NBS TECHNICAL NOTE

433

Input/Output Packages for the Systems 360 Assembly Language Processor

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] was established by an act of Congress March 3, 1901. Today, in addition to serving as the Nation's central measurement laboratory, the Bureau is a principal focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce. To this end the Bureau conducts research and provides central national services in three broad program areas and provides central national services in a fourth. These are: (1) basic measurements and standards, (2) materials measurements and standards, (3) technological measurements and standards, and (4) transfer of technology.

The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, and the Center for Radiation Research.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement, coordinates that system with the measurement systems of other nations, and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of an Office of Standard Reference Data and a group of divisions organized by the following areas of science and engineering:

> Applied Mathematics—Electricity—Metrology—Mechanics—Heat—Atomic Physics—Cryogenics[2]—Radio Physics[2]—Radio Engineering[2]—Astrophysics[2]—Time and Frequency.[2]

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to methods, standards of measurement, and data needed by industry, commerce, educational institutions, and government. The Institute also provides advisory and research services to other government agencies. The Institute consists of an Office of Standard Reference Materials and a group of divisions organized by the following areas of materials research:

> Analytical Chemistry—Polymers—Metallurgy — Inorganic Materials — Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides for the creation of appropriate opportunities for the use and application of technology within the Federal Government and within the civilian sector of American industry. The primary functions of the Institute may be broadly classified as programs relating to technological measurements and standards and techniques for the transfer of technology. The Institute consists of a Clearinghouse for Scientific and Technical Information,[3] a Center for Computer Sciences and Technology, and a group of technical divisions and offices organized by the following fields of technology:

> Building Research—Electronic Instrumentation — Technical Analysis — Product Evaluation—Invention and Innovation— Weights and Measures — Engineering Standards—Vehicle Systems Research.

THE CENTER FOR RADIATION RESEARCH engages in research, measurement, and application of radiation to the solution of Bureau mission problems and the problems of other agencies and institutions. The Center for Radiation Research consists of the following divisions:

> Reactor Radiation—Linac Radiation—Applied Radiation—Nuclear Radiation.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D. C. 20234.

[2] Located at Boulder, Colorado 80302.

[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

UNITED STATES DEPARTMENT OF COMMERCE
C. R. Smith, Secretary
NATIONAL BUREAU OF STANDARDS • A. V. Astin, Director

NBS TECHNICAL NOTE 433

ISSUED SEPTEMBER 1968

Input/Output Packages for the Systems 360 Assembly Language Processor

P. A. D. deMaine

Systems Research and Development Division
Center for Computer Sciences and Technology
Institute for Applied Technology
National Bureau of Standards
Washington, D.C. 20234

NBS Technical Notes are designed to supplement the Bureau's regular publications program. They provide a means for making available scientific data that are of transient or limited interest. Technical Notes may be listed or referred to in the open literature.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402
Price 25 cents.

Contents

INPUT/OUTPUT PACKAGES FOR THE SYSTEMS 360 ASSEMBLY LANGUAGE PROCESSOR

P. A. D. deMaine

Three input-output (I/O) software packages for use with the Assembly Language Processor (ALP) of the Systems 360 are described. They are for card read, on-line-print and card punch operations. A single pseudo-operation statement, which contains all required formats and addresses, suffices for the execution of each input-output package. Printed error and guide messages aid in program debugging. In addition to the conventional formats (A, I, F and E), Systems 360 column binary (X) and hexadecimal (J and B) are permitted. With a single pseudo-operation these I/O packages can handle up to eight individual items or arrays of any length in a single or mixed format.

Key words: Assembly language; card punch; card read; input/output; on-line print; system 360.

1. Introduction

As the first step in coding the SOLID System [1] for the Systems 360, some additions to the Assembly Language Processor (APL)[1] had to be made. At the time of writing there is still a lack of input/output capability for handling any but the most primitive formats (Systems 360 column binary and core dumps). The I/O packages which are described here have been coded in compiler. The packages themselves have been incorporated into the Systems [2], which is now being implemented for evaluation on the IBM 360/40 (with 262K memory, two 2311 disk drives and eight 2402 tape drives) at the Washington Data Processing Center, Department of Agriculture, Independence Avenue, Washington, D. C.

