRESS                                    2332
0125 65 1328 1233          R Q0008       65 83RD     BP                    N G O.  CARD IS UNUSABLE                         2340
0126 65 1328 1233          R 00009       65 83RD     BP                    BLANK D.  CARD IS UNUSABLE                       2342
0127 20 0536 1289  0536    N Q0010       20 EQUIV    SD              EQUIV OLD SYMBOL.  STORE I AS NEW EQUIV                2344
0128 20 0536 1289  0536    R 00011       20 EQUIV    SD              EQUIV NEW SYMBOL.  STORE I AS ITS EQUIVALENT           2346
0129 20 0536 1289  0536    R 00012       20 EQUIV    SD              EQUIV 800X.  STORE ITS EQUIVALENT.                     2348
0130 20 0536 1289  0536    R Q0013       20 EQUIV    SD              EQUIV CORE.  STORE I AS ITS EQUIVALENT.                2350
0131 20 0536 1289  0536    R 00014       20 EQUIV    SO              EQUIV OTHER.  STORE I AS THE EQUIVALENT.               2352
0132 01 0000 0000          K 12NDX       01    0000     0000                                                                 2672
0133 96 0136 0088                        96 B        C                     WITH I OR L, RESPECTIVELY                        430
0134 20 1899 0302  1899    J             20 ZMAX1                    ZMAX1 CLEAR REGION AND SYMBOL TABLES )                 954
0135 69 0040 0343                        69 SAVED                          BRING BACK L AND D )                              678
0136 60 0153 0357          C B           60 R0003                          IS I A FIXED ADDRESS )                            468
0137 65 0117 0571          J ENDED       65 VAR2X                          MAKE NEW BRINGING ORDER )                         904
0138 69 0141 0042                        69          SUB19                 PROCESS L                                         540
0139 69 1044 0297          J             69 81STX                          CHANGE TAG TO SECOND-CARD TAG )                   588
0140 98 0291 0145                        98 MISC     899                   MULTIPLE BRANCH ACCORDING TO TAGS )               742
0141 69 0012 0045          J             69 ABCOE    SUB20                 PROCESS D, AND TO 08 ROUTINE                      542
0142 24 0177 0330  0177    N SUBR6       24 EXITX                    EXITX STORE EXIT                                      1290
0143 44 0247 0198                        44          OUT                   BRING BACK A SET )                                562
0144 69 0197 0150          C K           69 ALOPT                          IS IT AN MDF OPERATION                            460
0145 69 0298 0400          N 899         69          SUBR5                 PROCESS D BACKWARDS                               772
0146 24 0155 0408  0155    J             24 R0005    X               R0005 BRING BACK A SET )                                648
0147 10 0050 8003                        10 QS          8003               STORE SET OF DATA )                               420
0148 20 0103 0056  0103    N OUT         20 FINAL                    FINAL STORE VARIABLE ORDER                            422
0149 69 0102 0018          J             69 LN       SUB21                 PROCESS I FORWARDS                                784
0150 94 0026 0055                        94 QUITT                          IF SO, QUIT SEARCH                                462
0161 15 0038 0143                        15 16THX                          BRING BACK A SET )                                560
0162 16 0515 0619                        16 110TH                          REDUCE NUMBER YET TO BE DONE )                   1014
0163 69 0066 0400          J             69          SUBR5                 PROCESS BACKWARDS D ONCE MORE                     852
0164 24 0117 0020  0117                  24 VAR2X                    VAR2X PRESET TO STORE AFTER PROCESSING )                620
0165 16 0068 0323                        16 810TH                          IS IT TYPE 08)                                    496
0166 10 1003 0558                        10 N                              UPPER, LAST ADDRESS - 2000                       1048
0168 24 0178 0945  0178    R T0001       24 P0002                    P0002 STORE AVAILABILITY WORD                          2574
0169 24 0180 0995  0180    R T0002       24 P0004                    P0004 STORE AVAILABILITY WORD                          2578
0170 24 0182 1045  0182    R T0003       24 P0006                    P0006 STORE AVAILABILITY WORD                          2582
0171 24 0184 1095  0184    R T0004       24 P0008                    P0008 STORE AVAILABILITY WORD                          2586
0172 71 0177 1096          R T0005       71 P0001                          PUNCH A CARD OF THE TABLE                         2590
0173 44 0026 0078                        44 OUITT                          IF I IS N G, QUIT SEARCH                          474
0174 69 1199 8003          0 QL          69 SMAXM       8003                                                                 944
0175 11 1111 1111          K AVAL        11    1111     1111                AVAILABILITY WORD                                 988
0176 15 0079 0233                        15 710                            IS TYPE 01                                        500
0187 20 0197 0081  0197    N X2          20 ALOPT    F               ALOPT STORE MODIFIED ALOPT                              736
0188 69 0114 0067          N B           69 91STX                          START ON L.  FIRST-CARD TAG )                     614
0189 69 0238 0241          J             69 SAVEL                          BRING BACK L AND D )                              674
0190 00 0908 0344          J             00    0908                        TAGS AND EXIT FOR SUBROUTINE 13                  1270
0191 69 0184 0087                        69 P0008                          SAVE D  FROM CARD THAT STARTED SRCH )             626
0192 69 0195 0305          J             69          SUBR4                 PROCESS L BACKWARDS                               792
0193 69 0096 0049                        69 DN1                            PRESET EXIT FROM BACKWARDS ROUTINE )              630
0194 69 0397 0400          J             69 LNM      SUBR5                 PROCESS D BACKWARDS                               760
0195 69 0102 0045          J             69 LN       SUB20                 PROCESS D FORWARDS                                794
0196 69 0149 0305          J             69          SUBR4                 PROCESS L BACKWARDS                               782
0198 20 0353 0106  0353    N OUT         20 VAR                      VAR   STORE VARIABLE ORDER                              566
0199 16 0202 1107                        16 251XX    BOT                   WHICH L IS LESS, MEASURED ON CIRCLE )             844
0200 24 0156 0204  0156    0 OS          24 R0006    X               R0006 TO RESTORE AND ADVANCE                            598
0201 69 1050 1062          N SUB22       69    1050                        FIRST-CARD TAG                                   2236
0202 00 0000 0025          K 251XX       00    0000     0025                                                                2652
0203 90 0207 0058                        90          NO                    IS THIS FIRST SET OF SEARCH )                     426
0204 11 0607 0161            X           11 Q                              BRING BACK A SET )                                558
0205 65 0103 0757                        65 FINAL                          BRING BACK A SET )                                634
0206 65 0353 0229          J             65 VAR      LOOP                  BRING VARIABLE ORDER, AND REPEAT                  594
0207 69 1030 0133                        69    1030                        IF SO, WHERE DID SEARCH START                     428
0208 35 0005 0071          J             35    0005                        IS L FIXED ADDRESS )                              442
0209 20 0197 0397  0197                  20 ALOPT    LNM             ALOPT STORE NEW ALOPT, AND JUMP BACK                    860
0210 20 1200 0028  1200    Q MAX         24 SMAX1    X               SMAX1 CONSTANT FOR WHETHER STORAGE IS FULL              518
0211 24 1199 0252  1199    J SEN         24 SMAXM                    SMAXM STORE PROCESSED CARD )                            882
0212 16 8003 0669                        16    8003                        MODIFY TO END WITH 1999 )                        1052
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0213 20 0181 0234  0181    N OUT      20 P0005                P0005 CLEAR CARD NUMBER                                  962
0214 69 0317 0142          J          69          SU8R6             PROCESS I BACKWARDS AGAIN                        864
0215 22 0069 0022  0069               22 0C                   OC    NOT 1ST CARD.  MAKE COMP. CONST. )               548
0216 15 0769 0973                     15 C5                         MODIFY TO TAKE NEXT COLUMN OF TABLE )            1100
0217 14 0320 1036                     14 501XX                      SAVE DYNAMIC LEVEL OF L FROM D )                 820
0218 60 0068 0177          R F0001    60 810TH    EXITX             ADDRESS IS N G                                   1154
0219 65 0068 0177          R F0002    65 810TH    EXITX             BLANK ADDRESS                                    1156
0220 65 1680 0177          N F0003    65 ZEROX    EXITX             ORUM ADDRESS, OR EQUIVALENT TO ORUM              1158
0221 65 0068 0177          R F0004    65 810TH    EXITX             SYMBOLIC ADDRESS, WITH UNDEFINED SYMB            1160
0222 35 0005 0177          R F0005    35    0005  EXITX             800X ADDRESS                                     1162
0223 65 0068 0177          R F0006    65 810TH    EXITX             CORE ADDRESS                                     1164
0224 60 0068 0177          R F0007    60 810TH    EXITX             OTHER ADDRESS.  USUALLY PART OF CONST.           1166
0225 65 0359 0413          N TP       65 SPR                        8OTTOM LINE OF TABLE                             1094
0226 69 0279 0039                     69          SUB14             GET OP, C.I., TAGS, OPTIM, ALOPT.                572
0227 65 0103 0041          C LP       65 FINAL    LOOP              ALL CASES, BACK TO START OF LOOP                 512
0229 10 0082 8002          C LOOP     10 SENO        8002           BRING BACK A SET )                               552
0230 60 0152 0958                     60 R0002                      ALPHABETIC D INTO UPPER                          1224
0231 61 0134 8003                     61             8003           CLEAR REGION AND SYMBOL TABLES )                 952
0232 24 0235 0388  0235               24 T1                   T1    SAVE IN CASE I IS BLANK                          800
0233 45 0236 0037                     45 YYY                        O, NO,  I, YES.                                  502
0234 69 1044 0647                     69 81STX                      PRESET ORUM TAG )                                964
0236 24 0155 0227  0155    C YYY      24 R0005    LP          R0005 EITHER CASE, SOMETHING INTO R0005                510
0237 20 0197 0550  0197               20 ALOPT                ALOPT MODIFY TO USE ROUTINE FOR UNFIXED D )             828
0239 69 0192 0142          N 9X8      69          SUBR6             PROCESS I BACKWARDS                              790
0240 10 8001 0997                     10    8001                  ARE LAST FOUR CHARACTERS DIGITS )                1460
0241 24 0182 0135  0182               24 P0006                P0006 BRING BACK L AND O )                             676
0242 24 0182 0285  0182    J SEND     24 P0006    X           P0006 BRING BACK A SET OF RESULTS )                    926
0243 10 0146 8002          N LOOP     10             8002           BRING BACK A SET )                               646
0244 24 0447 0450  0447               24 T2                   T2    SAVE IN CASE I IS CORE )                         804
0245 46 0348 0199                     46 AE8                        WHICH L IS LESS, MEASURED ON CIRCLE )            842
0246 35 0000 0750          P C1       35    0000  XX                TO PRESET LEFT SHIFT ORDER                       1124
0247 10 0200 8002                     10 OS          8002           BRING BACK A SET )                               564
0248 20 0553 0256  0553    N OUT      20 VAR                  VAR   STORE VARIABLE ORDER                            658
0249 22 0901 0354  0901               22    0901                   MAKE SEVERAL VARIABLE ORDERS )                   1086
0250 24 0150 0408  0150    0 OS       24 R0000    X           R0000 RESTORE COMPARISON CONSTANT AND MODIFY           750
0251 16 0254 0059                     16 11STX                      CHANGE ITS FIRST DIGIT TO 8                      808
0252 11 0355 0259                     11 O2                         STORE PROCESSED CARD )                           884
0253 70 0151 1007                     70 R0001                      READ ANOTHER CARD                                492
0254 10 0000 0000          K 11STX    10    0000          0000                                                       2674
0255 60 0153 0957                     60 R0003                      BRING ALPHABETIC I                               690
0256 69 0009 0039                     69          SU814             GET OP, C.I., TAGS, OPTIM, ALOPT.                660
0257 69 0060 0061                     69          SUBR3             IF SO, IS IT FIXED )                             454
0258 65 0103 0557          N SKP      65 FINAL                      NOT 1ST CARD.  MAKE COMP. CONST. )               544
0259 16 0038 0443                     16 16THX                      STORE PROCESSED CARD )                           886
0260 69 1125 8003          J BRNG     69 S0001       8003           BRING BACK A SET )                               554
0261 24 0151 0408  0151    0 O        24 R0001    X           R0001 COMPARISON CONSTANT FOR END OF SET               748
0262 10 0565 0331                     10 C3       SU                MAKE SEVERAL VARIABLE ORDERS )                   1092
0263 11 0116 0671                     11 796                        ARE WE TO LAST LINE OF TABLE )                   1020
0264 45 0000 0001          P C4       45    0000     0001          DIFFERENCE OF BRINGING AND STORING ORD           1130
0265 16 0038 0293                     16 16THX                      BRING BACK A SET )                               652
0266 00 0196 0000          P C6       00    0196     0000          TO MODIFY BRINGING ORDER FOR NEXT COL            1138
0267 14 0320 1080                     14 501XX                      WHICH L IS LESS, MEASURED ON CIRCLE )            836
0268 20 1679 0271  1679    N M0001    20 BLANB    M0004     BLAN8 STORE EQUIVALENT OF BLANK ADDRESS                1180
0269 60 0622 0627          R M0002    60 87THX    S8108           N. G.  OMIT PUNCHING                             1182
0270 69 1044 0697          R M0003    69 81STX                    BLANK.  CHANGE FIRST-CARD TAG )                  1184
0271 20 0182 0335  0182    N M0004    20 P0006    SB10C     P0006 DRUM ADDRESS.  STORE FOR PUNCHING                1192
0272 65 0325 0611          R M0005    65          SUB11           NEW SYMBOL.  FIND BEST EQUIVALENT                1194
0273 01 0555 0273          R M0006    01    0555  M0006           800X ADDRESS.  STOP THE MACHINE                  1198
0274 20 0182 0385  0182    R M0007    20 P0006                P0006 CORE ADDRESS.  STORE FOR PUNCHING                1200
0275 01 0555 0275          R M0008    01    0555  M0008           OTHER ADDRESS.  STOP MACHINE                     1208
0276 69 0197 0950          N M0009    69 ALOPT                      EQUIV OF NEW SYMBOL.                             1210
0277 00 0000 0269          R M0010    00    0000  M0002           NEW SYMBOL, BUT SYMBOL TABLE FULL                1216
0278 35 0001 0485                     35    0001                  ARE LAST FOUR CHARACTERS DIGITS )                1456
0279 69 1050 0403          J          69    1050                  IS THIS FIRST OUITT SET                          574
0280 69 0683 0586                     69          SUB17             CORRECTION TO DYNAMIC LEVEL                      1256
0281 30 0001 0337                     30    0001                  REPLACE DIGIT OF AVAIL. WORD BY W )              1006
0282 69 0447 0600                     69 T2                         SPEC. SUBR.  BRING BACK BLANB + ORCE8            872
0283 96 0012 0138                     96 ABC0E                      IF WITH I, PROCESS LIKE 08                       538
0285 11 0488 0493            X        11 0                          BRING BACK A SET OF RESULTS )                    928
0286 69 0139 0018          J JUMP     69          SU821             PROCESS I                                        586
0287 15 0254 0209          C XY       15 11STX                      MODIFY ALOPT AGAIN )                             858
0288 69 0137 0090          N L        69 ENDED                      WITH L.  ALTER EXIT )                            682
0289 10 0242 0547                     10 SEND     A                 BRING BACK A SET OF RESULTS )                    920
0290 10 1689 1002          J Y        10 Z0001    LOOP              ADD A SYMBOL INTO UPPER, FROM BOTTOM             1508
0291 69 0194 0142          N MISC     69          SUBR6             PROCESS I BACKWARDS                              758
0293 44 0347 0248                     44          OUT               BRING BACK A SET )                               654
0295 30 0003 1053                     30    0003                  MAKE SEVERAL VARIABLE ORDERS )                   1062
0296 15 0549 0954                     15 601                        INITIAL OF VARIABLE BRINGING ORDER               1638
0297 24 1050 0453  1050               24    1050                   1050 CHANGE TAG TO  SECOND-CARD TAG )           590
0298 69 0101 0018          J          69          SU821             PROCESS I FORWARDS                               774
0299 22 0901 0404  0901               22    0901                   0901 MODIFY TO TAKE NEXT COLUMN OF TABLE )      1104
0300 95 0603 0255                     95 SHX                        D, NO,  I, YES.                                  688
0301 15 0132 0237                     15 12NDX                      MODIFY TO USE ROUTINE FOR UNFIXED D )            826
0302 10 0405 0309                     10 0A                         CLEAR REGION AND SYMBOL TABLES )                 956
