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The Conversion of Paper Tape to Magnetic Tape: A PDP-1 Program

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Introduction

Though paper tape as a storage medium is inefficient with respect to both speed and space, the low cost of a punch recommends it for use in exploratory experiments where the initial cost of more efficient storage is not justified. And so over the past several years, I have been asked to transfer information stored on punched paper tape to magnetic tape. The first two such requests I fulfilled by writing a different PDP-1 program for each paper tape, since both format and character sets were different. When the third request came with yet another variation of character set and format, I was convinced that writing a generalized code would be worth the effort. I felt more requests would follow as, indeed, they did. But by then, the following program was written and all that is now necessary each time is a new set of definition cards. Those needing to convert paper tape to magnetic tape should find this method quite useful.

General Information

Behind the subroutine (binary) deck of this PDP-1 program are one or more cards (called ''character definition cards'') which define the translation of characters from paper tape code to magnetic tape code. Each source of paper tape requires the generation of a set of definition cards which contain an entry for each paper tape character (combination of punched holes across the paper tape). For almost every definition card entry, an entry is made in a PDP-1 memory table which contains three parts: (1) a vector to that subroutine which is to be executed as a result of encountering the character, (2) a six bit character translation to be used by those subroutines which put it into the magnetic tape output buffer, (3) a seven bit character to be used by those subroutines which put it into the CRT display buffer. Following the reading of these cards, communications between user and program is through the console CRT and light pen, and it is for this communication that the latter display buffer is sometimes used. Since the magnetic tape is intended for FORTRAN format reading (i.e., some variant of 6 bit BCD), its parity is even and its records are limited to 120 characters. For this parity, the character, $\emptyset\emptyset_8$, must not be used or a character skip error on the magnetic tape results. The limit on record length means the output buffer must be written before it exceeds 120 characters. Also, because the PDP-1 can write magnetic tape only with record lengths that are multiples of 18 bits (or three tape characters), the final one to three characters are 77_8. If this choice of padding character proves too inconvenient, an additional load control can be used to specify any other character desired. (See Definition Cards Section.)

Running the Program

For the moment, assume that definition cards are available and, in fact, are stacked behind the binary subroutine and main program cards. Refer to the labelled photograph of the PDP-1 console and tape reader (Figure 1). To the left of the console in the

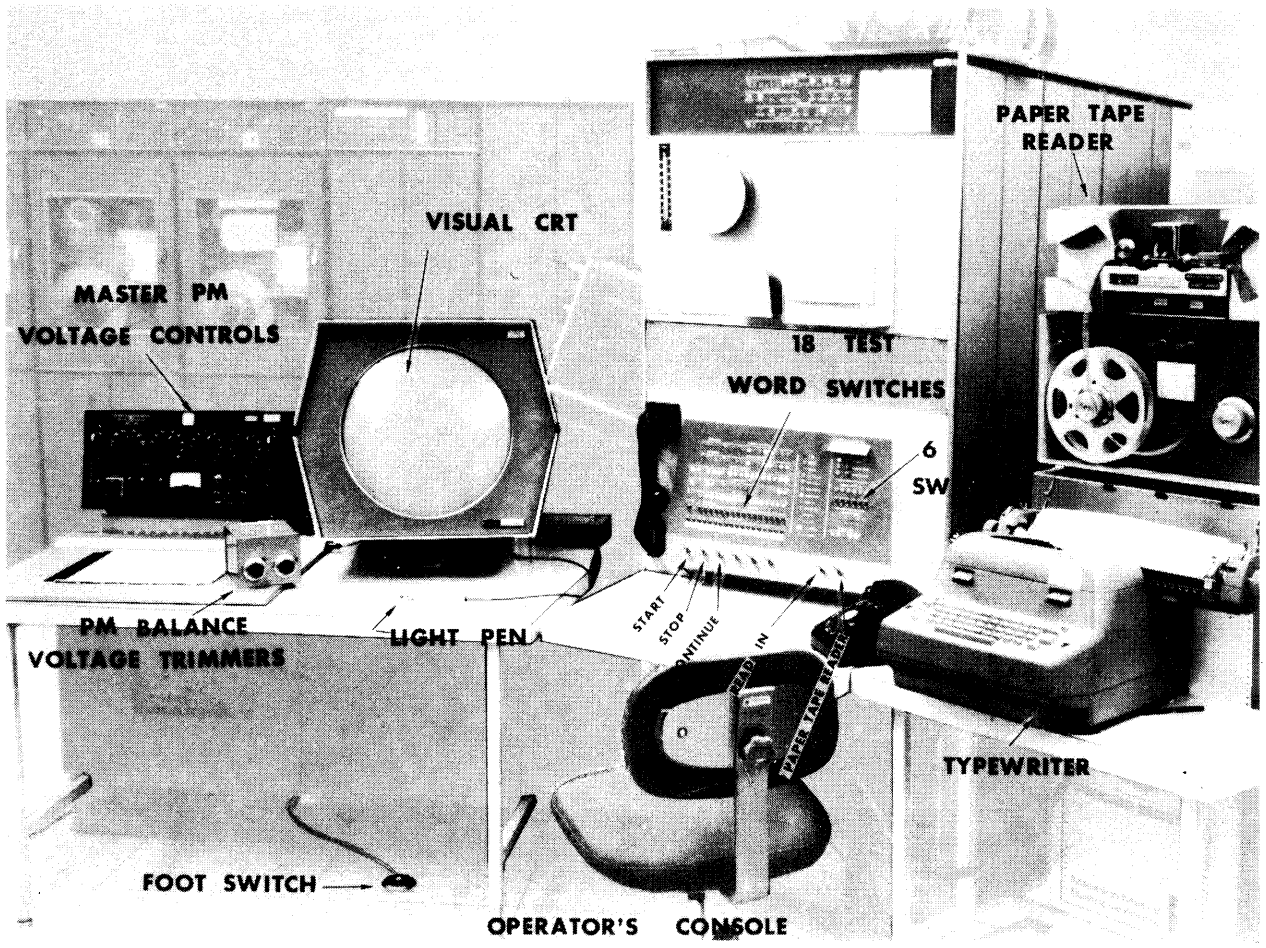


Fig. 1. PDP-1 console and paper tape reader.

background of the area covered by the photograph are three IBM 729 magnetic tape transports. Proceed as follows:

1. Take a magnetic tape onto which the information is to be transferred and load it onto any of these units. The write enable ring must be in the reel, of course.
2. Turn the ''logical unit'' dial on the tape drive to 3.
3. Place the binary program deck in the card reader (which is located further to the left of the installation shown in Figure 1).
4. Place the steel card on top.
5. Close the wobble gate.
6. Make sure the ''read'' rocker switch is on.
7. Depress ''reset''.
8. Depress ''load''. Normally, there is a closed loop of paper tape loaded in the paper tape reader (Figure 1, upper right). This is the system bootstrap loader which allows the selection of any program from the system magnetic tape for execution.
9. Raise the ''paper tape reader'' switch at the bottom right of the PDP-1 console; this starts the paper tape reader capstan and energizes the electromagnetic clamp to hold the tape from moving.
10. Depress ''read in'' switch on the Console. This results in the paper tape loop program being read in, which then reads a table from the system tape. The typewriter then prints ''TYPE ID''.
11. Depress the ''paper tape reader'' switch so that the loop will not be read as your input tape.
12. Type: lbc/
    The slash (/) indicates to the loader that the set of three letters preceding it is the name of the system routine to be executed. In this instance, lbc stands for *l*oad *b*inary *c*ards routine which is read from the system tape. The binary cards in the card reader are then read, followed by a four or five second pause, and then the definition cards. As indicated by the flow chart of Figure 2, the statement ''When paper tape is ready use light pen'' now appears on the console CRT.
13. Remove system loop from paper tape reader.
14. Load the paper data tape onto the reader, being certain that about ten leader characters are between the data and the read head. The reason for this is that the fifth character read is accepted as leader and all subsequent repetitions of this character in the leader are ignored until some other character is encountered.
15. Raise the ''paper tape reader'' toggle and the first few inches of the tape will be read.

16. Using the light pen, point at the displayed statement and depress against the CRT face (gently!). A slight movement of the light pen across the CRT face may be necessary in order to include some displayed point within its cone of sensitivity. When the light pen ''sees'' a point, the display disappears and the program begins interpreting the characters on the paper tape according to the definitions supplied. The system's response to certain types of tape information (as in the case of undefined characters, for example) may involve further user participation, as follows.

Undefined Characters

As indicated in Figure 2 should a previously undefined character be read from the paper tape, the program halts and a display will appear on the CRT which allows the operator three choices. These are:

- ''IGNORE IT?''
- ''CHANGE IT?''
- ''START OVER?''

If the undefined character occurs in the middle of a paper tape and the operator selects ''IGNORE IT'' the character will be ignored and the tape will continue. If the undefined character occurs during the leader portion of the paper tape, selecting the ''IGNORE IT'' response will not restart the tape. In this case, the operator must select ''START OVER''. The ''START OVER'' response clears the paper tape reader and allows the paper tape to run to its end without reading in any further characters. The operator can switch off the tape reader at any time to permit rewinding and restarting. During this process the position of the magnetic tape is not changed.

If the operator selects the ''CHANGE IT'' option the CRT display is replaced by the (octal) numerals 0 through 7. By use of the light pen the operator can then select two digits to replace those corresponding to the undefined character. The new digits selected are then ready to be read into the output buffer. The reading of paper tape is resumed after the operator actually causes the selected digits to be read into the output buffer by placing the light pen on one of the digits. Note that the selection of the replacement character does *not* mean that it is placed in the character definition table in memory. Only the output buffer is affected. Thus every subsequent occurrence of the undefined character will require the operator's intervention.

Included in the CRT display at the time an undefined character is encountered are symbols representing those characters read from paper tape since the last output buffer was written onto magnetic tape. Also, up to three octal digits are presented which represent the character in question as read from the paper tape. Were all holes punched for this character, this would be represented by 377 (octal), with the sprocket hole between the two sevens. Should the operator wish to look at the paper tape itself, he would find the character in question conveniently just to the left of the capstan.

Label Mode

As shown in Figure 2, certain characters on whose Definition Card an octal 12 is punched in the Memory Table Control column require the program to enter the label mode. Before doing so, any output buffer contents are written onto the magnetic tape. Termination of this mode is accomplished by striking the ''return'' key of the typewriter, and if nothing has been typed prior to it, nothing is written onto magnetic tape. Thus, the use of this subroutine does not require a label to be typed. If, however, the expected format of the magnetic tape requires a label, be sure to type one. Termination of this routine always results in ''ignore leader character'' mode. Should an error be made in the label, pointing at the display with the light pen will erase it, but even if there is insufficient room to retype the label on the typewriter the ''return'' key should not be struck or the label routine will terminate. Instead, manually return the carriage and roll the platen up one line. The translation of the typewriter keys to magnetic tape is in no way dictated by the definition cards; it is strictly according to ''Introduction to Octopus/6600'' (CIC Manual I-002), pages 24 and 25 in the ''on tape'' column.

The label mode has one function not indicated by its name; it allows the writing of as many file marks onto the magnetic tape as desired. Simply point at the statement ''Write an end of file'' and a file mark will be written followed by a pause during which no display exists, and then return to the label mode. This pause prevents unintended file marks from being written.

Definition Cards

Character definition cards contain the following data about each character in the paper tape character set, arranged in groupings of three columns (see Figure 3):

1. The paper tape character defined in an 8 bit, 3 digit octal code.
2. A memory table control character in a 5 bit, 2 digit octal code.
3. The PDP-1 ''Concise III'' display code for the character. It is in a 7 bit, 3 digit octal code.
4. The magnetic tape translation of the paper tape character in 6 bit tape code.
5. A load control character in 6 bit, 2 digit octal code.

The definition cards are read so that each column is treated in sequence without regard for card size. That is, logically, column 80 of one card immediately precedes column 1 of the card following with no significance attached to passing the end of a card. Initial blank columns are passed over. Starting with the first non-blank one, the columns are treated in *sets of three* as shown in Figure 3. The lower six positions of the third column are load control. These six bits allow sixty-four functions to be defined, but only three are presently implemented: Ø (no punches), 1 (9 punch), 2 (8 punch). Any other combination results in an error message on the CRT at the time it is encountered. See Table 1.

Punching Definition Cards

Note the following points:

1. When punching coded data on definition cards, note that in all cases the least significant bit position in any column is toward the 9 edge of the card.

2. When punching the paper tape character code in the first of a set of 3 columns, note the following example:

- To enter the octal code 216 (i.e., 10001110) the 2, 6, 7, and 8 positions would have to be punched.

3. When punching the Concise III display code for a character in the lower part of column two of a group of three columns on a definition card, note the following example:

- To enter the Concise III code for the letter A, i.e., octal 161 (1110001), the 3, 4, 5, and 9 positions would have to be punched.

TABLE 1. MEANING OF LOAD CONTROL CHARACTERS ON DEFINITION CARDS

LOAD CONTROL CHARACTER	MEANING
Ø	Definition information for this character is loaded into its unique location in the memory table (see Memory Table section for a description of the table). As shown in Figure 3, the lower eight positions of the first column of each set is the three digit octal code for the character to be defined; the pattern of punches on paper tape is mapped onto the eight positions (2 through 9) such that the sprocket hole is mapped between positions 6 and 7. Though any combination of the upper four positions of this column may be punched they contribute nothing to the definition; such punches cause the column to be non-blank and therefore satisfy the first non-blank column requirements. Of the second column, the upper five positions are a memory table control number (see following section) and the lower seven positions are the PDP-1 Concise III code for the symbol that represents this character on the console CRT, as listed in Table 4. Of the third column, the upper six positions define the character to be written onto magnetic tape. If

TABLE 1. (Continued)

LOAD CONTROL CHARACTER	MEANING
	within a set of definition cards a character is defined more than once, the last definition encountered is the one in the table at the time the paper data tape is processed.
1	All other parts of this triplet are ignored and reading of definitions is terminated. This control must be included so that the program will proceed to processing the input paper tape. Anything after it will be ignored.
2	The twelve bit number (i.e., 4 octal digits) represented by the lower six positions of the second column followed by the upper six positions of the third column is used in conjunction with the memory table control entry 03 as explained in Table 2. Column 1 is ignored. The upper six positions of the second column must be unpunched.

Memory Table

The PDP-1 is an 18 bit word machine and these bits are numbered Ø through 17, from left to right, high order to low order. Though this numbering is opposite to that used in the computer field generally, the console lights and switches are so labelled, and to conform to general usage might lead to confusion for an operator seated at the PDP-1.

Each entry in the memory table is one word and the number of entries is 256 (or 2^8) or precisely one for each possible character on paper tape. Each paper tape character is interpreted as a binary number (with the sprocket hole just before the three low order bits) which is added to the address of the first entry of the memory table to obtain the address of the entry in the table for that character. Figure 4 depicts this.

The format of the data read into the memory table is as follows:

Bits 0 to 4 - Memory Table Control. Dictates which of up to 32 subroutines is associated with each entry. It is through these five bits that the response to each paper tape character is controlled. Only eleven subroutines are presently implemented as described following the octal representation of the five control bits for each (see Table 2).

TABLE 2. DESCRIPTION OF MEMORY TABLE CONTROL CHARACTERS (Bits 0 to 4)

MEMORY TABLE CONTROL CHARACTER (OCTAL)	MEANING
ØØ	Deposit the output character (table bits 12-17) into the output buffer and the CRT display character (table bits 5-11) into the display buffer and proceed to the next paper tape character.
Ø1	Identical to ØØ except for response within subroutine Ø4, Ø7, or 1Ø.
Ø2	Ignore the rest of the entry. Read paper tape until no more is ''seen''. Start the whole program at the beginning of paper tape read (i.e., at the place where the leader character is redefined).
Ø3	Ignore the rest of the entry. Put carriage return (77) into display buffer. Increment counter and if equal to the number specified by the last load control 2 (see Table 1), write output buffer onto magnetic tape, reset counter to Ø, and proceed; if not equal simply proceed.
Ø4	Ignore the rest of the entry. Write output buffer onto magnetic tape, skip paper tape characters until either three have been passed or a character with table control ≠ ØØ has been encountered, which must then be processed. If three characters are passed, reset counter to Ø.
Ø5	Ignore the rest of the entry. Write output buffer onto magnetic tape followed by a file mark. Return to ''pass over leader'' mode. (The leader character is *not* redefined.)
Ø6	Ignore this character; proceed directly to the next character on paper tape.
Ø7	If one of the following has not occurred since the last encounter of this control, ignore it. a) a control ØØ b) a control Ø1 c) a control 1Ø

TABLE 2. (Continued)

MEMORY TABLE CONTROL CHARACTER (OCTAL)	MEANING
	d) "change it" selected as a result of encountering an undefined character. Note that these controls result in a character being placed into the output buffer. If one of the foregoing has been encountered, write output buffer onto magnetic tape, reset counter to Ø, and proceed to the next character.
1Ø	Deposit output character (table bits 12-17) into the output buffer and display character (table bits 5-11) into the display buffer. Skip paper tape characters until either three have been passed or a character with table control ≠ Ø has been encountered, which must be processed.
11	Ignore the rest of the entry. Write a file mark onto magnetic tape. Proceed to "ignore leader character" mode. (The leader character is *not* redefined.)
12	Ignore the rest of the entry. Proceed to label mode requiring operator as described in section on Label Mode.
37	This is reserved for undefined characters. A carriage return (77) is placed into the display buffer and the undefined character routine is entered requiring operator to proceed as described in section on Undefined Characters.

Bits 5 to 11 - These bits contain the PDP-1 Consise III representation of the paper tape character to be placed into the display buffer (for use in the CRT display).

Bits 12 to 17 - These bits contain the magnetic tape translation of the input paper tape character. This character is also placed in the magnetic tape output buffer.

Adding to the Program

Since this program is written to be assembled by the PDP-1 symbolic assembler, PAL, any changes or additions such as control response subroutines must be made to the symbolic form and then reassembled using PAL. The resulting binary cards must then be substituted for the corresponding cards of the former version in the entire binary deck which includes along with this program a number of subroutines that do not need reassembly (see Figure 5).

Adding a Response Subroutine

For each additional table control implemented, the constant TCH, which now has a value of 12 (near the end of the main program), must be increased by one because, for the first table control read from the definition cards that exceeds TCH, an error message is displayed upon the CRT to the effect that no provisions are available for handling it. Included within this message is the date that this version was assembled, so the text of this display must also be updated along with the date in the text for the load control error message (see following section).

The label given to the entry of the new subroutine may have up to six alphabetic characters, say ABCDEF, and the instruction ''jmp ABCDEF'' must be added just prior to NONEMP. The subroutine itself may be placed just before TABLE and must return to the main program with a ''jmp γ,'' where γ is one of the following:

PROCES	If the display buffer should be cleared before processing the next paper tape character.
NEXT	For continuing directly to the next paper tape character.
VALID-2	If the table entry for the next character to be processed is already in the IO register.
VALID	If the table entry for the next character had been in the IO with Accumulator = Ø but was left shifted 5 bits into the Accumulator.

Adding a Load Control Subroutine

For each additional load control implemented, the assigned value, LCONT (near beginning of program), must be increased by one because, for the first load control read from the definition cards that exceeds LCONT, an error message is displayed upon the CRT to the effect that no provisions are available for handling it. Included within this message is the date that this version was assembled, so the text of this display must also be updated along with the date in the text for the table control error message (see previous section).

The new subroutine which is intended to respond to this control should be inserted just before MEASR and preceded by the instruction, jmp MEASR. Return from this subroutine should be by instruction, jmp LOAD+1, so that the next column is processed.

TABLE 3. PAPER-TAPE-TO-MAGNETIC-TAPE SUBROUTINES

NAME	RETURN	MEANING
CARDIN	c+1	Last card was read and processed; no more are in the card reader hopper.
	c+2	The last card has been processed and a new one is being read in.
	c+3	The next column is in the accumulator bits 6-17 corresponding to punches 12-9, respectively.
LETBEG (xo,yo)	c+1	xo,yo are the CRT coordinates of the upper left point of a page. Subroutine PAGE is used to restore to this point before text display is begun.
RPAPER	c+1	There is no ''seeable'' paper tape.
	c+2	Next character from paper tape is in accumulator bits 10-17 with sprocket hole mapped between bits 14 and 15.
NPAP	c-1	Light pen has been used to designate display text: ''When paper tape is ready use light pen.''
TEXARN (DISP,K)	c+1	DISP is the location of the word into which the next character is to be put by TEXN and K (=Ø,1,2) is the position within the word. There are 3 positions and each call to TEXN uses the next one, passing to the beginning of the next word if necessary.
TEXART (BUT,J)	c+1	Same as TEXARN but used with TEXT to create the output buffer.
TEXN	c+1	See TEXARN
TEXT	c+1	See TEXART
IBM (F,FW,LW,S)	c+5	IBM magnetic tape handler. F is the function to be performed and tape unit number. FW is the first word address. LW is the last word address+1 and S is set to -Ø. S is reset to Ø when function has been accomplished, so don't try to execute this call at this location until S is Ø or problems will result.