The author's prior experience with monitors for medium machines[2] and the PORTHEUS and IBSYS executive systems have contrib-

---

[1]See IBM manuals A22-6821-2 and A22-6810-7

[2]For example, the IBM 620/40K with 1316 disk drive at the University of California, Santa Barbara, and the IBM 620/60K at the University of Mississippi, Oxford.

uted[1] much to the design of the new I/O packages. Basic to the design is the concept that I/O should be easy to use, without sacrificing the versatility achieved in some large systems (e.g., with FORTRAN IV). In this regard the elegant simplicity of the I/O for earlier versions of FORTRAN for smaller machines, notably the FORTRAN WITHOUT FORMAT (IBM 4-1-61), and especially for FAP in PORTHEUS are particularly attractive. The Systems 360 assembly language, with its instructions for selectively opening (OPEN) and closing (CLOSE) peripheral devices and its dual logic[2] appears to be ideally suited for designing general-purpose I/O packages that can be used in any of the coding levels of the SOLID System.

The purpose of this report is to describe the essential features of the new Systems 360 I/O packages. The individual packages are described in detail in other reports[3].

2. Description of New I/O Packages

Each of the three new I/O packages, read cards (REIDY), punch cards (PUNXH), and print (PRlNT), contains a single macro-subroutine and at least one calling macro, which generates the calling procedure for the subroutine at assembly time. The prototype statements for each macro contain all the information needed to execute the I/O operation. The prototype statement for each macro-subroutine defines the registers which are to be used to establish addressability, i.e., USING, and to branch, i.e., the return vector. See Table I. Storage (in bytes) required for the assembled components are given in the table. At assembly time the instruction SUBMP correctly positions each subroutine. Calling procedures, generated by the single pseudo-operations are assembled in the main body of the object program; formats (&F) and addresses (&FROM, &TO, &W1, &W2, ..., &W8) are defined, and the USING and branch registers &UR and &RR are discussed in the following paragraphs.

---

[1]PORTHEUS, the executive system for the IBM 7094/1401 at the University of Illinois, is itself a modification of the University of Michigan's MAD System, and the IBSYS is the executive system for the IBM 7094/7040 at the Western Data Processing Center, University of California, Los Angeles.

[2]These are identified at (1) storage-to-storage instructions in which only base registers appear and (2) the normal instruction set in which registers are used for indexing and/or arithmetic.

[3]All detailed reports on the SOLID System are published as National Bureau of STnadards Technical Notes. Listing of the packages can be obtained on request.

TABLE I. Prototype statements for the calling procedure macros and macro-subroutines for the indicated I/O packages.

	Calling Procedure Macro		Macro-Subroutine	
I/O Package	Prototype Statement for I/O Pseudo-Operstions	Storage		Storage
PRINT	&J PRINT &F, &FROM,&TO	12.6	SPRINT PRINT, &UR, &RR	1406
PUNCH (Cards)	&J PUNXH &F, &FROM, &TO	356*	SPUNXH PUNCH, &UR, &RR	1400
	&J REIDI &F, &W1	164		
	&J REID2 &F, &W1, &W2	170		
	&J REID3 &F, &W1, &W2, &W3	176		
READ	&J REID4 &F, &W1, &W2, ..., &W4	182	SREID READC, &UR, &RR	2400
(Cards)	&J REID5 &F, &W1, &W2,...,&W5	188		
	&J REID6 &F, &W1, &W2,...,&W6	194		
	&J REID7 &F, &W1, &W2,...,&W7	200		
	&J REID8 &F, &W1, &W2,...,&W8	206		

* Special X-format version requiring no SPUNXH subroutine.

