NBS TECHNICAL NOTE

444

Reform: A General-Purpose Program for Manipulating Formatted Data Files

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

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Institute for Basic Standards
National Bureau of Standards
Washington, D.C. 20234

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FOREWORD

This report describes one of a series of computer programs being developed by the Data Systems Design Group of the NBS Office of Standard Reference Data to assist the Data Centers affiliated with the National Standard Reference Data System. The text of this report was reproduced from a typescript prepared on a typewriter terminal connected to a time-shared computer system. The program listing was produced on a phototypesetting machine at the Government Printing Office from a magnetic tape produced at NBS.

Edward L. Brady, Chief
Office of Standard Reference Data

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Reform:

A General-Purpose Program for Manipulating Formatted Data Files

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A program listing and description is given of REFORM, an independent program with which it is possible to manipulate and edit files containing as many as nine different fixed-field card formats. It can select or abridge information from any of the cards and print that information, or reformat new cards in any desired order or arrangement. Provision is made for introducing as many as twenty-six arbitrary strings of characters, each of which may be up to seventy-nine characters in length, thereby permitting the insertion of labels, headings, or comments into the file. The program, which operates on the 1108 computer at NBS, is written in ASA FORTRAN, and care has been taken to reduce to a minimum the program changes required to make the program run on other computers.

Key words: File editor; fixed-field file editor; Fortran program; insert program; packing program; reformatting; report generator; unpacking program.

1. Introduction

A large number of data files and bibliographies have been generated in the NSRDS program and elsewhere on punched cards or stored as card images on magnetic tape, or written as fixed length records on magnetic tape. Such files are usually formatted in such a way as to conserve space on the card or on print-line. Thus, labels or other identifiers are a luxury that few programmers indulge in when designing a file. In fact, in many files, the decimal points and blank spaces are omitted from the stored data. These are inserted later during the print-out in accord with specific instructions via format cards. While the insertion of decimal points and spaces between columns of numbers is relatively easy, the insertion of textual material requires considerably more labor.

REFORM is an independent program with which it is possible to manipulate files containing as many as nine different card formats. It can select or abridge information from any of the cards and print that information, or reformat new cards in any desired order or arrangement. Provision is made for introducing as many as twenty-six arbitrary strings of characters, each of which may be up to seventy-nine characters in length, thereby permitting the insertion of labels, headings, or comments into the file.

The program has application in the modification of formatted files of data. Among the applications that are foreseen are:

a. abridgment of complex structured files,
b. selection of isolated items of information,
c. combination of two or more data files into a single file,
d. insertion of new data fields into an existing file,
e. insertion of labels or comments into existing files, either permanently or for printing of reports,
f. insertion of typesetting code instructions for a photocomposition machine,
g. rearrangement of the order of records in a file,
h. packing and unpacking of card images,
i. blocking and unblocking of tables of data.

2. Objectives

Conventional methods for handling the printing of such files -- suitably spaced and with the desired notation -- require that a special computer program be written and assembled. Such programs contain explicit instructions for what is to be printed, and must therefore be rewritten if changes are later desired. Such changes invariably require the services of an experienced programmer.

The program described here is one of a series of general purpose programs for text and data manipulation which permit one to reformat files and print reports without writing a new program for each job. The instructions for fragmenting the records, rearranging the fragments, and inserting any ad hoc character strings between them are given in a series of control cards, which are fed to the machine at run time.

The present version of the program, called REFORM, handles files in fixed-field format. The program can handle three types of files:

a. one in which each record has an identical format,
b. a file with as many as nine different types of records (or cards or lines) all of which must be present and in order within each group,
c. files with as many as nine different card or format types, but not necessarily all present in each group. In this case, each card must carry an identification number whose location is in a fixed column or position in the line.

Each card can be broken into as many as nine fragments. The program assigns names to the designated fragments of the various cards. Thus, the name 31 is assigned automatically by the program to the third piece of the first card, while 43 is assigned to the fourth piece of the third card. Similarly, the names A, B, C, etc., are assigned automatically to a series of ad hoc strings which may be as long as seventy-nine characters. Having thus defined all of the segments in the existing file as well as the ad hoc strings, it is now possible to put together new cards or records by juxtaposing any desired sequence of names. Thus the sequence A11C31054B would produce a card or line containing: the first ad hoc string, the first piece of card 1, the third string, the third piece of card 1, followed immediately by the fifth piece of card 4, and finally, the second string B.

3. Characteristics of REFORM

One of the goals in writing REFORM was to make it as machine-independent and system-independent as possible. The program has been written in ASA FORTRAN IV so that it can be used on any computer with a compiler accepting the standard FORTRAN IV instructions.

The logical unit numbers designating the system card reader, printer, and card punch differ not only from machine to machine, but also from installation to installation. Therefore, some changes will be necessary if REFORM is to be used on any machine other than the UNIVAC 1108 at NBS. In order to minimize the changes the input and output instructions reference variables, READX, PRINTX, and PUNCHX, which are defined at the beginning of the program. In the listing of the program accompanying this report they are equated to 5, 6, and 3 - the logical unit numbers for the reader, printer, and punch, respectively, at NBS. The user of REFORM must set them equal to the proper values for his system.

REFORM consists of a main program and two subprograms, COVFL and IFEND, which are compiled separately. In a preliminary version of the program the subroutines were incorporated in the main program. The linkages, however, were of two types which some compilers do not allow. Since it was our aim to make the program system-independent, it was necessary to rewrite the subroutines as separately compiled programs. This may cause a slight increase in compilation and loading time; but execution time should be unaffected. The programmer who is interested in optimization can, if his system allows it, incorporate the subroutines into the main program.

The input for a REFORM run consists of six types of control cards, describing the form of the input and the desired output. These are followed by a data deck. The input medium will normally be punched cards via the system card reader or the peripheral input tape. If it is desired, the control cards can be read from the standard system input unit and the data deck from an alternate input tape. The unit number of the tape must be specified.

There are two output media: the printer or system output tape, and the card punch or punch tape. Typical print output from REFORM is shown in Figure 4. Each line of print produced from the data is also punched onto a card, unless punching is suppressed. Either the print-out or the punch file may be written on a magnetic tape. In this case, an end-of-file will be written on the tape at the end of the run and the tape will be rewound.

4. Discussion of the Control Cards

Card Type 1 is a standard input to define the legal characters. The symbol in card column 80 is used as a string terminator on the type 5 cards. The first twenty-six characters should be the letters of the alphabet.

Card Type 2 contains 5 single digit numbers as follows:

a. The number of different cards in each input group
b. The number of different cards in each reformatted output group
c. Designations of the unit number for the card reader or input tape, printer or output tape, and punch-file. If any of these are blank, default values indicating the standard input and output units for the system will be assigned.