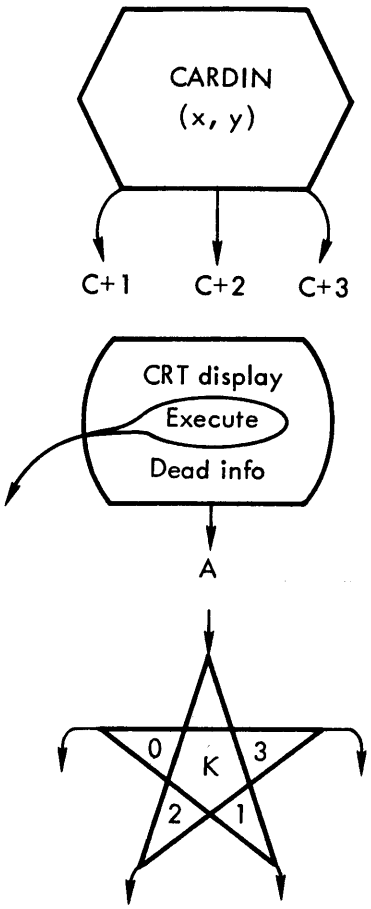
TABLE 3. (Continued)

NAME	RETURN	MEANING
WROUT	c+1	This uses IBM, and manages three separate output buffers so that maximum output rates can be maintained easily. Upon return, the currently used output buffer is closed and put in line to go out onto magnetic tape. A new buffer is then designated for filling by executing TEXART.
TYPEIN	c+1	No typewriter key has been depressed.
	c+2	The next character from the typewriter is in the accumulator bits 12-17. Note that typewriter input and output uses 6 bit characters. As shown in Table 4, upper case is indicated by a 1 in the most significant bit position. Any change of case implied by the most significant bit is preceded by either a 74_8 for upper or 72_8 for lower case. This is also true for the display routine.
REPORT (A)	c+1	A is the first word address of the text to be displayed on the CRT. Upon return, if the light pen sensed no points, the accumulator is Ø. If if did, the accumulator contains one more than the address of the word containing the character being generated at the time of sensing.

Program Flowchart

Aside from some personal conventions used, the flowchart makes clear enough the structure of this program, and any ambiguities will be removed by referring to the code listing. The one convention which facilitates this reference is the placing of each listing label outside of, but associated with, a flowchart box. When searching for the flowchart location corresponding to a listing location, proceed up the listing until a labelled statement is encountered, find this label in the flowchart, and then follow the flowchart logically to the desired location.

The following chart explains the personal conventions used.



Refers to a subroutine whose name appears underlined followed by parameters, if any, in parenthesis. For those subroutines with more than one return, each is labelled as to location with respect to the calling instruction which is considered to be at location 'c'.

Refers to a CRT display. Normal exit from one pass of displayed text is at A, but if this is not shown then continuous display is assumed. Any balloons surrounding text lead off to paths which are followed as a result of light pen response to the text contained within the balloon (which is actual display text on CRT).

Refers to a multiple branch flow; the particular branch followed is governed by the variable designated at the center, K, and the value it may have shown near the exit point. If one of the points of the ''star'' is shown as black it indicates the ''all other'' or ''fall-through'' condition.

TABLE 4. CONCISE III CHARACTER DISPLAY CODE

Octal representation of Concise III Code	Character displayed
ØØØ	(space)
ØØ1	1
ØØ2	2
ØØ3	3
ØØ4	4
ØØ5	5
ØØ6	6
ØØ7	7
Ø1Ø	8
Ø11	9
Ø12	ρ
Ø14	α
Ø15	Σ
Ø16	η
Ø17	:
Ø2Ø	Ø
Ø21	/
Ø22	s
Ø23	t
Ø24	u
Ø25	v
Ø26	w
Ø27	x

TABLE 4. (Continued)

Octal representation of Concise III Code	Character displayed
030	y
031	z
032	Δ
033	,
036	(tab)
037	β
040	• (center dot)
041	j
042	k
043	l
044	m
045	n
046	o
047	p
050	q
051	r
052	λ
053	*
054	-
055	)
056	– (overstrike)
057	(
060	;
061	a
062	b
063	c
064	d
065	e
066	f
067	g
070	h
071	i
073	.
075	(back space)
076	π
077	(carriage return)
100	(space)
101	''
102	'
103	~
104	⊃
105	∨
106	∧
107	<
110	>
111	↑
112	ρ
113	(space)
114	α
115	Σ
116	η
117	:
120	→
121	?
122	S

TABLE 4. (Continued)

Octal representation of Concise III Code	Character displayed
123	T
124	U
125	V
126	W
127	X
130	Y
131	Z
132	Δ
133	=
136	(tab)
137	β
140	– (understrike)
141	J
142	K
143	L
144	M
145	N
146	O
147	P
150	Q
151	R
152	λ
153	*
154	+
155	]
156	| (center strike)
157	[
160	;
161	A
162	B
163	C
164	D
165	E
166	F
167	G
170	H
171	I
173	× (multiply)
175	(backspace)
176	π
177	(carriage return)

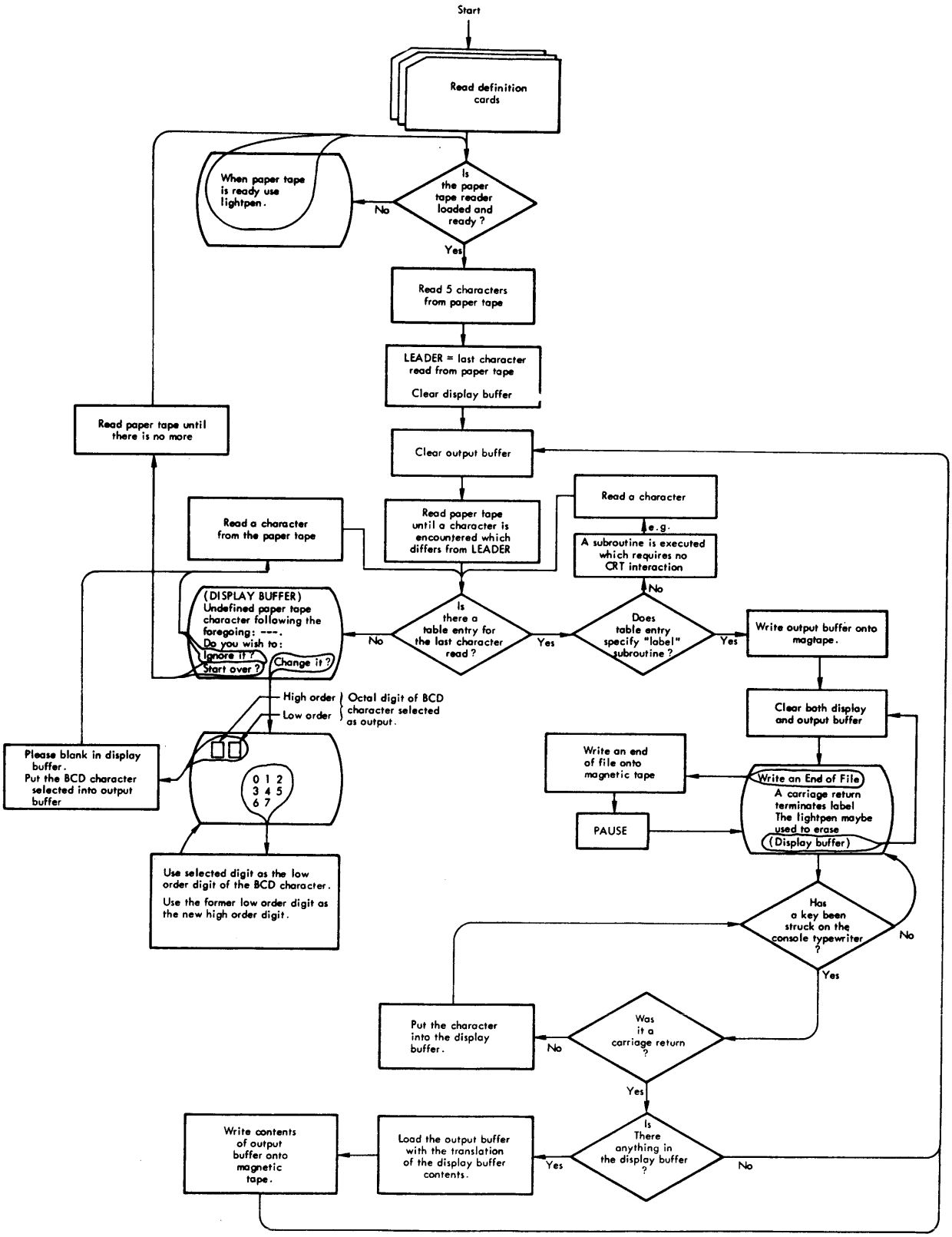


Fig. 2. System flow chart.

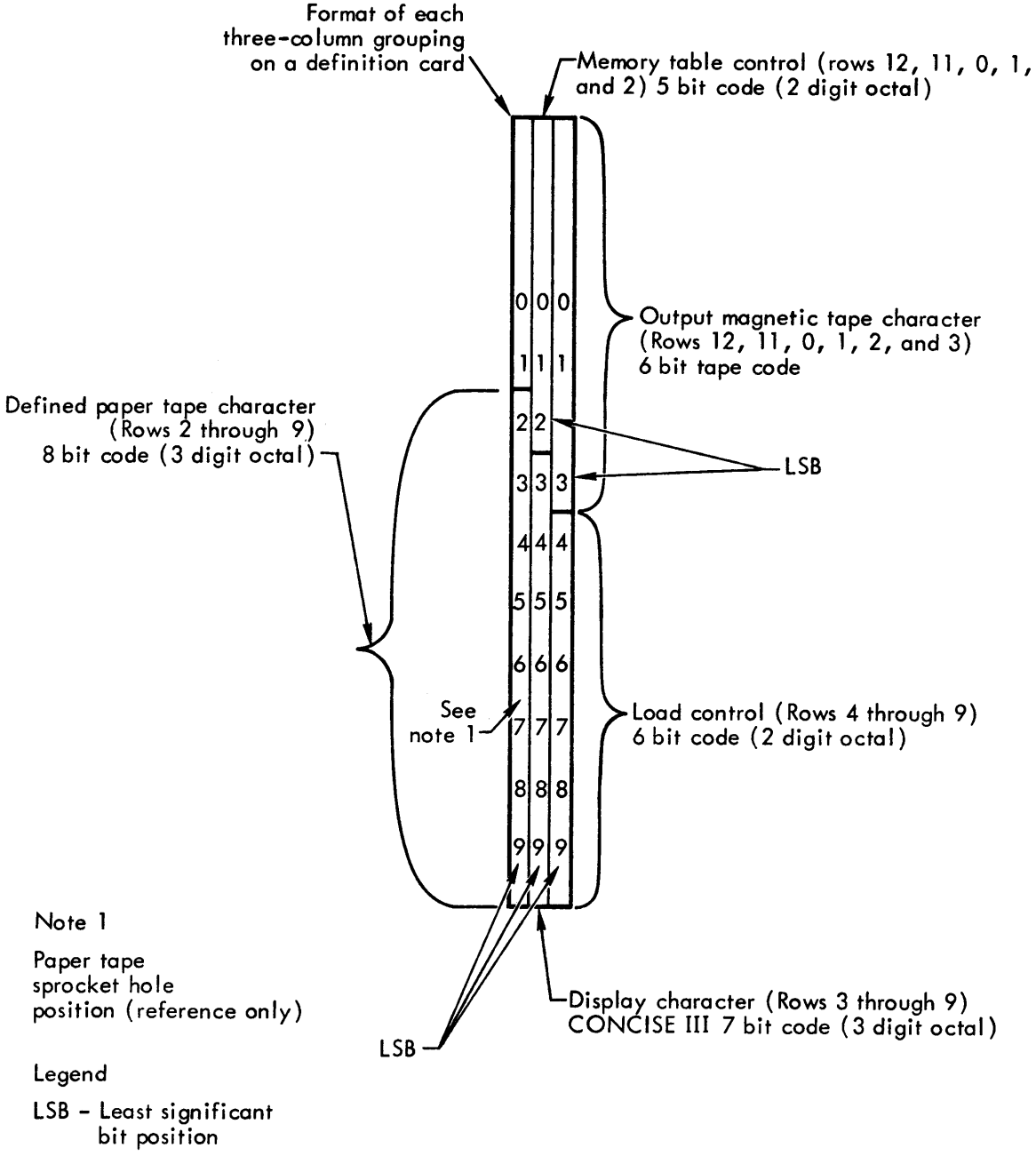


Fig. 3. Format of three-column groupings on character definition cards.

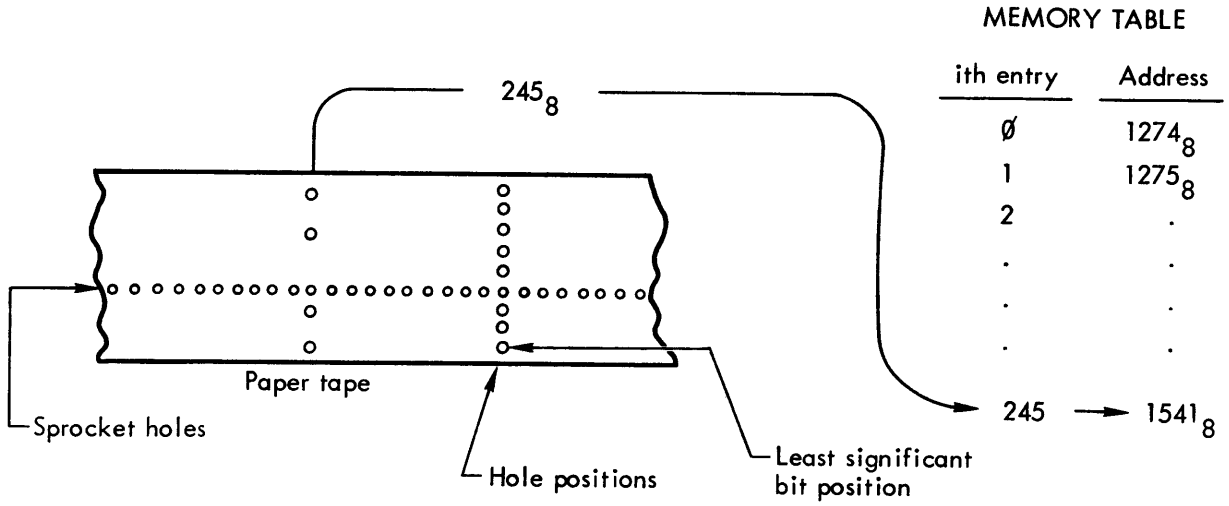


Fig. 4. Paper tape coding example.

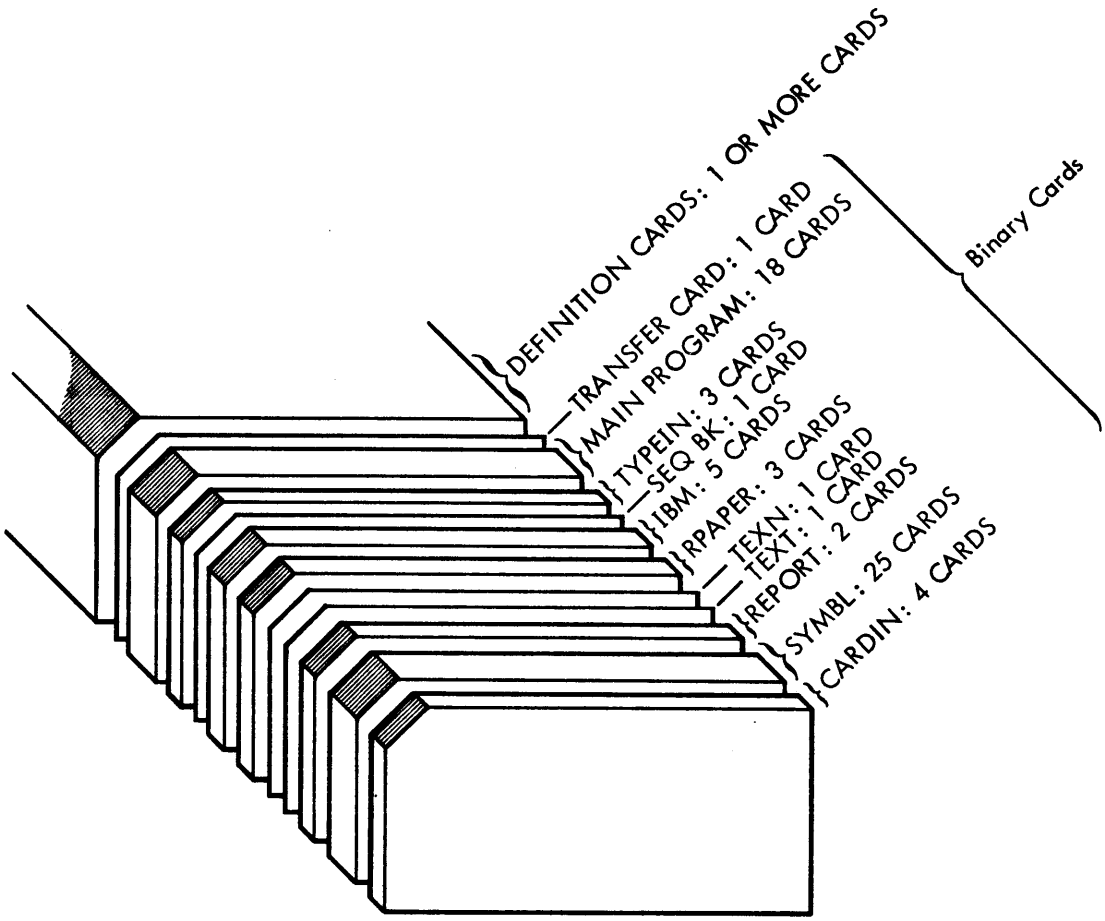


Fig. 5. Typical program and character definition deck.

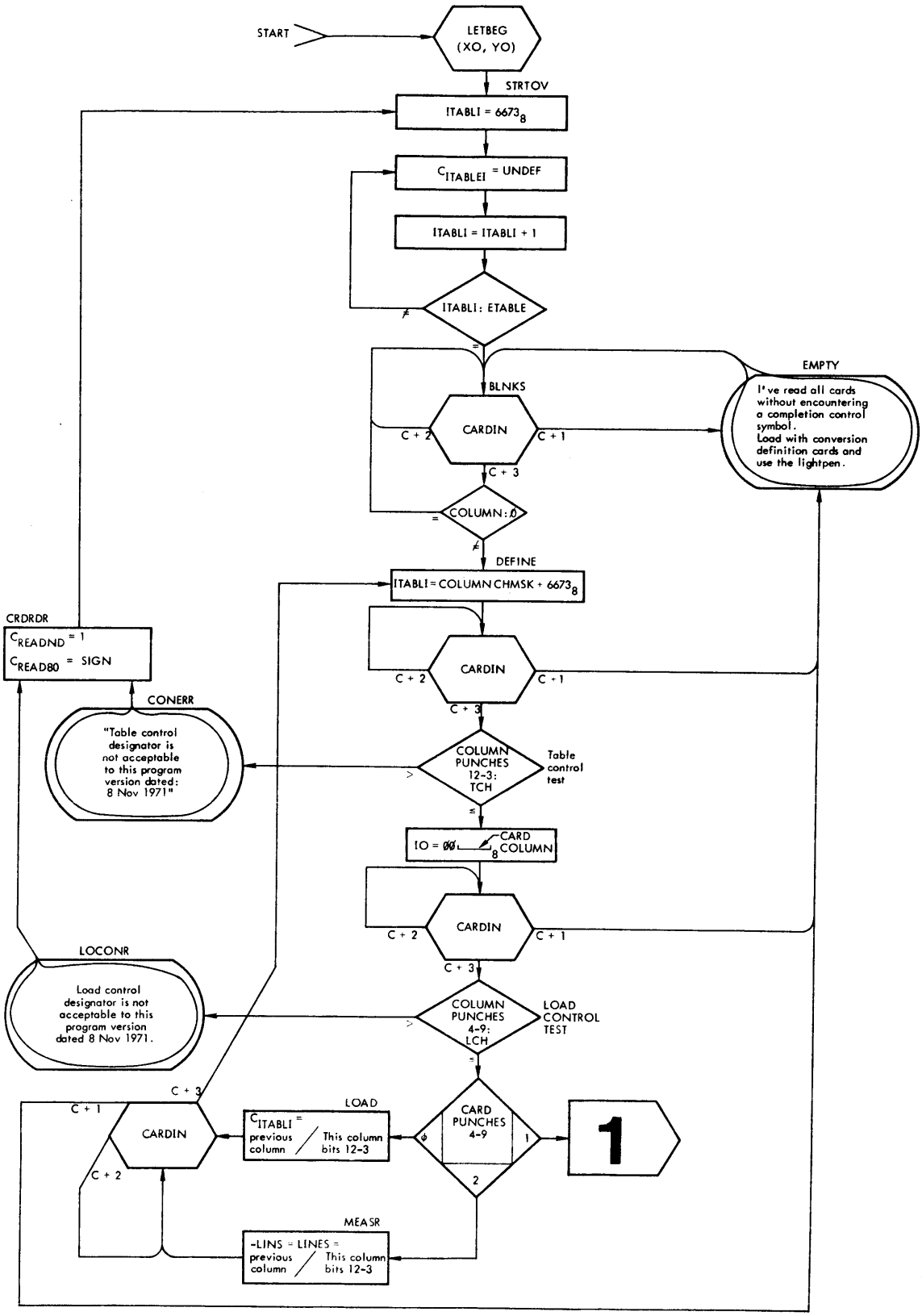


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 1 of 7).