Two other macros, which have no arguments, play an important part: (1) RESERVE, which is inserted immediately after the START instruction of the source program, generates instructions for opening peripheral devices and defines all constants, counters, words, DCB or format statements[1], arrays and registers used in the SOLID System. If the new I/O packages are to be used separately from the SOLID System some instructions in RESERVE can be omitted. (2) SUBMP, which precedes the END instruction in the source program, generates instructions for closing peripheral devices, establishes addressability (via the USING statement), allocates the branch register and correctly positions each subroutine. The branch, i.e., the return vector, and USING registers for each subroutine are changed by replacing a single instruction (the prototype statement for the macro-subroutine) in the SUBMP macro. In our programs either of two registers (8 or 9) may be used to establish addressability in the subroutine. Any one of five registers (1, 4, 6, 7, and 8 or 9) may be assigned for

[1]Two DCB's are defined: The first (for printing) handles 133 bytes, and the second (for punching or reading) handles 80 bytes.

branching back from the subroutine to the calling procedure.

The single statement (pseudo-operation) which assembles the calling procedure for the designated subroutine can be inserted anywhere in the source program between the RESERVE and SUBMP pseudo-operations. The storage required for each calling procedure is given in Table I.

INPUT/OUTPUT PACKAGES.....

I/O PSEUDO-OPERATIONS

The pseudo-operations for the three I/O packages are as follows:

PRINT	F, FROM, TO	... On-line print
PUNXH	F, FROM, TO	... Punch card(s)
REIDY	F, W1, W2, ..., ..., WY	... Read cards(s)

In the REIDY pseudo-operation, Y is a numeral (1 to 8) which corresponds to the number of variables (W1, W2, ...) entered.

Addressing: Addresses of variables appearing in the pseudo-operations (FROM, TO, W1, W2, ¶3, ..., W8) can have any form, permitted for the Systems 360 assembly language, except D1(R1, B1) Some examples of permitted addresses are Z, Z+1, Z(IR), O(IR), 1000, 1000(IR), IR, = C'ADDRESS', and *+r, with IR an index register.

PRINT F,0,9 will list the contents of general registers 0 to 9. Except for the requirement that FROM must not be greater than TO[1], there is no restriction on the addresses which can appear in the PRINT and PUNXH pseudo-operations. If protected locations in low and high core areas are addressed in a REIDY pseudo-operation, the ADDRESSING ERROR message is given and the I/O is terminated.

Formats: The code F, which appears in all pseudo-operations, is used to compute the individual formats for each string or word handled by the I/O packages. The seven individual formats are Hollerith (A), Systems 360 Column Binary (X), Strings (J) and four-byte words (B) of hexadecimal digits, and the conventional decimal formats (I, E and F).

---

[1] In case of this error the I/O operation is terminated with the message ADDRESSING ERROR, and control returns to the calling procedure for reassignment to the next instruction.

The following definitions are needed to understand the computational rules. A field of length N contains N printed or punched EBCDIC codes (the System 360 field data doces of eight bits). In the PUNXH and PRINT pseudo-operations B, I, F, E, or mixed formats[1] yield fields with a fixed length of 14 EBCDIC codes, which are separated either by two blanks (PRINT) or by a blank and a 0-8-2 punch (PUNXH). With the REIDY pseudo-operation and the same formats a single card can have up to 20 fields with a maximum total length of 80 columns. In this case a single 0-8-2 punch terminates each field. However, only for single arrays (Y + 1) will the computer read more than Y fields per card.

With an A, X, or J format and one variable the single field can have any length. Strings of Hollerith (A) or hexadecimal (J) information are terminated with two 0-8-2 punches. Each field of Systems 360 column binary (X format) is prefaced with a single card which contains the total number of bytes which are to be read (REIDY) or punched (PUNXH).

A variable designates either an array or a single item of I/O information. The number of variables (NOV) in the REIDY pseudo-operation equals the integer Y, which is less than nine. In the PUNXH and PRINT the number of variables equals the number of individual formats in the format code F. In this case the maximum value for NOV is five (PUNXH) or eight (PRINT).