0303 90 0507 0258                     90          SKP               D, ONLY ONE.                                     534
0305 24 0177 0080  0177    N SUBR4    24 EXITX                EXITX STORE EXIT                                       1172
0306 69 0397 0142          J          69 LNM      SUBR6             PROCESS I BACKWARDS                              768
0307 45 0026 0136                     45 OUITT    B                 IF SO, OUIT SEARCH                               466
0308 69 1030 0333                     69    1030                  IF SO, WHERE DID WE START                        578
0309 46 0112 0213                     46          OUT               CLEAR REGION AND SYMBOL TABLES )                 958
0310 69 0286 0045          J          69 JUMP     SUB20             PROCESS D                                        584
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0311 65 0214 0113          N 2NO      65          SSB          USE I-COMP.  BRING BLANK AND ORCEB                862
0312 60 0108 0513                     60 SA                    MODIFY TO TAKE FIRST LINE, SAME COLUMN          1108
0313 46 0166 0178                     46          EXITY        I, OVER 1999.  WE RESERVE NOTHING               1046
0314 67 8001 0721          N LH       67    8001               EQUIVALENT IN D POSITION OF LOWER               1548
0315 45 0468 0319                     45 NO                    D, NO, I, YES.                                   666
0316 00 0195 0000          P C8       00    0195    0000       MODIFY BRINGING ORDER TO START NEW COL          1142
0317 65 0197 0287          J          65 ALOPT    XY           BRING ALOPT, AND JUMP BACK                       866
0318 65 0903 0457                     65    0903               IS I INDEXED                                     484
0319 69 1030 0433                     69    1030               IF SO, WHERE OID SEARCH START                    668
0320 00 0000 0050          K 50IXX    00    0000    0050                                                       2656
0321 10 0024 8003                     10          8003         STORE PROCESSED CARD )                           878
0322 20 1355 0000  1355    0 OSB      20 A0001    0000  A0001  RESTORE COMPARISON CONSTANT AND MODIFY           986
0323 45 0176 0227                     45          LP           D, IT IS NOT.  I, IT IS.                         498
0324 10 0427 0331                     10 800      SU           RESTORE, AND TAKE WORD FROM NEXT LINE           1024
0325 00 0989 0276          J          00    0989  M0009        TAGS AND EXIT FOR USE IN SUBROUTINE 11          1196
0327 16 0038 0243                     16 16THX    LOOP         BRING BACK A SET )                               642
0328 35 0004 0639                     35    0004               MAKE BRINGING ORDER )                           1482
0329 20 0197 0350  0197    C X1       20 ALOPT               ALOPT STORE MODIFIED ALOPT                         712
0330 60 0153 1108                     60 R0003                 ALPHABETIC I TO UPPER                           1292
0331 21 0108 0361  0108    C SU       21 SA                  SA    STORE VARIABLE STORING ORDER               1026
0332 15 8001 0289                     15    8001               BRING BACK A SET OF RESULTS )                    918
0333 96 0286 0657                     96 JUMP     NO           D, STARTED WITH I.  I, WITH L.                   580
0334 00 0000 9060          K 9060     00    0000    9060                                                       1414
0335 20 0062 0177  0062    N SB10C    20 OPREG    EXITX  OPREG FROM 4-5, 19-20.  STORE DYNAMIC LEVEL           1602
0336 95 0032 0012                     95 BCOEF    A8CDE        WITH I.  EXIT ACCORDING TO WHY SEARCH            612
0337 10 0304 0359                     10 UH       SPR          REPLACE DIGIT OF AVAIL. WORD BY W )             1008
0338 98 0341 0393                     98 888      898          MULTIPLE BRANCH ACCORDING TO TAGS )              746
0339 24 0292 0003  0292               24 ORCEQ    READC  ORCEQ FINISHED.  SAVE SAVOR AS ORCEQ )                 938
0340 10 1898 1002          J          10 ZMAXM    LOOP         ADD A SYMBOL, STARTING AT TOP                   1516
0341 69 1679 0232          N 888      69 BLANB               SAVE IN CASE I IS BLANK                          798
0342 20 0391 0335  0391               20 ORCEB    SB10C  ORCE8 STORE DYNAMIC LEVEL OF CORE ADDRESS            1206
0343 24 0184 0137  0184               24 P0008    ENDED  P0008 BRING BACK L AND O )                            680
0344 69 1050 0504                     69    1050               FIRST-CARD TAG                                  1272
0345 20 0435 0588  0435               20 LSYMB               LSYM8 STORE ADDR OF SPACE RELATIVE TO START       1520
0347 10 0250 8002                     10 QS          8002      BRING BACK A SET )                               656
0348 15 0202 1107          N AEB      15 25IXX    BOT          WHICH L IS LESS, MEASURED ON CIRCLE )            846
0349 24 0901 0454  0901               24    0901                0901 LAST LINE AND END OF WORD.  MODIFY )     1114
0350 60 0152 1057                     60 R0002                 ALPHABETIC O, TO SEE WHETHER FIXED               714
0351 16 0132 0287                     16 12NOX    XY           MODIFY ALOPT AGAIN )                             856
0352 60 0515 1069                     60 110TH    OON          MODIFY EXIT, AND PREPARE TO OUIT                1528
0354 69 0708 0511                     69 C2                    MAKE SEVERAL VARIABLE ORDERS )                  1088
0355 69 0182 8002          Q O2       69 P0006       8002      COMPARISON CONSTANT FOR END OF SET                896
0356 65 0109 0113          J          65          SSB          BRING BACK BLANB AND ORCE8                       816
0357 69 0110 0061                     69          SUBR3        IS I A FIXED ADDRESS )                           470
0358 69 0211 0164          C A        69 SEN                   PRESET TO STORE AFTER PROCESSING )               618
0360 69 9999 8003          J BRNG     69    9999    8003       BRING BACK A SET )                               644
0361 10 0264 8003                     10 C4          8003      MAKE VARIABLE BRINGING ORDER                    1028
0362 60 0108 0563                     60 SA                    LAST LINE AND END OF WORD.  MODIFY )            1120
0363 15 0228 0583                     15 P                     MAKE SEVERAL VARIABLE ORDERS )                  1080
0364 99 0688 0490                     99 FD       FIBD         I, BACKWARD L, BRANCH, UNFIXED D                1814
0365 20 1660 0000  1660    Q QSA      20 G0001       0000  G0001 RESTORE COMPARISON CONSTANT AND MODIFY          982
0366 10 1019 1123                     10 ODIFF                 DRUM,  ADD RELOCATION AMOUNT                    1388
0367 35 0001 0773                     35    0001               MAKE SEVERAL VARIABLE ORDERS )                  1068
0368 69 0911 0661          N J0001    69 PRE      SUBR7        STORE EQUIVALENT OF NEW SYMBOL                  1298
0369 60 0722 0627          R J0002    60 89THX    SB10B        N.G.  OMIT PUNCHING                             1300
0370 69 1669 0772          R J0003    69 ORUMT                 BLANK I, IS DRUM FULL                           1302
0371 24 0062 0615  0062    N J0004    24 OPREG               OPREG DRUM OR DRUM EQUIVALENT                     1308
0372 65 0675 0611          R J0005    65          SUB11        NEW SYMBOL.  FIND BEST VALUE                    1314
0373 01 0000 0373          R J0006    01    0000  J0006        800X RANGE.  ERROR.                             1318
0374 69 0391 0371          R J0007    69 ORCEB    J0004        CORE.  BRING DYNAMIC LEVEL                      1320
0375 20 0185 0177  0185    R J0008    20 P0009    EXITX  P0009 OTHER ADDRESS, USUALLY A CONSTANT              1322
0376 20 0062 0925  0062    N A        20 OPREG    C0008  OPREG STORE ADDRESS FOR OPTIMIZING NEXT ADDR          1278
0377 22 0167 0620  0167               22 XXXX1    LOOP   XXXX1 MAKE NEW BRINGING ORDER )                     908
0378 60 0000 0605                     60    0000               BRING APPROPRIATE TABULAR VALUE                 1568
0379 45 0332 0483                     45          OVR          BRING BACK A SET OF RESULTS )                    916
0380 11 0254 0559                     11 11STX                 IS FIRST POSITION BLANK                         1376
0381 69 1680 0533                     69 ZEROX    RU           BRING ZERO TO INDICATE RESERVATION              1032
0382 20 1554 1307  1554    J          20 A0200               A0200 MAKE DRUM AVAILABLE )                       972
0383 96 0336 0188                     96          B            D, WITH I.  I, WITH L.                           610
0385 69 0538 0441                     69          SUB13        FIND DYNAMIC LEVEL OF CORE ADDRESS              1202
0386 69 0189 0142                     69          SUBR6        PROCESS I BACKWARD                               672
0387 20 1003 0506  1003               20 N                   N     STORE N-1                                 1042
0388 69 0391 0244                     69 ORCEB                 SAVE IN CASE I IS CORE )                         802
0389 10 8001 0295                     10    8001               MAKE SEVERAL VARIABLE ORDERS )                  1060
0390 22 0167 0441  0167               22 XXXX1    SUB13  XXXX1 PREPARE EXIT AND GO TO SUBROUTINE 13 )           1620
0392 24 1689 0442  1689    J SS       24 Z0001               Z0001 STORE SYMBOL )                             1336
0393 69 0196 0400          N 898      69          SUBR5        PROCESS D BACKWARDS                              780
0394 23 1555 0179  1555    P P3       23 E0001    EXITZ  E0001 INITIAL OF ORDER TO STORE I-POSITION           1368
0395 00 0210 0000          K ZTABL    00    0210    0000       LENGTH OF SYMBOL TABLE                          2680
0396 15 0599 1104                     15 602                   INITIAL BRINGING ORDER )                        1662
0397 69 0052 0305          J LNM      69 ONE      SUBR4        PROCESS L BACKWARDS                              762
0398 20 0117 0570  0117    N OUT2     20 VAR2X               VAR2X STORE PROCESSED CARD )                      892
0399 44 0654 0704                     44          ABS          I, ZERO.  ADDRESS WAS ABSOLUTE                  1472
0400 24 0177 0230  0177    N SUBR5    24 EXITX               EXITX STORE EXIT                                 1222
0401 10 0658 0363                     10 X                     MAKE SEVERAL VARIABLE ORDERS )                  1078
0402 60 0184 0789          N SHOP     60 P0008                 SHIFT OPERATION.  FORWARD I, BACKW L.           1816
0403 90 0657 0308                     90 NO                    O, IT IS NOT                                     576
0404 20 0359 0312  0359               20 SPR                 SPR   MODIFY TO TAKE NEXT COLUMN OF TABLE )     1106
0405 20 1661 0000  1661    Q OA       20 G0002       0000  G0002 COMPARISON CONSTANT                            980
0406 65 0062 0267          J          65 OPREG                 WHICH L IS LESS, MEASURED ON CIRCLE )            834
0407 16 0210 0115                     16 MAX                   IS STORAGE AREA FULL )                           480
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0408 11 0261 0265          X        11 O                          BRING BACK A SET )                          650
D409 00 DODD 2D00          K 2000I  00    0000       200D                                                2664
D41D 69 1124 8DD3          O OF     69 SOODO         8D03                                                 752
D411 60 D284 0389          C OK     60 XXXXA                      MAKE SEVERALVARIABLE ORDERS )              1058
D412 10 8OD1 0969                   1D    8DD1                    RESTORE TO POSITIVE                        138D
D413 16 0708 D463                   16 C2                         IS IT ALSO RIGHT END OF WORD               1096
D414 65 D167 D985          N EVN    65 XXXX1    BOTH              EVEN.  WE SHOULD USE FIRST ADDEND          1898
D415 46 0178 D569                   46 EXITY                      MAKE DRUM AVAILABLE )                       976
D416 6D D1D8 1D13          N SYM    6D HSYMB                      SYMBOLIC ADDRESS.  BRING SYMBOL            1496
D417 69 D246 0349          N ZP     69 C1                         LAST LINE AND END OF WORD.  MODIFY )       1112
D418 69 1D15 0661          N LODD1  69 PRE      SUBR7             SUB 11 FOUND EOU OF SYMB.  RESERVE         2076
D419 60 D622 D627          R LDD02  60 87THX    SB1DB             N.G.  FIX TO OMIT PUNCHING                 2078
D42D 69 1669 1224          R LODD3  69 DRUMT                      BLANK ADDRESS.  IS DRUM FULL               2080
D421 20 0182 1285  0182    N LDD04  2D PDD06             PD006    DRUM.  STORE ADDRESS FOR PUNCHING          2086
D422 69 103D D983          R L0005  69    1D30                    NEW SYMBOL.  WHERE ARE WE                  2D94
D423 DO DDDD 0D01          R LDOD6  DO    ODDO  SETCC             8ODX ADDRESS.   OUIT IMMEDIATELY           21D2
D424 20 0182 1335  0182    R LODO7  20 PODO6             P0D06    CORE ADDRESS.  STORE FOR PUNCHING          2104
0425 DO ODDO 0419          R LDDO8  00    OODO  LD002             MISCELLANEOUS ADDRESS.  OUIT AND OMIT      211D
D426 DO 0908 0280          J        00    0908                    TAGS AND EXIT FOR SUBROUTINE 13            1254
0427 20 1555 0900  1555    O 800    2D AD201       09D0  AD2D1    TO RESTORE FOR NEXT LINE OF TABLE          1134
0428 65 DDOD 0756          J        65    0D00                    BRING ADDENDS                              1842
0429 10 0382 8003                   10             8DD3           MAKE DRUM AVAILABLE )                       970
0430 69 D154 111D                   69 ROOD4                      CONTROL INFORMATION FOR PUNCHING )         1926
0431 69 D515 D533                   69 110TH    RU                BRING UNITY TO INDICATE UNRESERVATION      1036
0432 65 0435 0439                   65 LSYMB                      SYMBOL-STORING OROER )                     133D
0433 96 0386 0288                   96          L                 D, WITH I.  I, WITH L.                      67D
0434 71 0177 8D03                   71 P0001       8003           PUNCH CARD.  PERFORM UPPER.                1594
0436 99 0140 0291                   99          MISC              MULTIPLE BRANCH ACCORDING TO TAGS )         740
0437 35 D002 0543                   35    0002                    MAKE SEVERAL VARIABLE ORDERS )             1074
0438 2■ 1679 0282  1679             24 BLANB             BLANB    SPEC. SUBR.  BRING BACK BLANB + ORCEB       870
0439 15 0392 0747                   15 SS                         SYMBOL-STORING ORDER )                     1332
0440 24 0743 0296  0743             24 SW                SW       FORWARD.  SET SWITCH OFF FOR 1ST PART      1636
D441 24 0179 D532  D179    N SUB13  24 EXITZ             EXITZ    STORE EXIT                                 1778
0442 65 0435 0489                   65 LSYMB                      LOCATION OF EOUIVALENT RELATIVE TO E1      1338
0443 44 0497 0398                   44          OUT2              STORE PROCESSED CARD )                      888
0444 30 ODDO 0717          J        30    ODDO                    SHIFT MODIFIED WORD BACK INTO PLACE        1728
0445 16 0498 0754                   16 JBRL                       SUBTRACT INITIAL BRINGING ORDER            1532
0446 65 1354 1020                   65 60D      SAI               RESET BRINGING ORDER, ANO SEARCH MORE      1682
0448 20 D167 0620  0167    N OUT    2D XXXX1    LOOP     XXXX1    STORE MODIFIED BRINGING ORDER + REPEAT      934
0449 46 D352 0791                   46          FULL              I, TABLE IS FULL                           1526
0450 65 0197 0251                   65 ALOPT                      ALOPT TO LOWER                              8D6
0451 10 0554 0509                   1D P2       A                 MAKE STORING ORDER )                       1356
0452 10 0916 0980                   10 O                          OUPLICATE INTO AVAILABILITY TABLE )        2414
0453 60 D206 0D57                   60          SB1DA             PUNCH CARD                                  592
0454 69 0758 0561                   69 C7                         LAST LINE AND END OF WORO.  MODIFY )       1116
0455 69 0908 0063                   69 PRE      SUBR9             ANALYZE THE ADDRESS                        1176
0456 60 0108 0263                   60 SA                         ARE WE TO LAST LINE OF TABLE )             1018
0457 45 0026 0111                   45 OUITT                      IF SO, OUIT SEARCH                          486
0458 35 0D01 0465                   35    D001                    REPLACE DIGIT OF AVAIL. WORD BY W )        10D0
0459 20 0486 0335  0486             20 SAVOR    SB10C    SAVOR    STORE DYN LEV OF CORE, AND FINISH UP       1276
0460 65 0197 0520          J        65 ALOPT    X0D03              MULTIPLE EXIT, ACCORDING TO KIND           694
D461 11 8001 0367                   11    8D01                    MAKE SEVERAL VARIABLE ORDERS )             1066
0462 16 D038 D793                   16 16THX    ST                COMPARISON CONSTANT FOR LAST PART          1642
0463 45 0216 0417                   45          ZP                D, NO                                      1098
0464 15 0515 0514                   15 110TH    UM                COUNT OF TAGS IN LOWER                     1956
0465 65 8002 0723                   65    8002                    REPLACE DIGIT OF AVAIL. WORD BY W )        1002
0466 10 1119 0724                   10 29IXX                      ADD 29                                     1478
0467 10 8001 1223          N RC     10    80D1                    CORE ADDRESS.  RESTORE THE 2000            1394
0468 69 0197 0300          C NO     69 ALOPT                      IS D AN ACTUAL ADDRESS                      686
0469 20 1023 0476  1023    N D0001  20 BLANK    00D08    BLANK    STORE EOUIV OF BLANK FOR REFERENCE         2124
0470 60 0672 0627          R DD002  60 88THX    SB10B             N.G.  OUIT AND OMIT PUNCHING               2126
0471 69 0095 0748          R DOOD3  69 OPTIM                      BLANK D.  IS IT MDF OPERATION              2128
0472 69 1226 0677          N 00004  69          INDEX             DRUM ADDRESS.  INDEX IF TAGGED             2136
0473 65 1276 0611          R DDD05  65          SUB11             NEW SYMBOL.  FIND EOUIVALENT               2140