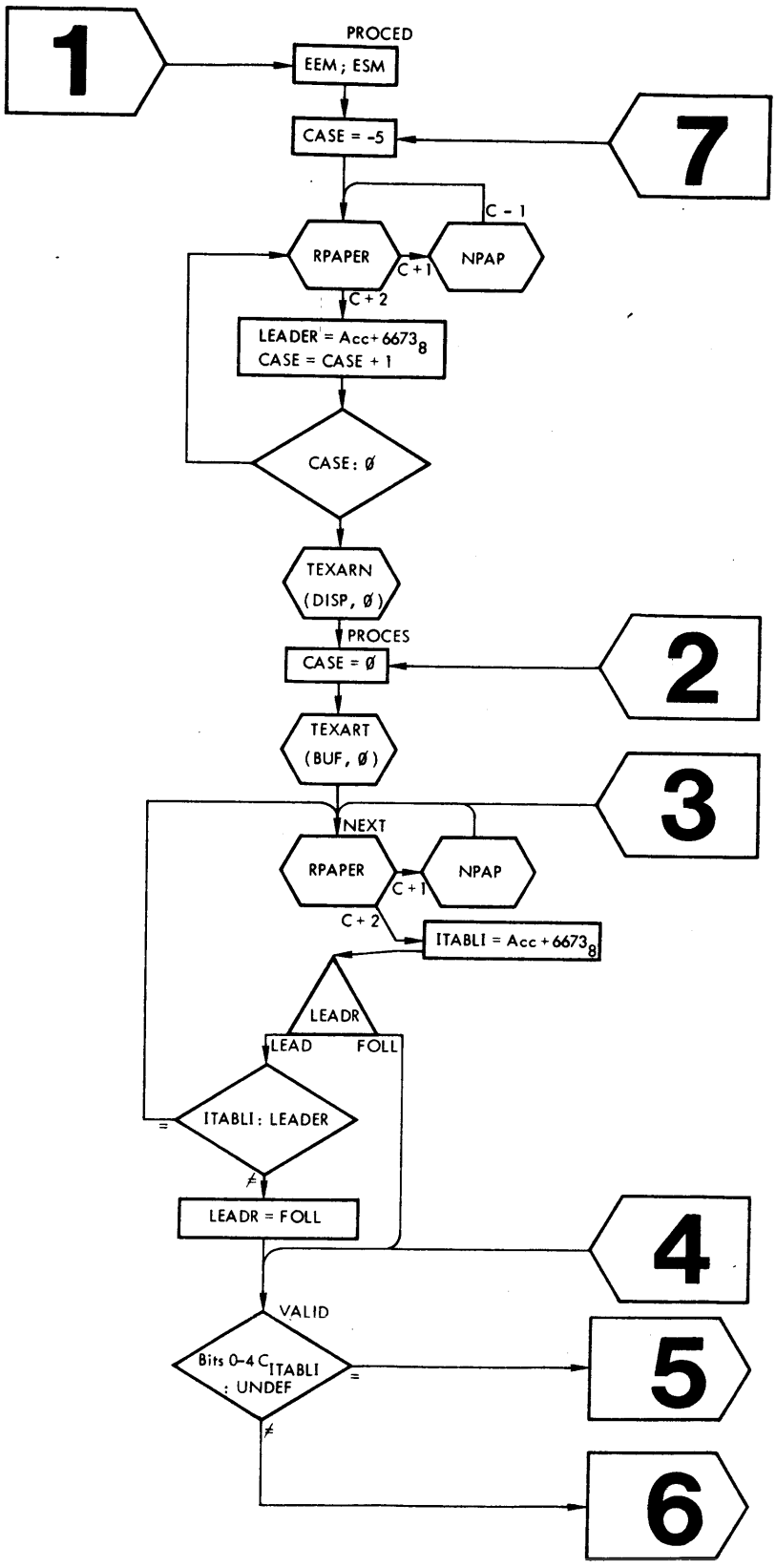


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 2 of 7).

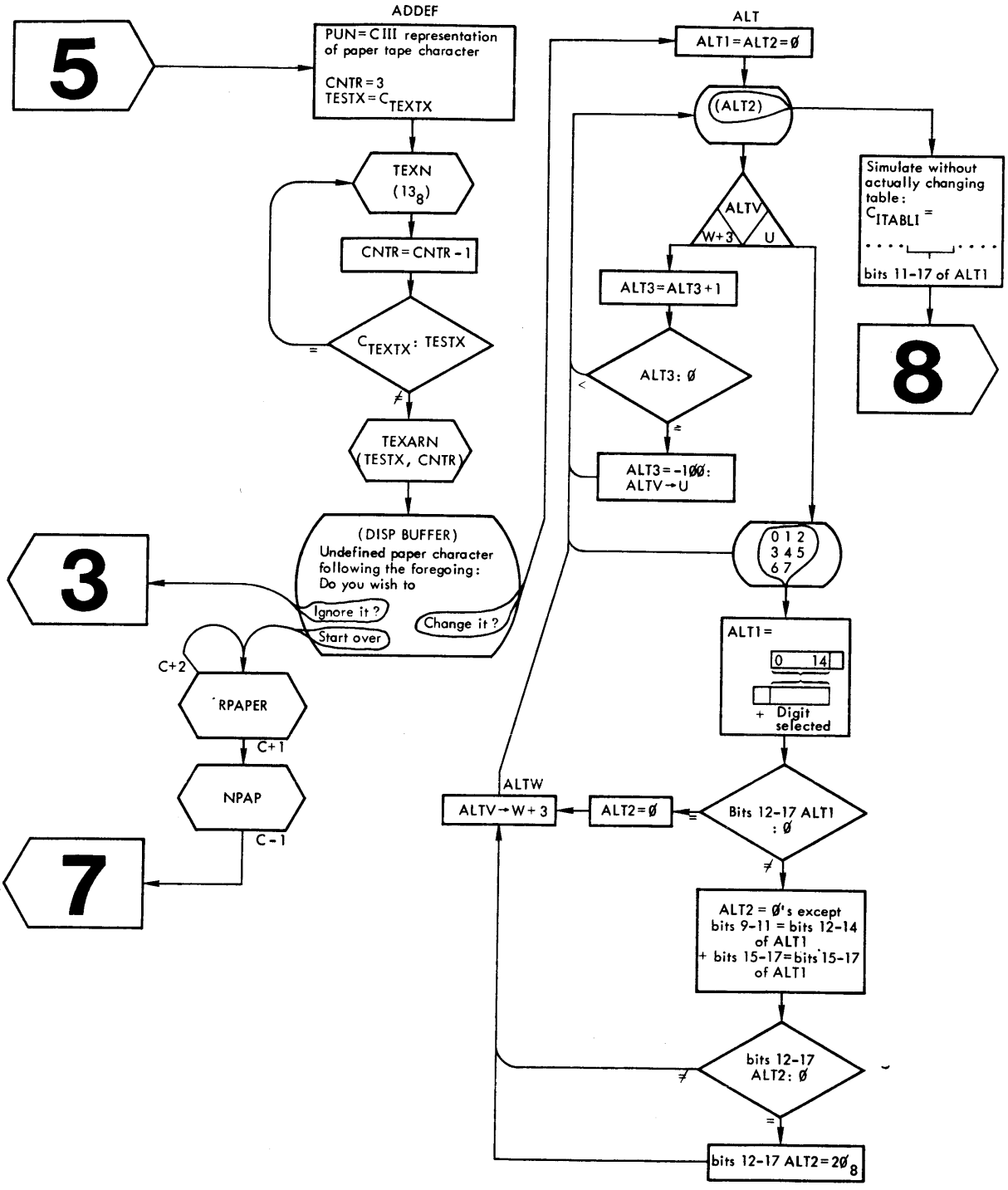


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 3 of 7).

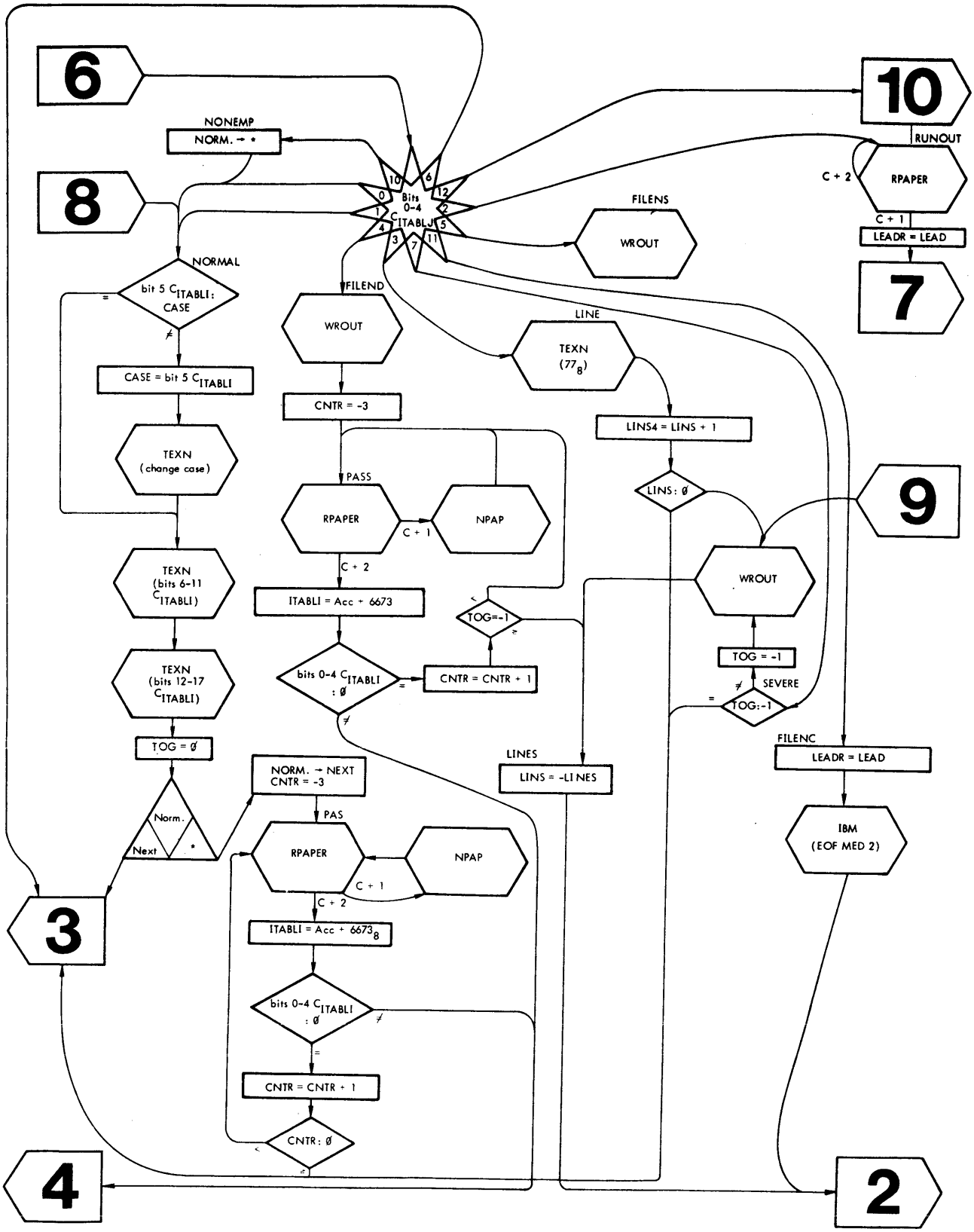


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 4 of 7).

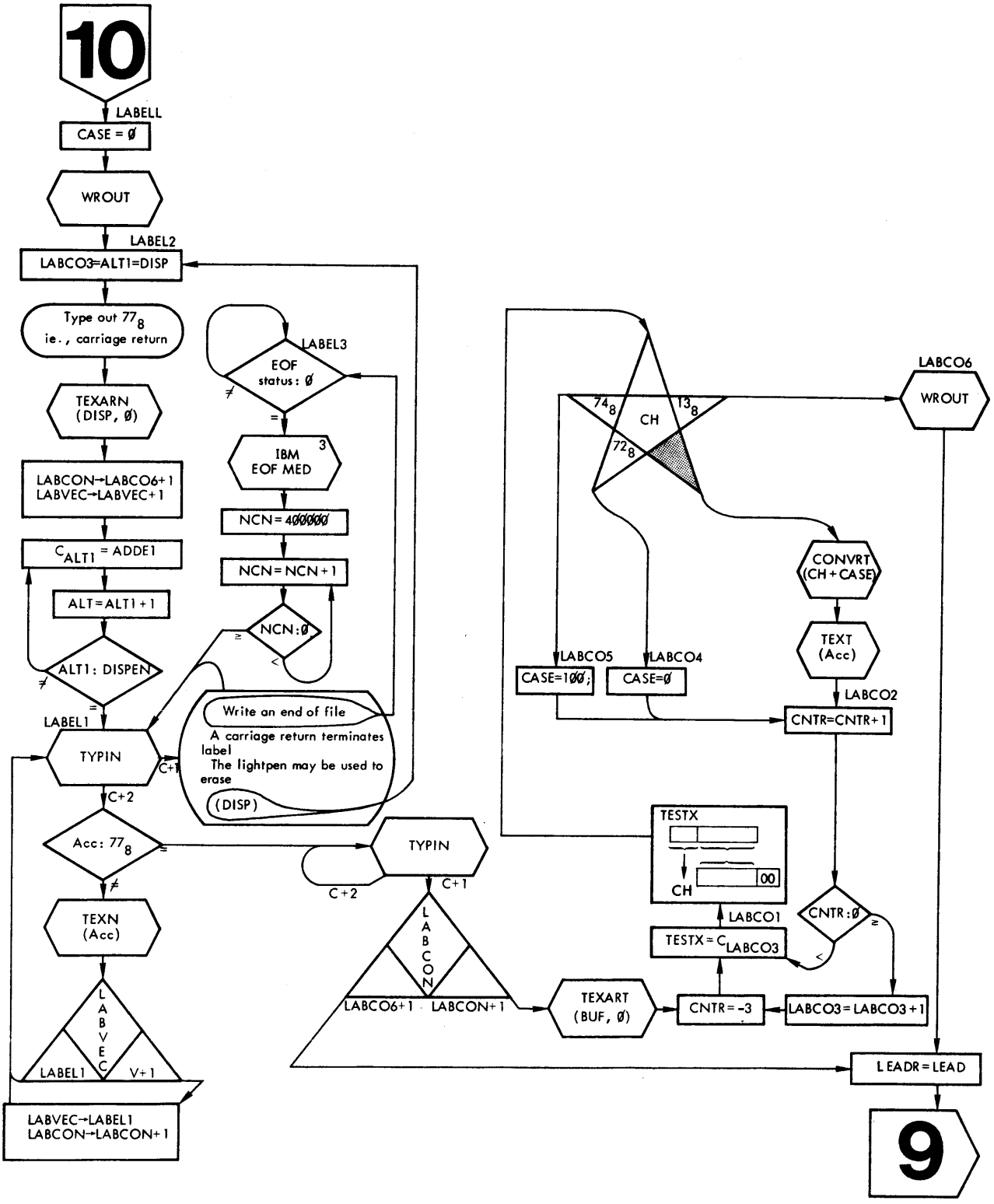


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 5 of 7).

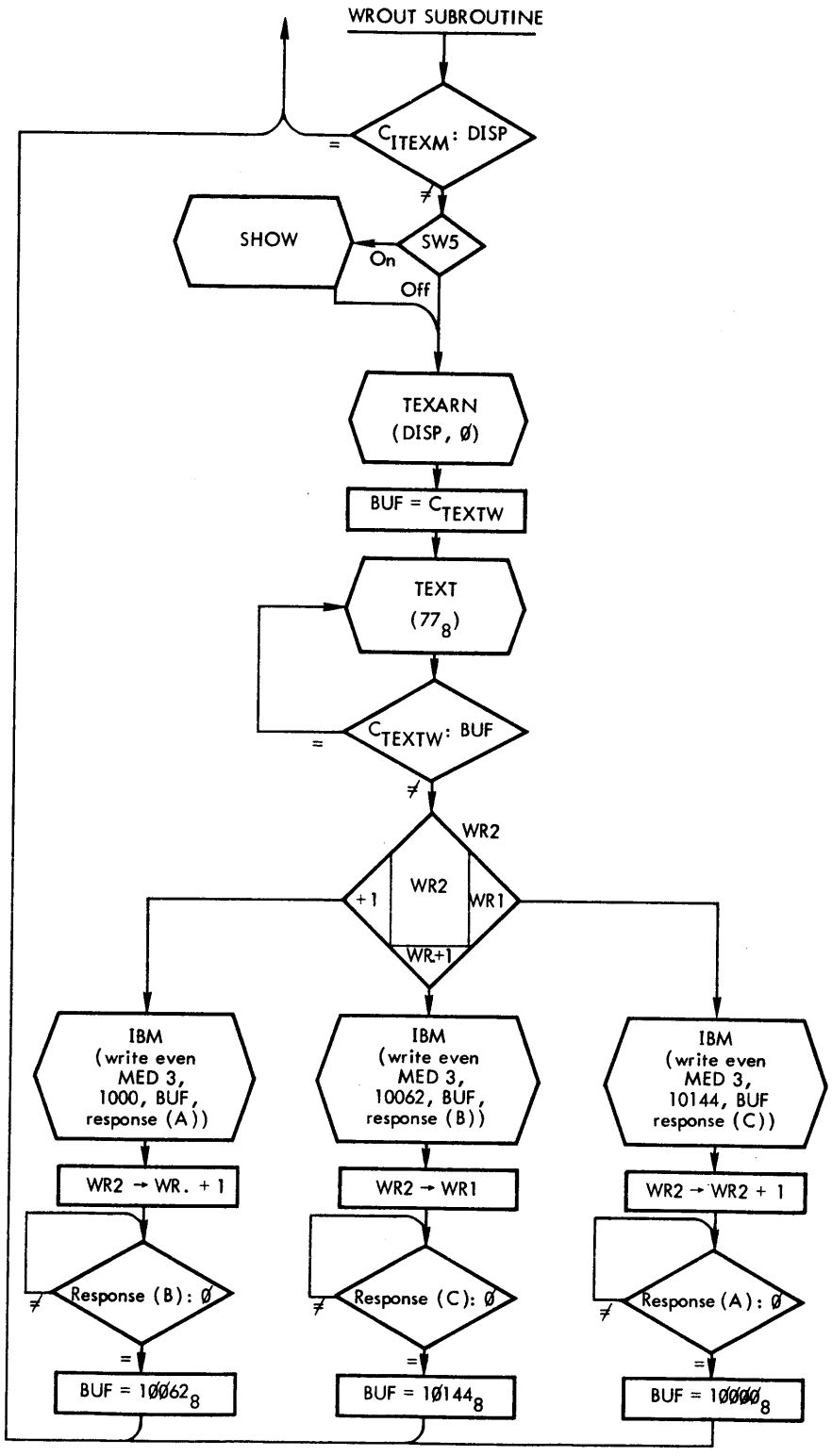


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 6 of 7).