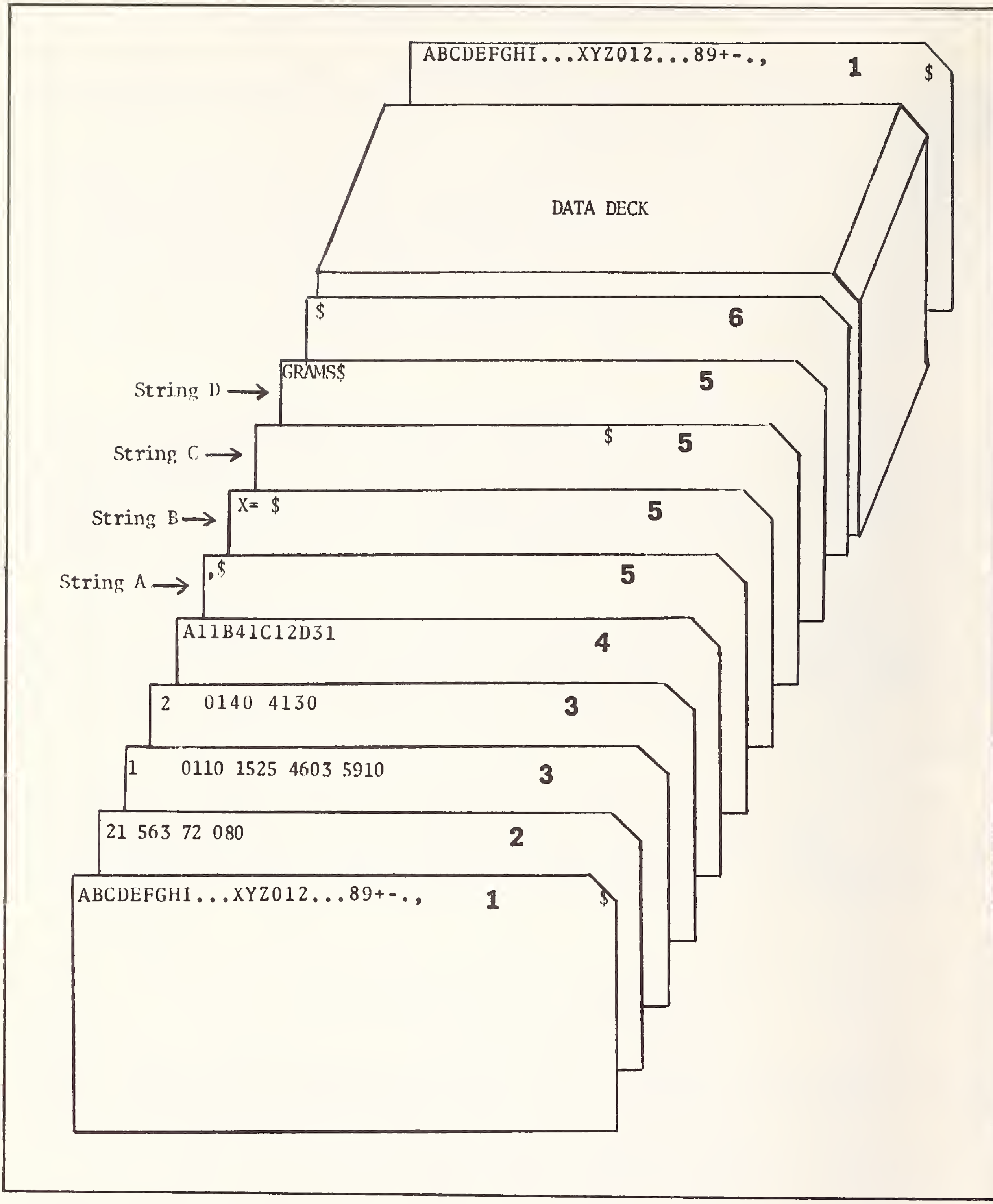

Figure 1. Arrangement of control cards and data deck for a REFORM run. The system control cards have been ommitted.

d. These numbers are followed by a two-digit number indicating the column on each data card which carries a one-digit identification number telling which format the card is in. This is necessary if not every kind of input card is present in each group. If each group includes one card of each format, and there are no identification numbers, the two-digit number should be omitted or set to zero. If the input is from tape, a three-digit number follows specifying the number of characters to a record. If it is omitted, records are assumed to be 80-character card images. In the example above, column 72 contains an identification number on each card of data. Input is in standard 80-character records.

Type 3 cards are used to partition each of the different card types in the file. In this example each group is to consist of two cards as is indicated by the first number in the Type 2 card. Hence there are two type three cards. The first number on each tells which kind of input card it applies to. In this case the first Type 3 card describes the first kind of input card, which will be broken into four fields as follows:

a. The first is 10 characters long starting in column 1. The program names this piece 11.
b. The second is 25 characters long starting in column 15. The program names this piece 21.
c. The third is 3 characters long starting in column 46. The program names this piece 31.
d. The fourth is 10 characters long starting in column 59. The program names this piece 41.

The second card is broken into two pieces, the first 40 characters long, and the next 30. Their names are 12 and 22, respectively. These segments will henceforth be called by name. Note that columns 49 through 58 on input card number 1 will be ignored.

Card Type 4 indicates how a new card (or line of print) is to be built up from the existing file. Here again there is one card of instruction for each type of card to be produced. In this case, there is only one card. It is composed of pieces from the existing file and new information, consisting of strings whose names are the letters A,B,C...X,Y,Z. In this case, the new card will contain the pieces and strings A, 11, B, 41, C, 12, D, 31. The format of this card requires that a single letter alternate with two -digit numbers. Thus, if pieces 11 and 41 must be adjacent, it would be necessary to insert a zero or a blank between them (11041 or 11 41).

Type 5 cards contain the strings of characters to be inserted between the cards (lines) or the segments or both. The strings may be any combination of characters or numbers or punctuation marks or even blanks. The string is terminated by a $ sign in this case, as it is the $ sign which appears as the last character of the Type 1 card. A string insert may be as long as 79 characters. There may be up to 26 strings. The strings are automatically assigned as names the letters of the alphabet in order. Thus the first string is A and the fourth is D.

Card Type 6 contains a $ sign (the terminator) in column 1 to indicate the end of the input strings and signals the beginning of the data deck. If the $ sign is used in the data bank, any other unique unused character can be used in its place. It will be necessary to punch that character in column 80 of the Type 1 card. The data deck will be read from a tape unit if the Type 2 card indicates so.

The repetition of a Type 1 card at the end of the data serves as a flag to tell the program that its work is done.

5. Allocation of Core Storage

The present version of REFORM uses 8321 cells of storage in the Univac 1108. In the following paragraphs we describe how this space is allocated and how it may, if necessary, be reduced.

The program itself when fully assembled occupies 3750 cells of core storage. This amount will vary from machine to machine, as it includes the system input-output package and depends on the machine language. The remaining 4571 cells are used by the program variables and data.

In the writing of REFORM we have been quite liberal in the use of core storage. In particular, we have used a full machine word for each alphameric character, rather than conserving memory by packing the possible 6 characters into a 36-bit word. This non-optimal use of storage was necessary to assure complete machine-independence. To store more than one character to a word would have required a knowledge of the characteristics of alphameric storage on the particular machine and would not have been possible in ASA FORTRAN IV.

Much of the alphameric storage requirements is used by buffers. This includes a temporary input buffer and nine line buffers, one for each kind of input card or record, each consisting of 132 characters, accounting in all for 1320 characters. An output buffer of 80 characters raises the buffer spaces to 1400 cells. If the data file consists of 80 column card images, it is possible to conserve 520 cells of memory by cutting the length of each input buffer to 80. The 132 character buffers are only necessary if the input is from a tape containing records longer than 80-character card images.