The format code F in each I/O pseudo-operation consists of a single string of from one to five (PUNXH) or eight (PRINT and REIDY) format symbols (i.e., A, X, J, B, I, F and E). Mixed strings like AEIFBB can contain the column binary (X) and hexadecimal string (J) formats but the reader is advised to avoid their use. Word alignments are particularly important and, in the general case, difficult to keep straight. In the REIDY pseudo-operation an asterisk at the beginning of the format code F means that the information will be read from more than one card.

X format was designed for the esay manipulation of Systems 360 column binary information. The pseudo-operation PUNXH X, FROM,TO means that (TO - FROM + 1) bytes of information, located in the computer in the area FROM to TO, are to be punched in column binary, i.e., 80 bytes/card. A single card containing the column binary number (TO - FROM + 1) prefaces the card deck. The pseudo-operation REID1 *X,BEGIN means that column binary is to be loaded starting at the byte with address BEGIN. The first card, of the input deck contains the number of bytes (column binary) to be read.

---

[1] A typical mixed format is obtained by entering ABFIEIII for the code F; this means that eight fields are to have formats A, B, F, I, E, I, I and I, respectively.

3. Computer Procedures

One feature of the new I/O package is a system of error messages and corrective procedures that greatly increases its usefulness. In this section the computational procedures are first described and then some actual examples of formats and I/O messages are given.

At assembly time the Pseudo-operations, which appear in the source program, are used to construct the calling procedures for the I/O subroutines. The flow-chart for a typical calling procedure is given in Figure I. After saving all index registers, the format (F) and number of variables (Y) are transferred to storage areas FORMAT and NOV. In the next step certain information from the calling procedure (see examples) is stores in a temporary array. This information will be used in the subroutine to construct the printed guide statement. Next the absolute address for each variable (W1, W2, --- WY) is obtained by the load address operation and stored in the array ADDRESS. The location of the pseudo-operation in the source program is stored in register 5, after which the branch-and-link procedure is executed. The return vector (branch register) contains the address of the last statement in the calling procedure, which resets all index registers to their initial values. For the PUNXH and PRINT I/O packages, NOV (number of variables) is calculated in the subroutines.

In all subroutines the number of format symbols in FORMAT are counted in NF. In the REIDY subroutine the next step is to compare the number of variables (NOV) and the number of formats (NF). If NOV = NF ≠ 1, either arrays (designated by an asterisk in the left-hand byte of FORMAT) or NOV single items are to be read. If NOV = NF = 1 and a single array is indicated (see previous discussion of Formats on page), NOV is set equal to 20 and the format symbol (in the left byte of FORMAT) is propagated in the first 20 positions of array FORMAT. If NOV ≠ NF, NOV is set equal to NF and the first symbol in FORMAT is propagated for all fields. Some results of these computations are illustrated below:

1. Each of the pseudo-operations REID2 I,W1,W2; REID2 IBE, W1,W2 and REID2 II,W1,W2 will read two fields with decimal integer formats from a single card.

2. REID2 *I,W1,W2; REID2 *IAE,W1,W2; or REID2 *II,W1,W2 will read two fields per card with decimal integer format until a double 0-8-2 punch, which signified the end of the arrays, is encountered.

3. REID1 *I,W1 will read up to 20 decimal integer fields per card until the termination code (a double 0-8-2 punch) is encountered.