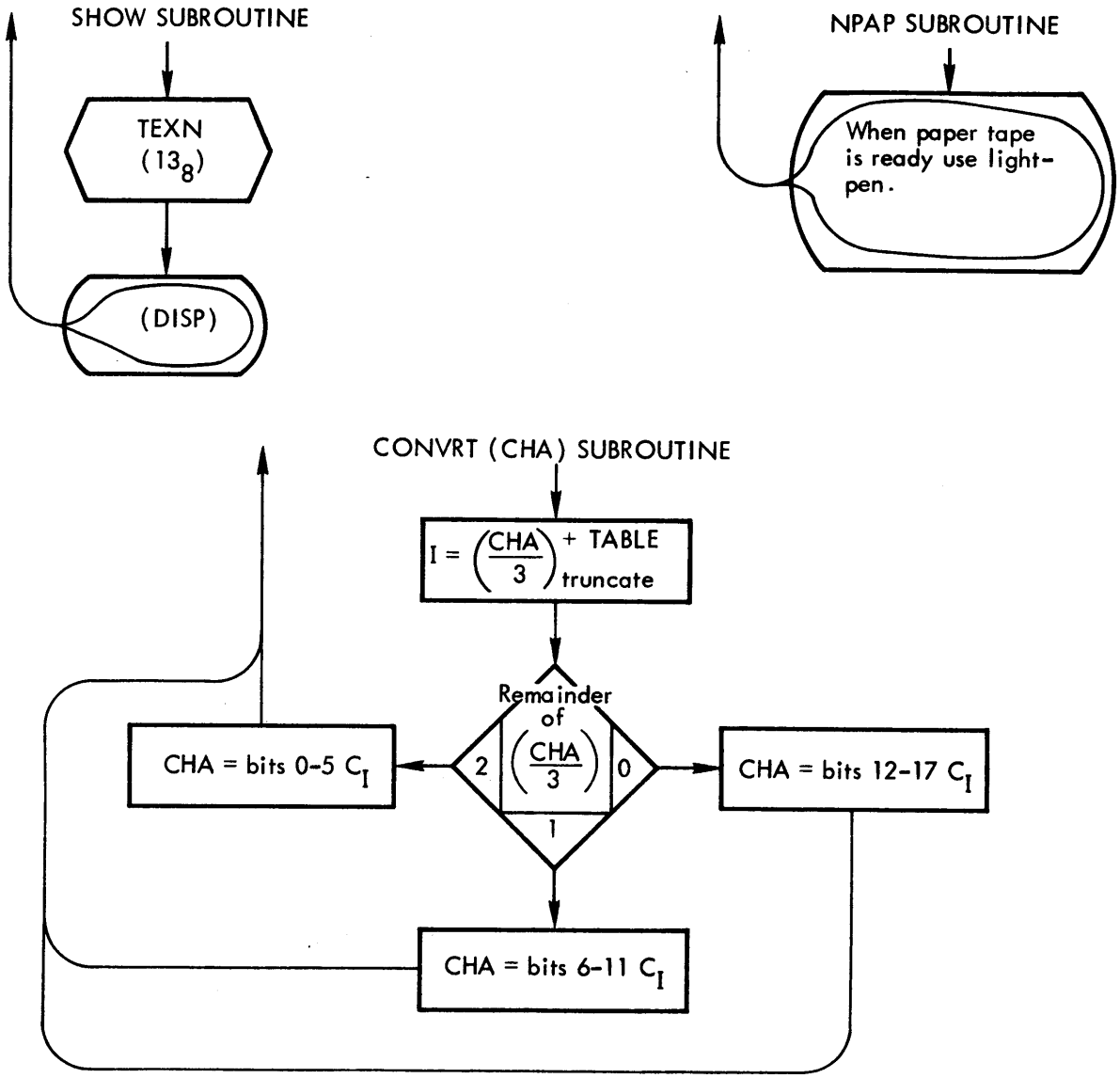


Fig. 6. Paper tape to magnetic tape conversion program flow chart (Part 7 of 7).

APPENDIX

PROGRAM AND SUBROUTINE LISTINGS

Program Interrupt Chain

```
                                      S Y M B Ø L   T A B L E

         IBM   0013                   S Y M B Ø L   T A B L E
       PAPIN   0014                   S Y M B Ø L   T A B L E
        LPEN   0015                   S Y M B Ø L   T A B L E
       TYPIN   0016                   S Y M B Ø L   T A B L E
```

```
                                        *3
RE-DEF                                    EEM = 724074
RE-DEF                                    LEM = 720074
          0003   724074            EEM
          0004   630013            JSP I IBM
          0005   630014            JSP I PAPIN
          0006   630015            JSP I LPEN
          0007   630016            JSP I TYPIN
          0010   200000            LAC
          0011   220002            LIO 2
          0012   610001            JMP I 1
          0013   000005     IBM,   5
          0014   000006   PAPIN,   6
          0015   000007    LPEN,   7
          0016   000010   TYPIN,   10
```

Main Program

SYMBOL TABLE

SYMBOL TABLE

ODD	0000	SYMBOL TABLE
EVEN	0040	SYMBOL TABLE
LOW	0010	SYMBOL TABLE
MED	0020	SYMBOL TABLE
HIGH	0030	SYMBOL TABLE
UNLOAD	0000	SYMBOL TABLE
REWIND	0100	SYMBOL TABLE
EOF	0400	SYMBOL TABLE
WRITE	0500	SYMBOL TABLE
READ	0600	SYMBOL TABLE
TEXL	4166	SYMBOL TABLE
TEXM	4117	SYMBOL TABLE
READBO	6573	SYMBOL TABLE
READND	6544	SYMBOL TABLE
LCONT	0002	SYMBOL TABLE
START	0100	SYMBOL TABLE
XO	1445	SYMBOL TABLE
YO	1446	SYMBOL TABLE
STRTOV	0103	SYMBOL TABLE
ITABLI	1451	SYMBOL TABLE
UNDEF	1450	SYMBOL TABLE
ETABLE	1447	SYMBOL TABLE
BLNKS	0112	SYMBOL TABLE
EMPTY	0167	SYMBOL TABLE
DEFINE	0117	SYMBOL TABLE
CHMSK	1452	SYMBOL TABLE
TCH	1453	SYMBOL TABLE
CONERR	0252	SYMBOL TABLE
LCH	1454	SYMBOL TABLE
LOCONR	0321	SYMBOL TABLE
LOAD	0162	SYMBOL TABLE
PROCED	0364	SYMBOL TABLE
MEASR	0154	SYMBOL TABLE
LINES	0524	SYMBOL TABLE
LINS	0557	SYMBOL TABLE
CONMSG	0264	SYMBOL TABLE
CRORDR	0257	SYMBOL TABLE
SIGN	1455	SYMBOL TABLE
LCNR	0327	SYMBOL TABLE
CASE	1441	SYMBOL TABLE
NPAP	0664	SYMBOL TABLE
LEADER	1436	SYMBOL TABLE
DISP	1435	SYMBOL TABLE
PROCES	0401	SYMBOL TABLE
BUF	1434	SYMBOL TABLE
NEXT	0405	SYMBOL TABLE
LEADR	0411	SYMBOL TABLE
FOLL	1443	SYMBOL TABLE
VALID	0420	SYMBOL TABLE