The largest single component of storage is for the 26 ad hoc strings of 80 characters each. This allocation of 2080 characters is obviously a place where considerable economization of core is possible. If it is necessary to reduce the amount of storage used, one can cut either the maximum length of a string or the number of strings. Since strings can be concatenated, it is better to have provision for 26 strings of length 40 than 13 of length 80. Few applications of REFORM are foreseen which will require 2080 characters of strings. The insertion of the number 10 (the first piece of the zeroth card) between two ad hoc strings concatenates them, as 10 refers to a non-existent fragment.

Another 839 cells are devoted to storage of the field and string specifications. These specifications, read from the control cards, include 163 cells of input parameters and 676 cells of output parameters.

The 4571 cells of storage include 1487 cells of so-called blank common, accessible to both the main program and the subprograms. The remainder is divided into 3056 cells used by the main program, 9 used by COVFL, and 19 by IFEND. Formats occupy 110 cells of memory. The breakdown of the 4571 cells is as follows: 1400 cells of buffer arrays; 2080 cells of string storage; 110 cells of formats; 839 of input-output specifications; 80 cells containing an image of the first control card; and 62 cells of indexes, counters, switches, and parameters.

The arrays which can be reduced in size are called STRING, in the main program, and KARD and KARDIN, buffers in blank common. The latter two arrays are dimensioned in each subprogram and the main program. It is important that these three declarations of size be identical.

6. Applications of REFORM

In this example of an abbreviated author index to certain references it is desired to move the second author in a column adjacent to the first; to enclose the journal code in parenthesis and to insert 'VOL.' between the journal code and the volume number.

1st Card. The first card is the standard input card with a $ in column 80 denoting that symbol as the string delimiter in certain of the control cards.

2nd Card. The numbers 5, 6, 3 refer to input and output units.

3rd Card. Tells how card format 1 is to be broken up: 15 characters wide starting in CC7, 15 starting in 52, 03 starting in 22, and 15 starting in 31. Note that the order is immaterial. In fact the pieces can even overlap.

4th Card. Tells how to put the single output card together. The order is: piece 1, piece 2, string A, piece 3, string B, and piece 4. Two strings follow on 2 cards. The first consists of (and the second is) VOL. A control card with $ in column 1 and the control cards and the data deck follows.

Figures 2 and 3 on the following pages show the arrangement of the control cards in the original file as well as the reformatted information.

The authors wish to express their appreciation to a number of persons who contributed toward the preparation of this report: to Wanda Hein who prepared the typescript, and to Carla G. Messina whose program was used to phototypeset the program listing. Special thanks are due Rubin Wagner, Chief of the Electronic Printing Section, who, as editorial reader of this report, tested the program by applying it to a problem of inserting instruction codes for automatic typesetting on the Linofilm phototypesetter. Figures 11, 12, and 13 show the result of that exercise.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
11 563
1     0715 5215 2203 3115
011021A31B41
  ($
)  VOL. $
$
      MORLEY          ACJ        17    267    1895
      AMAGAT          ACP        29     68    1893
      DULONG          ACP        41    113    1829
      CAZIN           ACP        66    206    1862
      KENNEDY         AJS       248    540    1950
      KENNEDY         AJS       252    225    1954
      KELLSTROM       AMA        27      1    1941
      TRAUTZ          APK         2    733    1929      BAUMANN
      TRAUTZ          APK         2    737    1929      STAUF
      ECKERLEIN       APK         3    120    1900
      WULLNER         APK         3    321    1878
      TRAUTZ          APK         3    409    1929      LUDEWIGS
      WULLNER         APK         4    321    1878
      SCHULTZE        APK         5    140    1901
      TRAUTZ          APK         5    561    1930      BINKELE
      TRAUTZ          APK         7    409    1930      MELSTER
      TRAUTZ          APK         7    427    1930      ZINK
      TRAUTZ          APK         9    981    1931      KURZ
      TRAUTZ          APK        10     81    1931      SORG
      TRAUTZ          APK        10    155    1931      HEBERLING
      MICHELS         APK        12    562    1932      NIJHOFF GERVER
      HEUSE           APK        14    185    1932      OTTO
      GRAETZ          APK        14    232    1881
      MARKOWSKI       APK        14    742    1904
      BESTELMEYER     APK        15     61    1904      VALENTINER
      MICHELS         APK        16    745    1933      GERVER
      TRAUTZ          APK        20    118    1934      HEBERLING
      HOLBURN         APK        23    809    1907      HENNING
      KOCH            APK        27    311    1908
      NOTHDURFT       APK        28    137    1937
      SCHLEIERMACHER  APK        34    623    1888
      WINKELMANN      APK        44    429    1891
      HOLBURN         APK        47   1089    1915      SCHULTZE
      SCHWEIKERT      APK        48    593    1915
      GILLE           APK        48    799    1915
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
```

Figure 2. An arrangement of control cards to reformat an author index. See Figure 4 for an explanation of the control cards.

MORLEY		(ACJ)	VOL. 17	267	1895
AMAGAT		(ACP)	VOL. 29	68	1893
DULONG		(ACP)	VOL. 41	113	1829
CAZIN		(ACP)	VOL. 66	206	1862
KENNEDY		(AJS)	VOL. 48	540	1950
KENNEDY		(AJS)	VOL. 52	225	1954
KELLSTROM		(AMA)	VOL. 27	1	1941
TRAUTZ	BAUMANN	(APK)	VOL. 2	733	1929
TRAUTZ	STAUF	(APK)	VOL. 2	737	1929
ECKERLEIN		(APK)	VOL. 3	120	1900
WULLNER		(APK)	VOL. 3	321	1878
TRAUTZ	LUDEWIGS	(APK)	VOL. 3	409	1929
WULLNER		(APK)	VOL. 4	321	1878
SCHULTZE		(APK)	VOL. 5	140	1901
TRAUTZ	BINKELE	(APK)	VOL. 5	561	1930
TRAUTZ	MELSTER	(APK)	VOL. 7	409	1930
TRAUTZ	ZINK	(APK)	VOL. 7	427	1930
TRAUTZ	KURZ	(APK)	VOL. 9	981	1931
TRAUTZ	SORG	(APK)	VOL. 10	81	1931
TRAUTZ	HEBERLING	(APK)	VOL. 10	155	1931
MICHELS	NIJHOFF GERVER	(APK)	VOL. 12	562	1932
HEUSE	OTTO	(APK)	VOL. 14	185	1932
GRAETZ		(APK)	VOL. 14	232	1881
MARKOWSKI		(APK)	VOL. 14	742	1904
BESTELMEYER	VALENTINER	(APK)	VOL. 15	61	1904
MICHELS	GERVER	(APK)	VOL. 16	745	1933
TRAUTZ	HEBERLING	(APK)	VOL. 20	118	1934
HOLBURN	HENNING	(APK)	VOL. 23	809	1907
KOCH		(APK)	VOL. 27	311	1908
NOTHDURFT		(APK)	VOL. 28	137	1937
SCHLEIERMACHER		(APK)	VOL. 34	623	1888
WINKELMANN		(APK)	VOL. 44	429	1891
HOLBURN	SCHULTZE	(APK)	VOL. 47	1089	1915
SCHWEIKERT		(APK)	VOL. 48	593	1915
GILLE		(APK)	VOL. 48	799	1915

Figure 3. Results of the reformatting run of the deck in Figure 2. Note that the author fields have been moved, the journal coden has been enclosed in parentheses and the abbreviation VOL. now precedes the volume number. See Figure 11 for the result of using REFORM to produce a phototypeset copy of this table.