0474 69 D778 D441          R DOOD6  69          SUB13             800X ADORESS.  FIND DYNAMIC LEVEL          2144
0475 69 0928 0677          R ODD07  69          INDEX             CORE ADDRESS.  INDEX IF TAGGED             2152
0476 20 D184 1049  0184    R D0008  20 PODO8    B        P0008    MISC ADDRESS, USUALLY A CONSTANT           2164
0477 69 1065 0661          N 00009  69 PRE      SUBR7             STORE EOUIVALENT OF NEW SYMBOL             2170
0478 00 0D00 0470          R 00010  00    0000  D0002             SYMB TABLE FULL OR DRUM PACKED. OUIT       2172
0479 21 0284 0387  0284             21 XXXXA             XXXXA    STORE INITIAL ADDRESS TO BE RESERVED       1D40
0480 60 0151 0712                   60 ROOD1                      ALPHABETICAL L TO UPPER                    2D70
0481 11 8001 0437                   11    8001                    MAKE SEVERAL VARIABLE OPOERS )             1072
D482 45 0636 0537                   45 ABC                        I, THE ADDRESS IS BLANK                    1436
D483 69 0486 0339          N OVR    69 SAVOR                      FINISHED.  SAVE SAVOR AS ORCEO )            936
0484 69 0687 0390          N OI     69 F                          PREPARE EXIT AND GO TO SUBROUTINE 13 )     1618
0485 44 0416 0240                   44 SYM                        ARE LAST FOUR CHARACTERS DIGITS )          1458
0487 69 019D 0441                   69          SUB13             GET DYNAMIC LEVEL OF CORE ADDRESS          1268
0488 24 0186 0285  0186    O O      24 PD010    X        P0010                                                940
D489 14 D492 1D29                   14 2DXXX                      LOCATION OF EOUIVALENT RELATIVE TO E1      134D
D49D 65 0D95 0749          N FIBO   65 OPTIM                      FORWARD I OR BACKWARD D.  GET ADDENDS      1798
0491 15 D294 0335                   15 XXXX2    SB10C             ADD TO GIVE MODIFIED DYNAMIC LEFEL         126D
D492 DO 00D2 DDDD          K 2DXXX  DO    D002     DOOD                                                  2670
D493 44 0597 0448                   44          OUT               BRING BACK A SET OF RESULTS )               93D
D494 21 D186 1238  D186             21 PDD10    PROI     PDD1D    FIX C.I. SO THAT D WILL NOT PUNCH )        2282
D495 3D DD06 096D                   30    DDD6                       SHOULD WE INTERCHANGE ADDENDS )         1856
0496 65 1D54 1D2D                   65 799      SAI               START BACK FROM TOP OF TABLE               1696
D497 10 D65D 8003                   1D OS2         8D03           STORE PROCESSED CARD )                      89D
D499 20 D186 D689  D186             2D PDO1D             PDO1D    C.I. TO PUNCH X-9 )                        1584
050D 69 0753 D4DD                   69          SUBR5             PROCESS D BACKWARDS                         812
D5D1 15 8DD2 D909                   15    80D2                    4 TIMES DYNAMIC ADDRESS IN D POSITION      1626
0502 1D 1019 1232          J        10 DDIFF    ZO                A00 RELOCATION AMOUNT                      2456
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0503 90 0707 0358                      90          A          IF NOT, JUMP AHEAO                                606
0504 90 0335 0459                      90 SB10C               D, WE SHOULD STORE THIS DYNAMIC LEVEL            1274
0505 69 0908 0661                      69 PRE      SUBR7      USUAL CASE.  STORE SYMBOL ANO EQUIV              1214
0506 11 0409 0313                      11 2000I               IS INITIAL ADDRESS LESS THAN 2000                1044
0507 69 1030 0283                      69    1030             WHERE DIO SEARCH START                            536
0508 45 0162 0178                      45          EXITY      O, WE HAVE NOT FINISHED.  I, WE HAVE.            1012
0509 10 0294 0167          C A         10 XXXX2    XXXX1      MAKE STORING ORDER )                             1358
0510 65 0197 0527          J           65 ALOPT    X0010      MULTIPLE EXIT                                     718
0511 22 0359 0262  0359                22 SPR                 SPR   MAKE SEVERAL VARIABLE ORDERS )             1090
0512 15 0765 1020                      15 800      SAI        AOVANCE VARIABLE BRINGING ORDER                  1654
0513 11 0266 0331                      11 C6       SU         MOOIFY TO TAKE FIRST LINE, SAME COLUMN           1110
0514 20 0545 0598  0545    C UM        20 COUNT               COUNT STORE TAG-COUNT                            1958
0515 00 0000 0001          K 110TH     00    0000     0001                                                     2644
0516 65 0346 0651          J ON        65 AI                  AFTER RESTART.  BRING BRINGING ORDER             1684
0517 10 8001 1323          C NZ        10    8001             WRONG SYMBOL.  RESTORE UPPER TO PLUS             1428
0518 15 0075 0329          R X0001     15 13RD     X1         AODRESS N G.  CALL UNFIXED                        698
0519 69 1050 0653          R X0002     69    1050             BLANK ADDRESS. IS THIS FIRST CARD                 700
0520 00 0000 0329          R X0003     00    0000     X1      ORUM, OLD SYMB, REG. FIXED                        704
0521 15 0075 0329          R X0004     15 13RO     X1         NEW SYMBOL. UNFIXEO                               706
0522 15 0075 0329          R X0005     15 13RD     X1         BOOX.  CALL IT UNFIXED                            696
0523 00 0000 0519          R X0006     00    0000     X0002   CORE.  TREAT SAME AS BLANK                        708
0524 00 0000 0329          R X0007     00    0000     X1      OTHER AODRESS.  FIXEO                             710
0525 15 0132 0187          R X0008     15 12NOX    X2         O IS N G.  CALL UNFIXEO                           722
0526 69 1050 0703          R X0009     69    1050             BLANK.  IS THIS FIRST CARO                        724
0527 00 0000 0081          R X0010     00    0000     F       OLO SYMBOL, ORUM, REGION.  FIXED                  728
0528 15 0132 0187          R X0011     15 12NOX    X2         NEW SYMBOL.  UNFIXEO                              730
0529 15 0132 0187          R X0012     15 12NOX    X2         BOOX AOORESS.  UNFIXEO                            720
0530 91 0526 0525          R X0013     91 X0009    X0008      CORE.  BRANCH, LIKE BLANK. ARITH, UNF             732
0531 01 0666 0531          R X0014     01    0666  X0014      OTHER.  ERROR.  SHOULO NOT BE HERE.               734
0532 95 0735 0787                      95          9          O, O ADORESS.  I, FORWARO I OR BACKW L           1780
0533 24 0326 0479  0326    C RU        24 W                   W     STORE O OR 1                               1038
0534 69 0737 0440                      69 OFF                 FORWARD.  SET SWITCH OFF FOR 1ST PART            1634
0535 30 0001 0641                      30    0001             THEY ARE OIGITS.  GET VALUE )                    1466
0537 61 0515 1069                      61 110TH    OON        MODIFY EXIT ANO PREPARE TO OUIT                  1438
0538 00 0909 0342          J           00    0909             TAGS ANO EXIT FOR USE IN SUBR 13                 1204
0539 46 0542 0977                      46          8A0        I, RELOCATEO CORE AOORESS TOO HIGH               1400
0540 04 0000 0000          K 42NO      04    0000     0000                                                     1918
0541 35 0004 0451                      35    0004             SHIFT TO O POSITION                              1354
0542 10 8001 0713                      10    8001  RES        RESTORE THE 9060                                 1402
0543 10 8003 0401                      10    8003             MAKE SEVERAL VARIABLE ORDERS )                   1076
0544 21 0186 1338  0186                21 P0010    ALL        P0010 FIX C.I. SO THAT I WILL NOT PUNCH )        2302
0546 67 8003 0178          N NZ        67    8003 EXITY       IF NOT 8001. CORRECTION IS ZERO                  2020
0547 15 0038 8002          C A         15 16THX       8002    BRING BACK A SET OF RESULTS )                     922
0548 93 1101 0785                      93          SEO        O, OPERATION 31.  I, 30,35,36.                   1828
0549 60 1356 1088          P 601       60 A0002    TA                                                       1766
0550 69 0953 0142                      69          SUBR6      PROCESS I BACKWARDS                               830
0551 16 1054 1009             SWOF     16 799                 SUBTRACT END OF TABLE                            1650
0552 15 1266 0784                      15 ST                  MAKE STORING ORDER                               2488
0554 22 1555 0179  1555    P P2        22 E0001    EXITZ      E0001 INITIAL OF ORDER TO STORE O-POSITION       1366
0555 20 0167 0670  0167                20 XXXX1               XXXX1 MAKE BRINGING ORDER )                      1348
0556 00 0989 0268                      00    0989  M0001      TAGS ANO EXIT FOR SUBROUTINE 11                  1190
0557 10 0260 0215                      10 BRNG                NOT 1ST CARO.  MAKE COMP. CONST. )                546
0558 46 0411 0212                      46 OK                  I, LAST ONE WOULO BE OVER 1999                   1050
0559 46 0412 0613                      46          FXT        I, FIRST IS NON-BLANK.  FIXEO AOORESS.           1378
0560 65 0163 0113                      65          SSB        BRING BACK BLANB ANO ALOPT ONCE MORE              850
0561 24 0359 0362  0359                24 SPR                 SPR   LAST LINE ANO END OF WORO.  MOOIFY )       1118
0562 15 0038 0793                      15 16THX    ST         COMPARISON CONSTANT FOR LAST PART                1666
0563 11 0316 0331                      11 C8       SU         LAST LINE ANO ENO OF WORO.  MOOIFY )             1122
0564 65 0902 0662          J           65    0902             BRING APPROPRIATE TAG                            2044
0565 20 1355 0900  1355    P C3        20 A0001       0900    A0001 INITIAL OF STORING ORDER                   1128
0566 22 0183 0986  0183                22 P0007               P0007 STORE OPERATION FOR PUNCHING               1934
0567 11 8003 0725          C LOO       11    8003             ARE LAST FOUR CHARACTERS OIGITS )                1452
0568 00 0001 0375          J           00    0001  J0008      AOOEND ANO EXIT FOR SUBROUTINE 18                1312
0569 10 0322 8003                      10 OSB         8003    MAKE DRUM AVAILABLE )                             978
0570 65 0553 0243                      65 VAR      LOOP       BRINGING ORDER.  BACK FOR ANOTHER CARO            894
0571 69 0074 0377                      69 BRNG                MAKE NEW BRINGING ORDER )                         906
0572 20 1023 0577  1023    N I0001     20 BLANK    I0006      BLANK STORE EQUIVALENT OF BLANK FOR REFERENC     2186
0573 60 0722 0627          R I0002     60 89THX    SB10B      N.G.  QUIT ANO OMIT PUNCHING                     2188
0574 60 0152 1012          R I0003     60 R0002               BLANK I.  IS O ALSO BLANK                        2190
0575 69 1028 0677          N I0004     69          INOEX      ORUM AOORESS.  INDEX IF TAGGEO                   2204
0576 65 0979 0611          R I0005     65          SUB11      NEW SYMBOL.  FIND BEST VALUE.                    2208
0577 20 0185 0177  0185    R I0006     20 P0009    EXITX      P0009 BOOX AODRESS.  STORE AND EXIT              2212
0578 69 1331 0677          R I0007     69          INDEX      CORE AODRESS.  INDEX IF TAGGEO                   2214
0579 20 0185 0177  0185    R I0008     20 P0009    EXITX      P0009 OTHER AOORESS.  STORE ANO EXIT.            2226
0580 20 0185 0988  0185    N I0009     20 P0009               P0009 STORE EQUIVALENT OF NEW SYMBOL             2228
0581 00 0000 0573          R I0010     00    0000  I0002      SYMBOL TABLE FULL.  OMIT PUNCHING ADOR           2232
0582 97 0935 0937                      97 P.                  O, FORWARO.  I, BACKWARO.                        1852
0583 35 0004 0593                      35    0004             MAKE SEVERAL VARIABLE ORDERS )                   1082
0584 98 8009 0000          K 9         98    8009     0000                                                     1986
0585 69 0038 0741                      69 16THX               PRESET T AS POSITIVE 1 )                         1502
0586 24 0178 1231  0178    N SUB17     24 EXITY               EXITY STORE EXIT INSTRUCTION                     1992
0587 65 0290 8001                      65 Y           8001    BRINGING ORDER INTO LOWER                        1506
0588 46 0791 0642                      46 FULL                O, TABLE IS FULL                                 1522
0589 10 0294 0399                      10 XXXX2               FIRST CHARACTER INTO UPPER                       1470
0590 65 0800 1306          J           65    0800             BRING OPTIMIZING AODENDS ANO TAGS                1964
0591 10 0394 0509                      10 P3       A          MAKE STORING ORDER                               1362
0592 65 1660 0665          J           65 G0001               BRING EQUIVALENT OF REGION                       1486
0593 69 0246 0249                      69 C1                  MAKE SEVERAL VARIABLE ORDERS )                   1084
0594 60 0095 1099          J           60 E                   BRING SYMBOL-EQUIVALENT TO UPPER                 2356
0595 65 0182 1337                      65 P0006    MW         BRING BACK NUMERICAL AOORESS                     2092
0596 65 0158 0646                      65 R0008    SDD        BRING NUMERICAL O                                2624
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0597 10 0700 0547                    10 QS       A          BRING BACK A SET OF RESULTS )                    932
0598 60 0183 1237                    60 P0007               OPERATION IN D OF UPPER                         1960
0599 60 1357 1088          P 602     60 A0003    TA                                                         1768
0600 24 0391 8002  0391              24 ORCEB        8002   ORCEB SPEC. SUBR.  BRING BACK BLANB + ORCEB      874
0601 16 1354 1059                    16 600                 SUBTRACT COMPARISON CONSTANT                    1672
0602 20 0184 1340  0184              20 P0008               P0008 STORE NEXT 4 DIGITS IN D POSITION         2540
0603 69 0306 0045          N SHX     69          SUB20      PROCESS D FORWARDS                               766
0604 16 1208 0913                    16 909                 SUBTRACT 9090908995                             1448
0605 35 0006 0970                    35    0006             SHIFT TO REMOVE TABULAR ADDRESS )               1570
0606 16 0290 0345          N UND     16 Y                   SYMB NOT IN TABLE.  SUBTRACT Y                  1518
0607 20 0155 0204  0155    Q O       24 R0005    X          R0005 COMPARISON CONSTANT FOR BRINGING SET       596
0608 44 1316 0001          R U0001   44          SETCC      I, IT IS ZERO AND WE HAVE FINISHED              2502
0609 16 1218 8002          R U0002   16 KA           8002   RESTORE LOWER, AND A00 NEXT SYMBOL              2512
0610 20 1356 0000  1356    O QB      20 A0002        0000   A0002 COMPARISON CONSTANT                       984
0611 69 1669 1072          N SUB11   69 DRUMT               IS THE DRUM FULL                                1608
0612 15 0915 1020                    15 599      SAI        RESTORE AND MODIFY                              1676
0613 65 8002 0177          N FXT     65    8002  EXITX      FIXED ADDRESS.  CLEAR UPPER AND EXIT.           1410
0614 10 0152 1312                    10 R0002               ALPHABETIC O                                    2266
0615 69 0568 0677                    69          INDEX      TO SUBROUTINE 18 TO INDEX                       1310
0616 69 1669 1274                    69 ORUMT               BLANK D AND I.  CHECK ORUM TAG                  2194
0617 24 1669 1122  1669              24 ORUMT               ORUMT CHANGE DRUM TAG TO 9 )                    1702
0618 46 0517 0972                    46 NZ       DEF        D, IT WAS NOT RIGHT ONE . I, IT AS.             1426
0619 20 1003 0456  1003              20 N                   N  REDUCE NUMBER YET TO BE DONE )               1016
0620 60 0673 0057          C LOOP    60          SB10A      TO SUB 10A TO PUNCH ONE CARD                    910
0621 16 0174 0379                    16 QL                  BRING BACK A SET OF RESULTS )                   914
0622 00 0000 8000          K 87THX   00    0000    8000                                                     2666
0623 45 0226 0160                    45          R0010      IF SO, MULTIBRANCH + EXIT FROM QUITT             570
0624 00 0000 0376          J         00    0000  A          TAG-IDENTIFICATION, AND EXIT FROM 18            1246
0625 00 0988 0926          J         00    0988  C0009      EXIT AND TAGS FOR SUBROUTINE 11                 1250
0626 65 1679 0371                    65 BLANB    J0004      BRING EQUIVALENT OF BLANK BACKWARD L            1306
0627 10 0186 0941          N SB10B   10 P0010               FROM 4-6,19-21.  TO SUPPRESS )                  1596
0628 20 0903 1106  0903              20    0903             0903 STORE I TAG                                1946
0629 21 0294 0947  0294              21 XXXX2               XXXX2 ALSO STORE FIRST LETTER OF ADDRESS )      1444
0630 60 0152 0762                    60 R0002               ALPHABETICAL D INTO UPPER                       2118
0631 20 0184 0487  0184              20 P0008               P0008 STORE CORE ADDRESS FOR PUNCHING           1266
0632 95 1085 1087                    95 CP                  IF BACKWARD L, SUBTRACT TAG-COUNT )             1908
0633 65 0536 0220          J         65 EQUIV    F0003      BRING EQUIV AND MULTIBRANCH                     1152
0634 11 8001 8002                    11    8001    8002   DUPLICATE INTO AVAILABILITY TABLE )             2418
0635 15 1022 1027                    15 2IXXX               ADVANCE CARD NUMBER )                           1590
0636 21 0108 0961  0108    N ABC     21 HSYMB               HSYMB ADDRESS NOT BLANK.  STORE SYMBOL          1440
0637 65 0340 8001                    65              8001   BRINGING ORDER INTO LOWER                       1514
0638 14 0492 0904                    14 20XXX               DIVIDE BY 2                                     1536
0639 10 0592 8003                    10              8003   MAKE BRINGING ORDER )                           1484
0640 65 1043 1347          N XY      65 8001                8001 INTO RIGHT END LOWER                       2012