JNDF	1437	S Y M B O L T A B L E
ADDEF	0712	S Y M B O L T A B L E
NORMAL	0471	S Y M B O L T A B L E
RUNOUT	0511	S Y M B O L T A B L E
LINE	0517	S Y M B O L T A B L E
FILEND	0527	S Y M B O L T A B L E
FILENS	0546	S Y M B O L T A B L E
SEVERE	0464	S Y M B O L T A B L E
NONEMP	0441	S Y M B O L T A B L E
FILENC	0547	S Y M B O L T A B L E
LABELL	1140	S Y M B O L T A B L E
NORM.	0510	S Y M B O L T A B L E
CNTR	1457	S Y M B O L T A B L E
PAS	0450	S Y M B O L T A B L E
TOG	1440	S Y M B O L T A B L E
LC	1444	S Y M B O L T A B L E
LEAD	1442	S Y M B O L T A B L E
WROUT	0562	S Y M B O L T A B L E
PASS	0532	S Y M B O L T A B L E
TWO	0556	S Y M B O L T A B L E
WR.	0620	S Y M B O L T A B L E
ITEXM	1464	S Y M B O L T A B L E
SHOW	0653	S Y M B O L T A B L E
TEKTW	1456	S Y M B O L T A B L E
WR2	0602	S Y M B O L T A B L E
WR1	0636	S Y M B O L T A B L E
SHOW.	0662	S Y M B O L T A B L E
NPAP.	0673	S Y M B O L T A B L E
LAWC	1460	S Y M B O L T A B L E
PUN	1111	S Y M B O L T A B L E
TEXTX	1461	S Y M B O L T A B L E
TESTX	1462	S Y M B O L T A B L E
ADDEF1	0742	S Y M B O L T A B L E
ADDE	1066	S Y M B O L T A B L E
IGN	1126	S Y M B O L T A B L E
ALTT	1122	S Y M B O L T A B L E
ALT	0771	S Y M B O L T A B L E
SOV	1133	S Y M B O L T A B L E
ALT1	1051	S Y M B O L T A B L E
ALT2	1052	S Y M B O L T A B L E
ALTV	0777	S Y M B O L T A B L E
ALTU	1005	S Y M B O L T A B L E
ARR	1055	S Y M B O L T A B L E
ALTO	1050	S Y M B O L T A B L E
ALTW	1037	S Y M B O L T A B L E
ALT3	1054	S Y M B O L T A B L E
ADDE1	1121	S Y M B O L T A B L E
LABEL2	1142	S Y M B O L T A B L E
LABC03	1244	S Y M B O L T A B L E
LABC06	1331	S Y M B O L T A B L E
LABCON	1214	S Y M B O L T A B L E
LABEL1	1162	S Y M B O L T A B L E
DISPEN	1465	S Y M B O L T A B L E
LABDIS	1200	S Y M B O L T A B L E

```
   FLE   1262
LABEL3   1245
 LABDI   1273
LABC01   1222
 STOPR   1466
LABC04   1324
    UC   1432
LABC05   1326
CONVRT   1335
LABC02   1237
CONVT.   1356
 THREE   1433
 TABLE   1357
   ONE   1463
```

```
SYMBOL TABLE
SYMBOL TABLE
SYMBOL TABLE
SYMBOL TABLE
SYMBOL TABLE
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SYMBOL TABLE
SYMBOL TABLE
SYMBOL TABLE
```

```
                        *100
                         ODD = 0
                        EVEN = 40
                         LOW = 10
                         MED = 20
                        HIGH = 30
                      UNLOAD = 0
                      REWIND = 100
                         EOF = 400
                       WRITE = 500
                        READ = 600
                      LETBEG = JDA 4413
                      RPAPER = JSP 3743
                         IBM = JSP 3422
                      TEXARN = JDA 4104
                        PAGE = JSP 4415
                        TEXN = JDA 4120
                      TEXART = JDA 4153
                        TEXL = 4166
                        TEXM = 4117
                        TEXT = JDA 4167
                      REPORT = JDA 4222
                       TYPIN = JSP 3214
RE-DEF                   EEM = 724074
RE-DEF                   LEM = 720074
                      CARDIN = JSP 6341
                      READ80 = 6573
                      READND = 6544
                       LCONT = 2
0100  201465    START,  LAC X0                  /  = 420000
0101  221466            LIO Y0                  /  = 357777
0102  174413            LETBEG
0103  706673    STRTOV, LAW 6673
0104  261431            DAP ITABLI
0105  221450            LIO UNDEF
0106  331431            DIO I ITABLI
0107  441431            IDX ITABLI
0110  521447            SAS ETABLE
0111  600106            JMP .-3
0112  626341    BLNKS,  CARDIN
0113  600157            JMP EMPTY
0114  600112            JMP .-2
0115  650100            SZA I
0116  600112            JMP .-4
0117  021432    DEFINE, AND CHMSK               /  377
0120  400103            ADD STRTOV
0121  261431            DAP ITABLI
0122  626341            CARDIN
0123  600157            JMP EMPTY
0124  600122            JMP .-2
0125  764000            CLI
0126  673177            RCR S7
```

```
0127  421453          SUB TCH                    /  TABLE CONTROL HIGH
0130  640500          SMA SZA
0131  600232          JMP CONERR
0132  401453          ADD TCH
0133  673777          RCR S9
0134  673006          RCR S2
0135  626341          CARDIN
0136  600167          JMP EMPTY
0137  600135          JMP .-2
0140  661077          RAL S6
0141  663077          RCL S6
0142  661077          RAL S6
0143  421454          SUB LCH                    /  LOAD CONTROL HIGH
0144  640500          SMA SZA
0145  600321          JMP LOCONR
0146  400151          ADD .+3
0147  240150          DAC .+1
0150  000000          ..
0151  600154          JMP .+1+LCONT
0152  600162          JMP LOAD
0153  600364          JMP PROCED
0154  673777  MEASR,  RCR S9
0155  673777          RCR S9
0156  260524          DAP LINES
0157  761000          CMA
0160  240537          DAC LINS
0161  600163          JMP LOAD+1
0162  331451  LOAD,   DIO I ITABLI
0163  626341          CARDIN
0164  600167          JMP EMPTY
0165  600163          JMP .-2
0166  600117          JMP DEFINE
0167  624415  EMPTY,  PAGE
0170  700175          LAW .+5
0171  174222          REPORT
0172  650100          SZA I
0173  600167          JMP EMPTY
0174  600112          JMP BLNKS
0175  747102          747102
0176  722565          722565
0177  005165          5165
0200  616400          616400
0201  614343          614343
0202  006361          6361
0203  516422          516422
0204  002671          2671
0205  237046          237046
0206  242300          242300
0207  654563          654563
0210  462445          462445
0211  236551          236551
0212  714567          714567
0213  776100          776100
0214  634644          634644
```

```
0215  474365              474365
0216  237146              237146
0217  450063              450063
0220  464523              464523
0221  514643              514643
0222  002230              2230
0223  446246              446246
0224  437377              437377
0225  744372              744372
0226  466164              466164
0227  002671              2671
0230  237000              237000
0231  634645              634645
0232  256551              256551
0233  227146              227146
0234  450064              450064
0235  656671              656671
0236  457123              457123
0237  714645              714645
0240  006361              6361
0241  516422              516422
0242  006145              6145
0243  647724              647724
0244  226500              226500
0245  237065              237065
0246  004371              4371
0247  677023              677023
0250  476545              476545
0251  731300              731300
0252  624415    CONERR,   PAGE
0253  700264              LAW CONMSG
0254  174222              REPORT
0255  650100              SZA I
0256  600232              JMP CONERR
0257  201435    CRDRDR,   LAC SIGN
0260  246573              DAC READ80
0261  700001              LAW 1
0262  246544              DAC READND
0263  600103              JMP STRTOV
0264  742372    CONMSG,   742372
0265  616243              616243
0266  650063              650063
0267  464523              464523
0270  514643              514643
0271  006465              6465
0272  227167              227167
0273  456123              456123
0274  465177              465177
0275  712200              712200
0276  454623              454623
0277  006163              6163
0300  636547              636547
0301  236162              236162
0302  436500              436500
```

```
0303  234600            234600
0304  237071            237071
0305  227747            227747
0306  514667            514667
0307  516144            516144
0310  002565            2565
0311  512271            512271
0312  464500            464500
0313  646123            646123
0314  656400            656400
0315  001000            1000
0316  454625            454625
0317  000111            111
0320  070113            70113
0321  624415  LOCONR,    PAGE
0322  700327            LAW LCNR
0323  174222            REPORT
0324  650100            SZA I
0325  600321            JMP LOCONR
0326  600257            JMP CRDRDR
0327  744372    LCNR,   744372
0330  466164            466164
0331  006346            6346
0332  452351            452351
0333  464300            464300
0334  646522            646522
0335  716745            716745
0336  612346            612346
0337  517771            517771
0340  220045            220045
0341  462300            462300
0342  616363            616363
0343  654723            654723
0344  616243            616243
0345  650023            650023
0346  460023            460023
0347  707122            707122
0350  774751            774751
0351  466751            466751
0352  614400            614400
0353  256551            256551
0354  227146            227146
0355  450064            450064
0356  612365            612365
0357  640000            640000
0360  100045            100045
0361  462500            462500
0362  011107            11107
0363  017313            17313
0364  724074  PROCED,   EEM
0365  720035            ESM
0366  710006            LAW I 5
0367  241441            DAC CASE
0370  623743            RPAPER
```

```
0371  620664            JSP NPAP
0372  400103            ADD STRTOV
0373  241436            DAC LEADER
0374  461441            ISP CASE
0375  600370            JMP .-5
0376  764000            CLI
0377  201435            LAC DISP
0400  174103            TEXARN
0401  764000  PROCES,    CLI
0402  341441            DZM CASE
0403  201434            LAC BUF
0404  174133            TEXART
0405  623743    NEXT,    RPAPER
0406  620664            JSP NPAP
0407  400103            ADD STRTOV
0410  261431            DAP ITABLI
0411  501436   LEADR,    SAD LEADER
0412  600405            JMP NEXT
0413  201443            LAC FOLL
0414  240411            DAC LEADR
0415  231431            LIO I ITABLI
0416  760200            CLA
0417  663037            RCL S5
0420  501437   VALID,    SAD UNDF
0421  600712            JMP ADDEF
0422  400425            ADD .+3
0423  240424            DAC .+1
0424  000000            ..
0425  600426            JMP .+1
0426  600471            JMP NORMAL
0427  600471            JMP NORMAL
0430  600511            JMP RUNOUT
0431  600517            JMP LINE
0432  600527            JMP FILEND
0433  600546            JMP FILENS
0434  600405            JMP NEXT
0435  600464            JMP SEVERE
0436  600461            JMP NONEMP
0437  600567            JMP FILENC
0440  601140            JMP LABELL
0441  700464  NONEMP,    LAW .+3
0442  260510            DAP NORM.
0443  600471            JMP NORMAL
0444  700405            LAW NEXT
0445  260510            DAP NORM.
0446  710003            LAW I 3
0447  241437            DAC CNTR
0450  623743     PAS,    RPAPER
0451  620664            JSP NPAP
0452  400103            ADD STRTOV
0453  261431            DAP ITABLI
0454  231431            LIO I ITABLI
0455  760200            CLA
0456  663037            RCL S5
```

```
0457  640100            SZA
0460  600420            JMP VALID
0461  461437            ISP CNTR
0462  600430            JMP PAS
0463  600436            JMP NEXT
0464  761200  SEVERE,   CLA CMA
0465  501440            SAD TOG
0466  600436            JMP NEXT
0467  241440            DAC TOG
0470  600523            JMP LINE+4
0471  760200  NORMAL,   CLA
0472  663001            RCL S1
0473  501441            SAD CASE
0474  600501            JMP .+5
0475  241441            DAC CASE
0476  661001            RAL S1
0477  401444            ADD LC
0500  174120            TEXN
0501  760200            CLA
0502  663077            RCL S6
0503  174120            TEXN
0504  760200            CLA
0505  663077            RCL S6
0506  174157            TEXT
0507  341440            DZM TOG
0510  600436  NORM.,     JMP NEXT
0511  623743  RUNOUT,    RPAPER
0512  600514            JMP .+2
0513  600511            JMP RUNOUT
0514  201442            LAC LEAD
0515  240411            DAC LEADR
0516  600366            JMP PROCED+2
0517  700077    LINE,   LAW 77
0520  174120            TEXN
0521  460537            ISP LINS
0522  600436            JMP NEXT
0523  620542            JSP WROUT
0524  710000   LINES.   LAW I ..
0525  240537            DAC LINS
0526  600401            JMP PROCES
0527  620542  FILEND,   JSP WROUT
0530  710003            LAW I 3
0531  241437            DAC CNTR
0532  623743    PASS,   RPAPER
0533  620664            JSP NPAP
0534  400003            ADD STRTOV
0535  261431            DAP ITABLI
0536  231431            LIO I ITABLI
0537  760200            CLA
0540  663037            RCL S5
0541  640100            SZA
0542  600420            JMP VALID
0543  461437            ISP CNTR
0544  600532            JMP PASS
```

```
0545  600524            JMP LINES
0546  620552  FILENS,   JSP WRBUT
0547  201442  FILENC,   LAC LEAD
0550  240411            DAC LEADR
0551  200560            LAC LINS+1
0552  640100            SZA
0553  600551            JMP .-2
0554  623422            IBM
0555  000423            EOF MED 3
0556  000002     TWO,   2
0557  000000     LINS,  ..
0560  000000            ..
0561  600411            JMP PROCES
0562  260520    WRBUT,  DAP WR.
0563  211454            LAC I ITEXM
0564  501435            SAD DISP
0565  600520            JMP WR.
0566  640030            SZS 50
0567  620533            JSP SHOW
0570  201435            LAC DISP
0571  764000            CLI
0572  174104            TEXARN
0573  211456            LAC I TEXTW
0574  241434            DAC BUF
0575  700077            LAW 77
0576  174107            TEXT
0577  211456            LAC I TEXTW
0600  501434            SAD BUF
0601  600575            JMP .-4
0602  600603     WR2,   JMP .+1
0603  240607            DAC .+4
0604  623422            IBM
0605  000553            WRITE EVEN MED 3
0606  010000            10000
0607  010000            10000
0610  000000            ..
0611  700621            LAW WR.+1
0612  260602            DAP WR2
0613  200625            LAC WR.+6
0614  640100            SZA
0615  600613            JMP .-2
0616  200624            LAC WR.+4
0617  241434            DAC BUF
0620  600620     WR.,   JMP .
0621  240625            DAC .+4
0622  623422            IBM
0623  000553            WRITE EVEN MED 3
0624  010062            10062
0625  010062            10062
0626  000000            ..
0627  700636            LAW WR1
0630  260602            DAP WR2
0631  200643            LAC WR1+5
0632  640100            SZA
```

```
0633  600631            JMP .-2
0634  200641            LAC WR1+3
0635  600617            JMP WR.-1
0636  240642     WR1,   DAC .+4
0637  623422            IBM
0640  000563            WRITE EVEN MED 3
0641  010144            10144
0642  010144            10144
0643  000000            ..
0644  700603            LAW WR2+1
0645  260602            DAP WR2
0646  200610            LAC WR2+6
0647  640100            SZA
0650  600646            JMP .-2
0651  200606            LAC WR2+4
0652  600617            JMP WR.-1
0653  260652     SHOW,  DAP SHOW.
0654  700013            LAW 13
0655  174120            TEXN
0656  624415            PAGE
0657  201435            LAC DISP
0660  174222            REPORT
0661  640100            SZA
0662  600000     SHOW.,  JMP
0663  600666            JMP .-5
0664  420566     NPAP,  SUB TWO
0665  260673            DAP NPAP.
0666  624415            PAGE
0667  700674            LAW NPAP.+1
0670  174222            REPORT
0671  650100            SZA I
0672  600666            JMP .-4
0673  600000     NPAP.,  JMP ..
0674  742672            742672
0675  706545            706545
0676  004761            4761
0677  476551            476551
0700  002361            2361
0701  476500            476500
0702  712200            712200
0703  516561            516561
0704  643000            643000
0705  242265            242265
0706  004371            4371
0707  677023            677023
0710  004765            4765
0711  457313            457313
0712  200100     ADDEF,  LAC STRTOV
0713  765000            CMA CLI
0714  041460            IOR LAWC
0715  401451            ADD ITABLI
0716  673007            RCR S3
0717  672007            RIR S3
0720  673007            RCR S3
```

```
0721  672007            RIR S3
0722  673007            RCR S3
0723  672007            RIR S3
0724  321111            DIO PUN
0725  700003            LAW 3
0726  241457            DAC CNTR
0727  211461            LAC I TEXTX
0730  241462            DAC TESTX
0731  700013            LAW 13
0732  174120            TEXN
0733  361457            NIX CNTR
0734  211461            LAC I TEXTX
0735  501462            SAD TESTX
0736  600731            JMP .-5
0737  201462            LAC TESTX
0740  221457            LIO CNTR
0741  174104            TEXARN
0742  624415  ADDEF1,    PAGE
0743  201435            LAC DISP
0744  174222            REPORT
0745  701056            LAW ADDE
0746  174222            REPORT
0747  701126            LAW IGN
0750  174222            REPORT
0751  640100            SZA
0752  600406            JMP NEXT
0753  701122            LAW ALTT
0754  174222            REPORT
0755  640100            SZA
0756  600771            JMP ALT
0757  701153            LAW SOV
0760  174222            REPORT
0761  650100            SZA I
0762  600742            JMP ADDEF1
0763  623743            RPAPER
0764  640600            SMA SPA
0765  600763            JMP .-2
0766  640600            SMA SPA
0767  600356            JMP PROCED+2
0770  620654            JSP NPAP
0771  341031     ALT,   DZM ALT1
0772  341032            DZM ALT2
0773  624415            PAGE
0774  701032            LAW ALT2
0775  174222            REPORT
0776  650100            SZA I
0777  601006     ALTV,  JMP ALTU
1000  201031            LAC ALT1
1001  764000            CLI
1002  673077            RCR S6
1003  672177            RIR S7
1004  600471            JMP NORMAL
1005  701036     ALTU,  LAW ARR+1
1006  174222            REPORT
```

```
1007  650100          SZA I
1010  600773          JMP ALT+2
1011  421035          SUB ARR
1012  673007          RCR S3
1013  201031          LAC ALT1
1014  663007          RCL S3
1015  241031          DAC ALT1
1016  021030          AND ALT0
1017  640100          SZA
1020  601023          JMP .+3
1021  241032          DAC ALT2
1022  601037          JMP ALTW
1023  673077          RCR S6
1024  760200          CLA
1025  663007          RCL S3
1026  661007          RAL S3
1027  663007          RCL S3
1030  261032          DAP ALT2
1031  021030          AND ALT0
1032  640100          SZA
1033  601037          JMP .+4
1034  700020          LAW 20
1035  041032          IOR ALT2
1036  241032          DAC ALT2
1037  701042  ALTW,    LAW .+3
1040  260777          DAP ALTV
1041  600773          JMP ALT+2
1042  461034          ISP ALT3
1043  600773          JMP ALT+2
1044  710100          LAW I 100
1045  241034          DAC ALT3
1046  701006          LAW ALTU
1047  601040          JMP .-7
1050  000077  ALT0,    77
1051  000000  ALT1,    ..
1052  000000  ALT2,    ..
1053  777713          777713
1054  777677  ALT3,    0-100
1055  001057   ARR,    .+2
1056  777720          777720
1057  000100          100
1060  020000          20000
1061  777703          777703
1062  000400          400
1063  050000          50000
1064  777706          777706
1065  000713          713
1066  007777  ADDE,    7777
1067  742472          742472
1070  456465          456465
1071  667145          667145
1072  656400          656400
1073  476147          476147
1074  655100          655100
```

```
1075  637061                637061
1076  516163                516163
1077  236551                236551
1100  006646                6646
1101  434346                434346
1102  267145                267145
1103  670023                670023
1104  706500                706500
1105  664651                664651
1106  656746                656746
1107  714567                714567
1110  742072                742072
1111  000000      PUN,      ..
1112  737475                737475
1113  027764                27764
1114  724600                724600
1115  304624                304624
1116  002671                2671
1117  227000                227000
1120  234677                234677
1121  131313     ADDE1,     131313
1122  776370      ALTT,     776370
1123  614567                614567
1124  650071                650071
1125  237713                237713
1126  777167       IGN,     777167
1127  454651                454651
1130  650071                650071
1131  237421                237421
1132  777213                777213
1133  772223       SOV,     772223
1134  615123                615123
1135  004625                4625
1136  655174                655174
1137  217213                217213
1140  341441   LABELL,      DZM CASE
1141  620562                JSP WROUT
1142  201435   LABEL2,      LAC DISP
1143  241051                DAC ALT1
1144  241244                DAC LABC03
1145  221050                LIO ALTO
1146  730003                TYOW
1147  764000                CLI
1150  174104                TEXARN
1151  701332                LAW LABC06+1
1152  261214                DAP LABCON
1153  701170                LAW LABEL1+6
1154  261167                DAP LABEL1+5
1155  221121                LIO ADDE1
1156  331051                DIO I ALT1
1157  441051                IDX ALT1
1160  521466                SAS DISPEN
1161  601136                JMP .-3
1162  623214   LABEL1,      TYPIN
```

```
1163  601200            JMP LABDIS
1164  501050            SAD ALTO
1165  601175            JMP .+10
1166  174120            TEXN
1167  601152            JMP LABEL1
1170  701152            LAW LABEL1
1171  261167            DAP .-2
1172  701215            LAW LABCON+1
1173  261214            DAP LABCON
1174  601162            JMP LABEL1
1175  623214            TYPIN
1176  601214            JMP LABCON
1177  601175            JMP .-2
1200  624415  LABDIS,    PAGE
1201  701252            LAW FLE
1202  174222            REPORT
1203  640100            SZA
1204  601245            JMP LABEL3
1205  701273            LAW LABDI
1206  174222            REPORT
1207  201435            LAC DISP
1210  174222            REPORT
1211  650100            SZA I
1212  601152            JMP LABEL1
1213  601142            JMP LABEL2
1214  601214  LABCON,    JMP .
1215  201434            LAC BUF
1216  764000            CLI
1217  174136            TEXART
1220  710003            LAW I 3
1221  241437            DAC CNTR
1222  231264  LABC01,    LIO I LABC03
1223  760200            CLA
1224  663077            RCL S6
1225  321452            DIO TESTX
1226  501456            SAD STOPR
1227  601331            JMP LABC06
1230  501464            SAD LC
1231  601324            JMP LABC04
1232  501432            SAD UC
1233  601325            JMP LABC05
1234  401441            ADD CASE
1235  171335            JDA CONVRT
1236  174157            TEXT
1237  221452  LABC02,    LIO TESTX
1240  461437            ISP CNTR
1241  601223            JMP LABC01+1
1242  441264            IDX LABC03
1243  601220            JMP LABC01-2
1244  000000  LABC03,    ..
1245  760200  LABEL3,    CLA
1246  521234            SAS .+6
1247  601245            JMP .-2
1250  623422            IBM
```

```
1251  000423              EOF MED 3
1252  400000              400000
1253  000000              ..
1254  000000              ..
1255  201252              LAC .+3
1256  241253              DAC .+3
1257  461253              ISP .+4
1260  601257              JMP .+1
1261  601162              JMP LABEL1
1262  007777      FLE,    7777
1263  742672              742672
1264  517123              517123
1265  650061              650061
1266  450065              450065
1267  456400              456400
1270  466600              466600
1271  667143              667143
1272  657713              657713
1273  746172    LABDI,    746172
1274  006361              6361
1275  515171              515171
1276  616765              616765
1277  005165              5165
1300  232451              232451
1301  450023              450023
1302  655144              655144
1303  714561              714561
1304  236522              236522
1305  004361              4361
1306  626543              626543
1307  777423              777423
1310  727065              727065
1311  004371              4371
1312  677023              677023
1313  476545              476545
1314  004461              4461
1315  300062              300062
1316  650024              650024
1317  226564              226564
1320  002346              2346
1321  006551              6551
1322  612265              612265
1323  777713              777713
1324  341441    LABC04,   DZM CASE
1325  601237              JMP LABC02
1326  700100    LABC05,   LAW 100
1327  241441              DAC CASE
1330  601237              JMP LABC02
1331  620552    LABC06,   JSP WROUT
1332  201442              LAC LEAD
1333  240411              DAC LEADR
1334  600524              JMP LINES
1335  000000    CONVRT,   ..
1336  261336              DAP CONVT.
```

```
1337  221335            LIO CONVRT
1340  760200            CLA
1341  663001            RCL S1
1342  561433            DIV THREE
1343  001357            TABLE
1344  401343            ADD .-1
1345  261346            DAP .+1
1346  200000            LAC
1347  672001            RIR S1
1350  642000            SPI
1351  671077            RAR S6
1352  672001            RIR S1
1353  642000            SPI
1354  661077            RAL S6
1355  021050            AND ALTO
1356  600000  CONVT.,    JMP ..
1357  020120   TABLE,    20120
1360  050403            50403
1361  100706            100706
1362  535311            535311
1363  535353            535353
1364  211253            211253
1365  242322            242322
1366  272625            272625
1367  533130            533130
1370  535333            535333
1371  535353            535353
1372  434241            434241
1373  464544            464544
1374  515047            515047
1375  405453            405453
1376  345374            345374
1377  626160            626160
1400  656463            656463
1401  706766            706766
1402  735371            735371
1403  535353            535353
1404  532053            532053
1405  533253            533253
1406  535353            535353
1407  535353            535353
1410  535353            535353
1411  535353            535353
1412  232253            232253
1413  262524            262524
1414  313027            313027
1415  531353            531353
1416  535353            535353
1417  424153            424153
1420  454443            454443
1421  504746            504746
1422  545351            545351
1423  537460            537460
1424  615334            615334
```

```
1425  646362              646362
1426  676665              676665
1427  537170              537170
1430  535354              535354
1431  535353              535353
1432  000074       UC,    74
1433  000003    THREE,    3
1434  010000      BUF,    10000
1435  014000     DISP,    14000
1436  000000   LEADER,    0
1437  000037     UNDF,    37
1440  777777      TOG,    1!0-1
1441  000000     CASE,    ..
1442  501436     LEAD,    SAD LEADER
1443  600415     FOLL,    JMP LEADR+4
1444  000072       LC,    72
1445  420000       XO,    420000
1446  357777       YO,    357777
1447  007273   ETABLE,    7273
1450  770000    UNDEF,    770000
1451  000000   ITABLI,    ..
1452  000377    CHMSK,    377
1453  000012      TCH,    12
1454  000002      LCH,    LCONT
1455  400000     SIGN,    400000
1456  004156    TEXTW,    TEXL
1457  000000     CNTR,    ..
1460  700000     LAWC,    LAW
1461  004117    TEXTX,    TEXM
1462  000000    TESTX,    ..
1463  000001      ONE,    1
1464  004117    ITEXM,    TEXM
1465  020000   DISPEN,    20000
1466  000013    STOPR,    13
```

TYPIN (Console Typewriter Input)

S Y M B O L   T A B L E

TYPSEQ	0007	S Y M B O L T A B L E
TYPIN	3214	S Y M B O L T A B L E
TYPIN.	3270	S Y M B O L T A B L E
WHAT	3217	S Y M B O L T A B L E
LOOP	3301	S Y M B O L T A B L E
JAY	3277	S Y M B O L T A B L E
LOOPE	3420	S Y M B O L T A B L E
LEN	3275	S Y M B O L T A B L E
JUN	3300	S Y M B O L T A B L E
TYPINT	3240	S Y M B O L T A B L E
NINT	3274	S Y M B O L T A B L E
EYE	3276	S Y M B O L T A B L E
EYES	3271	S Y M B O L T A B L E
REENA	3273	S Y M B O L T A B L E
ENAB	3262	S Y M B O L T A B L E
SEE	3272	S Y M B O L T A B L E

```
                                *3214
                               TYPSEQ = 7
3214  243270     TYPIN,  DAC TYPIN,
3215  443270             IDX TYPIN,
3216  720034             LSM
3217  603304      WHAT,  JMP LOOP+3
3220  253277             DAC I JAY
3221  443277             IDX JAY
3222  523420             SAS LOOPE
3223  603226             JMP .+3
3224  423275             SUB LEN
3225  243277             DAC JAY
3226  213277             LAC I JAY
3227  720035             ESM
3230  640400             SMA
3231  613270             JMP I TYPIN,
3232  363270             NIX TYPIN,
3233  363277             NIX JAY
3234  503300             SAD JUN
3235  403275             ADD LEN
3236  243277             DAC JAY
3237  613270             JMP I TYPIN,
3240  720033   TYPINT,   LSR0
3241  662007             RIL 3
3242  652000             SPI I
3243  613274             JMP I NINT
3244  720004             TYI
3245  333276             DIO I EYE
3246  443276             IDX EYE
3247  523420             SAS LOOPE
3250  603253             JMP .+3
3251  423275             SUB LEN
3252  243276             DAC EYE
3253  523277             SAS JAY
3254  613274             JMP I NINT
3255  203274             LAC NINT
3256  253271             DAC I EYES
3257  203273             LAC REENA
3260  243217             DAC WHAT
3261  613274             JMP I NINT
3262  203272     ENAB,   LAC SEE
3263  253271             DAC I EYES
3264  203267             LAC .+3
3265  243217             DAC WHAT
3266  603217             JMP WHAT
3267  761200             CLA CMA
3270  000000   TYPIN.,   ..
3271  003271     EYES,   .
3272  003240      SEE,   TYPINT
3273  603252    REENA,   JMP ENAB
3274  003274     NINT,   .
3275  000117      LEN,   LOOPE-LOOP
```

```
3276  003301      EYE,  LOOP
3277  003417      JAY,  LOOPE-1
3300  003300      JUN,  .
3301  003240     LOOP,  TYPINT
3302  000007            TYPSEQ
3303  007777            7777
3304  223301            LIO LOOP
3305  213302            LAC I LOOP+1
3306  023303            AND LOOP+2
3307  243271            DAC EYES
3310  213271            LAC I EYES
3311  243274            DAC NINT
3312  333271            DIO I EYES
3313  203316            LAC .+3
3314  243217            DAC WHAT
3315  603413            JMP .+76
3316  761200            CLA CMA
                          *.+74
3413  223417            LIO .+4
3414  323301            DIO LOOP
3415  443414            IDX .-1
3416  603414            JMP .-2
3417  603216            JMP WHAT-1
3420  003420    LOOPE,  .
```

IBM (Tape Handler)

SYMBOL TABLE

IBMSEQ	0004
IBM.	3421
IBM	3422
THR	3711
STRING	3706
STRT	3432
RETRN	3710
STRTD	3704
SEQ	3712
INTAD	3576
NINT	3736
COMPF	3616
COMP	3442
SPOOL	3707
FUNCT	3713
FWA	3714
NW	3715
DENS	3716
INSTR3	3564
UNLOAD	3522
VECTR	3717
VECT	3475
EOF	3546
WR	3513
REA	3502
RR0	3720
RRE	3721
INSTR4	3570
INT0	3722
INSTR1	3561
DAT	3510
LOC	3723
INSTR2	3563
EXEC	3556
WW0	3724
WWE	3725
OUTPT	3726
VESTR	3727
VEST	3526
UNL	3533
REWX	3537
BYPAS	3677
ERR	3610
REWUN	3730
REEW	3731
SETR	3732
NET	3550
WEFF	3733
NOOP	3734

INTAD3 3741
INTAD1 3603
DISCØ 3735
ØRDER 3740
MINØNE 3737
TERM 3651
CØMPT 3625
CØMP1 3742
D1 3634
INTAD2 3641
STRUTS 3703
STRUT 3705
STRTS 3702

SYMBØL TABLE
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```
                        *3421
                         CG0 = 720073
                       IBMSEQ = 4
3421  000000    IBM,,  ..
3422  403711     IBM,  ADD THR
3423  243421           DAC IBM,
3424  253706           DAC I STRING
3425  243706           DAC STRING
3426  761200           CLA CMA
3427  253706           DAC I STRING
3430  443421           IDX IBM,
3431  720272           CER
3432  243710    STRT,  DAC RETRN
3433  203704           LAC STRTD
3434  243431           DAC .+3
3435  213712           LAC I SEQ
3436  263574           DAP INTAD-2
3437  213574           LAC I INTAD-2
3440  243736           DAC NINT
3441  603616           JMP COMPF
3442  213707    COMP,  LAC I SP00L
3443  243713           DAC FUNCT
3444  443707           IDX SP00L
3445  213707           LAC I SP00L
3446  243714           DAC FWA
3447  443707           IDX SP00L
3450  213707           LAC I SP00L
3451  423714           SUB FWA
3452  243715           DAC NW
3453  443707           IDX SP00L
3454  203713           LAC FUNCT
3455  673007           RCR S3
3456  023711           AND THR
3457  650100           SZA I
3460  700001           LAW 1
3461  663007           RCL S3
3462  661077           RAL S6
3463  043716           IOR DENS
3464  243564           DAC INSTR3
3465  223713           LIO FUNCT
3466  672777           RIR S9
3467  652000           SPI I
3470  603522           JMP UNLOAD
3471  760200           CLA
3472  663007           RCL S3
3473  403717           ADD VECTR
3474  243475           DAC .+1
3475  000000    VECT,  ..
3476  603546           JMP EOF
3477  603513           JMP WR
3500  603502           JMP REA
3501  760400           HLT
```

```
3502  203720      REA,  LAC RR0
3503  642000            SPI
3504  203721            LAC RRE
3505  243570            DAC INSTR4
3506  203722            LAC INT0
3507  243564            DAC INSTR1
3510  203723      DAT,  LAC LOC
3511  243566            DAC INSTR2
3512  603556            JMP EXEC
3513  203724       WR,  LAC WW0
3514  642000            SPI
3515  203725            LAC WWE
3516  243570            DAC INSTR4
3517  203726            LAC OUTPT
3520  243564            DAC INSTR1
3521  603510            JMP DAT
3522  760200    UNLOAD, CLA
3523  663007            RCL S3
3524  403727            ADD VESTR
3525  243526            DAC .+1
3526  000000     VEST,  ..
3527  603533            JMP UNL
3530  603537            JMP REWX