```
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READ UNIT IS 5 PRINT UNIT IS 6 PUNCH UNIT IS 6

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890/*()'=+,.
1 CARDS ARE TO BE READ ON EACH PASS
1 CARDS ARE TO BE PUNCHED ON EACH PASS

THE STARTING COLUMNS AND FIELD WIDTHS ARE:

        7 15     52 15     22  3     31 15

THE REARRANGEMENT PLAN IS:

011 021 A31 B41

THERE ARE  2 STRINGS.  THEY ARE:

A   3 CHARACTERS     (
B   8 CHARACTERS  )  VOL.

READ DATA DECK
```

Figure 4. A portion of the output of REFORM showing how the control cards in Figure 2 were interpreted by the program.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789                 $
32 563 01
1     0209 1102 1407
2     0406 1008
3     0807
 11A21B31C12D22
E13
   AT.NO.=$
    AT.WT.=$
   M.P.=$
 DEGREES  SP.GR.=$
                              HALF-LIFE= $
$
1ACTINIUM 89 (227)
2AC1050   10.07
3AC227 22 YR
1ALUMINUM 13 26.9815
2AL660.2 2.6989
1AMERICIUM95 (243)
3AM243 8800YR
1ANTIMONY 51 121.75
2SB630.5 6.691
1ARGON     18 39.948
2AR-198.2.00173787
1ARSENIC   33 74.9216
2AS814S  5.727
1ASTATINE 85 (210)
3AT210 8.3 HR
1BARIUM    56 137.34
2BA725    3.51
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789                 $
```

Figure 5. Control cards for printing a report from a condensed file. Figure 6 shows how the program interpreted the control cards.

```
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READ UNIT IS 5 PRINT UNIT IS 6 PUNCH UNIT IS 3

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
3 CARDS ARE TO BE READ ON EACH PASS
2 CARDS ARE TO BE PUNCHED ON EACH PASS

THE STARTING COLUMNS AND FIELD WIDTHS ARE:

    2  9    11  2    14  7
    4  6    10  8
    8  7

THE REARRANGEMENT PLAN IS:

 11 A21 B31 C12 D22
E13

THERE ARE  5 STRINGS.  THEY ARE:

A    9 CHARACTERS    AT.NO.=
B   10 CHARACTERS     AT.WT.=
C    7 CHARACTERS    M.P.=
D   17 CHARACTERS   DEGREES  SP.GR.=
E   30 CHARACTERS                     HALF-LIFE=

READ DATA DECK
```

Figure 6. A portion of the output of REFORM showing how the control cards in Figure 5 were interpreted by the program.

```
ACTINIUM    AT.NO.=89    AT.WT.=(227)     M.P.=1050    DEGREES   SP.GR.=10.07
                  HALF-LIFE= 22 YR
ALUMINUM    AT.NO.=13    AT.WT.=26.9815   M.P.=660.2   DEGREES   SP.GR.=2.6989
                  HALF-LIFE=
AMERICIUM   AT.NO.=95    AT.WT.=(243)     M.P.=        DEGREES   SP.GR.=
                  HALF-LIFE= 8800YR
ANTIMONY    AT.NO.=51    AT.WT.=121.75    M.P.=630.5   DEGREES   SP.GR.=6.691
                  HALF-LIFE=
ARGON       AT.NO.=18    AT.WT.=39.948    M.P.=-198.2  DEGREES   SP.GR.=.0017378
                  HALF-LIFE=
ARSENIC     AT.NO.=33    AT.WT.=74.9216   M.P.=814S    DEGREES   SP.GR.=5.727
                  HALF-LIFE=
ASTATINE    AT.NO.=85    AT.WT.=(210)     M.P.=        DEGREES   SP.GR.=
                  HALF-LIFE= 8.3 HR
END-OF-DATA CARD READ
```

Figure 7. Report generated from data and control cards shown in Figure 5.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
56 563
1    0160
2    0160
3    0160
4    0160
5    0160
  11
  12
  13
  14
  15
A
  $
$
100      00 000  043  087  130  173  217  260  303  346  389
101         432  475  518  561  604  647  689  732  775  817
102         860  903  945  988 *030 *072 *115 *157 *199 *242
103      01 284  326  368  410  452  494  536  578  620  662
104         703  745  787  828  870  912  953  995 *036 *078
105      02 119  160  202  243  284  325  366  407  449  490
106         531  572  612  653  694  735  776  816  857  898
107         938  979 *019 *060 *100 *141 *181 *222 *262 *302
108      03 342  383  423  463  503  543  583  623  663  703
109         743  782  822  862  902  941  981 *021 *060 *100
110      04 139  179  218  258  297  336  376  415  454  493
111         532  571  610  650  689  727  766  805  844  883
112         922  961  999 *038 *077 *115 *154 *192 *231 *269
113      05 308  346  385  423  461  500  538  576  614  652
114         690  729  767  805  843  881  918  956  994 *032
115      06 070  108  145  183  221  258  296  333  371  408
116         446  483  521  558  595  633  670  707  744  781
117         819  856  893  930  967 *004 *041 *078 *115 *151
118      07 188  225  262  298  335  372  408  445  482  518
119         555  591  628  664  700  737  773  809  846  882
120         918  954  990 *027 *063 *099 *135 *171 *207 *243
121      08 279  314  350  386  422  458  493  529  565  600
122         636  672  707  743  778  814  849  884  920  955
123         991 *026 *061 *096 *132 *167 *202 *237 *272 *307
124      09 342  377  412  447  482  517  552  587  621  656

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
```

Figure 8. Control cards for inserting a blank line after every fifth line in a table.

```
PAGE:      17

READ UNIT IS 5 PRINT UNIT IS 6 PUNCH UNIT IS 3

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
5 CARDS ARE TO BE READ ON EACH PASS
6 CARDS ARE TO BE PUNCHED ON EACH PASS

THE STARTING COLUMNS AND FIELD WIDTHS ARE:

      1 60
      1 60
      1 60
      1 60
      1 60

THE REARRANGEMENT PLAN IS:

 11
 12
 13
 14
 15
A**

THERE ARE  1 STRINGS.  THEY ARE:

A   1 CHARACTERS

READ DATA DECK
```

Figure 9. A portion of the output of REFORM showing how the control cards in Figure 8 were interpreted by the program.

100	00	000	043	087	130	173	217	260	303	346	389
101		432	475	518	561	604	647	689	732	775	817
102		860	903	945	988	*030	*072	*115	*157	*199	*242
103	01	284	326	368	410	452	494	536	578	620	662
104		703	745	787	828	870	912	953	995	*036	*078
105	02	119	160	202	243	284	325	366	407	449	490
106		531	572	612	653	694	735	776	816	857	898
107		938	979	*019	*060	*100	*141	*181	*222	*262	*302
108	03	342	383	423	463	503	543	583	623	663	703
109		743	782	822	862	902	941	981	*021	*060	*100
110	04	139	179	218	258	297	336	376	415	454	493
111		532	571	610	650	689	727	766	805	844	883
112		922	961	999	*038	*077	*115	*154	*192	*231	*269
113	05	308	346	385	423	461	500	538	576	614	652
114		690	729	767	805	843	881	918	956	994	*032
115	06	070	108	145	183	221	258	296	333	371	408
116		446	483	521	558	595	633	670	707	744	781
117		819	856	893	930	967	*004	*041	*078	*115	*151
118	07	188	225	262	298	335	372	408	445	482	518
119		555	591	628	664	700	737	773	809	846	882
120		918	954	990	*027	*063	$099	*135	*171	*207	*243
121	08	279	314	350	386	422	458	493	529	565	600
122		636	672	707	743	778	814	849	884	920	955
123		991	*026	*061	*096	*132	*167	*202	*237	*272	*307 *
124	09	342	377	412	447	482	517	552	587	621	656

Figure 10. Results of the reformatting operation indicated in Figure 8.

MORLEY		(ACJ)	VOL. *17*	267	1895
AMAGAT		(ACP)	VOL. *29*	68	1893
DULONG		(ACP)	VOL. *41*	113	1829
CAZIN		(ACP)	VOL. *66*	206	1862
KENNEDY		(AJS)	VOL. *48*	540	1950
KENNEDY		(AJS)	VOL. *52*	225	1954
KELLSTROM		(AMA)	VOL. *27*	1	1941
TRAUTZ	BAUMANN	(APK)	VOL. *2*	733	1929
TRAUTZ	STAUF	(APK)	VOL. *2*	737	1929
ECKERLEIN		(APK)	VOL. *3*	120	1900
WULLNER		(APK)	VOL. *3*	321	1878
TRAUTZ	LUDEWIGS	(APK)	VOL. *3*	409	1929
WULLNER		(APK)	VOL. *4*	321	1878
SCHULTZE		(APK)	VOL. *5*	140	1901
TRAUTZ	BINKELE	(APK)	VOL. *5*	561	1930
TRAUTZ	MELSTER	(APK)	VOL. *7*	409	1930
TRAUTZ	ZINK	(APK)	VOL. *7*	427	1930
TRAUTZ	KURZ	(APK)	VOL. *9*	981	1931
TRAUTZ	SORG	(APK)	VOL. *10*	81	1931
TRAUTZ	HEBERLING	(APK)	VOL. *10*	155	1931
MICHELS	NIJHOFF GERVER	(APK)	VOL. *12*	562	1932
HEUSE	OTTO	(APK)	VOL. *14*	185	1932
GRAETZ		(APK)	VOL. *14*	232	1881
MARKOWSKI		(APK)	VOL. *14*	742	1904

Figure 11. Output from a Linofilm phototypesetter machine of a series of records on magnetic tape produced by REFORM. Figure 12 shows how the program interpreted the REFORM control cards. The character stream produced by REFORM is shown in Figure 13. This is set in 10 point Roman typeface with 12 point leading (spacing). It is this information which is specified in Format A(=FA).

```
READ UNIT IS 5 PRINT UNIT IS 6 PUNCH UNIT IS 7

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789'(*)/=,$.+
1 CARDS ARE TO BE READ ON EACH PASS
1 CARDS ARE TO BE PUNCHED ON EACH PASS

THE STARTING COLUMNS AND FIELD WIDTHS ARE:

    7 14     52 14     22  3     31  2     35  4     42  4

THE REARRANGEMENT PLAN IS:

A11 B21 C31 D41 E51 F61

THERE ARE  7 STRINGS.  THEY ARE:

A    3 CHARACTERS   =FA
B    2 CHARACTERS   =L
C    6 CHARACTERS   =L=G2(
D   14 CHARACTERS   )=L=G1VOL. =G3
E    6 CHARACTERS   =36=G1
F    3 CHARACTERS   =36
G    4 CHARACTERS   =L >

READ DATA DECK
```

Figure 12. A summary of the instructions required to produce records shown in Figure 13 from cards containing data shown in Figure 2. The functions of the inserted strings are given in the next figure.

```
=FAMORLEY      =L          =L=G2(ACJ)=L=G1VOL. =G317=36=G1 267=361895=L >
=FAAMAGAT      =L          =L=G2(ACP)=L=G1VOL. =G329=36=G1  68=361893=L >
=FADULONG      =L          =L=G2(ACP)=L=G1VOL. =G341=36=G1 113=361829=L >
=FACAZIN       =L          =L=G2(ACP)=L=G1VOL. =G366=36=G1 206=361862=L >
=FAKENNEDY     =L          =L=G2(AJS)=L=G1VOL. =G348=36=G1 540=361950=L >
=FAKENNEDY     =L          =L=G2(AJS)=L=G1VOL. =G352=36=G1 225=361954=L >
=FAKELLSTROM   =L          =L=G2(AMA)=L=G1VOL. =G327=36=G1   1=361941=L >
=FATRAUTZ      =LBAUMANN   =L=G2(APK)=L=G1VOL. =G3 2=36=G1 733=361929=L >
=FATRAUTZ      =LSTAUF     =L=G2(APK)=L=G1VOL. =G3 2=36=G1 737=361929=L >
=FAECKERLEIN   =L          =L=G2(APK)=L=G1VOL. =G3 3=36=G1 120=361900=L >
=FAWULLNER     =L          =L=G2(APK)=L=G1VOL. =G3 3=36=G1 321=361878=L >
=FATRAUTZ      =LLUDEWIGS  =L=G2(APK)=L=G1VOL. =G3 3=36=G1 409=361929=L >
=FAWULLNER     =L          =L=G2(APK)=L=G1VOL. =G3 4=36=G1 321=361878=L >
=FASCHULTZE    =L          =L=G2(APK)=L=G1VOL. =G3 5=36=G1 140=361901=L >
=FATRAUTZ      =LBINKELE   =L=G2(APK)=L=G1VOL. =G3 5=36=G1 561=361930=L >
```

Figure 13. The string =FA signifies a format specified in a G.P.O. typesetting program; =L performs the function of a tab key on a typewriter; =G2 brings up the bold face grid; =G3 brings up the italic grid; =36 inserts a 36 unit space between columns; =G1 restores the normal grid.