0641 20 0536 0589  0536              20 EQUIV               EQUIV STORE THESE 4 DIGITS                      1468
0642 16 0395 0449                    16 ZTABL                                                               1524
0643 20 0384 0637  0384              20 T                   T    SHORT.  PRESET T AS -1 )                   1512
0644 61 1248 0966          N ALL     61 SEND                DUPLICATE INTO AVAILABILITY TABLE )             2420
0645 20 0486 8002  0486              24 SAVOR        8002   SAVOR STORE ORCED FOR USE WHEN WE START FORW    2242
0646 20 1019 0696  1019    C SDO     20 DDIFF               DDIFF STORE DRUM RELOCATION AMOUNT              2626
0647 24 1669 0072  1669              24 DRUMT               ORUMT PRESET DRUM TAG )                         966
0648 69 8003 1261                    69    8003             CLEAR DISTRIBUTOR                               1968
0649 19 0320 1074                    19 50IXX               WHAT CELL DID WE RESERVE )                      1756
0650 69 0181 8002          O QS2     69 P0005        8002   RESTORE CONSTANT AND MODIFY                     898
0651 16 1097 0701                    16 A0                  COMPARISON CONSTANT, SUBTRACTED                 1686
0652 20 0183 8003  0183              20 P0007        8003   P0007 STORE LOCATION OF AVAILABILITY WORD       2572
0653 90 0329 0521                    90 X1       X0004        FIRST, UNFIXED.  OTHER, FIXED.                702
0654 11 1308 0963                    11 99THX               NON-ZERO.  SUBTRACT 90                          1474
0655 15 0959 1020                    15 BP1      SAI        RESTORE AND MODIFY                              1690
0656 93 0660 1061                    93 XAS                    D, IT IS AN INDEXING OPERATION               1810
0657 69 0310 0042          C NO      69          SUB19      STARTED WITH L, OR NOT FIRST. PROC. L           582
0659 44 1063 0314                    44          LH         D, ADDR IS ODD.  EQUIV IN RIGHT END             1544
0660 60 0184 0939          N XAS     60 P0008               INDEXING OP,  FORWARD I, BACKWARD L.            1832
0661 24 0179 0432  0179    N SUBR7   24 EXITZ               EXITZ STORE EXIT                                1328
0662 15 8002 1221                    15    8002             DOUBLE IT                                       2046
0663 46 0366 0467                    46          RC         D, DRUM.  I, CORE.                              1386
0664 10 0153 0714                    10 R0003               ALPHABETIC I                                    2286
0665 45 0668 1219                    45          NG         I, REGION IS UNDEFINED                          1488
0666 44 1326 1078          J         44 NGD                 D, RELOCATED O IS EXCESSIVE                     2270
0667 11 8003 0975                    11    8003             PUT INTO DISTRIBUTOR                            1720
0668 15 0536 0691                    15 EQUIV               GET EQUIVALENT OF REGIONAL ADDRESS )            1490
0669 16 0515 0719                    16 110TH               MODIFY TO END WITH 1999 )                       1054
0670 44 1073 0674                    44 IPOS                O, USE I-POSITION.  I, USE D-POSITION.          1350
0671 46 0324 0225                    46          TP         O, NOT LAST LINE.                               1022
0672 00 0000 0800          K 88THX   00    0000    0800                                                     2662
0673 65 0167 0621          J         65 XXXX1               BRING BACK A SET OF RESUTTS )                   912
0674 65 0536 0541                    65 EQUIV               BRING EQUIVALENT                                1352
0675 00 0990 0368          J         00    0990  J0001      TAGS AND EXIT FOR SUBROUTINE 11                 1316
0676 10 0409 0713                    10 20001    RES        RESTORE RELOCATED DRUM ADDRESS                  1392
0677 24 0178 1281  0178    N INDEX   24 EXITY               EXITY STORE EXIT                                2032
0678 44 1081 0682                    44 YES                 I, D IS NOT TRUE ADDRESS                        1974
0679 65 8001 0535          N OUT     65    8001             THEY ARE DIGITS.  GET VALUE )                   1464
0680 60 0153 0962                    60 R0003               ALPHABETIC I TO UPPER                           2180
0681 11 0334 0539                    11 9060                SUBTRACT 9060                                   1398
0682 60 1235 1089                    60 8        AX         MORE TAGS INTO UPPER                            1976
0683 66 8002 0491          J         66    8002             CHANGE SIGN OF CORRECTION                       1258
0684 15 1119 0734                    15 29IXX               ADD 29                                          2482
0685 10 8001 1291                    10    8001             AVAILABILITY WORD BACK INTO UPPER               1724
0686 66 0038 0643          N SHRT    66 16THX               SHORT.  PRESET T AS -1 )                        1510
0687 00 0000 0991          J F       00    0000             TO BUILD EXIT FROM SUBROUTINE 13                1622
0688 65 0095 0699          N FO      65 OPTIM               FORWARD O.  L-O ADDENDS, LEFT END LOWE          1786
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0689 60 8003 0057                    60    8003   SB10A          CLEAR LOWER                                          1586
0690 69 0794 1025                    69           SUB2R          RESERVE 0000                                         2430
0691 16 0515 1269                    16 110TH                    GET EQUIVALENT OF REGIONAL ADDRESS )                 1492
0692 24 0743 0396 0743               24 SW                SW     GOING BACKWARD.  SET SWITCH OFF )                    1660
0693 69 0178 0981         C SSW      69 EXITY                    ALL CASES.  GOING WHICH DIRECTION                    1630
0694 60 8001 0709                    60    8001   SUB10          PUNCH A CARD, AND REPEAT RBD                         2408
0695 00 0500 0500         K C3       00    0500      0500      TO MODIFY IDENTIFICATION                             2610
0696 65 0153 0746                    65 R0003                    ALPHABETIC I                                         2628
0697 24 1050 1103 1050               24    1050          1050          CHANGE FIRST-CARD TAG )                      1186
0698 66 0515 0178                    66 110TH     EXITY          IF 8001, CORRECTION IS -1                            2018
0699 35 0001 1055                    35    0001                      L-D ADDENDS TO LEFT END LOWER )                1788
0700 24 0187 0285 0187    O OS       24 P0011     X      P0011                                                       942
0701 45 0655 0705                    45           FULL           I, THERE IS NO AVAILABLE LOCATION.                   1688
0702 00 0001 0001         P C6       00    0001      0001      TO MODIFY VARIABLE BRINGING ORDER                    2602
0703 90 0187 0528                    90 X2        X0011            NO, FIXED.  YES, UNFIXED.                        726
0704 35 0006 0770         N ABS      35    0006                ABSOLUTE ADDRESS OR EQUIVALENT                       1560
0705 01 0222 1109         N FULL     01    0222                STOP BECAUSE ORUM IS PACKED                          1698
0706 69 0095 0548                    69 OPTIM                    OPTIMIZING TAGS                                      1826
0707 69 1030 0383                    69    1030                IF SO, WHERE DID SEARCH START                        608
0708 30 0009 0108         P C2       30    0009   SA           PRESETTER AND ALSO COMPARISON CONSTANT               1126
0709 15 1044 0499         C SUB10    15 81STX                    C.I. TO PUNCH X-9 )                              1582
0710 35 0002 0785                    35    0002   SED             OTHER.  I-ADDENDS TO LEFT END LOWER              1804
0711 65 0536 0921         J PRE      65 EQUIV     C0004         BRING EQUIVALENT.  MULTIBRANCH                       1228
0712 69 1015 0063                    69 PRE       SUBR9         ANALYZE L-ADDRESS                                    2072
0713 21 0167 0720 0167    C RES      21 XXXX1                   XXXX1 STORE ADDRESS TEMPORARILY                      1404
0714 69 1117 1024                    69           SUBR8          PROCESS I                                            2288
0715 15 0718 8002                    15              8002        MAKE BRINGING ORDER                                  1540
0716 61 8003 0780                    61    8003                CHANGE ITS SIGN                                      2396
0717 60 8003 1225                    60    8003                CLEAR LOWER                                          1730
0718 69 1555 0659         J          69 E0001                   BRING WORD SHOWING EQUIVALENT                        1542
0719 20 1003 0411 1003               20 N         OK       N     MODIFY TO END WITH 1999 )                            1056
0720 69 1273 1025                    69           SUB2R          RESERVE IF ORUM ADDRESS                              1406
0721 30 0004 1319                    30    0004   LR             EQUIVALENT IN I POSITION OF LOWER                    1550
0722 00 0000 0080         K 89THX    00    0000      0080                                                            2658
0723 10 0326 0281                    10 W                       REPLACE DIGIT OF AVAIL. WORD BY W )                  1004
0724 46 0416 0328                    46 SYM                     D, FIRST IS SPEC. CHAR.  SYMBOLIC                    1480
0725 45 0278 0679                    45           OUT           ARE LAST FOUR CHARACTERS DIGITS )                    1454
0727 00 0000 0631         J          00    0000                ADDEND AND EXIT FOR SUBROUTINE 18                    1264
0728 65 1023 0421                    65 BLANK     L0004         USE PROPER VALUE FOR BLANK ADDRESS                   2084
0729 84 1200 0775                    84    1200                SEARCH TABLE ACCORDING TO SIZE OF ADDR               1564
0730 21 0158 1314 0158               21 R0008                   R0008 STORE ADVANCED D ADDRESS                       2392
0731 15 0384 8002                    15 T            8002       ADVANCE LOWER AND BRING ANOTHER                      1432
0732 10 8001 0999         N ORM      10    8001   A              ORUM.   MAKE POSITIVE AGAIN                         2058
0734 46 0029 0940                    46    0029                IF SPEC CHAR, TO BLR DIRECTLY                        2484
0735 97 0688 0490                    97 FD        F1BD          D, FORWARD D.   I, BACKWARD D.                       1782
0736 65 8003 0693                    65    8003   SSW            CLEAR ACCUMULATOR AND JUMP                           1616
0737 65 0346 0551         J OFF      65 AI        SWOF           HAVE WE REACHED TOP OF TABLE                         1648
0738 65 1342 0611                    65           SUB11          FIND AN EQUIVALENT                                   2098
0739 65 0346 0601         J OFB      65 AI                       START BACKWARDS SEARCH.  HOW FAR                     1670
0740 24 0179 1282 0179    N SUB      24 EXITZ                   EXITZ STORE EXIT                                     2458
0741 24 0384 0587 0384               24 T                       T  PRESET T AS POSITIVE 1 )                          1504
0742 65 0197 1051         N BL       65 ALOPT                    BACKWARD L.  GET ALOPT                               1806
0743 65 0346 0551           SW       65 AI        SWOF           NOT PERFORMED--JUST FOR OPTIMIZING                   1646
0744 11 8001 0452                    11    8001                OUPLICATE INTO AVAILABILITY TABLE )                  2412
0745 15 0695 1349                    15 C3                      MODIFY IDENTIFICATION OF WORD                        2566
0746 45 0796 0946                    45           SCD            JUMP IF I IS BLANK                                   2630
0747 69 0108 8002                    69 HSYMB        8002       STORE SYMBOL )                                       1334
0748 94 0800 0912                    94    0800                IF BLANK D AND MOF,  STOP MACHINE                    2130
0749 92 0402 1105                    92 SHOP                      D, IT IS A SHIFT OPERATION                         1800
0750 21 0304 0458 0304    R XX       21 UH                      UH  REPLACE DIGIT OF AVAIL. WORD BY W )              998
0751 69 0955 1209                    69 STR                      NEW AVAILABILITY WORD INTO ORUM )                    1734
0752 10 1245 0952                    10 OS                       RESTORE VARIABLE BRINGING ORDER                      2596
0753 69 0356 0305         J          69           SUBR4          PROCESS L BACKWARDS FROM D                           814
0754 20 0435 0638 0435               20 LSYMB                   LSYMB ADDRESS OF SYMBOL RELATIVE TO START            1534
0755 65 0346 0951         C SKP      65 AI                       ALL CASES.  WHAT DID WE RESERVE )                    1740
0756 35 0004 0767                    35    0004                SHIFT ADDENDS TO LEFT END                            1844
0757 69 0360 0013                    69 BRNG                     BRING BACK A SET )                                   636
0758 30 0000 0108         P C7       30    0000   SA             PRESETTER FOR START OF NEW COLUMN                    1140
0759 21 0186 0177 0186               21 P0010     EXITX          P0010 FROM 4-6,19-21.  TO SUPPRESS )                 1600
0760 30 0005 0974                    30    0005                ISOLATE LAST DIGIT OF D-ADDRESS )                    1820
0761 00 0988 0918         J          00    0988   C0001          TAGS AND EXIT FOR SUBROUTINE 11                      1242
0762 69 1065 0063                    69 PRE       SUBR9          ANALYZE D-ADDRESS                                    2120
0763 44 0517 0618                    44 NZ                       D, IT WAS NOT RIGHT ONE                            1424
0764 69 1217 0063         C BOTH     69           SUBR9          ANALYZE I                                            2316
0765 60 1555 1088         Q 800      60 A0201     TA                                                                  1772
0766 16 0930 1339                    16 941                      IS THIS ANOTHER RBD CARD )                           2404
0767 92 0785 1222                    92 SED                      JUMP UNLESS OPERATION 80,82, OR 88                   1846
0768 00 0889 0572         J          00    0889   I0001          TAGS AND EXIT FOR SUBROUTINE 11                      2202
0769 30 0010 0108         D C5       30    0010   SA             TO RESTORE AFTER SUBTRACTING C2                      1136
0770 16 8002 0729                    16    8002                ADDRESS INTO LEFT END DISTRIBUTOR                    1562
0771 35 0002 1327                    35    0002                000.  SEPARATE LAST ADDEND.                          1894
0772 90 0626 0369                    90           J0002          D, ORUM IS NOT FULL                                  1304
0773 21 0228 0481 0228               21 P                       P  MAKE SEVERAL VARIABLE ORDERS )                    1070
0774 00 0000 0004         K 41XXX    00    0000      0004                                                            2648
0775 15 0378 8002                    15              8002       MAKE BRINGING ORDER                                  1566
0776 23 0536 0704 0536               23 EQUIV     ABS            EQUIV STORE EQUIVALENT OF SYMBOL                     1554
0777 11 0409 0663                    11 2000I                    SUBTRACT 2000                                        1384
0778 00 0808 0782         J          00    0808                TAGS AND EXIT FOR USE IN SUBR 11                     2146
0779 20 0733 0936 0733               20 B                       B     SHOULD WE INTERCHANGE ADDENDS )                1860
0780 46 1329 0094                    46 OUT          0094         D, WE HAVE FINISHED                                2398
0781 44 0585 0686                    44              SHRT         D, LONG SYMBOL                                     1500
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0782 69 1086 0586                    69          SUB17          PERHAPS MODIFY DYNAMIC LEVEL )                    2148
0783 30 0004 1093                    30    0004                 0-POSITION HOLDS 0 FOR 0, 1 FOR 1 )               2038
0784 69 0158 8002                    69 R0008        8002       ADDRESS OF 0001 OF REGION                         2490
0785 69 0179 0582          C SEO     69 EXITZ                   ALL CASES.  WHICH DIRECTION                       1850
0786 69 0739 0692          N BAK     69 OFB                     GOING BACKWARD.  SET SWITCH OFF )                 1658
0787 97 0490 0742          N 9       97 FIBO      BL            0, FORWARD 1.  1, BACKWARD 2.                     1784
0788 69 1243 0441                    69          SUB13          FIND DYNAMIC LEVEL                                2158
0789 35 0009 0760                    35    0009                 ISOLATE LAST DIGIT OF 0-ADDRESS )                 1818
0790 16 1308 1216                    16 99THX                   SUBTRACT 90                                       2478
0791 01 0111 1219          J FULL    01    0111   NG            STOP IF SYMBOL TABLE IS FULL                      1556
0793 20 1097 1020 1097     C ST      20 A0        SAI     A0    STORE COMPARISON CONSTANT                         1668
0794 60 0160 0709                    60 R0010     SUB10          PUNCH CARD AND PROCEED                            2432
0795 15 0695 0652                    15 C3                       MODIFY IDENTIFICATION OF WORD                     2570
0796 65 0159 0946                    65 R0009     SCO            BRING NUMERICAL 1                                 2632
0797 15 1000 0555                    15 P1                       MAKE BRINGING ORDER )                             1346
0798 20 0292 1049 0292               20 ORCEQ     B       ORCEQ  STORE DYNAMIC LEVEL FOR REFERENCE                 2162
0799 16 8002 0910                    16    8002                 0-ADDRESS TO LEFT END OF DISTR )                  1836
0800 00 0404 9998          K    0800 00    0404    9998        FOR OPERATION = LOCATION - 0800                    110
0801 00 0404 9998          K    0801 00    0404    9998        FOR OPERATION = LOCATION - 0800                    112