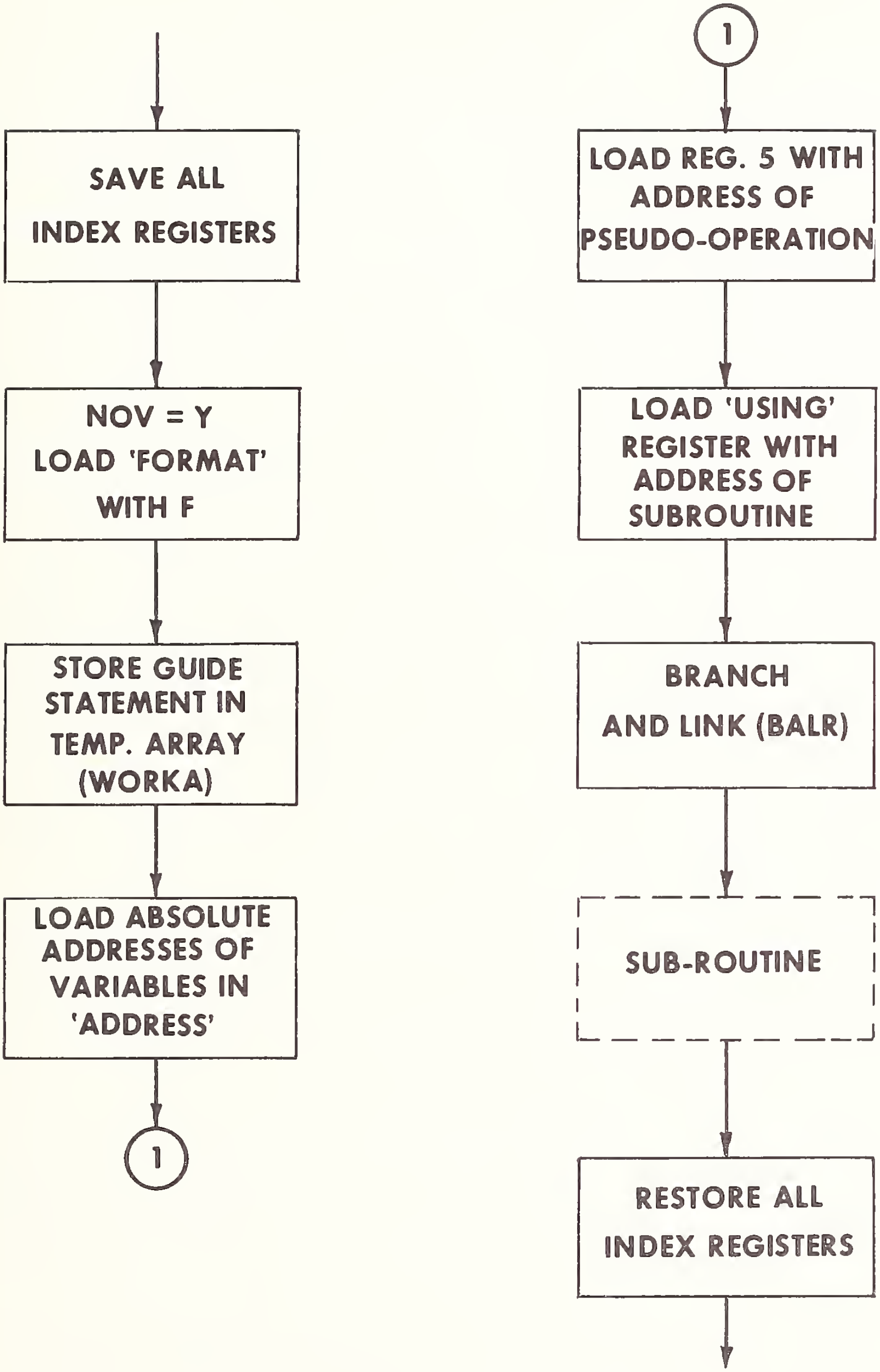

FIGURE 1. Flow Chart for the CALLING PROCEDURE of the Card-Read I/O Package: Pseudo-Operation REIDY F, W1, W2, W3, ..., WY

4. REID1 *I$\overline{X}$,W1, with $\overline{X}$ equal to any format symbol, will read one decimal integer per card until the termination code is encountered.

In the PUNXH and PR1NT subroutines, after counting the format symbols in FORMAT with NF, the two addresses (FROM and TO) are compared. If FROM is greater than TO, the guide and error statements are assembled and printed (see examples), then control returns to the calling procedure for reassignment. Otherwise, the number of variables (NOV) is set equal to minimum [N, (1 + (TO - FROM)/4][1], with N = 5 (PUNXH) or 8 (PR1NT), and NOV is compared with NF. If NF equals NOV, all fields have been assigned formats. Otherwise NF is set equal to NOV and the first format symbol is propagated in the first five (PUNXH) or eight (PR1NT) bytes of FORMAT. The consequences of these actions are illustrated next:

1. PR1NT B,FROM,FROM+28; PR1NT BIA,FROMFROM+28 will print a single line with eight fields of length 14. Each field will contain eight hexadecimal digits, right-adjusted.