```
C
C     REFORM                                                            A  10
C     THIS PROGRAM, REFORM, IS A GENERAL-PURPOSE INDEPENDENT PROGRAM    A  20
C     FOR REFORMATTING FIXED-FIELD CARDS.  UP TO 9 KINDS OF INPUT CARDS A  30
C     MAY BE ACCEPTED AS INPUT TO THIS PROGRAM, AND UP TO 9 KINDS OF    A  40
C     OUTPUT CARDS PRODUCED.  UP TO 26 STRINGS MAY BE INSERTED AS       A  50
C     DESIRED BETWEEN FIELDS OF DATA.  EACH KIND OF INPUT CARD MAY BE   A  60
C     DIVIDED INTO NOT MORE THAN 9 FIELDS.                              A  70
C                                                                       A  80
C     THIS PROGRAM WRITTEN BY R. MCCLENON AT THE NATIONAL BUREAU OF     A  90
C     STANDARDS JANUARY, 1968.                                          A 100
C                                                                       A 110
C     THE FIRST CONTROL CARD FOR THIS PROGRAM CONTAINS A LIST OF VALID  A 120
C     CHARACTERS.  THE FIRST 26 COLUMNS CONTAIN THE LETTERS OF THE      A 130
C     ALPHABET IN ORDER.  THE NEXT 10 COLUMNS (27-36) CONTAIN THE TEN   A 140
C     DIGITS IN ORDER, STARTING WITH ZERO.  COLUMN 79 MUST BE BLANK, AND A 150
C     COLUMN 80 CONTAINS A CHARACTER USED AS THE STRING TERMINATOR.     A 160
C     THE SECOND CARD, IN (2I1,1X,3I1,1X,I2,1X,I3) FORMAT, CONTAINS A   A 170
C     LIST OF VARIOUS PROGRAM PARAMETERS.  THE FIRST TWO ARE THE NUMBER A 180
C     OF KINDS OF INPUT CARDS TO BE READ AND THE NUMBER OF KINDS OF     A 190
C     OUTPUT CARDS TO BE PRODUCED.    THE NEXT THREE INTEGERS SPECIFY   A 200
C     THE UNIT NUMBERS OF THE READER, PRINTER, AND CARD PUNCH.  PUNCHING A 210
C     IS SUPPRESSED IF THESE LAST TWO ARE EQUAL.  A TWO-DIGIT INTEGER   A 230
C     GIVES THE COLUMN IN EACH INPUT CARD WHICH CONTAINS A LABEL (A ONE- A 240
C     DIGIT NUMBER) INDICATING WHICH OF THE UP TO 9 TYPES OF INPUT CARD A 250
C     IT IS.  IF THIS FIELD ON THE CONTROL CARD IS BLANK, INPUT CARDS   A 260
C     ARE NOT LABELED AS TO TYPE, AND TYPING IS DONE SEQUENTIALLY (THE  A 270
C     FIRST CARD IS TYPE 1, THE SECOND CARD TYPE 2).  THE LAST FIELD ON A 280
C     THIS CONTROL CARD GIVES THE NUMBER OF CHARACTERS TO A RECORD ON   A 290
C     INPUT.  IF THE INPUT IS FROM CARDS OR IF THE FIELD IS BLANK       A 300
C     STANDARD 80-CHARACTER RECORDS WILL BE ASSUMED.  (THIS FIELD IS    A 310
C     ONLY NECESSARY IF THE INPUT IS FROM TAPE.)                        A 320
C     THE THIRD TYPE OF CONTROL CARDS SPECIFY THE FIELD ARRANGEMENT ON  A 330
C     THE INPUT CARDS.  THERE MUST BE ONE FOR EACH TYPE OF INPUT CARD,  A 340
C     IN (I1,4X,9(2I2,1X)) FORMAT.  THE FIRST NUMBER INDICATES TO WHICH A 350
C     TYPE OF INPUT CARD THIS PARAMETER CARD APPLIES.  THE REMAINDER OF A 360
C     THE CARD IS OCCUPIED BY PAIRS OF TWO-DIGIT NUMBERS IN WHICH THE   A 380
C     FIRST NUMBER OF THE PAIR INDICATES THE STARTING COLUMN OF ONE OF  A 390
C     THE FIELDS INTO WHICH THIS TYPE OF INPUT CARD IS DIVIDED, AND THE A 400
C     SECOND NUMBER THE WIDTH OF THE FIELD.                             A 410
C     THE FOURTH TYPE OF CONTROL CARD FOR THIS PROGRAM GIVES THE OUTPUT A 420
C     INFORMATION.  IT IS IN (24(A1,2I1)) FORMAT, THE LETTER DESIGNATING A 430
C     ONE OF THE AD HOC STRINGS TO BE INSERTED, AND THE TWO DIGITS THE  A 440
C     NUMBER OF A FIELD ON AN INPUT CARD AND THE TYPE OF INPUT CARD ON  A 450
C     WHICH THIS FIELD IS TO BE FOUND.  IT WILL BE SEEN THAT STRINGS AND A 460
C     FIELDS ALTERNATE IN THE OUTPUT, AND THAT A STRING PRECEDS THE     A 470
C     FIRST FIELD.  IF THE SPACE RESERVED FOR THE STRING LETTER IS BLANK A 480
C     NO STRING WILL BE INSERTED.                                       A 490
C     EACH OF THE TYPE FIVE CONTROL CARDS CONTAINS ONE AD HOC STRING.   A 500
C     A STRING TERMINATOR INDICATES THE END OF THE STRING.  THE LAST    A 510
C     STRING CARD IS FOLLOWED BY A CARD WITH A STRING TERMINATOR IN     A 520
C     COLUMN 1.  THIS SERVES AS A SIGNAL TO THE PROGRAM THE THE DATA    A 530
C     DECK FOLLOWS THIS CARD.                                           A 540
C     THE END OF THE DATA DECK IS INDICATED BY A DUPLICATE OF THE FIRST A 550
C     CONTROL CARD, THE ONE CONTAINING THE VALID CHARACTERS.            A 560
C                                                                       A 570
C     THIS PROGRAM MUST BE LOADED WITH TWO SUBROUTINES, COVFL AND IFEND. A 580
C                                                                       A 590
C     ******************************************************************* A 600
C                                                                       A 610
```

```
C     ALL VARIABLES IN THIS PROGRAM ARE DEFINED AS INTEGERS
      INTEGER READX,PRINTX,PUNCHX,READ,PRINT,PUNCH,STOP,SPACE,BUFFR
      INTEGER ALPHB,FWIDTH,FSTRT,STRING,FNUMBR,CNUMBR,SNUMBR,SLNGTH
      DIMENSION FWIDTH(9,9), FSTRT(9,9), FNUMBR(9,24), CNUMBR(9,24)
      DIMENSION SNUMBR(9,24), BUFFR(80), ALPHB(80), SLNGTH(26), NFLDS(9)
      DIMENSION INFS(9), INFW(9)
C     **** THE DIMENSIONS BELOW MAY BE REDUCED TO CONSERVE STORAGE ****
      DIMENSION KARDIN(132), KARD(9,132), STRING(26,80)
C     **** THE DIMENSIONS ABOVE MAY BE REDUCED TO CONSERVE STORAGE ****
C     THE FOLLOWING VARIABLES ARE SHARED WITH THE SUBPROGRAMS
      COMMON ALPHB,READX,READ,PRINTX,PRINT,PUNCHX,PUNCH,KARDIN,KNTR,KARD
      COMMON BUFFR
C     THESE ARE THE INPUT FORMATS
5     FORMAT (80A1)
10    FORMAT (2I1,1X,3I1,1X,I2,1X,I3)
15    FORMAT (I1,4X,9(2I2,1X))
20    FORMAT (24(A1,2I1))
C     THESE ARE THE OUTPUT FORMATS
25    FORMAT (/1X,80A1)
30    FORMAT (1X,I1,34H CARDS ARE TO BE READ ON EACH PASS)
35    FORMAT (1X,I1,37H CARDS ARE TO BE PUNCHED ON EACH PASS)
40    FORMAT (13H0READ UNIT IS,I2,14H PRINT UNITIS,I2,14H PUNCH UNIT IS
     1,I2)
45    FORMAT (44H0THE STARTING COLUMNS AND FIELD WIDTHS ARE    /)
50    FORMAT (9(4X,I2,1X,I2))
55    FORMAT (48H0THE REARRANGEMENT PLAN IS (FIELD,CARD,STRING)    /)
60    FORMAT (24(1X,A1,2I1))
65    FORMAT (10H0THERE ARE,I3,21H STRINGS.  THEY ARE    /)
70    FORMAT (1X,A1,2X,I2,13H CHARACTERS  ,80A1)
75    FORMAT (15H0READ DATA DECK/1H1)
C     READX, PRINTX, PUNCHX ARE DEFAULT VALUES FOR THE INPUT AND OUTPUT
C     UNIT NUMBERS
C     ***** THE INSTRUCTIONS BELOWARE SYSTEM-DEPENDENT *****
      READX=5
      PRINTX=6
      PUNCHX=3
C     ***** THE INSTRUCTIONS ABOVE ARE SYSTEM-DEPENDENT *****
C     READ A LIST OF VALID CHARACTERS
C     THE FIRST 26 CHARACTERS IN THIS LIST MUST BE THE ALPHABET IN ORDER
      READ (READX,5) ,(ALPHB(J),J=1,80)
C     NCIN IS THE NUMBER OF KINDS OF INPUT CARDSTO BE READ ON EACH PASS
C     NCOUT IS THE NUMBER OF KINDS OF OUTPUT CARDS TO BE PUNCHED ON EACH
C     PASS THROUGH THE PROGRAM
C     READ, PRINT, PUNCH ARE THE UNIT NUMBERS FOR THE CARD READER,
C     PRINTER, AND CARD PUNCH
C     LCOL IS THE COLUMN IN WHICH THE CARD TYPE LABEL IS PUNCHED
C     IF IT IS ZERO, TYPING IS DONE BY ORDER OF APPEARANCE (FIRST CARD
C     IS TYPE ONE, AND SO ON)
      READ (READX,10) ,NCIN,NCOUT,READ,PRINT,PUNCH,LCOL,IWIDTH
C     IF THESE SPECIFICATIONS ARE BLANK, DEFAULT VALUES ARE TO BE
C     ASSIGNED
      IF (READ.EQ.0) READ=READX
      IF (PRINT.EQ.0) PRINT=PRINTX
      IF (PUNCH.EQ.0) PUNCH=PUNCHX
      IF (IWIDTH.EQ.0.OR.READ.EQ.READX) IWIDTH=80
      WRITE (PRINTX,40) ,READ,PRINT,PUNCH
      IF (PRINT.NE.PRINTX) WRITE (PRINT,40) ,READ,PRINT,PUNCH
C     COLUMN 80 OF THE FIRST CARD (THE LIST OF VALID CHARACTERS)
C     CONTAINS A CHARACTER USED AS A STRING TERMINATOR
      STOP=ALPHB(80)
C     COLUMN 79 OF THIS CARD IS BLANK
      SPACE=ALPHB(79)
      WRITE (PRINT,25) ,(ALPHB(J),J=1,80)
      WRITE (PRINT,30) ,NCIN
```