3531  760400            HLT                    / FORWARD SPACE
                                               /
3532  760400            HLT                    / BACKSPACE
3533  703677      UNL,  LAW BYPAS              /
3534  263610            DAP ERR
3535  203730            LAC REWUN
3536  603540            JMP .+2
3537  203731     REWX,  LAC REEW
3540  243570            DAC INSTR4
3541  700700            LAW 700
3542  023564            AND INSTR3
3543  043732            IOR SETR
3544  243564            DAC INSTR3
3545  603550            JMP NET
3546  203733      EOF,  LAC WEFF
3547  243570            DAC INSTR4
3550  203734      NET,  LAC NOOP
3551  243564            DAC INSTR1
3552  203741            LAC INTAD3
3553  243606            DAC INTAD1
3554  203735            LAC DISC0
3555  243566            DAC INSTR2
3556  720072     EXEC,  STCF
3557  603556            JMP .-1
3560  223715            LIO NW
3561  000000    INSTR1, ..
3562  223714            LIO FWA
3563  000000    INSTR2, ..
3564  000000    INSTR3, ..
3565  720172            LSR
```

```
3566  642000            SPI
3567  603566            JMP .-2
3570  000000  INSTR4,   ..
3571  203575            LAC INTAD-1
3572  253574            DAC I INTAD-2
3573  613710            JMP I RETRN
3574  000000            ..
3575  003576            .+1
3576  203736  INTAD,    LAC NINT
3577  243710            DAC RETRN
3600  703600            LAW .+2
3601  263575            DAP INTAD-1
3602  720172            LSR
3603  672037  INTAD1,   RIR S5
3604  652000            SPI I
3605  613736            JMP I NINT
3606  662077            RIL S6
3607  642000            SPI
3610  603610    ERR,    JMP .
3611  672037            RIR S5
3612  760200            CLA
3613  642000            SPI
3614  203614            LAC .
3615  313740            DIP I ORDER
3616  213700  COMPF,    LAC I SPOOL
3617  353700            DZM I SPOOL
3620  503737            SAD MINONE
3621  603631            JMP TERM
3622  423711            SUB THR
3623  243740            DAC ORDER
3624  243700            DAC SPOOL
3625  603626  COMPT,    JMP .+1
3626  703631            LAW .+3
3627  263625            DAP .-2
3630  603442            JMP COMP
3631  203742            LAC COMP1
3632  253574            DAC I INTAD-2
3633  613710            JMP I RETRN
3634  720172      D1,   LSR
3635  662377            RIL S8
3636  642000            SPI
3637  613736            JMP I NINT
3640  603442            JMP COMP
3641  662377  INTAD2,   RIL S8
3642  642000            SPI
3643  613736            JMP I NINT
3644  203611            LAC ERR+1
3645  243603            DAC INTAD1
3646  703626            LAW COMPT+1
3647  263625            DAP COMPT
3650  603616            JMP COMPF
3651  203703    TERM,   LAC STRUTS
3652  243706            DAC STRING
3653  243700            DAC SPOOL
```

```
3654  703626            LAW COMPT+1
3655  263625            DAP COMPT
3656  703661            LAW .+3
3657  273574            DAP I INTAD-2
3660  613710            JMP I RETRN
3661  720172            LSR
3662  662377            RIL S8
3663  642000            SPI
3664  613736            JMP I NINT
3665  203705            LAC STRUT
3666  640100            SZA
3667  603616            JMP COMPF
3670  203702            LAC STRTS
3671  243431            DAC STRT-1
3672  703575            LAW INTAD
3673  263575            DAP INTAD-1
3674  203736            LAC NINT
3675  253574            DAC I INTAD-2
3676  613710            JMP I RETRN
3677  703610   BYPAS,   LAW ERR
3700  263610            DAP ERR
3701  603402            JMP COMP
3702  720272   STRTS,   CER
3703  003705  STRUTS,   STRUT
3704  613421   STRTD,   JMP I IBM,
3705  000000   STRUT,   ..
3706  003705  STRING,   STRUT
3707  003705   SPOOL,   STRUT
3710  000000   RETRN,   ..
3711  000003     THR,   3
3712  000004     SEQ,   IBMSEQ
3713  000000   FUNCT,   ..
3714  000000     FWA,   ..
3715  000000      NW,   ..
3716  720070    DENS,   720070
3717  603472   VECTR,   JMP VECT-3
3720  721471     RR0,   R0
3721  721671     RRE,   RE
3722  722046    INT0,   SWCI
3723  720346     L0C,   SDLC
3724  721071     WW0,   W0
3725  721271     WWE,   WE
3726  726046   OUTPT,   SWC0
3727  603527   VESTR,   JMP VEST+1
3730  720571   REWUN,   REWU
3731  720471    REEW,   REW
3732  724070    SETR,   SFR
3733  723271    WEFF,   WEF
3734  760000    NOOP,   NOP
3735  720146   DISC0,   DDC
3736  003736    NINT,   .
3737  777777  MINONE,   1:0-1
3740  000000   ORDER,   ..
3741  603641  INTAD3,   JMP INTAD2
3742  003634   COMP1,   D1
```

RPAPER (Read Paper Tape)

SYMBOL TABLE

PAPSEQ	0005
RPAPER	3743
RPAP.	4024
WHAT	3745
LOOP	4034
JAY	4032
LOOPE	4103
LEN	4030
DELAY	4026
REMOVE	4025
JUN	4033
MOVE	3773
PAPINT	4000
NINT	4027
EYE	4031

SYMBOL TABLE

```
                        *3743
                        PAPSEQ = 5
3743  244024   RPAPER,  DAC RPAP.
3744  444024            IDX RPAP.
3745  604037     WHAT,  JMP LOOP+3
3746  254032            DAC I JAY
3747  444032            IDX JAY
3750  524103            SAS LOOPE
3751  603754            JMP .+3
3752  424030            SUB LEN
3753  244032            DAC JAY
3754  214032            LAC I JAY
3755  640400            SMA
3756  614024            JMP I RPAP.
3757  464026            ISP DELAY
3760  603754            JMP .-4
3761  204025            LAC REMOVE
3762  243745            DAC WHAT
3763  364024            NIX RPAP.
3764  716405            LAW I 6405
3765  244026            DAC DELAY
3766  364032            NIX JAY
3767  504033            SAD JUN
3770  404030            ADD LEN
3771  244032            DAC JAY
3772  614024            JMP I RPAP.
3773  720001     MOVE,  RPA
3774  203777            LAC .+3
3775  243745            DAC WHAT
3776  603745            JMP WHAT
3777  761200            CLA CMA
4000  720033   PAPINT,  LSR0
4001  662001            RIL S1
4002  652000            SPI I
4003  614027            JMP I NINT
4004  720030            RRB
4005  716405            LAW I 6405
4006  244026            DAC DELAY
4007  334031            DIO I EYE
4010  444031            IDX EYE
4011  524103            SAS LOOPE
4012  604015            JMP .+3
4013  424030            SUB LEN
4014  244031            DAC EYE
4015  504032            SAD JAY
4016  604021            JMP .+3
4017  720001            RPA
4020  614027            JMP I NINT
4021  204025            LAC REMOVE
4022  243745            DAC WHAT
4023  614027            JMP I NINT
4024  000000   RPAP.,   ..
```

```
4025  603773  REMOVE,  JMP MOVE
4026  771372   DELAY,  771372
4027  004027    NINT,  .
4030  000047     LEN,  LOOPE-LOOP
4031  004034     EYE,  LOOP
4032  004102     JAY,  LOOPE-1
4033  004033     JUN,  .
4034  004000    LOOP,  PAPINT
4035  000035           PAPSEQ
4036  007777           7777
4037  224034           LIO LOOP
4040  214035           LAC I LOOP+1
4041  024036           AND LOOP+2
4042  244042           DAC .
4043  214042           LAC I .-1
4044  244027           DAC NINT
4045  334042           DIO I .-3
4046  604076           JMP .+30
                         *.+27
4076  224102           LIO .+4
4077  324034           DIO LOOP
4100  444077           IDX .-1
4101  604077           JMP .-2
4102  603772           JMP MOVE-1
4103  004103   LOOPE,  .
```

SYMBOL TABLE

TEXART	4104	SYMBOL TABLE
TEXT.	4130	SYMBOL TABLE
WRITE	4117	SYMBOL TABLE
TEXT1	4140	SYMBOL TABLE
TEXT2	4150	SYMBOL TABLE
TEXT	4120	SYMBOL TABLE

```
*4104          /  JDA TEXT THIS SUBROUTINE DEPOSITS
                  /            OCTALS INTO THE NEXT TWO OCTAL POSITIONS
                  /            IN MEMORY, SO THAT TEXT MAY BE COMPOSED FOR
                  /            FUTURE OUTPUTTING.
                  /  JDA TEXART  ACCUMULATOR CONTAINS MEMORY ADDRESS OF
                  /              WORD INTO WHICH THE FIRST OCTAL PAIR IS
                  /              TO BE INSERTED AND THE IC DESIGNATES WHICH
                  /              POSITION OF THE WORD  (0, 1, 2 FROM HIGH
                  /              TO LOW ORDER).

4104   000000   TEXART,  ..                                              **
4105   264130          DAP TEXT,
4106   204104          LAC TEXART
4107   244117          DAC WRITE
4110   672001          RIR S1
4111   642000          SPI
4112   604126          JMP TEXT,+2
4113   672001          RIR S1
4114   642000          SPI
4115   604140          JMP TEXT1
4116   604150          JMP TEXT2
4117   000000   WRITE,  ..
4120   000000    TEXT,  ..
4121   264130          DAP TEXT,
4122   604123          JMP .+1
4123   204120          LAC TEXT
4124   671077          RAR S6
4125   314117          DIP I WRITE
4126   704131          LAW .+3
4127   264122          DAP TEXT+2
4130   600000   TEXT..  JMP
4131   204120          LAC TEXT
4132   661077          RAL S6
4133   244120          DAC TEXT
4134   717700          LAW I 7700
4135   034117          AND I WRITE
4136   044120          IOR TEXT
4137   254117          DAC I WRITE
4140   704143   TEXT1,  LAW .+3
4141   264122          DAP TEXT+2
4142   604130          JMP TEXT,
4143   710077          LAW I 77
4144   034117          AND I WRITE
4145   044120          IOR TEXT
4146   254117          DAC I WRITE
4147   444117          IDX WRITE
4150   704123   TEXT2,  LAW TEXT+3
4151   264122          DAP TEXT+2
4152   604130          JMP TEXT,
```

TEXART (Output-Buffer Stuffer)

SYMBOL TABLE

TEXART	4153	SYMBOL TABLE
TEXT.	4177	SYMBOL TABLE
WRITE	4166	SYMBOL TABLE
TEXT1	4207	SYMBOL TABLE
TEXT2	4217	SYMBOL TABLE
TEXT	4167	SYMBOL TABLE

```
*4153          /  JDA TEXT THIS SUBROUTINE DEPOSITS
               /            OCTALS INTO THE NEXT TWO OCTAL POSITIONS
               /            IN MEMORY, SO THAT TEXT MAY BE COMPOSED FOR
               /            FUTURE OUTPUTTING.
               /   JDA TEXART  ACCUMULATOR CONTAINS MEMORY ADDRESS OF
               /               WORD INTO WHICH THE FIRST OCTAL PAIR IS
               /               TO BE INSERTED AND THE IO DESIGNATES WHICH
               /               POSITION OF THE WORD  (0, 1, 2 FROM HIGH
               /               TO LOW ORDER).
                                                                        **
4153  000000   TEXART, ..
4154  264177           DAP TEXT.
4155  204153           LAC TEXART
4156  244166           DAC WRITE
4157  672001           RIR S1
4160  642000           SPI
4161  604175           JMP TEXT.+2
4162  672001           RIR S1
4163  642000           SPI
4164  604207           JMP TEXT1
4165  604217           JMP TEXT2
4166  000000    WRITE, ..
4167  000000     TEXT, ..
4170  264177           DAP TEXT.
4171  604172           JMP .+1
4172  204167           LAC TEXT
4173  671077           RAR S6
4174  314166           DIP I WRITE
4175  704200           LAW .+3
4176  264171           DAP TEXT+2
4177  600000    TEXT., JMP
4200  204167           LAC TEXT
4201  661077           RAL S6
4202  244167           DAC TEXT
4203  717700           LAW I 7700
4204  034166           AND I WRITE
4205  044167           IOR TEXT
4206  254166           DAC I WRITE
4207  704212    TEXT1, LAW .+3
4210  264171           DAP TEXT+2
4211  604177           JMP TEXT.
4212  710077           LAW I 77
4213  034166           AND I WRITE
4214  044167           IOR TEXT
4215  254166           DAC I WRITE
4216  444166           IDX WRITE
4217  704172    TEXT2, LAW TEXT+3
4220  264171           DAP TEXT+2
4221  604177           JMP TEXT.
```

REPORT (Text Display)

SYMBOL TABLE

LPEN	0006	SYMBOL TABLE
REPORT	4222	SYMBOL TABLE
REPRT.	4250	SYMBOL TABLE
LP1	4254	SYMBOL TABLE
LP2	4255	SYMBOL TABLE
LP3	4256	SYMBOL TABLE
LP4	4257	SYMBOL TABLE
REPRTA	4232	SYMBOL TABLE
REPRT2	4252	SYMBOL TABLE
REPRTP	4236	SYMBOL TABLE
REPRT3	4253	SYMBOL TABLE
REPRT1	4251	SYMBOL TABLE
REPO.	4267	SYMBOL TABLE
REPRTL	4244	SYMBOL TABLE

```
4222        /   PDP-1  SUBROUTINE REPORT     ( E.W.CARR)
            /     BECAUSE DISPLAYING ON THE VISUAL CRT OF ENTIRE
            /  STATEMENTS OR BLOCKS OF TEXT IS DESIRED AND THE
            /  SUBROUTINE  SYMBL  DISPLAYS BUT ONE CHARACTER AT A
            /  TIME, THIS ROUTINE WAS DESIGNED TO ACCEPT THE FIRST
            /  WORD ADDRESS OF A BLOCK OF MEMORY AND, PRESENT TO
            /  SUBROUTINE SYMBL EACH CONCISE III CODED CHARACTER
            /  IN ORDER UNTIL A 13 IS ENCOUNTERED, OR UNTIL A LIGHT
            /  PEN INTERRUPT OCCURS. UPON RETURN TO THE
            /  INSTRUCTION FOLLOWING JDA REPORT (WITH ACCUMULATOR
            /  EQUAL TO THE ADDRESS OF THE FIRST WORD OF THE BLOCK
            /  TO BE DISPLAYED), IF A LIHGTPEN INTERRUPT OCCURED,
            /  THE ACCUMULATOR WILL EQUAL ONE GREATER THAN THE ADDRESS
            /  OF THE WORD CONTAINING THE LAST CHARACTER DISPLAYED,
            /  OTHERWISE THE ACCUMULATOR WILL BE ZERO.
                                                                    **

                          LPEN = 6
                         SYMBL = JDA 4305
4222  000000   REPORT,  ..
4223  244250           DAC REPRT.
4224  214254           LAC I LP1
4225  264255           DAP LP2
4226  214255           LAC I LP2
4227  244256           DAC LP3
4230  204257           LAC LP4
4231  254255           DAC I LP2
4232  710003   REPRTA,  LAW I 3
4233  244252           DAC REPRT2
4234  234222           LIO I REPORT
4235  444222           IDX REPORT
4236  760200   REPRTP,  CLA
4237  663077           RCL S6
4240  324253           DIO REPRT3
4241  504251           SAD REPRT1
4242  604267           JMP REPO.
4243  174305           SYMBL
4244  224253   REPRTL,  LIO REPRT3
4245  464252           ISP REPRT2
4246  604236           JMP REPRTP
4247  604232           JMP REPRTA
4250  000000   REPRT,,  ..
4251  000013   REPRT1,  13
4252  000000   REPRT2,  ..
4253  000000   REPRT3,  ..
4254  000006      LP1,  LPEN
4255  000000      LP2,  ..
4256  000000      LP3,  ..
4257  004250      LP4,  .+1
4260  720033           LSR0
4261  652000           SPI I
```

```
4262  614235          JMP I LP3
4263  204256          LAC .+3
4264  244244          DAC REPRTL
4265  614235          JMP I LP3
4266  604270          JMP .+2
4267  344222  REP0,,  DZM REP0RT
4270  204275          LAC .+6
4271  244244          DAC REPRTL
4272  204235          LAC LP3
4273  274235          DAP I LP2
4274  204222          LAC REP0RT
4275  614230          JMP I REPRT.
4276  224253          LIO REPRT3
```

SYMBL (Display-Symbol Generator)

S Y M B O L T A B L E

SYMBGO	4277
SYMGO.	4304
DO1	4501
DO2	4514
SYMBL	4305
SYMBL.	4345
TABLE	4524
CASE	4441
PATRN	4456
LETPOS	4443
ΣLET	4445
LINPOS	4444
ΣLINE	4446
LETBEG	4413
TABS	4447
LINBEG	4442
PAGE	4415
TAB	4424
TABSET	4430
PATRN.	4522
PATRN3	4505
PATRN2	4503
PATRN1	4473
LET1	4724
LET2	4732
LET3	4741
LET4	4751
LET5	4760
LET6	4771
LET7	5002
LET8	5007
LET9	5022
LETRHO	5033
LETIMP	5042
LETPHA	5052
LETGMA	5063
LETETA	5075
LETCLN	5110
LETO	5112
LETSLA	5121
LETSS	5126
LETST	5136
LETSU	5145
LETSV	5155
LETSW	5162
LETSX	5173
LETSY	5202

S Y M B O L T A B L E

```
  LETSZ  5213          SYMBOL TABLE
 LETLTA  5223
 LETCMA  5233
 LETBET  5263
 LETDOT  5274
  LETSJ  5276
  LETSK  5305
  LETSL  5315
  LETSM  5323
  LETSN  5334
  LETSO  5343
  LETSP  5352
  LETSQ  5363
  LETSR  5375
 LETBDA  5403
 LETISK  5413
 LETMIN  5422
  LETRP  5425
 LETUST  5432
  LETLP  5435
 LETSCN  5442
  LETSA  5447
  LETSB  5457
  LETSC  5471
  LETSD  5501
  LETSE  5515
  LETSF  5527
  LETSG  5536
  LETSH  5551
  LETSI  5561
  LETLC  5237
   LET.  5566
  LETUC  5570
  LETBS  5602
  LETPI  5612
 LETCAR  5251
 LETQUO  5622
 LETAPO  5626
 LETILD  5630
 LETLCO  5635
  LETOR  5643
 LETAND  5651
 LETSMA  5657
 LETGRE  5664
  LETUP  5671
 LETRIG  5700
 LETQUE  5706
  LETCS  5715
  LETCT  5726
  LETCU  5734
  LETCV  5744
  LETCW  5753
  LETCX  5766
  LETCY  5776
```

LETCZ	6005	S Y M B O L T A B L E
LETEQ	6016	S Y M B O L T A B L E
LETLS	6024	S Y M B O L T A B L E
LETCJ	6027	S Y M B O L T A B L E
LETCK	6035	S Y M B O L T A B L E
LETCL	6046	S Y M B O L T A B L E
LETCM	6054	S Y M B O L T A B L E
LETCN	6070	S Y M B O L T A B L E
LETCO	6103	S Y M B O L T A B L E
LETCP	6115	S Y M B O L T A B L E
LETCQ	6126	S Y M B O L T A B L E
LETCR	6141	S Y M B O L T A B L E
LETPLS	6154	S Y M B O L T A B L E
LETRBK	6161	S Y M B O L T A B L E
LETCNT	6167	S Y M B O L T A B L E
LETLBK	6174	S Y M B O L T A B L E
LETCA	6202	S Y M B O L T A B L E
LETCB	6215	S Y M B O L T A B L E
LETCC	6234	S Y M B O L T A B L E
LETCD	6246	S Y M B O L T A B L E
LETCE	6262	S Y M B O L T A B L E
LETCF	6273	S Y M B O L T A B L E
LETCG	6302	S Y M B O L T A B L E
LETCH	6313	S Y M B O L T A B L E
LETCI	6325	S Y M B O L T A B L E
LETIMS	6334	S Y M B O L T A B L E