0802 33 2322 8999          K    0802 33    2322    8999        FOR OPERATION = LOCATION - 0800                    114
0803 00 0505 8998          K    0803 00    0505    8998        FOR OPERATION = LOCATION - 0800                    116
0804 00 0505 8998          K    0804 00    0505    8998        FOR OPERATION = LOCATION - 0800                    118
0805 00 0505 8998          K    0805 00    0505    8998        FOR OPERATION = LOCATION - 0800                    120
0806 00 0505 8998          K    0806 00    0505    8998        FOR OPERATION = LOCATION - 0800                    122
0807 00 0505 8998          K    0807 00    0505    8998        FOR OPERATION = LOCATION - 0800                    124
0808 33 1212 9999          K    0808 33    1212    9999        FOR OPERATION = LOCATION - 0800                    126
0809 33 0202 9999          K    0809 33    0202    9999        FOR OPERATION = LOCATION - 0800                    128
0810 33 0504 9999          K    0810 33    0504    9999        FOR OPERATION = LOCATION - 0800                    130
0811 33 0504 9999          K    0811 33    0504    9999        FOR OPERATION = LOCATION - 0800                    132
0812 99 9999 8999          K    0812 99    9999    8999        FOR OPERATION = LOCATION - 0800                    134
0813 99 9999 8999          K    0813 99    9999    8999        FOR OPERATION = LOCATION - 0800                    136
0814 33 1110 8999          K    0814 33    1110    8999        FOR OPERATION = LOCATION - 0800                    138
0815 33 0504 9999          K    0815 33    0504    9999        FOR OPERATION = LOCATION - 0800                    140
0816 33 0504 9999          K    0816 33    0504    9999        FOR OPERATION = LOCATION - 0800                    142
0817 33 0504 9999          K    0817 33    0504    9999        FOR OPERATION = LOCATION - 0800                    144
0818 33 0504 9999          K    0818 33    0504    9999        FOR OPERATION = LOCATION - 0800                    146
0819 33 2120 8999          K    0819 33    2120    8999        FOR OPERATION = LOCATION - 0800                    148
0820 54 0303 9999          K    0820 54    0303    9999        FOR OPERATION = LOCATION - 0800                    150
0821 45 0303 9999          K    0821 45    0303    9999        FOR OPERATION = LOCATION - 0800                    152
0822 34 0303 9999          K    0822 34    0303    9999        FOR OPERATION = LOCATION - 0800                    154
0823 34 0303 9999          K    0823 34    0303    9999        FOR OPERATION = LOCATION - 0800                    156
0824 33 0303 9999          K    0824 33    0303    9999        FOR OPERATION = LOCATION - 0800                    158
0825 44 0505 9999          K    0825 44    0505    9999        FOR OPERATION = LOCATION - 0800                    160
0826 00 0505 9998          K    0826 00    0505    9998        FOR OPERATION = LOCATION - 0800                    162
0827 00 0505 9998          K    0827 00    0505    9998        FOR OPERATION = LOCATION - 0800                    164
0828 33 1212 9999          K    0828 33    1212    9999        FOR OPERATION = LOCATION - 0800                    166
0829 33 0202 9999          K    0829 33    0202    9999        FOR OPERATION = LOCATION - 0800                    168
0830 00 0000 9988          K    0830 00    0000    9988        FOR OPERATION = LOCATION - 0800                    170
0831 00 0000 9888          K    0831 00    0000    9888        FOR OPERATION = LOCATION - 0800                    172
0832 33 2726 8999          K    0832 33    2726    8999        FOR OPERATION = LOCATION - 0800                    174
0833 33 2726 8999          K    0833 33    2726    8999        FOR OPERATION = LOCATION - 0800                    176
0834 33 2726 8999          K    0834 33    2726    8999        FOR OPERATION = LOCATION - 0800                    178
0835 00 0000 9988          K    0835 00    0000    9988        FOR OPERATION = LOCATION - 0800                    180
0836 00 0000 9988          K    0836 00    0000    9988        FOR OPERATION = LOCATION - 0800                    182
0837 33 2726 8999          K    0837 33    2726    8999        FOR OPERATION = LOCATION - 0800                    184
0838 33 2726 8999          K    0838 33    2726    8999        FOR OPERATION = LOCATION - 0800                    186
0839 33 2726 8999          K    0839 33    2726    8999        FOR OPERATION = LOCATION - 0800                    188
0840 33 0404 9998          K    0840 33    0404    9998        FOR OPERATION = LOCATION - 0800                    190
0841 33 0404 9998          K    0841 33    0404    9998        FOR OPERATION = LOCATION - 0800                    192
0842 33 0404 9998          K    0842 33    0404    9998        FOR OPERATION = LOCATION - 0800                    194
0843 33 0404 9998          K    0843 33    0404    9998        FOR OPERATION = LOCATION - 0800                    196
0844 34 0405 9998          K    0844 34    0405    9998        FOR OPERATION = LOCATION - 0800                    198
0845 43 0504 9998          K    0845 43    0504    9998        FOR OPERATION = LOCATION - 0800                    200
0846 33 0404 9998          K    0846 33    0404    9998        FOR OPERATION = LOCATION - 0800                    202
0847 33 0505 9998          K    0847 33    0505    9998        FOR OPERATION = LOCATION - 0800                    204
0848 33 0404 9998          K    0848 33    0404    9998        FOR OPERATION = LOCATION - 0800                    206
0849 33 0404 9998          K    0849 33    0404    9998        FOR OPERATION = LOCATION - 0800                    208
0850 00 0000 9898          K    0850 00    0000    9898        FOR OPERATION = LOCATION - 0800                    210
0851 00 0000 9898          K    0851 00    0000    9898        FOR OPERATION = LOCATION - 0800                    212
0852 00 0000 9898          K    0852 00    0000    9898        FOR OPERATION = LOCATION - 0800                    214
0853 00 0000 9898          K    0853 00    0000    9898        FOR OPERATION = LOCATION - 0800                    216
0854 44 0505 9999          K    0854 44    0505    9999        FOR OPERATION = LOCATION - 0800                    218
0855 00 0505 8998          K    0855 00    0505    8998        FOR OPERATION = LOCATION - 0800                    220
0856 00 0505 8998          K    0856 00    0505    8998        FOR OPERATION = LOCATION - 0800                    222
0857 00 0505 8998          K    0857 00    0505    8998        FOR OPERATION = LOCATION - 0800                    224
0858 00 0000 9898          K    0858 00    0000    9898        FOR OPERATION = LOCATION - 0800                    226
0859 00 0000 9898          K    0859 00    0000    9898        FOR OPERATION = LOCATION - 0800                    228
0860 33 0504 9999          K    0860 33    0504    9999        FOR OPERATION = LOCATION - 0800                    230
0861 33 0504 9999          K    0861 33    0504    9999        FOR OPERATION = LOCATION - 0800                    232
0862 99 9999 8999          K    0862 99    9999    8999        FOR OPERATION = LOCATION - 0800                    234
0863 99 9999 8999          K    0863 99    9999    8999        FOR OPERATION = LOCATION - 0800                    236
0864 33 1110 8999          K    0864 33    1110    8999        FOR OPERATION = LOCATION - 0800                    238
0865 33 0504 9999          K    0865 33    0504    9999        FOR OPERATION = LOCATION - 0800                    240
0866 33 0504 9999          K    0866 33    0504    9999        FOR OPERATION = LOCATION - 0800                    242
0867 33 0504 9999          K    0867 33    0504    9999        FOR OPERATION = LOCATION - 0800                    244
0868 33 0504 9999          K    0868 33    0504    9999        FOR OPERATION = LOCATION - 0800                    246
0869 33 0303 9999          K    0869 33    0303    9999        FOR OPERATION = LOCATION - 0800                    248
0870 00 0504 8999          K    0870 00    0504    8999        FOR OPERATION = LOCATION - 0800                    250
0871 00 0504 8999          K    0871 00    0504    8999        FOR OPERATION = LOCATION - 0800                    252
0872 00 0504 8999          K    0872 00    0504    8999        FOR OPERATION = LOCATION - 0800                    254
0873 00 0504 8999          K    0873 00    0504    8999        FOR OPERATION = LOCATION - 0800                    256
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0874 00 0504 8999          K    0874  00    0504      8999          FOR OPERATION = LOCATION - 0800                    258
0875 00 0504 8999          K    0875  00    0504      8999          FOR OPERATION = LOCATION - 0800                    260
0876 00 0504 8999          K    0876  00    0504      8999          FOR OPERATION = LOCATION - 0800                    262
0877 00 0504 8999          K    0877  00    0504      8999          FOR OPERATION = LOCATION - 0800                    264
0878 00 0504 8999          K    0878  00    0504      8999          FOR OPERATION = LOCATION - 0800                    266
0879 00 0505 9999          K    0879  00    0505      9999          FOR OPERATION = LOCATION - 0800                    268
0880 01 0100 9898          K    0880  01    0100      9898          FOR OPERATION = LOCATION - 0800                    270
0881 00 0000 9898          K    0881  00    0000      9898          FOR OPERATION = LOCATION - 0800                    272
0882 01 0100 9898          K    0882  01    0100      9898          FOR OPERATION = LOCATION - 0800                    274
0883 00 0000 9898          K    0883  00    0000      9898          FOR OPERATION = LOCATION - 0800                    276
0884 33 2526 8999          K    0884  33    2526      8999          FOR OPERATION = LOCATION - 0800                    278
0885 00 0606 8998          K    0885  00    0606      8998          FOR OPERATION = LOCATION - 0800                    280
0886 00 0606 8998          K    0886  00    0606      8998          FOR OPERATION = LOCATION - 0800                    282
0887 00 0606 8998          K    0887  00    0606      8998          FOR OPERATION = LOCATION - 0800                    284
0888 01 0100 9898          K    0888  01    0100      9898          FOR OPERATION = LOCATION - 0800                    286
0889 00 0000 9898          K    0889  00    0000      9898          FOR OPERATION = LOCATION - 0800                    288
0890 44 0505 9998          K    0890  44    0505      9998          FOR OPERATION = LOCATION - 0800                    290
0891 33 0505 9998          K    0891  33    0505      9998          FOR OPERATION = LOCATION - 0800                    292
0892 33 0505 9998          K    0892  33    0505      9998          FOR OPERATION = LOCATION - 0800                    294
0893 33 0505 9998          K    0893  33    0505      9998          FOR OPERATION = LOCATION - 0800                    296
0894 33 0505 9998          K    0894  33    0505      9998          FOR OPERATION = LOCATION - 0800                    298
0895 33 0505 9998          K    0895  33    0505      9998          FOR OPERATION = LOCATION - 0800                    300
0896 33 0505 9998          K    0896  33    0505      9998          FOR OPERATION = LOCATION - 0800                    302
0897 33 0505 9998          K    0897  33    0505      9998          FOR OPERATION = LOCATION - 0800                    304
0898 33 0505 9998          K    0898  33    0505      9998          FOR OPERATION = LOCATION - 0800                    306
0899 44 0505 9998          K    0899  44    0505      9998          FOR OPERATION = LOCATION - 0800                    308
0900 65 1003 0508          R    0900  65 N                          HAVE WE FINISHED                                  1010
0904 35 0004 0715                     35    0004                    QUOTIENT INTO D OF LOWER                          1538
0905 35 0001 1011                     35    0001                    RESERVE )                                         1716
0907 16 0410 0315                     16 OF                         IS THIS LAST SET )                                 664
0908 65 0536 0271          J PRE      65 EQUIV      M0004           EQUIVALENT TO LOWER.  MULTIBRANCH                 1178
0909 15 8002 0693                     15    8002    SSW             4 TIMES DYNAMIC ADDRESS IN D POSITION             1628
0910 84 1300 1275                     84    1300                    LOOK UP IN TABLE                                  1838
0911 65 0536 0371          J PRE      65 EQUIV      J0004           BRING EQUIVALENT.  MULTIBRANCH                    1296
0912 65 1115 0611                     65            SUB11           BLANK D, BUT NOT MOF.  FIND VALUE OF 0            2132
0913 46 0416 0567                     46 SYM        LOO             D, ADDRESS IS SYMBOLIC.                           1450
0914 69 1267 0063                     69            SUBR9           ANALYZE D                                         2336
0915 60 1354 1088          O 599      60 A0000      TA                                                                1762
0916 24 1555 0000  1555    O O        24 A0201         0000 A0201                                                     2434
0917 16 0733 0935                     16 B          P               INTERCHANGE AND MAKE NEGATIVE )                   1880
0918 20 1023 0376  1023    N C0001    20 BLANK      A           BLANK STORE EQUIV OF BLANK FOR FORWARD L              1230
0919 60 0672 0627          R C0002    60 88THX      S810B           N G.  OMIT PUNCHING                               1232
0920 69 1050 1353          R C0003    69    1050                    BLANK ADDRESS. WAS THERE BLANK BACK L             1234
0921 69 0624 0677          N C0004    69            INDEX           DRUM OR EQUIVALENT.  INDEX IF TAGGED              1244
0922 65 0625 0611          R C0005    65            SU811           NEW SYMBOL.  FIND BEST EQUIVALENT                 1248
0923 69 0426 0441          R C0006    69            SU813           800X ADDRESS.  GET DYNAMIC LEVEL                  1252
0924 69 0727 0677          R C0007    69            INDEX           CORE ADDRESS.  INDEX IT                           1262
0925 20 0184 0177  0184    R C0008    20 P0008      EXITX       P0008 MISC ADDR.  STORE FOR PUNCHING.  EXIT           1280
0926 69 0711 0661          N C0009    69 PRE        SU8R7           STORE EQUIVALENT OF NEW SYMBOL                    1282
0927 00 0000 0919          R C0010    00    0000    C0002           NEW SYMBOL, BUT TABLE FULL.  N.G.                 1284
0928 00 0000 0932          J          00    0000                    ADDEND AND EXIT FOR SUBROUTINE 18                 2154
0929 46 0732 0933                     46 DRM                        I,  CORE.  D, DRUM.                               2052
0930 00 0000 0094          K 94I      00    0000       0094                                                           2436
0931 96 0484 0736                     96 DI                         I,  ADDRESS IS BACKWARD I OR FORWARD L            1614
0932 20 0184 0788  0184               20 P0008                  P0008 STORE THE CORE ADDRESS FOR PUNCHING               2156
0933 11 8003 1242                     11    8003                    CORE.  CLEAR UPPER                                2054
0934 15 1090 8002                     15 K             8002         MAKE STORING ORDER, AND STORE ZERO                2510
0935 20 0167 1320  0167    C P        20 XXXX1                  XXXX1 ALL CASES.  STORE ADDENDS                         1884
0936 60 8003 0943                     60    8003                       SHOULD WE INTERCHANGE ADDENDS )                1862
0937 20 0792 0495  0792               20 IND                    IND   BACKWARD.  SHOULD WE INTERCHANGE ADDND          1854
0938 69 1293 0441                     69            SU813           FIND DYNAMIC LEVEL                                2220
0939 30 0004 0799                     30    0004                    D-ADDRESS TO LEFT END OF DISTR )                  1834
0940 35 0004 0552                     35    0004                    SHIFT TO 0 POSITION                               2486
0941 21 0154 0759  0154               21 R0004                  R0004 TO SUPPRESS IN CASE WE SEARCH                     1598
0942 16 0545 1085                     16 COUNT      CP              IF BACKWARD, SUBTRACT TAG-COUNT )                 1912
0943 30 0002 0949                     30    0002                       SHOULD WE INTERCHANGE ADDENDS )                1864
0944 65 0152 1318          J          65 R0002                      ALPHABETIC SYMBOL                                 2534
0945 10 0702 8003                     10 C6            8003         MODIFY BRINGING ORDER, AND BRING                  2576
0946 20 0726 0001  0726    C SCD      20 COIFF      SETCC       COIFF STORE CORE RELOCATION AMOUNT                      2634
0947 11 8001 0604                     11    8001                    CLEAR FIRST LETTER                                1446
0948 91 0177 0335                     91 EXITX      SB10C           0, BRANCH.  I, ARITHMETIC.                        2168
0949 20 0906 1010  0906               20 A                      A        SHOULD WE INTERCHANGE ADDENDS )              1866
0950 90 0271 0505                     90 M0004                      D, CASE WHERE WE DUPLICATE COMPUTATION            1212
0951 16 1354 1309                     16 600                        WHAT CELL OID WE RESERVE )                        1742
0952 16 1295 1249                     16 C7         LOOP            MODIFY IDENTIFICATION FOR NEXT CARD               2598
0953 69 0406 0305          J          69            SUBR4           PROCESS L BACKWARDS FROM I                         832
0954 20 0959 0462  0959               20 BP1                    BP1   STORE VARIABLE BRINGING ORDER                   1640
0955 21 9972 0755  9972    J STR      21    9972    SKP          9972 NEW AVAILABILITY WORD INTO DRUM )                 1738
0956 15 0062 1017                     15 OPREG                      ADD OLD DYNAMIC LEVEL                             1902
0957 69 0460 0063                     69            SUBR9           ANALYZE I, FOR TYPE OF ADDRESS                     692
0958 69 0711 0063                     69 PRE        SUBR9           ANALYZE THE ALPHABETIC D ADDRESS                  1226
0960 35 0008 0779                     35    0008                       SHOULD WE INTERCHANGE ADDENDS )                1858
0961 30 0008 0629                     30    0008                    ALSO STORE FIRST LETTER OF ADDRESS )              1442