```
      WRITE (PRINT,35) ,NCOUT
      WRITE (PRINT,45)
      DO 90 J=1,NCIN
C      READ THE SPECIFICATIONS GIVING THE ARRANGEMENT OF THE INPUT CARDS
C      INCARD SPECIFIES WHICH KIND OF CARD THESE SPECIFICATIONS APPLY TO
C      INFS AND INFW ARE TEMPORARY STORAGE AREAS
      READ (READ,15) ,INCARD,((INFS(JX),INFW(JX))JX=1,9)
C      TRANSFER THE TEMPORARY DATA TO FSTRT AND FWIDTH
      DO 80 JJ=1,9
C      FSTRT IS THE STARTING COLUMN OF AN INPUT FIELD ON A GIVEN CARD
      FSTRT(INCARDJJ)=INFS(JJ)
C      FWIDTH IS THE WIDTH OF THE FIELD BEGINNING IN A GIVEN COLUMN
      FWIDTH(INCARDJJ)=INFW(JJ)
      IF (INFW(JJ).EQ.0) GO TO 85
80    CONTINUE
      NFLDS(J)=9
      GO TO 90
85    NFLDS(J)=JJ-1
90    CONTINUE
      DO 95 J=1,NCIN
      M=NFLDS(J)
95    WRITE (PRINT,50) ,((FSTRT(JJX),FWIDTH(JJX))JX=1,M)
      WRITE (PRINT,55)
C      READ THE OUTPUT PLAN FOR EACH KIND OF CARD
      DO 110 J=1,NCOUT
C      FNUMBR IS THE NUMBER OF AN INPUT FIELD ON A GIVEN CARD
C      CNUMBR IS THE NUMBER INDICATING ON WHICH TYPE OF INPUT CARD THE
C      FIELD IS LOCATED
C      CNUMBR AND FNUMBR TOGETHER SPECIFY THE INPUT FIELD UNIQUELY
C      SNUMBR IS A LETTER SPECIFYING A STRING
      READ (READ,20) ,((SNUMBR(JJX),FNUMBR(JJX),CNUMBR(JJX))JX=1,24)
      DO 100 JJ=1,24
      IF (FNUMBR(JJJ).EQ.0) GO TO 105
100   CONTINUE
      NOUTS=24
      GO TO 110
105   NOUTS=JJ-1
110   WRITE (PRINT,60) ,((SNUMBR(JJX),FNUMBR(JJX CNUMBR(JJX))JX=1,N
     1OUTS)
      JJ=1
C      READ A STRING
115   READ (READ,5) ,(STRING(JJJ)J=1,80)
C      IF COLUMN 1 CONTAINS A TERMINATOR, NO MORE STRINGS ARE TO BE READ
      IF (STRING(JJ,1).EQ.STOP) GO TO 130
      K=1
120   K=K+1
C      SCAN THE STRING FOR A TERMINATOR TO DETERMINE ITS LENGTH
      IF (STRING(JJ,K).EQ.STOP) GO TO 125
      GO TO 120
C      SLNGTH IS THE NUMBER OF CHARACTERS COMPRISING A STRING
125   SLNGTH(JJ)=K-1
      JJ=JJ+1
C      READ ANOTHER STRING
      IF (JJ.LT.27) GO TO 115
130   NSTRNG=JJ-1
      WRITE (PRINT,65) ,NSTRNG
C      LIST THE STRINGS
      DO 135 J=1,NSTRNG
      M=SLNGTH )
135   WRITE (PRINT,70) ,ALPHB(J),SLNGTH(J),(STRING(JJX)JX=1,M)
C      READ DATA DECK
      WRITE (PRINT,75)
C      SET THE INPUT ARRAY TO BLANKS
      LTYPE=0
```