2. PR1NT IBIEFEIB,FROM,FROM+60 will print two lines, each with eight fields of length 14 and separated by two blanks. The eight data fields of numbers, beginning on the left, will be in I,B,I,E,F,E,I,and B formats. PUNXH would yield similar results for cards with 80 columns. If single A or J formats are used in either the PR1NT or PUNXH pseudo-operations the field boundaries are ignored and a single string of Hollerith (A) or hexadicimal (J) characters are printed (132 characters per line) or punched (80 characters per card).

In the next step the guide statement is constructed and printed. This statement contains the hexadecimal location of the pseudo-operation, the address(es) in the pseudo-operation (FROM, TO, etc.), and the format which is to be used for each field. With the PUNXH pseudo-operation another guide statement, with an asterisk in column one, is also punched. With the REIDY pseudo-operation the first 16 characters on the first data-card are printed immediately after the guide-statement. Also, in REIDY, any card with an asterisk in column one is treated as a normal comment card and is printed. The minor restriction this imposes on fields with Hollerith (A) format is a small price to pay for the easy method of clearly labeling input information.

No attempt will be made here to describe details of the three I/O packages. Single strings of Hollerith (A) or hexadecimal (J) information create no special problems.[2]

---

[1]A four-byte word is assumed

[2]All blanks are eliminated from hexadecimal input

The results achieved with these packages are summarized for B,I,F,E and mixed formats:

1. Input (REIDY) (B,I,F and E Formats)

a. The actual information stored for each field occupies four bytes. Floating-point numbers are always stored in their normalized forms. Hexadecimal and decimal integer numbers are right-adjusted.

b. Blanks and leading zeros in fields with B,I,E and F formats are eliminated. If the number is too large to be represented in 32 binary bits, truncation occurs on the right. Examples are as follows:

Hexadecimal: 00 12 375EF FE1 is stored as 12375EFF.
Decimal Integer: -01 23456789998 is stored as -12345678999.

The truncation rules for F and E formats are determined by the number of significant decimal digits before and after the decimal point and the magnitude of the exponent. In general, numbers between $\pm 10^{-12}$ and $\pm 10^{12}$ can, of course, be entered via the hexadecimal (B) format.

c. With E or F format 1, 1.0, 0.001E+3, 1000E-02 etc. is stored as 0.1 E+01.

2. Output (PUNXH and PRINT) (B,I,F and E Formats)

There is no special problem associated with a field which has B or I formats. With E and F formats the following rules apply:

a. All numbers are printed or punched in their normalized forms.

b. If the number requested has an exponent greater than 11 or less than -11, the hexadecimal form is printed or punched.

c. Blanks in the fractional part of a printed or punched floating-point number indicate that significant bits of information were lost during conversion of the binary representation to its decimal form. That is 0.11 E+12 means that only the first two significant numbers are reliable, 0.1100000E+12 means that the first seven significant numbers are reliable. Some examples of the various forms of I/O formats and messages are given in the next section.

4. Examples

Throughout this section the $ means an 0-8-2 punch. In the REIDY pseudo-operation a single 0-8-2 punch terminates each field and a double 0-8-2 punch at the end of the last field terminates arrays. Each line of data is on a single card.

I. The statement:

```
REID2 I, NV, JI
```

(1) read a single card:

```
2     $0   $          (two fields of length 6)
```

(2) and printed:

```
****************************************************************

READ IN AFTER STATEMENT 00009E82.  INFORMATION FOR NV, JI.
FORMAT=II
THE FIRST 16 BYTES READ WERE:  2    0    .8 BYTES STORED.

****************************************************************
```

(Both NV and JI are stored as decimal integers.) The location of the REIDY operation in the program is 00009E82.