```
77      /  PDP-1 SUBROUTINE SYMBL
        /      BECAUSE THE PDP-1 VISUAL DISPLAY DOES NOT INCLUDE
        /  AN AUTONOMOUS CHARACTER GENERATOR, THIS SUBROUTINE
        /  WAS DISIGNED TO GENERATE AND DISPLAY CHARACTERS,
        /  SELECTING FOR EACH CHARACTER A SUBSET OF POINTS FROM
        /  AN ARRAY SIXTEEN POINTS WIDE AND THIRTY TWO POINTS HIGH
        /     SINCE FOUR BITS ARE REQUIRED FOR THE HORIZONTAL
        / POSITION AND FIVE BITS FOR THE VERTICAL, TO DESIGNATE
        /  EACH POINT TO BE DISPLAYED NINE BITS ARE REQUIRED,
        /  RESULTING IN TWO POINTS FOR EACH PDP-1 WORD USED IN
        /  PATTERN DESIGNATION, AS A PROGRAMING CONVENIENCE THE
        /  LOWER LEFT HAND7POINT (0,0) IS NEVER DESIGNATED IN THE
        /  SECOND HALF OF A WORD EXCEPT TO INDICATE THE COMPLET-
        /  ION OF A CHARACTER, FOR EACH CHARACTER PATTERN AN
        /  INTEGRAL NUMBER OF WORDS IS ALLOCATED - THE FIRST
        /  HALF OF THE FIRST WORD IS IGNORED FOR THOSE PATTERNS
        /  CONSISTING OF AN EVEN NUMBER OF POINTS, ALL WORDS USED
        /  FOR PATTERN DESIGNATION ARE LOCATED AT THE END OF
        /  THIS SUBROUTINE STARTING AT THE SYMBOLIC ADDRESS
        /  LETBOX,
        /     AS A MEANS OF SELECTING THE PARTICULAR PATTERN TO
        /  BE GENERTAED, A BLOCK OF 200(8) WORDS JUST PRECEDING
        /  THE FOREGOING BLOCK CONTAINS IN SEQUENCE (FIRST
        /  REFERING TO LOWER CASE,THEN TO UPPER CASE) THE
        / FIRST WORD ADDRESS OF THE RELEVENT PATTERN,AND
        /  (DESIGNATED BY THE SIGN BIT) WHETHER THE PATTERN STARTS
        /  WITH THE FIRST HALF OF THIS FIRST WORD, THE INSTRUCTION
        /  PARTS, EXCLUSIVE OF SIGN BITS, OF THESE SELECTOR WORDS
        /  ARE USED FOR CONTROLING THE EXECUTION OF THE SUBROUTINE
        /  AS INDICATED IN THE FLOW CHART,
        /     JUST AS THE PAPER MUST BE INSERTED INTO THE
        /  TYPEWRITER AND ADJUSTED FOR MARGINS, SO THE CRT
        /  COORDINATES OF THE INITIAL LETTER MUST BE SET IN THIS
        /  SUBROUTINE, WITH THE ACCUMULATOR EQUAL TO THE ORDINANT
        /  AND THE I.O. EQUAL TO THE ABSCISSA OF THE LOWER LEFT
        /  CORNER OF THE MOST UPPER LEFT CHARACTER EXECUTING THE
        /  INSTRUCTION JDA LETBEG, THESE MARGINS ARE SET,
        /  EACH EXECUTION OF THE INSTRUCTION  JSP PAGE  RESTORES
        /  THE COORDINATES OF THE NEXT CHARACTER TO THESE VALUES -
        /  IN EFFECT THE PAGE IS RESTORED, UNLIKE THE TYPEWRITER
        /  WHICH WHEN REACHING A LIN END TYPES OVER THE LAST
        /  CHARACTER, THIS ROUTINE CAUSES THE NEXT CHARACTER TO
        /  APPEAR AT LEFT EDGE OF THE DISPLAY AND ONE LINE LOWER,
        /     CORRESPONDING TO THE TYPEWRITER TAB, UP TO FIVE
        /  POSITIONS MAY BE SET AS TABS, BUT TO BE EFFECTIVE THEY
        /  MUST BE SET IN ORDER OF INCREASING ORDINATE, EXECUTION
        /  OF THE INSTRUCTION  JDA  TABSET  ESTABLISHES THE VALUE
        /  OF THE ACCUMULATOR AS THE NEXT TAB, PROVIDING FIVE HAVE
        /  NOT BEEN ESTABLISHED ALREADY, TO CLEAR ALL TABS EXECUTE
        /  THE INSTRUCTION  JSP TAB,
        /     FINALLY, TO ALTER THE DISPLAY COMMAND (DVHC) TO
```

```
/  ANOTHER . EXECUTE JDA SYMBGO  WITH THE NEW INSTRUCTION
/  IN THE ACCUMULATOR.
/
/    ******  SHORT EXPLANATION   ******
/  JDA SYMBGO     ACCUMULATOR = INSTRUCTION TO BE SUBSTIT-
/                 UTED FOR DVHC IN SYMBOL GENERATOR
/  JSP TAB        REMOVES ALL TABS
/  JDA TABSET     SETS NEXT TAB TO COORDINATE IN ACCUMULAT-
/                 OR - MAXIMUM NUMBER OF TABS IS 5.
/                 IF A SIXTH ONE IS ATTEMPTED EFFECT IS NOP
/  JDA LETBEG     SETS THE COORDINATES OF THE LOWER LEFT
/                 CORNER OF THE FIRST CHARACTER OF THE
/                 PAGE TO (ACC,IO) FOR (X,Y) AND EXECUTES
/                 PAGE.
/  JSP PAGE       RESTORES PAGE
/  JDA SYMBL      ACC = 0000XX. DISPLAYS SYMBOL FOR WHICH
/                 XX IS THE PDP TYPEWRITER CONCISE III CODE
/                 ALL OPERATIONS OF THE TYPEWRITER ARE
/                 DUPLICATED ON THE VISUAL DISPLAY EXCEPT
/                 RED/BLACK RIBBON
/ THIS IS LIGHT PEN SENSITIVE
/  SENSE LIGHT 6 ON = SAW A POINT

                              **
4277  000000   SYMBGO,   ..
4300  264304             DAP SYMGO.
4301  204277             LAC SYMBGO
4302  244501             DAC D01
4303  244514             DAC D02
4304  600000   SYMGO.,   JMP
4305  000000    SYMBL,   ..
4306  264345             DAP SYMBL.
4307  704524             LAW TABLE
4310  404305             ADD SYMBL
4311  404441             ADD CASE
4312  264313             DAP .+1
4313  220000             LIO ..
4314  324305             DIO SYMBL
4315  760200             CLA
4316  662001             RIL S1
4317  663037             RCL S5
4320  404323             ADD .+3
4321  264322             DAP .+1
4322  600000             JMP ..
4323  604324             JMP .+1
4324  604335             JMP .+11
4325  604346             JMP SYMBL.+1
4326  604353             JMP .+35
4327  604404             JMP .+55
4330  604337             JMP .+7
4331  604342             JMP .+11
4332  604345             JMP SYMBL.
4333  604355             JMP .+22
4334  604344             JMP .+10
```

```
                4335  624435          JSP PATRN
                4336  604346          JMP .+10
                4337  700100          LAW 100
                4340  244441          DAC CASE
                4341  604345          JMP SYMBL.
                4342  344441          DZM CASE
                4343  604345          JMP SYMBL.
                4344  624435          JSP PATRN
                4345  600000  SYMBL.,  JMP ..
                4346  651600          SZ0 SMA SPA I
                4347  204443          LAC LETPOS
CHECK+          4350  404445          ADD ΣLET
                4351  244443          DAC LETPOS
CHECK+          4352  404445          ADD ΣLET
                4353  651000          SZ0 I
                4354  604345          JMP SYMBL.
                4355  204444          LAC LINPOS
CHECK+          4356  404446          ADD ΣLINE
                4357  244444          DAC LINPOS
                4360  204413          LAC LETBEG
                4361  244443          DAC LETPOS
                4362  604345          JMP SYMBL.
                4363  704447          LAW TABS
                4364  244435          DAC TABS+6
                4365  604401          JMP .+14
                4366  651600          SZ0 SMA SPA I
                4367  204443          LAC LETPOS
                4370  434435          SUB I TABS+6
                4371  641000          SZ0
                4372  761000          CMA
                4373  640400          SMA
                4374  604400          JMP .+4
                4375  214435          LAC I TABS+6
                4376  244443          DAC LETPOS
                4377  604352          JMP .+25
                4400  444435          IDX TABS+6
                4401  524434          SAS TABS+5
                4402  604356          JMP .+14
                4403  604345          JMP SYMBL.
                4404  651600          SZ0 SMA SPA I
                4405  204443          LAC LETPOS
CHECK+          4406  424445          SUB ΣLET
                4407  641000          SZ0
                4410  204413          LAC LETBEG
                4411  244443          DAC LETPOS
                4412  604345          JMP SYMBL.
                4413  000000  LETBEG,  ..
                4414  324442          DIS LINBEG
                4415  264345    PAGE,  DAP SYMBL.
                4416  344441          DZM CASE
                4417  204442          LAC LINBEG
                4420  244444          DAC LINPOS
                4421  204413          LAC LETBEG
                4422  244443          DAC LETPOS
```

```
         4423  604345              JMP SYMBL.
         4424  264345       TAB,   DAP SYMBL.
         4425  704447              LAW TABS
         4426  244454              DAC TABS+5
         4427  604345              JMP SYMBL.
         4430  000000    TABSET,   ..
         4431  264345              DAP SYMBL.
         4432  704454              LAW TABS+5
         4433  504454              SAD TABS+5
         4434  604345              JMP SYMBL.
         4435  204430              LAC TABSET
         4436  254454              DAC I TABS+5
         4437  444454              IDX TABS+5
         4440  604345              JMP SYMBL.
         4441  000000      CASE,   ..
         4442  360000    LINBEG,   360000
         4443  400000    LETPOS,   400000
         4444  000000    LINPOS,   ..
CHECK→   4445  012000      ΣLET,   12000
CHECK→   4446  753777     ΣLINE,   753777
         4447  000000      TABS,   ..
         4450  000000              ..
         4451  000000              ..
         4452  000000              ..
         4453  000000              ..
         4454  004454              .
         4455  004447              .. TABS
         4456  264522    PATRN,    DAP PATRN.
         4457  764000              CLI
         4460  204444              LAC LINPOS
         4461  673377              RCR S8
         4462  244523              DAC TABLE-1
         4463  204305              LAC SYMBL
         4464  264505              DAP PATRN3
         4465  650100              SZA I
         4466  604522              JMP PATRN.
         4467  640200              SPA
         4470  604503              JMP PATRN2
         4471  700777              LAW 777
         4472  104505              XCT PATRN3
         4473  671017   PATRN1,    RAR S4
         4474  404523              ADD TABLE-1
         4475  673001              RCR S1
         4476  677777              SCR S9
         4477  665017              SAL S4
         4500  404443              ADD LETPOS
         4501  723007      DO1,    DVH
         4502  444505              IDX .+3
         4503  764000   PATRN2,    CLI
         4504  710777              LAW I 777
         4505  020000   PATRN3,    AND ..
         4506  661037              RAL S5
         4507  404523              ADD TABLE-1
         4510  673001              RCR S1
```

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4511  677777            SCR S9
4512  665017            SAL S4
4513  404443            ADD LETP08
4514  727000      D02,  DVHC
4515  764000            CLI
4516  700777            LAW 777
4517  104506            XCT PATRN3
4520  640100            SZA
4521  604473            JMP PATRN1
4522  600000   PATRN,,  JMP ,,
4523  000000            ,,
4524  010000    TABLE,  1
4525  404724            ADD LET1
4526  404732            ADD LET2
4527  004741            LET3
4530  404731            ADD LET4
4531  004750            LET5
4532  004771            LET6
4533  405002            ADD LET7
4534  405007            ADD LET8
4535  005022            LET9
4536  405033            ADD LETRHO
4537  405042            ADD LETIMP
4540  005052            LETPHA
4541  005063            LETGMA
4542  005075            LETETA
4543  005110            LETCLN
4544  005112            LETO
4545  005121            LETSLA
4546  405126            ADD LETSS
4547  005135            LETST
4550  005145            LETSU
4551  405135            ADD LETSV
4552  405152            ADD LETSW
4553  405173            ADD LETSX
4554  005200            LETSY
4555  005213            LETSZ
4556  005223            LETLTA
4557  005233            LETCMA
4560  060000            XOR
4561  060000            XOR
4562  425042            SUB LETIMP
4563  405263            ADD LETBET
4564  505274            SAD LETDOT
4565  405276            ADD LETSJ
4566  005306            LETSK
4567  005315            LETSL
4570  405323            ADD LETSM
4571  405334            ADD LETSN
4572  005343            LETSO
4573  005352            LETSP
4574  405363            ADD LETSQ
4575  005375            LETSR
4576  405403            ADD LETBDA
```

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4577  405413          ADD LETISK
4600  405422          ADD LETMIN
4601  005425          LETRP
4602  505432          SAD LETUST
4603  005435          LETLP
4604  405442          ADD LETSCN
4605  005447          LETSA
4606  405437          ADD LETSB
4607  005471          LETSC
4610  005501          LETSD
4611  405515          ADD LETSE
4612  405527          ADD LETSF
4613  005536          LETSG
4614  405551          ADD LETSH
4615  005561          LETSI
4616  455237          IDX I LETLC
4617  405566          ADD LET.
4620  445570          IDX LETUC
4621  435602          SUB I LETBS
4622  405612          ADD LETPI
4623  075251          XOR I LETCAR
4624  010000          I
4625  005622          LETQUO
4626  405626          ADD LETAPO
4627  005630          LETILD
4630  405635          ADD LETLCO
4631  005643          LETOR
4632  005651          LETAND
4633  405657          ADD LETSMA
4634  405664          ADD LETGRE
4635  005671          LETUP
4636  405033          ADD LETRHO
4637  405237          ADD LETLC
4640  005052          LETPHA
4641  005063          LETGMA
4642  005075          LETETA
4643  005110          LETCLN
4644  005700          LETRIG
4645  405706          ADD LETQUE
4646  405715          ADD LETCS
4647  405726          ADD LETCT
4650  405734          ADD LETCU
4651  405744          ADD LETCV
4652  405753          ADD LETCW
4653  005756          LETCX
4654  005776          LETCY
4655  006006          LETCZ
4656  005223          LETLTA
4657  006016          LETEQ
4660  505570          SAD LETUC
4661  005251          LETCAR
4662  420000          SUB
4663  405263          ADD LETBET
4664  506024          SAD LETLS
```

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4665  406027            ADD LETCJ
4666  006035            LETCK
4667  006046            LETCL
4670  406054            ADD LETCM
4671  406070            ADD LETCN
4672  006103            LETCO
4673  406115            ADD LETCP
4674  006126            LETCQ
4675  406141            ADD LETCR
4676  405403            ADD LETBDA
4677  405413            ADD LETISK
4700  406154            ADD LETPLS
4701  006161            LETRBK
4702  506157            SAD LETCNT
4703  006174            LETLBK
4704  405442            ADD LETSCN
4705  006202            LETCA
4706  006215            LETCB
4707  406234            ADD LETCC
4710  406246            ADD LETCD
4711  406262            ADD LETCE
4712  406273            ADD LETCF
4713  406302            ADD LETCG
4714  406313            ADD LETCH
4715  006325            LETCI
4716  455237            IDX I LETLC
4717  406334            ADD LETIMS
4720  445570            IDX LETUC
4721  435602            SUB I LETBS
4722  405612            ADD LETPI
4723  075231            XOR I LETCAR
4724  144154     LET1,  144154
4725  150250            150250
4726  350450            350450
4727  550650            550650
4730  546504            546504
4731  422000            422000
4732  154150     LET2,  154150
4733  144140            144140
4734  223306            223306
4735  371454            371454
4736  556634            556634
4737  650624            650624
4740  561000            561000
4741  000221     LET3,  221
4742  164150            164150
4743  174256            174256
4744  355412            355412
4745  427452            427452
4746  515576            515576
4747  654650            654650
4750  625000            625000
4751  153253     LET4,  153253
4752  353453            353453
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4753  553653                    553653
4754  570505                    570505
4755  422340                    422340
4756  343347                    343347
4757  357000                    357000
4760  000201      LET5,         201
4761  144150                    144150
4762  174256                    174256
4763  356433                    356433
4764  447423                    447423
4765  361441                    361441
4766  541641                    541641
4767  645651                    645651
4770  655000                    655000
4771  000361      LET6,         361
4772  423447                    423447
4773  433356                    433356
4774  256174                    256174
4775  150144                    150144
4776  201260                    201260
4777  440541                    440541
5000  645651                    645651
5001  614000                    614000
5002  145247      LET7,         145247
5003  351453                    351453
5004  555657                    555657
5005  653647                    653647
5006  643000                    643000
5007  647624      LET8,         647624
5010  562502                    562502
5011  444427                    444427
5012  413356                    413356
5013  277216                    277216
5014  153147                    153147
5015  144201                    144201
5016  260341                    260341
5017  404452                    404452
5020  514574                    514574
5021  632000                    632000
5022  000163      LET9,         163
5023  147173                    147173
5024  255356                    255356
5025  456556                    456556
5026  633647                    633647
5027  623561                    623561
5030  460401                    460401
5031  344350                    344350
5032  374000                    374000
5033  103127      LETRHO,       103127
5034  210310                    210310
5035  407506                    407506
5036  606670                    606670
5037  714656                    714656
5040  575534                    575534
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5041  511000                  511000
5042  473567    LETIMP,       473567
5043  450444                  450444
5044  440300                  440300
5045  304310                  304310
5046  167231                  167231
5047  273335                  273335
5050  377435                  377435
5051  531000                  531000
5052  000137    LETPHA,       157
5053  134211                  134211
5054  311412                  311412
5055  471505                  471505
5056  443361                  443361
5057  300200                  300200
5060  144227                  144227
5061  413475                  413475
5062  556000                  556000
5063  000137    LETGMA,       137
5064  134130                  134130
5065  124120                  124120
5066  202304                  202304
5067  407471                  407471
5070  614651                  614651
5071  706743                  706743
5072  760764                  760764
5073  770774                  770774
5074  777000                  777000
5075  000420    LETETA,       420
5076  502545                  502545
5077  530430                  530430
5100  306204                  306204
5101  225347                  225347
5102  472534                  472534
5103  556477                  556477
5104  356275                  356275
5105  213113                  213113
5106  053015                  53015
5107  057000                  57000
5110  000130    LETCLN,       130
5111  410000                  410000
5112  000150      LETO,       150
5113  205303                  205303
5114  403503                  403503
5115  605650                  605650
5116  613515                  613515
5117  415315                  415315
5120  213000                  213000
5121  000140    LETSLA,       140
5122  243325                  243325
5123  407471                  407471
5124  553655                  553655
5125  757000                  757000
5126  200144    LETSS,        200144
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5127  150154          150154
5130  216276          216276
5131  334350          334350
5132  344361          344361
5133  440521          440521
5134  544550          544550
5135  514000          514000
5136  000175  LETST,  175
5137  153150          153150
5140  165244          165244
5141  344444          344444
5142  644544          644544
5143  547552          547552
5144  541000          541000
5145  000540  LETSU,  540
5146  440360          440360
5147  300221          300221
5150  163146          163146
5151  157152          157152
5152  215257          215257
5153  357457          357457
5154  557000          557000
5155  540442  LETSV,  540442
5156  344246          344246
5157  147251          147251
5160  353455          353455
5161  557000          557000
5162  540440  LETSW,  540440
5163  341242          341242
5164  143224          143224
5165  305366          305366
5166  450371          450371
5167  312233          312233
5170  154255          154255
5171  356457          356457
5172  557000          557000
5173  140223  LETSX,  140223
5174  306433          306433
5175  557475          557475
5176  370425          370425
5177  540463          540463
5200  312234          312234
5201  157000          157000
5202  000041  LETSY,  41
5203  003007          3007
5204  013056          13056
5205  157257          157257
5206  557457          557457
5207  356313          356313
5210  267303          267303
5211  341440          341440
5212  540000          540000
5213  000540  LETSZ,  540
5214  544550          544550
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5215  554537            554557
5216  474411            474411
5217  326243            326243
5220  140144            140144
5221  150134            150154
5222  157000            157000
5223  000134  LETLTA,    134
5224  124120            124120
5225  222303            222303
5226  365426            365426
5227  510532            510532
5230  373315            373315
5231  236137            236137
5232  130000            130000
5233  000026  LETCMA,    26
5234  071132            71152
5235  210206            210206
5236  167000            167000
5237  645545   LETLC,   645545
5240  445345            445345
5241  245145            245145
5242  124162            124162
5243  066030            66030
5244  072176            72176
5245  134153            134153
5246  253353            253353
5247  453553            453553
5250  653000            653000
5251  000566  LETCAR,    566
5252  624630            624630
5253  614517            614517
5254  416354            416354
5255  311246            311246
5256  203140            203140
5257  242344            242344
5260  303201            303201
5261  143146            143146
5262  151000            151000
5263  000101  LETBET,    101
5264  161262            161262
5265  343425            343425
5266  507551            507551
5267  553514            553514
5270  453410            453410
5271  332252            332252
5272  171126            171126
5273  123000            123000
5274  370407  LETDOT,    370407
5275  411000            411000
5276  120042   LETSJ,    120042
5277  005030            5030
5300  072153            72153
5301  253353            253353
5302  453553            453553
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5303  772753          772753
5304  774000          774000
5305  000760  LETSK,  760
5306  660540          660540
5307  440305          440305
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5311  343423          343423
5312  551506          551506
5313  340240          340240
5314  140000          140000
5315  000146  LETSL,  146
5316  150147          150147
5317  247347          247347
5320  447547          447547
5321  647747          647747
5322  746000          746000
5323  140240  LETSM,  140240
5324  340540          340540
5325  440502          440502
5326  506450          506450
5327  250150          250150
5330  350512          350512
5331  516437          516437
5332  357257          357257
5333  157000          157000
5334  140240  LETSN,  140240
5335  340540          340540
5336  440502          440502
5337  545551          545551
5340  534456          534456
5341  357257          357257
5342  157000          157000
5343  000357  LETSO,  357
5344  533547          533547
5345  523441          523441
5346  340241          340241
5347  163147          163147
5350  173256          173256
5351  457000          457000
5352  000540  LETSP,  540
5353  500300          500300
5354  204170          204170
5355  214276          214276
5356  357456          357456
5357  533547          533547
5360  503400          503400
5361  200100          200100
5362  000000          ..
5363  557477  LETSQ,  557477
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5367  402463          402463
5370  525550          525550
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5371   533475                 533475
5372   377277                 377277
5373   217117                 217117
5374   017000                 17000
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5376   440140                 440140
5377   240340                 240340
5400   502545                 502545
5401   550553                 550553
5402   536000                 536000
5403   120203    LETBDA,      120203
5404   265346                 265346
5405   427532                 427532
5406   667762                 667762
5407   745611                 745611
5410   433354                 433354
5411   275216                 275216
5412   137000                 137000
5413   202416    LETISK,      202416
5414   353245                 353245
5415   253216                 253216
5416   402345                 402345
5417   310450                 310450
5420   370230                 370230
5421   130000                 130000
5422   340344    LETMIN,      340344
5423   350354                 350354
5424   357000                 357000
5425   000145    LETRP,       145
5426   170252                 170252
5427   353453                 353453
5430   552630                 552630
5431   645000                 645000
5432   760765    LETUST,      760765
5433   770774                 770774
5434   777000                 777000
5435   000153    LETLP,       153
5436   170246                 170246
5437   345445                 345445
5440   546630                 546630
5441   653000                 653000
5442   026071    LETSCN,      26071
5443   152167                 152167
5444   206210                 206210
5445   367406                 367406
5446   410000                 410000
5447   000557    LETSA,       557
5450   257173                 257173
5451   147163                 147163
5452   241340                 241340
5453   441524                 441524
5454   550534                 550534
5455   457357                 457357
5456   157000                 157000
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5457  740640    LETSB,  740640
5460  560500            560500
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5462  260143            260143
5463  126151            126151
5464  214275            214275
5465  355434            355434
5466  512527            512527
5467  504462            504462
5470  420000            420000
5471  000476    LETSC,  476
5472  534552            534552
5473  547524            547524
5474  462401            462401
5475  320240            320240
5476  201143            201143
5477  126131            126131
5500  174000            174000
5501  000777    LETSD,  777
5502  717637            717637
5503  557337            557337
5504  236174            236174
5505  151146            151146
5506  164202            164202
5507  241300            241300
5510  360441            360441
5511  503526            503526
5512  531514            531514
5513  456417            456417
5514  157000            157000
5515  340343    LETSE,  340343
5516  346351            346351
5517  354356            354356
5520  416475            416475
5521  533547            533547
5522  524461            524461
5523  400260            400260
5524  221163            221163
5525  146151            146151
5526  174000            174000
5527  654733    LETSF,  654733
5530  750745            750745
5531  702621            702621
5532  540340            540340
5533  140240            140240
5534  440443            440443
5535  446000            446000
5536  000042    LETSG,  42
5537  004007            4007
5540  012033            12033
5541  114214            114214
5542  374454            374454
5543  532547            532547
5544  524461            524461
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5545  400300          400300
5546  221164          221164
5547  167232          167232
5550  314000          314000
5551  740640  LETSH,  740640
5552  540440          540440
5553  140240          140240
5554  340442          340442
5555  525550          525550
5556  533456          533456
5557  357257          357257
5560  157000          157000
5561  000150  LETSI,  150
5562  250350          250350
5563  450530          450530
5564  750767          750767
5565  771000          771000
5566  150167   LET..   150167
5567  171000          171000
5570  145245  LETUC,  145245
5571  345445          345445
5572  545645          545645
5573  664622          664622
5574  726770          726770
5575  732636          732636
5576  674653          674653
5577  553453          553453
5600  353253          353253
5601  153000          153000
5602  457453  LETBS,  457453
5603  447464          447464
5604  570526          570526
5605  422360          422360
5606  322226          322226
5607  173264          173264
5610  307313          307313
5611  317000          317000
5612  125245  LETPI,  125245
5613  345425          345425
5614  462505          462505
5615  440510          440510
5616  557535          557535
5617  513433          513433
5620  353253          353253
5621  133000          133000
5622  000545  LETQUO,  545
5623  605645          605645
5624  653613          653613
5625  553000          553000
5626  550610  LETAPO,  550610
5627  650000          650000
5630  000460  LETILD,  460
5631  521543          521543
5632  546511          546511
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5634  577000                577000
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5636  207233                207233
5637  316377                316377
5640  456533                456533
5641  547543                547543
5642  540000                540000
5643  000663    LETOR,      663
5644  544445                544445
5645  346247                346247
5646  146350                146350
5647  451552                451552
5650  673000                673000
5651  000143   LETAND,      143
5652  264365                264365
5653  466567                466567
5654  667470                667470
5655  371272                371272
5656  153000                153000
5657  177214   LETSMA,      177214
5660  250304                250304
5661  340404                340404
5662  450514                450514
5663  537000                537000
5664  140203   LETGRE,      140203
5665  247313                247313
5666  357413                357413
5667  447503                447503
5670  540000                540000
5671  000525    LETUP,      525
5672  667750                667750
5673  671533                671533
5674  612606                612606
5675  610510                610510
5676  410270                410270
5677  150000                150000
5700  000340   LETRIG,      340
5701  344351                344351
5702  251451                251451
5703  506414                506414
5704  357314                357314
5705  206000                206000
5706  126130   LETQUE,      126130
5707  147267                147267
5710  367451                367451
5711  514575                514575
5712  654711                654711
5713  706663                706663
5714  622000                622000
5715  200143   LETCS,       200143
5716  147153                147153
5717  216277                216277
5720  356434                356434
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5721  471505          471505
5722  522600          522600
5723  701744          701744
5724  770754          770754
5725  717000          717000
5726  740744  LETCT,  740744
5727  754757          754757
5730  750650          750650
5731  550450          550450
5732  350250          350250
5733  150000          150000
5734  740640  LETCU,  740640
5735  540440          540440
5736  340241          340241
5737  163147          163147
5740  173256          173256
5741  357457          357457
5742  557657          557657
5743  757000          757000
5744  740641  LETCV,  740641
5745  542443          542443
5746  344245          344245
5747  147251          147251
5750  352454          352454
5751  555656          555656
5752  757000          757000
5753  740640  LETCW,  740640
5754  540440          540440
5755  341242          341242
5756  143244          143244
5757  345446          345446
5760  547451          547451
5761  352253          352253
5762  154255          154255
5763  356457          356457
5764  557657          557657
5765  757000          757000
5766  000140  LETCX,  140
5767  242345          242345
5770  552757          552757
5771  654450          654450
5772  624740          624740
5773  702526          702526
5774  352254          352254
5775  157000          157000
5776  000740  LETCY,  740
5777  662604          662604
6000  526532          526532
6001  675757          675757
6002  613450          613450
6003  350250          350250
6004  150000          150000
6005  000740  LETCZ,  740
6006  744750          744750
```

```
6007  754737          754757
6010  675573          675573
6011  470406          470406
6012  324242          324242
6013  140144          140144
6014  150154          150154
6015  157000          157000
6016  000220  LETEQ,  220
6017  224230          224230
6020  234237          234237
6021  440444          440444
6022  450454          450454
6023  457000          457000
6024  000004  LETLS,  4
6025  010014          10014
6026  017000          17000
6027  200143  LETCJ,  200143
6030  167271          167271
6031  371471          371471
6032  571671          571671
6033  771766          771766
6034  774000          774000
6035  000140  LETCK,  140
6036  240460          240460
6037  660760          660760
6040  560360          560360
6041  527715          527715
6042  777612          777612
6043  444367          444367
6044  311234          311234
6045  157000          157000
6046  000760  LETCL,  760
6047  660560          660560
6050  460360          460360
6051  260140          260140
6052  144150          144150
6053  154000          154000
6054  140240  LETCM,  140240
6055  340440          340440
6056  540640          540640
6057  740662          740662
6060  603525          603525
6061  446370          446370
6062  451552          451552
6063  614675          614675
6064  757657          757657
6065  557457          557457
6066  357257          357257
6067  157000          157000
6070  140240  LETCN,  140240
6071  340440          340440
6072  540640          540640
6073  740662          740662
6074  604526          604526
```

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6075  447371                447371
6076  313235                313235
6077  157257                157257
6100  357457                357457
6101  557657                557657
6102  757000                757000
6103  000500     LETCO,     500
6104  300221                300221
6105  164147                164147
6106  173236                173236
6107  317417                317417
6110  517617                517617
6111  676753                676753
6112  767744                767744
6113  661600                661600
6114  400000                400000
6115  140220     LETCP,     140220
6116  300460                300460
6117  540640                540640
6120  740744                740744
6121  750734                750734
6122  656557                656557
6123  456413                456413
6124  370364                370364
6125  360000                360000
6126  000400     LETCQ,     400
6127  222165                222165
6130  150174                150174
6131  316417                316417
6132  517616                517616
6133  675733                675733
6134  750725                750725
6135  662601                662601
6136  500301                500301
6137  246231                246231
6140  137000                137000
6141  157234     LETCR,     157234
6142  311367                311367
6143  360220                360220
6144  120300                120300
6145  440540                440540
6146  640740                640740
6147  744750                744750
6150  734656                734656
6151  577517                577517
6152  436373                436373
6153  363000                363000
6154  340344     LETPLS,    340344
6155  354357                354357
6156  350550                350550
6157  450250                450250
6160  150000                150000
6161  000143     LETRBK,    143
6162  147153                147153
```

```
6163  253353                    253353
6164  453553                    453553
6165  653647                    653647
6166  643000                    643000
6167  010070    LETCNT,         10070
6170  170270                    170270
6171  370470                    370470
6172  570670                    570670
6173  770000                    770000
6174  000153    LETLBK,         153
6175  147143                    147143
6176  243343                    243343
6177  443543                    443543
6200  643647                    643647
6201  653000                    653000
6202  000316    LETCA,          316
6203  313310                    313310
6204  305302                    305302
6205  140221                    140221
6206  363444                    363444
6207  525606                    525606
6210  667750                    667750
6211  671612                    671612
6212  533454                    533454
6213  375237                    375237
6214  157000                    157000
6215  000146    LETCB,          146
6216  140220                    140220
6217  300360                    300360
6220  420540                    420540
6221  620700                    620700
6222  760763                    760763
6223  766751                    766751
6224  713654                    713654
6225  614533                    614533
6226  471463                    471463
6227  460466                    460466
6230  434376                    434376
6231  317257                    317257
6232  215152                    215152
6233  142000                    142000
6234  676735    LETCC,          676735
6235  753770                    753770
6236  745723                    745723
6237  661600                    661600
6240  520440                    520440
6241  360300                    360300
6242  241203                    241203
6243  145150                    145150
6244  173215                    173215
6245  256000                    256000
6246  146140    LETCD,          146140
6247  240320                    240320
6250  400460                    400460
```

```
6251  540620                 540620
6252  700760                 700760
6253  763766                 763766
6254  751733                 751733
6255  675636                 675636
6256  557477                 557477
6257  417356                 417356
6260  255172                 255172
6261  143000                 143000
6262  777774     LETCE,      777774
6263  770764                 770764
6264  760660                 760660
6265  560340                 560340
6266  140150                 140150
6267  157154                 157154
6270  144240                 144240
6271  460464                 460464
6272  470000                 470000
6273  470464     LETCF,      470464
6274  460260                 460260
6275  140360                 140360
6276  560660                 560660
6277  760764                 760764
6300  770774                 770774
6301  777000                 777000
6302  352356     LETCG,      352356
6303  256175                 256175
6304  152146                 152146
6305  163221                 163221
6306  300400                 300400
6307  500561                 500561
6310  642704                 642704
6311  747733                 747733
6312  676000                 676000
6313  140200     LETCH,      140200
6314  300400                 300400
6315  600760                 600760
6316  700500                 700500
6317  504507                 504507
6320  513517                 513517
6321  717777                 717777
6322  617417                 617417
6323  317217                 317217
6324  157000                 157000
6325  000145     LETCI,      145
6326  153150                 153150
6327  250350                 250350
6330  430510                 430510
6331  570670                 570670
6332  770765                 770765
6333  773000                 773000
6334  244306     LETIMS,     244306
6335  412454                 412454
6336  350444                 350444
6337  406312                 406312
6340  254000                 254000
```

READ (Read Cards)

SYMBOL TABLE

READ	6341
READ2	6574
READX	6452
REAEM2	6570
READ80	6573
READIT	6453
READA	6347
REAEM1	6567
REATR1	6571
REAEND	6544
REAERR	6564
REAIAR	6576
N100	6575
REABUF	6577
REAITA	6524
REAN80	6572

SYMBOL TABLE

```
/  READ: A GENERALIZED CARD READ SUBROUTINE FOR HOLLERITH
/
/  CARDS. THE PROGRAM IS SELF INITIALIZING IF HOWEVER THE
/
/  CARD READER IS INTERUPTED DURING A READ (I.E., BEFORE
/
/  ALL THE CARDS HAVE BEEN READ) TWO LOCATIONS MUST BE
/
/  INITIALIZED BEFORE BEGINNING AGAIN; 400000 INTO READ80
/
/  AND 1 INTO READEND.
/
/      FORMAT:
/
/  JSP READ
/
/  C+1    EXIT WHEN LAST COLUMN+1 OF LAST CARD WITH ACC=0
/
/  C+2    EXIT WHEN LAST COLUMN+1 OF PRESENT CARD WITH ACC=
/
/         ZERO
/
/  C+3    EXIT WITH THE NEXT CHARACTER IN THE ACC (RITHT
/
/         MOST 12 BITS). THE IO IS LEFT UNCHANGED IN ANY
/
/         OF THE THREE EXITS
/
/  EACH CHARACTER IS EQUAL TO THE SUM OF THE WITHTS FOR
/
/  EACH PUNCH IN THE CURRENT COLUMN, THE WIGTHS
/
/  FOR THE 9 TO 12 ROWS ARE AS FOLLOWS:
/
/  1,2,4,10,20,40,100,200,400,1000,2000,4000
/
6341  406574      READ,  ADD READ2
6342  266452             DAP READX
6343  326570             DIO READM2
6344  466573             ISP READ80
6345  606453             JMP READIT
6346  760200             CLA
6347  220000      READA, LIO
6350  663001             RCL S1
6351  320000             DIO
6352  220000             LIO
6353  663001             RCL S1
6354  320000             DIO
6355  220000             LIO
6356  663001             RCL S1
6357  320000             DIO
```

```
6360  220000          LIO
6361  663001          RCL S1
6362  320000          DIO
6363  220000          LIO
6364  663001          RCL S1
6365  320000          DIO
6366  220000          LIO
6367  663001          RCL S1
6370  320000          DIO
6371  220000          LIO
6372  663001          RCL S1
6373  320000          DIO
6374  220000          LIO
6375  663001          RCL S1
6376  320000          DIO
6377  220000          LIO
6400  663001          RCL S1
6401  320000          DIO
6402  220000          LIO
6403  663001          RCL S1
6404  320000          DIO
6405  220000          LIO
6406  663001          RCL S1
6407  320000          DIO
6410  220000          LIO
6411  663001          RCL S1
6412  320000          DIO
6413  246567          DAC REAEM1
6414  466571          ISP REATR1
6415  606450          JMP READX-2
6416  710022          LAW I 22
6417  246571          DAC REATR1
6420  446347          IDX READA
6421  446351          IDX READA+2
6422  446352          IDX READA+3
6423  446354          IDX READA+5
6424  446355          IDX READA+6
6425  446357          IDX READA+10
6426  446360          IDX READA+11
6427  446362          IDX READA+13
6430  446363          IDX READA+14
6431  446365          IDX READA+16
6432  446366          IDX READA+17
6433  446370          IDX READA+21
6434  446371          IDX READA+22
6435  446373          IDX READA+24
6436  446374          IDX READA+25
6437  446376          IDX READA+27
6440  446377          IDX READA+30
6441  446401          IDX READA+32
6442  446402          IDX READA+33
6443  446404          IDX READA+35
6444  446405          IDX READA+36
6445  446407          IDX READA+40
```

```
6446  446410            IDX READA+41
6447  446412            IDX READA+43
6450  206567            LAC REAEM1
6451  226570            LIO REAEM2
6452  600000  READX,    JMP
6453  206544  READIT,   LAC REAEND
6454  640100            SZA
6455  606545            JMP REAEND+1
6456  720033            LSR0
6457  672077            RIR S6
6460  652000            SMI
6461  606436            JMP .-3
6462  662001            RIL S1
6463  642000            SPI
6464  606554            JMP REAERR
6465  662001            RIL S1
6466  206576            LAC REAIAR
6467  652000            SMI
6470  406575            ADD N100
6471  266477            DAP .+6
6472  720040            PAC
6473  706577            LAW REABUF
6474  266500            DAP .+4
6475  710074            LAW I 74
6476  246571            DAC REATR1
6477  200000            LAC
6500  240000            DAC
6501  446477            IDX .-2
6502  446500            IDX .-2
6503  466571            ISP REATR1
6504  606477            JMP .-5
6505  760200            CLA
6506  662001            RIL S1
6507  642000            SPI
6510  710001            LAW I 1
6511  246544            DAC REAEND
6512  710014            LAW I 14
6513  246571            DAC REATR1
6514  706347            LAW READA
6515  266524            DAP REAITA
6516  706656            LAW REABUF+67
6517  246567            DAC REAEM1
6520  606524            JMP REAITA
6521  710005            LAW I 5
6522  406567            ADD REAEM1
6523  246567            DAC REAEM1
6524  260000  REAITA,   DAP
6525  700002            LAW 2
6526  406524            ADD REAITA
6527  266524            DAP REAITA
6530  206567            LAC REAEM1
6531  106524            XCT REAITA
6532  446524            IDX REAITA
6533  466571            ISP REATR1
```

```
6534  606521            JMP REAITA-3
6535  206572            LAC REAN80
6536  246573            DAC READ80
6537  710022            LAW I 22
6540  246571            DAC REATR1
6541  366432            NIX READX
6542  760200            CLA
6543  606431            JMP READX-1
6544  000001  REAEND,    1
6545  640200            SPA
6546  606550            JMP .+12
6547  226576            LIO REAIAR
6550  720041            LIR
6551  346544            DZM REAEND
6552  700000            LAW
6553  406574            ADD READ2
6554  526532            SAS .-2
6555  606533            JMP .-2
6556  720040            PAC
6557  606433            JMP READIT
6560  700001            LAW 1
6561  246544            DAC REAEND
6562  366432            NIX READX
6563  606541            JMP REAEND-3
6564  760400  REAERR,    HLT
6565  720040            PAC
6566  606433            JMP READIT
6567  000000  REAEM1,    ..
6570  000000  REAEM2,    ..
6571  000000  REATR1,    ..
6572  377657  REAN80,    377657
6573  400000  READ80,    400000
6574  000002   READ2,    2
6575  000100     N100,    100
6576  007600  REAIAR,    7600
6577  000000  REABUF,    ..
                          *REABUF*74
```

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