```
140   DO 145 J=1,NCIN                                                        A1900
      DO 145 JJ=1,IWIDTH                                                     A1910
145   KARD(J,JJ)=SPACE                                                       A1920
C     READ THE PROPER NUMBER OF INPUT CARDS                                  A1930
      IF (LTYPE.NE.0) GO TO 185                                              A1940
      KT=0                                                                   A1950
150   DO 180 J=1,NCIN                                                        A1960
C     KARDIN IS A TEMPORARY INPUT AREA                                       A1970
      READ (READ,5) ,(KARDIN(JX),JX=1,IWIDTH)                                A1980
      IF (KARDIN(80).EQ.STOP) CALL IFEND                                     A1990
C     IF LCOL IS ZERO, TYPE IS DETEMINED BY ORDER OF APPEARANCE              A2000
      IF (LCOL.EQ.0) GO TO 160                                               A2010
C     COMPARE LABEL WITH NUMBERS FROM ALPHABET CARD                          A2020
      DO 155 JJ=28,36                                                        A2030
      IF (ALPHB(JJ).NE.KARDIN(LCOL)) GO TO 155                               A2040
C     KTYPE IS THE TYPE OF CARD BEING READ                                   A2050
      KTYPE=JJ-27                                                            A2060
      GO TO 165                                                              A2070
155   CONTINUE                                                               A2080
      KTYPE=1                                                                A2090
      GO TO 165                                                              A2100
160   KTYPE=J                                                                A2110
C     IF THE CARD TYPE NUMBER IS LESS THAN FOR THE LAST CARD, THIS IS A      A2120
C     NEW SET OF DATA                                                        A2130
165   IF (KTYPE.LE.KT) GO TO 175                                             A2140
      KT=KTYPE                                                               A2150
      DO 170 JJ=1,IWIDTH                                                     A2160
C     TRANSFER THE INPUT FROM KARDIN TO KARD                                 A2170
C     KARD IS THE INPUT ARRAY                                                A2180
      GO TO 180                                                              A2200
170   KARD(KTYPE,JJ)=KARDIN(JJ)                                              A2190
C     LTYPE INDICATES WHAT TYPE OF CARD HAS BEEN LEFT IN KARDIN              A2210
175   LTYPE=KTYPE                                                            A2220
      KT=KTYPE                                                               A2230
      GO TO 195                                                              A2240
180   CONTINUE                                                               A2250
      LTYPE=0                                                                A2260
      GO TO 195                                                              A2270
185   DO 190 J=1,IWIDTH                                                      A2280
190   KARD(LTYPE,J)=KARDIN(J)                                                A2290
      GO TO 150                                                              A2300
C     PRODUCE THE OUTPUT CARDS, ACCORDING TO INSTRUCTIONS                    A2310
195   DO 240 KN=1,NCOUT                                                      A2320
C     BUFFR IS THE BUFFER ARRAY USED TO STORE THE OUTPUT UNTIL A CARD IS     A2330
C     READY TO BE PRODUCED                                                   A2 0
C     KNTR IS THE COLUMN POSITION IN BUFFER                                  A2350
      KNTR=0                                                                 A2360
      I=1                                                                    A2370
C     FIND THE REQUESTED STRING                                              A2380
200   N=SNUMBR(KN,I)                                                         A2390
      DO 205 J=1,26                                                          A2400
C     COMPARE STRING LETTER WITH ALPHABET                                    A2410
      IF (N.NE.ALPHB(J)) GO TO 205                                           A2420
      M=J                                                                    A2430
      GO TO 210                                                              A2440
205   CONTINUE                                                               A2450
C     IF NO STRING IS TO BE INSERTED, SKIP NEXT SECTION OF PROGRAM           A2460
      GO TO 220                                                              A2470
210   N=SLNGTH(M)                                                            A2480
C     TRANSFER THE STRING TO OUTPUT                                          A2490
      DO 215 J=1,N                                                           A2500
      KNTR=KNTR+1                                                            A2510
      IF (KNTR.GT.80) CALL COVFL                                             A2520
215   BUFFR(KNTR)=STRING(M,J)                                                A2530
```

```
220   IF (FNUMBR(KN,I).EQ.0) GO TO 235
      IF (CNUMBR(KN,I).EQ.0) GO TO 230
C     USE FNUMBR AND CNUMBR TO LOCATE A FIELD IN THE INPUT
      N1=FNUMBR(KN,I)
      N2=CNUMBR(KN,I)
      N=FSTRT(N2,N1)
      NN=FWIDTH(N2,N1)+N-1
C     READ THE FIELD INTO THE OUTPUT
      DO 225 J=N,NN
      KNTR=KNTR+1
      IF (KNTR.GT.80) CALL COVFL
225   BUFFR(KNTR)=KARD(N2,J)
230   I=I+1
C     IF ANY MORE FIELDS ARE TO BE FILLED, RECYCLE AND CONTINUE WRITING
C     IN THE OUTPUT ARRAY
      GO TO 200
C     PRINT THE BUFFER ARRAY
235   WRITE (PRINT,25) ,(BUFFR(J)J=1,KNTR)
C     PUNCHING IS SUPPRESSED IF THE SAME UNIT IS SPECIFIED FOR PUNCH AS
C     FOR PRINT
      IF (PUNCH.EQ.PRINT) GO TO 240
C     PUNCH THE BUFFER ARRAY ON A CARD
      WRITE (PUNCH,5) ,(BUFFR(J)J=1,KNTR)
C     ASSEMBLE THE NEXT KIND OF OUTPUT CARD
240   CONTINUE
C     MAKE ANOTHER PASS THROUGH THE PROGRAM
      GO TO 140
      END
```

```
      SUBROUTINE COVFL
C     THE SUBROUTINE COVFL IS CALLED IF KNTR EXCEEDS 80, INDICATING THAT
C     THE OUTPUT ARRAY BUFFR HAS BEEN FILLED
      COMMON ALPHB,READX,READ,PRINTX,PRINT,PUNCHX,PUNCH,KARDIN,KNTR,KARD
      COMMON BUFFR
      INTEGER PUNCH,PRINT,BUFFR
      DIMENSION BUFFR(80), ALPHB(80)
C     **** THE DIMENSIONS BELOW MAY BE REDUCED TO CONSERVE STORAGE ****
      DIMENSION KARD(9,132), KARDIN(132)
C     **** THE DIMENSIONS ABOVE MAY BE REDUCED TO CONSERVE STORAGE ****
5     FORMAT (80A1)
10    FORMAT (/1X,80A1)
      KNTR=1
C     TRANSFER THE ARRAY TO OUTPUT AS SPECIFIED BY THE UNIT NUMBERS
      WRITE (PRINT,10) ,(BUFFR(JX)JX=1,80)
      IF (PUNCH.EQ.PRINT) RETURN
      WRITE (PUNCH,5) ,(BUFFR(JX)JX=1,80)
      RETURN
      END
```

```
      SUBROUTINE IFEND
C     THE SUBROUTINE IFEND IS CALLED WHEN A STOP CHARACTER IS READ IN
C     COLUMN 80 OF AN INPUT
C     IT CHECKS TO SEE WHETHER AN END-OF-DATA CARD HAS BEEN READ
      COMMON ALPHB,READX,READ,PRINTX,PRINT,PUNCHX,PUNCH,KARDIN,KNTR,KARD
      COMMON BUFFR
      DIMENSION BUFFR(80), ALPHB(80)
C     **** THE DIMENSIONS BELOW MAY BE REDUCED TO CONSERVE STORAGE ****
      DIMENSION KARD(9,132), KARDIN(132)
```

```
C        **** THE DIMENSIONS ABOVE MAY BE REDUCED TO CONSERVE STORAGE ****
         INTEGER KARD,BUFFR,READ,PRINT,PUNCH,READX,PRINTX,PUNCHX,ALPHB
5        FORMAT (22H0END-OF-DATA CARD READ)
         DO 10 J=1,80
C        COMPARE EACH COLUMN AGAINST THE FIRST CONTROL CARD
         IF (KARDIN(J).NE.ALPHB(J)) RETURN
10       CONTINUE
C        THIS IS AN END-OF-DATA CARD
C        WRITE END-OF-JOB MESSAGE
         WRITE (PRINTX,5)
C        WRITE AN END OF FILE ON ANY OUTPUT TAPE UNITS
C        REWIND ALL TAPE UNITS
         IF (READ.NE.READX) REWIND READ
         IF (PRINT.NE.PRINTX) END FILE PRINT
         IF (PRINT.NE.PRINTX) REWIND PRINT
         IF (PUNCH.NE.PUNCHX.AND.PUNCH.NE.PRINT) END FILE PUNCH
         IF (PUNCH.NE.PUNCHX.AND.PUNCH.NE.PRINT) REWIND PUNCH
         STOP
         END
```


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