0962 69 1215 0063                     69            SUBR9           ANALYZE I-ADDRESS                                 2182
0963 46 0466 0416                     46            SYM             I, FIRST CHAR IS DIGIT.  ADDR SYMBOLIC            1476
0964 16 0409 1064                     16 2000I                      CORE OR DRUM                                      2364
0965 30 0005 0628                     30    0005                    I TAG TO RIGHT END LOWER                          1944
0966 16 1230 8002                     16               8002         DUPLICATE INTO AVAILABILITY TABLE )               2422
0967 14 1022 1060                     14 2IXXX                      WHICH ONE DO WE USE )                             1888
0968 15 0726 1082                     15 CDIFF      CD              ADD CORE RELOCATION AMOUNT                        2368
0969 60 8002 0777                     60    8002                    NUMERIC ADDRESS ALONE IN UPPER                    1382
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0970 30 0006 1069                        30    0006  DDN             SHIFT TO REMOVE TABULAR ADDRESS )                    1572
0971 35 0001 0678                        35    0001                  ONE DIGIT INTO UPPER                                 1972
0972 16 0290 0445          N DEF         16 Y                        DEFINED SYMBOL.  SUBTRACT Y                          1530
0973 69 0246 0299                        69 C1                       MODIFY TO TAKE NEXT COLUMN OF TABLE )                1102
0974 10 1277 8003                        10              8003        MAKE BRINGING ORDER                                  1822
0975 35 0004 0685                        35    0004                  MOVE AMOUNT OF SHIFT INTO D                          1722
0976 20 0178 0931  0178                  20 EXITY                EXITY STORE EXIT OUT OF LOWER                            1612
0977 60 0622 0177          N BAD         60 87THX      EXITX         MODIFIED ADDR TOD HIGH.  8000 TO UPPER               1412
0978 65 1023 0579                        65 8LANK      I0008         MAKE BLANK I EQUAL TO BLANK D                        2198
0979 00 0889 0580          J             00    0889    I0009         TAGS AND EXIT FOR SUBR 11.                           2210
0980 46 1283 0634                        46 DDNE                     DUPLICATE INTO AVAILABILITY TABLE )                  2416
0981 97 0534 0786                        97              BAK         D, FORWARD.  I, BACKWARD.                            1632
0982 00 0000 1336          J             00    0000                  ADDEND AND EXIT FOR INDEXING                         2274
0983 90 1001 0738                        90 MDFLL                    D, START SEARCH.  I, WE ARE ON QUITT                 2096
0984 24 1030 1084  1030                  24    1030             1030 TAG IN CASE L IS UNDEFINED SYMBOL )                  2524
0985 30 0008 0956          C BOTH        30    0008                  BOTH.  RIGHT ADDEND TO RIGHT END                     1900
0986 16 8001 0993                        16    8001                  CLEAR DP FROM ACCUMULATOR                            1936
0987 15 0132 1037                        15 12NDX                      SHOULD WE INTERCHANGE ADDENDS )                    1870
0988 69 0177 0661                        69 EXITX      SUBR7         STORE SYMBOL AND ITS EQUIVALENT                      2230
0989 65 0155 1210                        65 R0005                    BRING TAGS AND OPERATION                             1930
0990 10 1898 0608          J             10 ZMAXM      U0001         ADD A SYMBOL TO UPPER                                2500
0991 35 0004 0501                        35    0004                  4 TIMES DYNAMIC ADDRESS IN D POSITION                1624
0992 24 0184 1287  0184                  24 P0008                P0008 STORE THE ADDRESS FOR PUNCHING                       2006
0993 35 0005 1006                        35    0005                  D TAG INTO UPPER                                     1938
0994 60 0003 0057                        60 READC      SB10A           PUNCH                                              2544
0995 10 0702 8003                        10 C6              8003      MODIFY BRINGING ORDER, AND BRING                     2580
0997 35 0001 0567                        35    0001    LDD           ARE LAST FOUR CHARACTERS DIGITS )                    1462
0998 20 0292 0177  0292                  20 ORCEO      EXITX     ORCED STORE DYNAMIC LEVEL FOR REFERENCE                  2224
0999 15 0167 0178          C A           15 XXXX1      EXITY         ADD ADDRESS BEING INDEXED.  EXIT.                    2060
1000 69 1555 8003          P P1          69 E0001         8003       INITIAL OF BRINGING ORDER                            1364
1001 69 1004 0107          N MDFLL       69 L          A             STARTED WITH NEW-SYMBOL L                             402
1002 44 1005 0606          C LOOP        44            UND           I, SYMBOL IS NOT IN THE TABLE                        1420
1004 90 0090 0000          K L           90    0090       0000       TAG, SEARCH STARTED BY NEW-SYMBOL L                   524
1005 11 0108 0763                        11 HSYMB                    SOME SYMBOL WAS FOUND.  SUBTRACT DURS                1422
1006 21 0902 1056  0902                  21    0902             0902 STORE D TAG                                          1940
1007 65 0160 0165                        65 R0010                    IS IT TYPE 08)                                        494
1008 65 1679 0376                        65 8LANB      A             BRING EQUIVALENT OF BLANK BACKWARD L                 1238
1009 45 0512 1113                        45            MAX           I, WE HAVE REACHED TOP OF TABLE                      1652
1010 15 0733 0987                        15 B                           SHOULD WE INTERCHANGE ADDENDS )                  1868
1011 30 0001 0667                        30    0001                  RESERVE )                                            1718
1012 44 1265 0616                        44 DN8                      D, D IS NOT BLANK.                                   2192
1013 35 0008 0781                        35    0008                  CLEAR ALL BUT LAST CHARACTER                         1498
1014 65 0167 0771                        65 XXXX1                    DDD.  SEPARATE LAST ADDEND )                         1892
1015 65 0536 0421          J PRE         65 EQUIV      L0004         BRING EQUIVALENT.  MULTIBRANCH                       2074
1016 45 1330 1332                        45            BL            I, I IS UNPUNCHED                                    2462
1017 15 0320 1325                        15 501XX                    ADD 50 TO MAKE SURELY POSITIVE                       1904
1018 60 0153 1214          J             60 R0003                    IS THE I-ADDRESS BLANK                               2384
1020 20 0346 8001  0346    C SAI         20 AI              8001   AI    STORE BRINGING ORDER, AND DO IT                      1656
1021 16 8002 1079                        16    8002                  WHAT CELL DID WE RESERVE )                           1748
1022 00 0000 0002          K 2IXXX       00    0000       0002                                                            2646
1024 24 0177 0380  0177    N SUBR8       24 EXITX                EXITX STORE EXIT                                         1374
1025 20 0178 0381  0178    N SU82R       24 EXITY                EXITY ENTRY TO RESERVE.  STORE EXIT.                     1030
1026 65 1229 1033          N EVN         65 8003       EO            EVEN.  PUT 8003 AT RIGHT END OF LOWER                2002
1027 20 0181 0434  0181                  20 P0005                P0005 ADVANCE CARD NUMBER )                              1592
1028 00 0001 0577          J             00    0001    I0006         ADDENDS AND EXIT FOR USE IN SUBR 18.                 2206
1029 35 0004 1039                        35    0004                  LOCATION OF EQUIVALENT RELATIVE TO E1                1342
1031 20 0536 0178  0536                  20 EQUIV      EXITY     EQUIV STORE THIS ADDRESS IN EQUIV                        1760
1032 00 0001 1288          J             00    0001                  ADDEND AND EXIT FOR INDEXING                         2294
1033 16 0536 0992          C ED          16 EQUIV                    BOTH.  SUBTRACT  THE 800X ADDRESS                   2004
1034 16 0038 0744            A           16 16THX                    DUPLICATE INTO AVAILABILITY TABLE )                  2410
1035 15 8001 1341                        15    8001                  WHAT CELL DID WE RESERVE )                           1752
1036 21 1091 1094  1091                  21 DL0                  OLD   SAVE DYNAMIC LEVEL OF L FROM 0 )                     822
1037 14 0540 1048                        14 42NO                        SHOULD WE INTERCHANGE ADDENDS )                  1872
1038 16 1091 0245                        16 OLD                      WHICH L IS LESS, MEASURED ON CIRCLE )                 840
1039 20 0294 0797  0294                  20 XXXX2                XXXX2 LOCATION OF EQUIVALENT RELATIVE TO E1              1344
1040 30 0008 1118                        30    0008                  CLEAR ALL EXCEPT LAST CHARACTER )                    2506
1041 69 1044 1047                        69 81STX                    RESTORE FIRST CARD TAG )                              366
1042 65 0515 0178                        65 110TH      EXITY         UNIT CORRECTION TO DYNAMIC LEVEL                     2010
1043 00 0000 8001          K 8001        00    0000       8001                                                            2022
1044 80 0000 0000          K 81STX       80    0000       0000                                                            2676
1045 10 0702 8003                        10 C6              8003      MODIFY BRINGING ORDER, AND BRING                     2584
1046 44 0752 0003                        44 READC                    D, WE ARE NOT DDNE.                                  2594
1047 24 1050 0160  1050                  24    1050    R0010    1050 RESTORE FIRST CARD TAG )  MULTIBRANCH                 368
1048 44 1351 1052                        44 DK                       I, WE SHOULD INTERCHANGE                             1874
1049 69 0095 0948          C B           69 DPTIM                    SEVERAL CASES.  WHAT KIND OF DP                      2166
1051 92 0402 0656                        92 SHOP                        D, IT IS A SHIFT OPERATION                        1808
1052 66 0906 1111                        66 A                        INTERCHANGE AND MAKE NEGATIVE )                      1876
1053 21 0658 0461  0658                  21 X                    X     MAKE SEVERAL VARIABLE ORDERS )                       1064
1054 60 1554 1088          D 799         60 A0200      TA                                                                 1770
1055 16 8002 1313                        16    8002                        L-D ADDENDS TO LEFT END LOWER )                  1790
1056 65 8002 0965                        65    8002                  DELETE D TAG                                         1942
1057 69 0510 0063                        69            SUBR9         ANALYZE D                                             716
1058 65 0761 0611          N BB1         65            SU811         GET BLANK D DYNAMICALLY FROM I                       1240
1059 45 0612 1213                        45            MIN           D, WE ARE NOT BACK TO START YET                      1674
1060 44 1014 0414                        44            EVN           D, DREG WAS DDD.  I, EVEN.                           1890
1061 91 0364 0688                        91            FD               D, IT IS A BRANCH OPERATION                       1812
1062 90 8002 1067                        90    8002                  D, WE ARE NOT ON FIRST BACKWARD CARD                 2238
1063 67 8001 1319                        67    8001    LR            EQUIVALENT IS IN I POSITION OF LOWER                 1546
1064 46 1317 0968                        46 D                        D, DRUM.  I, CORE.                                   2366
1065 65 0536 0472          J PRE         65 EQUIV      00004         BRING EQUIVALENT.  MULTIBRANCH                       2122
1066 16 0158 1332                        16 R0008      BL            SUBTRACT NUMERICAL 0 FROM LOWER                      2466
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1D67 69 D292 0645                      69 ORCEQ                          STORE ORCEQ FOR USE WHEN WE START FORW          2240
1068 6D 0158 1264                      6D RDD08                          BRING FIRST ADDRESS AGAIN                       2388
1069 1D D179 8DD3          C DON       1D EXITZ        8003              FROM MANY PLACES.  MULTIBRANCH                  1574
107D 24 0743 0446  D743                24 SW                     SW      AT TOP.  SET SWITCH ON )                        1680
1071 21 D197 D177  D197                21 ALOPT        EXITX     ALOPT   STORE ALL OPTIMIZING TAGS                       1982
1072 9D D976 1077                      90              PAKT              I, YES.                                         161D
1073 65 D536 D591          N IPOS      65 EQUIV                          USE I-POSITION.  BRING EQUIVALENT               1360
1074 15 8003 1D31                      15    8003                        WHAT CELL DID WE RESERVE )                      1758
1075 2B D178 0431  D178    N SUB2U     24 EXITY                  EXITY   ENTRY TO UNRESERVE.  STORE EXIT.                1034
1076 65 1279 1033                      65 80D2         EO                OOO.  PUT 8002 AT RIGHT END OF LOWER            2D00
1077 15 0515 8DD2          C PAKT      15 110TH           8D02           MODIFY EXIT )                                   17D6
1078 69 0982 0677                      69              INDEX             INDEX D                                         2272
1079 35 0DD1 1035                      35    DDD1                        WHAT CELL DID WE RESERVE )                      1750
108D 65 8DD3 1038                      65    80D3                        WHICH L IS LESS, MEASURED ON CIRCLE )            838
1081 6D D584 1089          N YES       60 9            AX                MORE TAGS INTO UPPER                            1978
1082 15 D409 0124          C CD        15 2DD0I        Q0007             RESTORE THE 200D AND JUMP BACK                  2372
1083 10 D186 0494                      10 P001D                          FIX C.I. SO THAT O WILL NOT PUNCH )             2280
1084 24 D197 1350  D197                24 ALOPT                  ALOPT   TAG IN CASE L IS UNOEFINEO SYMBOL )             2526
1085 14 D320 1272          C CP        14 50IXX                          NEW LEVEL, MODULO 5D IN UPPER                   1914
1086 15 D294 1049          J           15 XXXX2        B                 PERHAPS MOOIFY OYNAMIC LEVEL )                  2150
1087 97 1085 0942                      97 CP                             IF BACKWARO L, SUBTRACT TAG-COUNT )             1910
1088 44 1241 D743          R TA        44 YES          SW                IS A LOCATION AVAILABLE IN THIS GROUP           1644
1089 10 0167 1071          C AX        1D XXXX1                          AOD IN TAGS FROM OPTIM                          198D
1090 11 DD0D DD01          P K         11    000D      D001              TO CHANGE AODING OROER TO STORING ONE           2514
1092 45 0546 D698                      45 NZ                             D, ADDRESS IS NOT 8001                          2016
1093 35 DDD4 1311                      35    D0D4                        0-POSITION HOLDS O FOR D, 1 FOR I )             2040
1094 65 D197 0301                      65 ALOPT                          MODIFY TO USE ROUTINE FOR UNFIXEO D )             824
1095 10 D7D2 8003                      10 C6             80D3            MODIFY BRINGING OROER, AND BRING                2588
1096 11 1352 1D46                      11 O                              ARE WE DONE                                     2592
1098 60 0152 0914          C X         60 R00D2                          ALPHABETIC D                                    2334
1099 69 00D1 1025                      69 SETCC        SUB2R             RESERVE ANO PUNCH CARO                          2358
11DD 9D 0755 D905                      90 SKP                            O, SKIP BECAUSE COMP IS OOUBLE                  1714
11D1 35 D0D4 0785                      35    0004      SEO               OPERATION 31.  TAKE LARGER ADOENOS.             1830
1102 65 0160 0766                      65 R0D1D                          IS THIS ANOTHER RBD CARD )                      2402
1103 65 D556 0611                      65              SUB11             FINO BEST EQUIVALENT TO BLANK                   1188
11D4 2D D959 0562  D959                20 BP1                    BP1     INITIAL BRINGING ORDER )                        1664
1105 93 D660 D71D                      93 XAS                            O, IT IS AN INOEXING OPERATION                  1802
1106 45 1260 1211                      45              BT                O, I TAG IS NON-ZERO                            1948
1107 46 0560 D311          C BOT       46              2ND               D, WE WILL USE ONE MEASUREO FROM D                848
1108 69 0911 DD63                      69 PRE          SUBR9             ANALYZE ALPHABETIC I                            1294
1109 69 0114 0617                      69 91STX                          CHANGE ORUM TAG TO 9 )                          17D0
1110 2W 0186 0989  0186                24 P0D1D                  P0010   CONTROL INFORMATION FOR PUNCHING )              1928
1111 30 D0D2 D917                      30    DDD2                        INTERCHANGE AND MAKE NEGATIVE )                 1878
1112 65 0157 1212          J           65 R0D07                          NUMERICAL L                                     2250
1113 69 0516 1070          N MAX       69 ON                             AT TOP.  SET SWITCH ON )                        1678
1114 69 1018 1025                      69              SUB2R             RESERVE FIRST CELL IN BANO                      2382
1115 0D 0888 0469          J           D0    0888      00D01             TAGS AND EXIT FOR SUBROUTINE 11                 2134
1116 30 DDD8 0790                      3D    DD08                        REGION DESIGNATOR TO RIGHT ENO )                2476
1117 44 1228 1278          J           44 NGI                            O,RELOCATEO I IS EXCESSIVE                      2290
1118 44 0D01 D934                      44 SETCC                          O, OUIT BECAUSE WE HAVE FOUND LONG SYM          2508
1119 D0 DD0D D029          K 29IXX     00    DDD0      0D29              2654
112D 24 D743 0496  0743                24 SW                     SW      SECOND PART, BACKWAROS.  CHANGE SWITCH          1694
1121 65 D178 D783                      65 EXITY                          0-POSITION HOLOS O FOR D, 1 FOR I )             2036
1122 65 D178 1D77                      65 EXITY        PAKT              MODIFY EXIT )                                   1704
1123 46 0676 0977                      46              BAO               I, RELOCATEO ORUM WILL EXCEED 1999              1390
1124 D0 D0DD 200D          K 27TH      DD    0000      2D00              FOR TELLING WHETHER DRUM OR CORE                2062
12D0 19 9900 0D0D          K    1200   19    9900      0000              IF ORUM AOORESS, USE REGULAR EXIT                344
1201 79 9900 DDD4          K    1201   79    9900      0004              IF NOT AN AODRESS, AOD 4                        346
1202 80 D300 00D2          K    1202   80    0300      DDD2              IF 800X ADDRESS, AOD 2                          348
1203 8D 04D0 DD04          K    1203   80    04D0      0004              IF NOT AN AODRESS, AOD 4                        350
12D4 80 07D0 0DD2          K    1204   80    D700      DD02              IF 8D0X AODRESS, ADD 2                          352
1205 89 9900 D004          K    1205   89    9900      0004              IF NOT AN AODRESS, AOO 4                        354
1206 90 5900 0003          K    1206   90    5900      0D03              IF CORE AODRESS, AOO 3                          356
1207 99 9999 0DD4          K    12D7   99    9999      0004              IF NOT AN AODRESS, ADD 4                        358
12D8 90 9D90 8995          K 9D9       90    9090      8995                                                              1576
1209 22 0167 8DD1  0167                22 XXXX1          8001    XXXX1   NEW AVAILABILITY WORO INTO ORUM )               1736
1210 69 8003 0566                      69    8003                        CLEAR DISTRIBUTOR                               1932
1211 10 0902 1310          C BT        1D    0902                        O TAG INTO UPPER                                1952
1212 10 0151 1262                      10 RD001                          ALPHABETIC L                                    2252
1213 69 0516 1120          N MIN       69 ON                             SECONO PART, BACKWARDS.  CHANGE SWITCH          1692
1214 45 1068 1329                      45              OUT               O, NOT BLANK.  I, IT IS BLANK.                  2386
1215 65 0536 D575          J           65 EQUIV        I00D4             BRING EQUIVALENT.  MULTIBRANCH                  2184
1216 46 0684 0D29                      46    D029                        IF A OIGIT, TO BLR WITHOUT OESIGNATING          2480
1217 65 0536 0120          J           65 EQUIV        Q0D03             BRING EQUIVALENT.  MULTIBRANCH.                 2318
1218 11 D001 0001          P KA        11    0DD1      0001              TO CHANGE STORING OROER TO ADOING ONE           2516
1219 61 1D22 1D69          C NG        61 2IXXX        DON               MOOIFY EXIT FOR N G SYMBOL                      1558
1220 14 D774 1D21                      14 4IXXX                          WHAT CELL OIO WE RESERVE )                      1746
1221 10 D167 1271                      1D XXXX1                          INOEXABLE ADORESS INTO UPPER                    2048
1222 16 DD95 0785                      16 OPTIM        SEO               REDUCE AOOENOS BY 1 FOR 80,82, OR 88            1848
1223 10 D726 0681                      1D CDIFF                          AOO RELOCATION AMOUNT                           1396
1224 90 D728 0419                      9D              L00D2             D, DRUM NOT FULL.  I, ORUM IS FULL.             2D82
1225 15 D346 D751                      15 AI                             NEW AVAILABILITY WORD INTO ORUM )               1732
1226 DD 000D D476          J           D0    0000      D0DD8             AODEND AND EXIT FOR USE IN SUBR 18              2138
1227 30 DDD3 0785                      30    DD03      SEO                   L-O ADOENOS TO LEFT END LOWER )             1796
1228 30 D002 1239          N NGI       3D    D002                        FIX C.I. SO THAT I WILL NOT PUNCH )             2298
1229 00 DDDD 8D03          K 80D3      0D    00D0      8D03                                                              2026
123D 69 1355 8DD3          J           69 A0001          80D3            OUPLICATE INTO AVAILABILITY TABLE )             2424
1231 20 D294 1297  D294                20 XXXX2                  XXXX2   STORE OYNAMIC LEVEL, RIGHT ENO WORD             1994
1232 69 DDD1 1D25          J ZQ        69 SETCC        SUB2R             TO RESERVING SUBROUTINE                         2444
1233 1D DDD3 D7D9          N BP        1D READC        SUB1D             BY-PASS INVALID CARD                            236D
1234 0D DD8D DDD0          K 85TH      D0    0080      D0DD                                                              2614
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1235 98 8008 0000          K 8          98    8008     0000                                                    1984
1236 20 0185 0938  0185                 20 P0009                 P0009 STORE CORE A00RESS FOR PUNCHING          2218
1237 10 0590 8003                       10       8003            MAKE BRINGING ORDER                           1962
1238 65 0159 0664          C PRO1       65 R0009                 NUMERICAL I                                   2284
1239 10 0186 0544                       10 P0010                 FIX C.I. SO THAT I WILL NOT PUNCH )           2300
1240 69 0944 0042                       69           SU819       PROCESS L, IF REGIONAL OR SYMBOLIC            2532
1241 36 0000 1263          N YES        36    0000               WE FOUND A CELL.  SHIFT AND COUNT             1708
1242 30 0001 0999                       30    0001  A            SHIFT RIGHT FOR CORE A00END                   2056
1243 00 0808 0798          J            00    0808               TAGS AND EXIT FOR SUBROUTINE 13               2160
1244 24 0186 1294  0186                 24 P0010                 P0010 C.I. FOR AVAILABILITY TABLE )           2554
1245 69 1555 0168          O QS         69 A0201       T0001     TO RESTORE BEFORE END OF JOB                  2606
1247 69 0197 1100                       69 ALOPT                 SHOULD WE RESERVE                             1712
1248 2[illegible] 1359 1034  1359       J SEND       24 A0005    A        A0005 DUPLICATE INTO AVAILABILITY TABLE ) 2426
1249 20 0177 1334  0177     C LOOP       20 P0001                 P0001 STORE LOCATION OF AVAILABILITY WORD      2560
1250 23 2225 2400  2225     K    1250    23    2225     2400      2225 TABLE TO OPTIMIZE SHIFT OPERATIONS        310
1251 07 0607 0600           K    1251    07    0607     0600           TABLE TO OPTIMIZE SHIFT OPERATIONS        312
1252 07 0609 0800           K    1252    07    0609     0800           TABLE TO OPTIMIZE SHIFT OPERATIONS        314
1253 09 0811 1000           K    1253    09    0811     1000           TABLE TO OPTIMIZE SHIFT OPERATIONS        316
1254 11 1013 1200           K    1254    11    1013     1200           TABLE TO OPTIMIZE SHIFT OPERATIONS        318
1255 13 1215 1400           K    1255    13    1215     1400           TABLE TO OPTIMIZE SHIFT OPERATIONS        320
1256 15 1417 1600           K    1256    15    1417     1600           TABLE TO OPTIMIZE SHIFT OPERATIONS        322
1257 17 1619 1800           K    1257    17    1619     1800           TABLE TO OPTIMIZE SHIFT OPERATIONS        324
1258 19 1821 2000           K    1258    19    1821     2000           TABLE TO OPTIMIZE SHIFT OPERATIONS        326
1259 21 2023 2200  2023     K    1259    21    2023     2200      2023 TABLE TO OPTIMIZE SHIFT OPERATIONS        328
1260 65 0515 1211                       65 110TH         BT            COUNT OF I TAGS IN LOWER                  1950
1261 23 0167 0971  0167                 23 XXXX1                 XXXX1 STORE LAST 4 DIGITS OF OPTIM            1970
1262 69 1315 1024                       69           SUBR8       PROCESS L                                     2254
1263 20 0294 1247  0294                 20 XXXX2                 XXXX2 STORE THE COUNT                         1710
1264 10 0320 0730                       10 501XX                 ADVANCE IT                                    2390
1265 65 0768 0611          N ON8        65           SU811       USUAL CASE, I BLANK AND NOT 0.                2200
1266 24 1660 0029  1660     J ST         24 G0001        0029 G0001 STORE ADDRESS OF 0001 OF REGION             2492
1267 65 0095 0127          J            65 E         Q0010       BRING VALUE OF I INTO LOWER                   2338
1268 24 0186 1240  0186                 24 P0010                 P0010 CONTROL INFORMATION )                   2530
1269 23 0536 0704  0536                 23 EQUIV         ABS     EQUIV STORE EQUIVALENT                        1494
1270 15 8001 1227                       15    8001               L-0 A00ENDS TO LEFT END LOWER )               1794
1271 11 1124 0929                       11 27TH                  SUBTRACT 2000, TO DETERMINE RANGE             2050
1272 65 8003 0179                       65    8003  EXIT2       NEW DYNAMIC LEVEL INTO LOWER                  1916
1273 65 0167 0177          J            65 XXXX1       EXITX     EQUIVALENT BACK TO LOWER AND EXIT             1408
1274 90 0978 0573                       90           I0002       I, ORUM IS FULL                               2196
1275 15 0428 8002                       15              8002     MAKE BRINGING ORDER                           1840
1276 00 0888 0477          J            00    0888     00009     TAGS AND EXIT FOR USE IN SUBR 11              2142
1277 65 1250 0706          J            65    1250               BRING SHIFT A00ENDS                           1824
1278 69 1032 0677                       69           INDEX       INDEX I                                       2292
1279 00 0000 8002          K 8002       00    0000     8002                                                    2024
1280 69 1333 0740                       69           SUB         TO SUBROUTINE                                 2450
1281 20 0167 1121  0167                 20 XXXX1                 XXXX1 STORE ADDRESS                           2034
1282 65 0153 1016                       65 R0003                 ALPHABETICAL I                                2460
1283 65 1680 0690          N ONE        65 ZEROX                 CLEAR ACCUMULATOR                             2428
1284 15 1344 1249                       15 RS1         LOOP      INITIAL WORD SHOWING LOCATION OF TABLE        2558
1285 60 8001 1292                       60    8001               PUT IT INTO UPPER                             2088
1286 65 0158 0614          C PROO       65 R0008                 NUMERICAL 0                                   2264
1287 45 0640 1042                       45 XY                    I, 8002-8003 + WRONG PARITY                   2008
1288 20 0185 1338  0185                 20 P0009       ALL       P0009 STORE I FOR PUNCHING                    2296
1289 69 0594 0661          C SO         69           SUBR7       STORE SYMBOL AND EQUIVALENT IN TABLE          2354
1290 30 0004 0602                       30    0004                                                            2538
1291 15 0444 8002                       15              8002     MAKE SHIFTING ORDER                           1726
1292 69 0595 1025                       69           SUB2R       RESERVE ADDRESS                               2090
1293 00 0809 0998          J            00    0809               TAGS AND EXIT FOR SUBROUTINE 13               2222
1294 60 1348 1284                       60 A1                    VARIABLE BRINGING ORDER INTO UPPER            2556
1295 00 1499 1499          K C7         00    1499     1499      TO MODIFY INDENTIFICATION AT END OF LI        2612
1297 14 1022 1322                       14 21XXX                 DIVIDE DYNAMIC LEVEL BY 2                     1996
1298 2[illegible] 1669 1280  1669       24 ORUMT                 ORUMT CHANGE ORUM TAG.  ORUM CANNOT BE FULL.  2448
1299 20 0179 0745  0179                 20 P0003                 P0003 STORE LOCATION OF AVAILABILITY WORD      2564
1300 19 9906 0690           K    1300    19    9906     0690           TABLE TO OPTIMIZE INDEXING OPERATIONS     330
1301 80 0008 0880           K    1301    80    0008     0880           TABLE TO OPTIMIZE INDEXING OPERATIONS     332
1302 80 0106 0680           K    1302    80    0106     0680           TABLE TO OPTIMIZE INDEXING OPERATIONS     334
1303 80 0209 0880           K    1303    80    0209     0880           TABLE TO OPTIMIZE INDEXING OPERATIONS     336
1304 80 0308 0980           K    1304    80    0308     0980           TABLE TO OPTIMIZE INDEXING OPERATIONS     338
1305 99 9908 0880           K    1305    99    9908     0880           TABLE TO OPTIMIZE INDEXING OPERATIONS     340
1306 24 0095 0648  0095                 24 OPTIM                 OPTIM STORE OPTIMIZING A00ENDS AND TAGS       1966
1307 11 0610 0415                       11 QB                    MAKE ORUM AVAILABLE )                          974
1308 00 0000 0090          K 99THX      00    0000     0090                                                    2660
1309 30 0004 1220                       30    0004               WHAT CELL DID WE RESERVE )                    1744
1310 44 0464 0514                       44           UM          0, D TAG IS NON-ZERO                          1954
1311 15 0564 8002                       15              8002     BRINGING ORDER                                2042
1312 69 0666 1024                       69           SUBR8       PROCESS 0                                     2268
1313 35 0001 1270                       35    0001               L-0 A00ENDS TO LEFT END LOWER )               1792
1314 11 0159 0716                       11 R0009                 SUBTRACT END OF AREA TO BE RESERVED           2394
1315 44 1321 1324          J            44 NGL                   0, RELOCATED L IS EXCESSIVE                   2256
1316 35 0008 1040                       35    0008               CLEAR ALL EXCEPT LAST CHARACTER )             2504
1317 15 1019 1082          N 0          15 ODIFF         C0        A00 ORUM RELOCATION AMOUNT                    2370
1318 24 0185 1290  0185                 24 P0009                 P0009 STORE LAST 4 DIGITS OF CONSTANT IN I     2536
1319 69 8003 0776          C LR         69    8003               CLEAR DISTRIBUTOR                             1552
1320 65 0062 0967                       65 OPREG                 WHICH ONE DO WE USE )                         1886
1321 10 0186 1343          N NGL        10 P0010                 FIX C.I. SO THAT L WILL NOT PUNCH )           2260
1322 44 1076 1026                       44           EVN         0, DYNAMIC LEVEL IS 000.                      1998
1323 65 8002 0731                       65    8002               CLEAR UPPER                                   1430
1324 20 0182 1286  0182                 20 P0006       PRO0      P0006 STORE L FOR PUNCHING                    2258
1325 69 0179 0632                       69 EXITZ                 IF BACKWARD L, SUBTRACT TAG-COUNT )           1906
1326 30 0001 1083          N NGO        30    0001               FIX C.I. SO THAT 0 WILL NOT PUNCH )           2278
1327 65 8002 0985                       65    8002  BOTH        OOD.  SEPARATE LAST A00END.                   1896
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1328 00 80D0 00D0          K 83R0     0D    8D0D     0000                                    2374
1329 70 0151 11D2          N OUT      70 RDD01                    WHEN DONE, READ NEXT CARD    24D0
133D 65 0159 1066                     65 RD009                    NUMERICAL 1 INTO LOWER       2464
1331 00 0001 1236          J          00    D001                  ADDEND AND EXIT FOR SUBROUTINE 18.  2216
1332 10 0158 0179          C BL       10 RDD08    EXITZ         NUMERICAL 0 INTO UPPER       2468
1333 69 D001 1075          J          69 SETCC    SUB2U         TO UNRESERVING SUBROUTINE    2452
1334 15 D695 1299                     15 C3       *             MODIFY IDENTIFICATION OF WORD  2562
1335 65 D292 1337                     65 ORCEQ    MW            DYNAMIC LEVEL OF LAST CORE ADDRESS  2106
1336 20 D184 1238  D184               2D P00D8    PR01     PD008 STORE 0 FOR PUNCHING         2276
1337 15 0545 0335          C MW       15 COUNT    SB10C         CORE OR DRUM.  ADD TAG-COUNT TO DYN LV  21D8
1338 6D D003 0D57          C ALL      60 REA0C    SB10A         PREPARE TO PUNCH AND READ NEXT CARD  2304
1339 45 0644 0694                     45 ALL                    1, IT IS ANOTHER RBD CARD    2406
1340 24 0183 0994  0183               24 P0007                  PD007 STORE FIRST 2 DIGITS IN OP POSITION  2542
1341 10 0294 0649                     10 XXXX2                  WHAT CELL DID WE RESERVE )   1754
1342 0D 0890 0418          J          00    0890  L0001         TAGS AND EXIT FOR USE IN SUBR 11  210D
1343 21 0186 1286  0186               21 P0010    PR00     P0D1D FIX C.I. SO THAT L WILL NOT PUNCH )  2262
1344 00 0000 0450          K RS1      00    D0DD     045D       INITIAL IDENTIFICATION OF WORD  26D8
1345 45 0596 0646                     45          S0D           IF 0 IS BLANK, WE SHOULD STORE ZERO  2622
1347 16 0536 1092                     16 EQUIV                  SUBTRACT THE ADDRESS IN QUESTION  2D14
1348 69 1355 0168          P A1       69 A0001    TD001         INITIAL VARIABLE BRINGING ORDER  2600
1349 20 0185 0795  0185               20 P0009                  PDD09 STORE LOCATION OF AVAILABILITY WORD  2568
1350 69 0154 1268                     69 R0004                  CONTROL INFORMATION )        2528
1351 66 0792 0935          N OK       66 IN0      P             MAKE NEGATIVE, BUT DO NOT INTERCHANGE  1882
1352 69 1555 0172          Q Q        69 A0201    T0005         COMPARISON CONSTANT FOR END OF JOB  26D4
1353 90 1008 1058                     90          BB1           0, THERE WAS A BLANK BACKWARDS L  1236
1354 60 1355 1088          Q 600      6D A00D1    TA                                         1764
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U.S. DEPARTMENT OF COMMERCE
Frederick H. Mueller, *Secretary*

NATIONAL BUREAU OF STANDARDS
A. V. Astin, *Director*

THE NATIONAL BUREAU OF STANDARDS

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ELECTRICITY. Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics.

METROLOGY. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

HEAT. Temperature Physics. Heat Measurements. Cryogenic Physics. Rheology. Molecular Kinetics. Free Radicals Research. Equation of State. Statistical Physics. Molecular Spectroscopy.

RADIATION PHYSICS. X-Ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

CHEMISTRY. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

MECHANICS. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Combustion Controls.

ORGANIC AND FIBROUS MATERIALS. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

METALLURGY. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics.

MINERAL PRODUCTS. Engineering Ceramics. Glass. Refractories. Enameled Metals. Constitution and Microstructure.

BUILDING RESEARCH. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials.

APPLIED MATHEMATICS. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics.

DATA PROCESSING SYSTEMS. Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Applications Engineering.

ATOMIC PHYSICS. Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics.

INSTRUMENTATION. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Office of Weights and Measures.

BOULDER, COLO.

CRYOGENIC ENGINEERING. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Gas Liquefaction.

IONOSPHERE RESEARCH AND PROPAGATION. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

RADIO PROPAGATION ENGINEERING. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Propagation-Terrain Effects. Radio-Meteorology. Lower Atmosphere Physics.

RADIO STANDARDS. High frequency Electrical Standards. Radio Broadcast Service. Radio and Microwave Materials. Atomic Frequency and Time Standards. Electronic Calibration Center. Millimeter-Wave Research. Microwave Circuit Standards.

RADIO SYSTEMS. High Frequency and Very High Frequency Research. Modulation Research. Antenna Research. Navigation Systems. Space Telecommunications.

UPPER ATMOSPHERE AND SPACE PHYSICS. Upper Atmosphere and Plasma Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.


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