II. The statement:

```
REID2 IE,SOS(3),LSX(3)
```

(1) read a single card:

```
0    $.12$          (two fields, lengths 6 and 3)
```

(2) and printed:

```
****************************************************************


READ IN AFTER STATEMENT 00009F34.  INFORMATION FOR SOS(3),LSK(3).
FORMAT=IE
THE FIRST L§ BYTES READ WERE:  0     .12     .8 BYTES STORES.

****************************************************************
```

(sos(3) contains a decimal integer; and LSX(3) contains a normalized floating point number.)

III. The statement:

```
REID1*E,O(BRYY)
```

read 561 floating and fixed point numbers and stored them as normalized floating point in the indicated array, beginning with O(BRYY)[1]. The 561 numbers were punched nine to a card, with fields of length 7. A double 0-8-2 punch terminated the I/O operation. The guide statement printed was:

```
**************************************************************

READ IN AFTER STATEMENT 0000A00E.  INFORMATION FOR O(BRYY) ARRAYS.
FORMAT=EEEEEEEE
THE FIRST 16 BYTES READ WERE:  90.0   88.5 86.2244 BYTES STORED.

**************************************************************
```

IV. The statement:

```
PRINT I,LEXMODE,LEXCON
```

printed:

```
**************************************************************

AFTER STATEMENT 00009BCA.  FIRST=LEXMODE; LAST=LEXCON; FORMAT=I
ADDRESSING ERROR

**************************************************************
```

because the address of LEXMODE was larger than LEXCON.

V. The statement:

```
PRINT BBBBE,PCORDS(2),PCORDS(3)
```

printed:

```
**************************************************************

AFTER STATEMENT 000085B0.  FIRST=PCORDS(2); LAST=PCORDS(3);
FORMAT=BBBBE
01502800   00000000    00000000    00000000    +0.3999996E-02

**************************************************************
```

---

[1]BRYY is an index register.

ACKNOWLEDGMENTS

This work was supported by transfer of funds AG-69 from the National Science Foundation. The helpful attitudes of personnel on the operations staff at the Washington Data Processing Center, Department of Agriculture, are gratefully acknowledged.

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, chemistry, and engineering. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts.

Published in three sections, available separately:

- **Physics and Chemistry**

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $5.00; foreign, $6.00*.

- **Mathematical Sciences**

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, $2.25; foreign, $2.75*.

- **Engineering and Instrumentation**

Reporting results of interest chiefly to the engineer and the applied scientist. This section includes many of the new developments in instrumentation resulting from the Bureau's work in physical measurement, data processing, and development of test methods. It will also cover some of the work in acoustics, applied mechanics, building research, and cryogenic engineering. Issued quarterly. Annual subscription: Domestic, $2.75; foreign, $3.50*.

TECHNICAL NEWS BULLETIN

The best single source of information concerning the Bureau's research, developmental, cooperative and publication activities, this monthly publication is designed for the industry-oriented individual whose daily work involves intimate contact with science and technology—*for engineers, chemists, physicists, research managers, product-development managers, and company executives.* Annual subscription: Domestic, $1.50; foreign, $2.25*.

*Difference in price is due to extra cost of foreign mailing.

NONPERIODICALS

Applied Mathematics Series. Mathematical tables, manuals, and studies.

Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications. Proceedings of NBS conferences, bibliographies, annual reports, wall charts, pamphlets, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

National Standard Reference Data Series. NSRDS provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated.

Product Standards. Provide requirements for sizes, types, quality and methods for testing various industrial products. These standards are developed cooperatively with interested Government and industry groups and provide the basis for common understanding of product characteristics for both buyers and sellers. Their use is voluntary.

Technical Notes. This series consists of communications and reports (covering both other agency and NBS-sponsored work) of limited or transitory interest.

CLEARINGHOUSE

The Clearinghouse for Federal Scientific and Technical Information, operated by NBS, supplies unclassified information related to Government-generated science and technology in defense, space, atomic energy, and other national programs. For further information on Clearinghouse services, write:

Clearinghouse
U.S. Department of Commerce
Springfield, Virginia 22151

Order NBS publications from:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

U.S. DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20230

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE