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ABSTRACT

A relational document retrieval system is developed that is primarily concerned with hierarchic tree structures and lateral links. The lateral linkages are relationships that cannot be represented within the tree structure representation. A number of annotated examples are given along with a detailed description of the relational data structure and the programs that manipulate and search this structure. The system was programmed in a string manipulating language designed for information retrieval purposes. (Author)

THE IMPLEMENTATION OF A RELATIONAL DOCUMENT RETRIEVAL SYSTEM

BY

YEAN-HSI CHANG

(4)

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DOCUMENT RETRIEVAL SYSTEM

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YEAN-HSI CHANG

B.S., Chinese Naval College of Technology, 1953

THESIS

p. N.

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Yean-Hsi Chang, M.S.
Department of Electrical Engineering
University of Illinois, 1970

A relational document retrieval system is developed that is primarily concerned with hierarchic tree structures and lateral links. The lateral linkages are relationships that cannot be represented within the tree structure representation. A number of annotated examples are given along with a detailed description of the relational data structure and the programs that manipulate and search this structure. The system was programmed in ISL, a string manipulating language designed for information retrieval purposes.

ACKNOWLEDGMENT

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I. INTRODUCTION

Document retrieval systems have been intensively studied in recent years. One of the more interesting aspects in this area is that of file structuring. One particular file structure may be found to be very effective in a particular system unacceptable in another system. A review of some of the well known document retrieval systems shows that there are many problematic aspects still remaining with respect to the file structure. The AESOP system [7] uses hierarchic tree structure to handle the category titles and tables to handle the items in the categories. The BOLD system [8] uses list subject category and matraces to show the relation between documents and index terms. The SMART system [9] uses an inverted file of clusters. But no one has considered relations between documents, such as: two documents could have the same descriptors and yet be discussing entirely different subjects, or conversely if two documents are concerned with the same topic but have entirely different descriptors; also the relationship between certain documents could be conditional upon the intent of the user. These relationships can not be expressed clearly by a simple list or a simple hierarchic tree structure. In view of this fact, Esser [1] has done some theoretical work on hierarchic tree structuring together with lateral links (LL) relating the terms used in the field of coding theory. The work reported here represents the development and implementation of the computational aspects of a relational data file for document retrieval employing the tree structuring a lateral-link concepts.

In order to give an overall picture of a system that employs these techniques described previously and shows the effectiveness of such an approach a number of annotated examples will be given in Chapter II. Following these examples a detailed description of the relational data structure developed is given in Chapter III. In Chapter IV a formal description of all the features available in system is given.

The Appendix contains a description of the programs, a user's manual and a sample tree structure from the relational model used.

This document retrieval system was programmed in ISL, a string manipulating language designed for information retrieval [2,3,4,5,6].

II. THE USE OF RELATIONAL INFORMATION IN DOCUMENT RETRIEVAL

The relational document retrieval system implemented in this paper is one which uses all the available relations between items of the data base to give the user as much information as possible. It is also designed in such a way that the user needs no technical background in order to do the retrieval. The examples given in this chapter show the system's actual performance. The detail step-by-step description of how to operate the system is given in Appendix B.

The data base area used for this implementation is from the area of coding theory. The names are either the categories or the terms generally used in coding theory texts, e.g., cyclic codes, optimum codes, decoding algorithms, binary codes, etc. Each node in the tree structure represents a topic area.

If the user has in mind a topic in coding theory and he wishes to know more about it, then this program can be used. Suppose that a user has "OPTIMUM CODES" in mind. After the computer has been set up by following the procedure given in Appendix B, the statement "STATE YOUR REQUEST" will appear on the display console as in Figure 1 and will also be typed on the console typewriter. Now, he can type "OPTIMUM CODES" followed by a carriage return. At this point in the program "ABORT" may be typed instead and the program control will be passed to the monitor.

The topic that has been typed will be shown in the display console. The program can be restarted again by typing "ERASE" or the program will continue by typing "GO". After typing "GO", the display console will appear as in Figure 2. Pressing the right-most arrow on the screen with the lightpen,

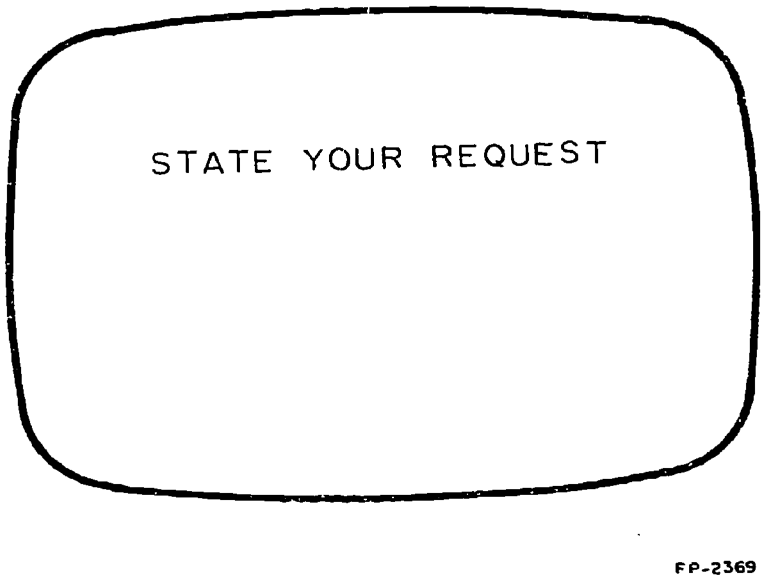


Figure 1.

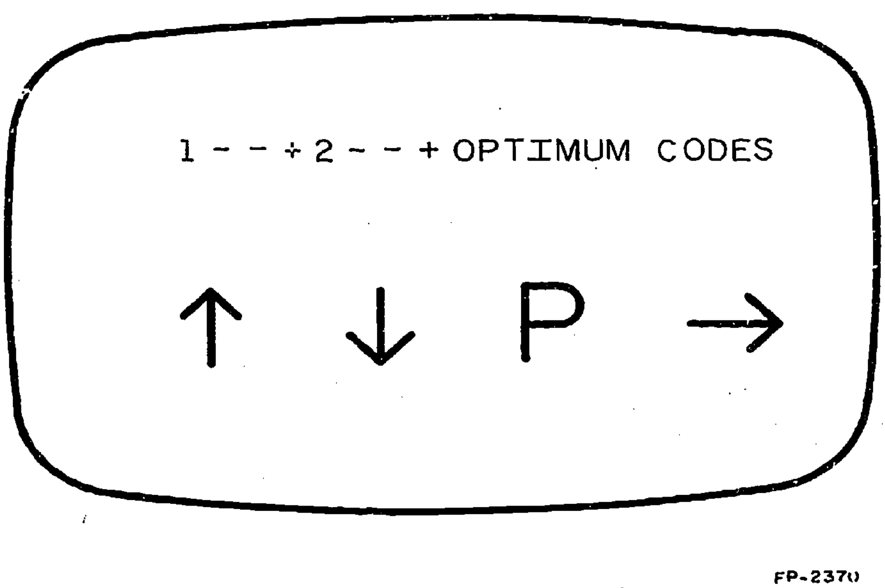
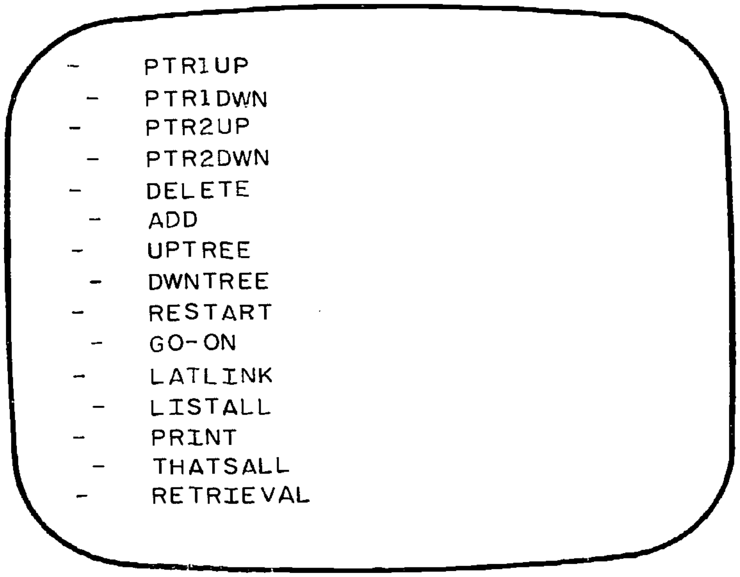


Figure 2.



FP-2371

Figure 3.

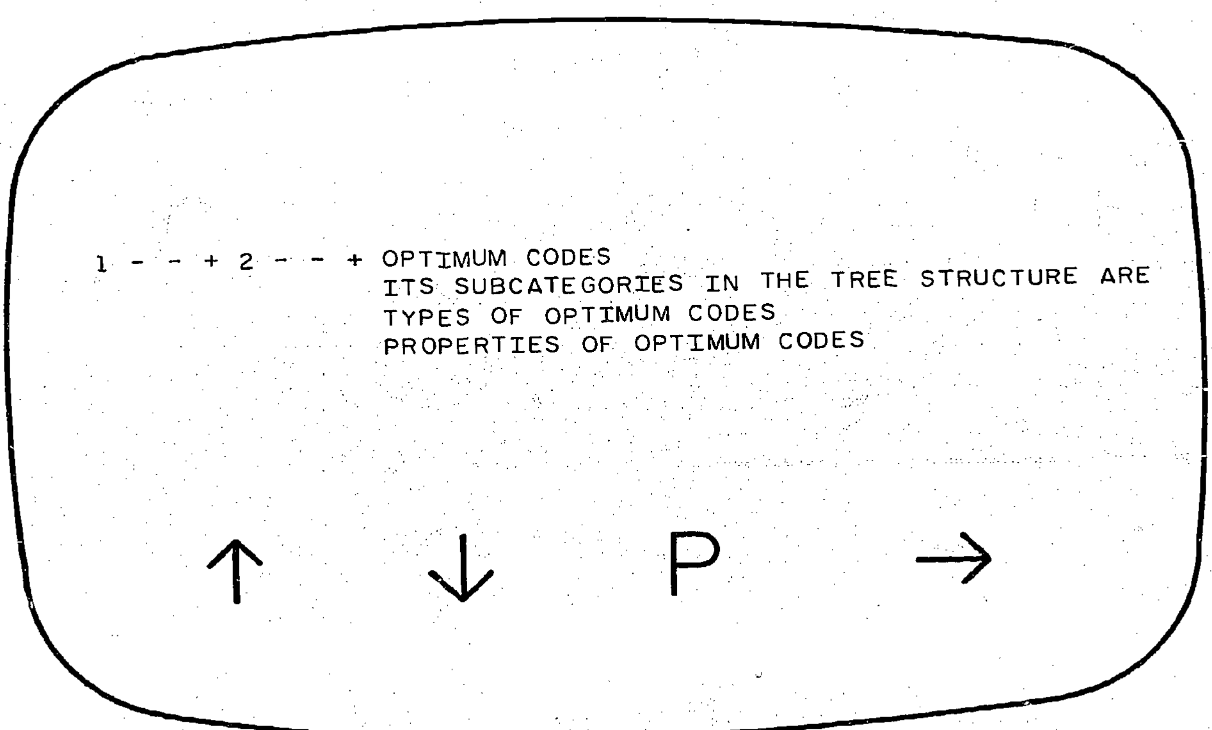


Figure 4.

FP-2372

the display console will appear as shown in Figure 3. There are 15 commands, the functions of which are explained in detail in Appendix B. If "DWNTREE" is selected with the light-pen, the display console will be as shown in Figure 4.

Suppose that the user wants to know the optimum codes under high rate transmission; he can press the right-most arrow with the light-pen to get Figure 3 shown on the display console again and select "ADD" with the light-pen. By typing "HIGH RATE" followed by a carriage return Figure 5 will be shown if "HIGH RATE" is available in the data file (in this case, it is).

By pressing the right-most arrow and selecting the "PTR2DWN" with the light-pen four times until the picture as shown in Figure 6 is shown on the display-console screen.

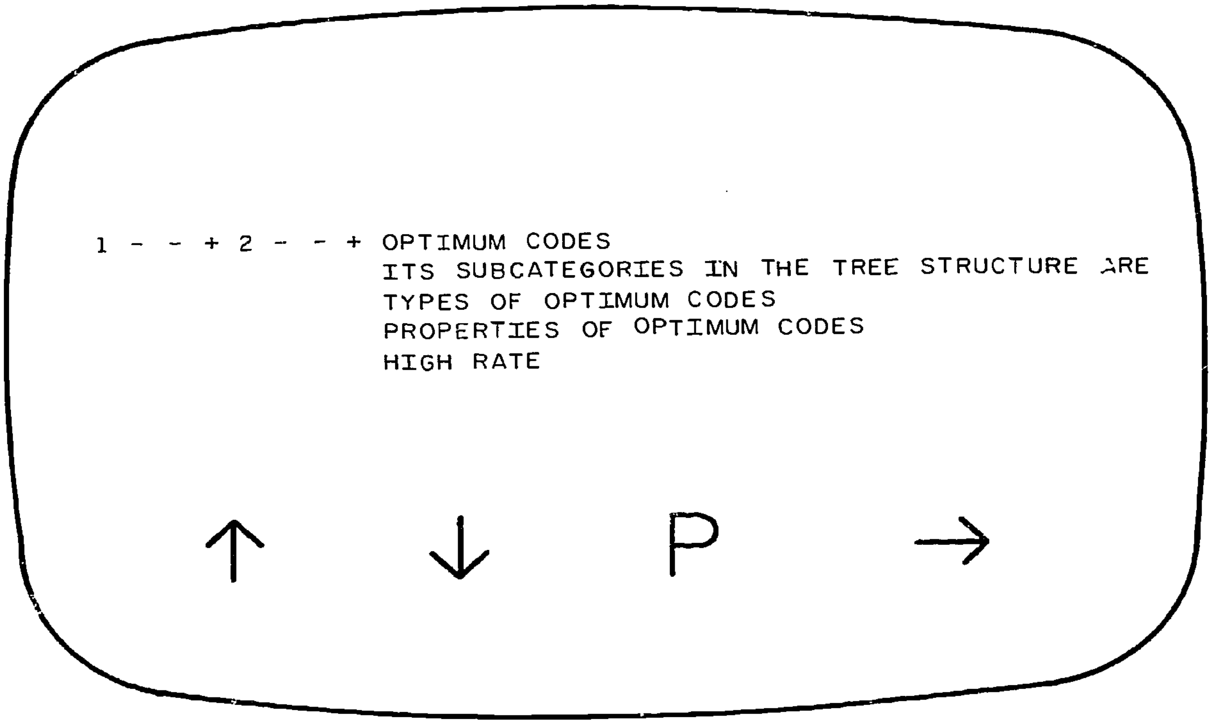
Pressing the right-most arrow and selecting "IATLINK" with the light-pen will then present the user the information shown in Figure 7.

If he presses the right-most arrow with the light-pen and selects "GO-ON", he will see the picture shown as in Figure 8. That means there is only one node whose name is "OPTIMUM CODES".

The user may start the retrieval process* if he feels that the topic names found are enough for his interests simply by pressing the right-most arrow and selecting "RETRIEVE" with the light-pen.

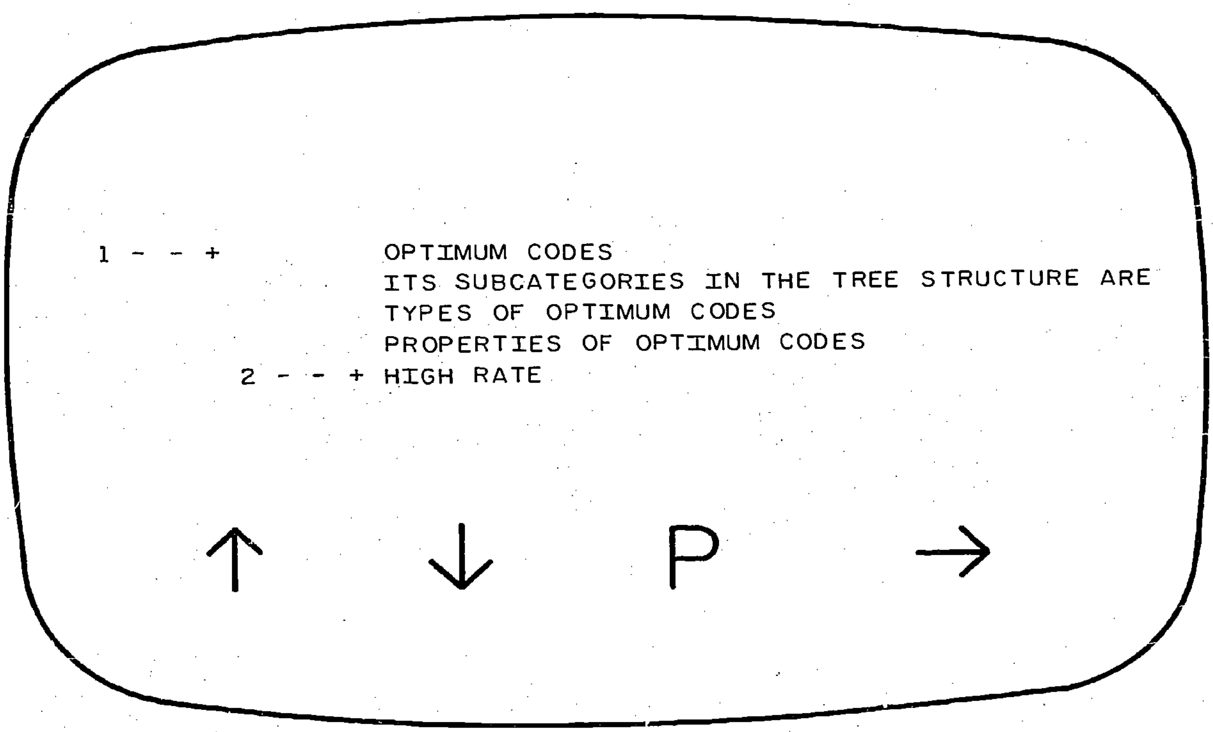
If he selects "LISTALL", he will have the whole list shown again. By selecting "PRINT", he will have the whole list printed. But, if he selects "RESTART", he will erase the whole list and start the program all over again.

*Program for retrieval process is not included in this implementation.



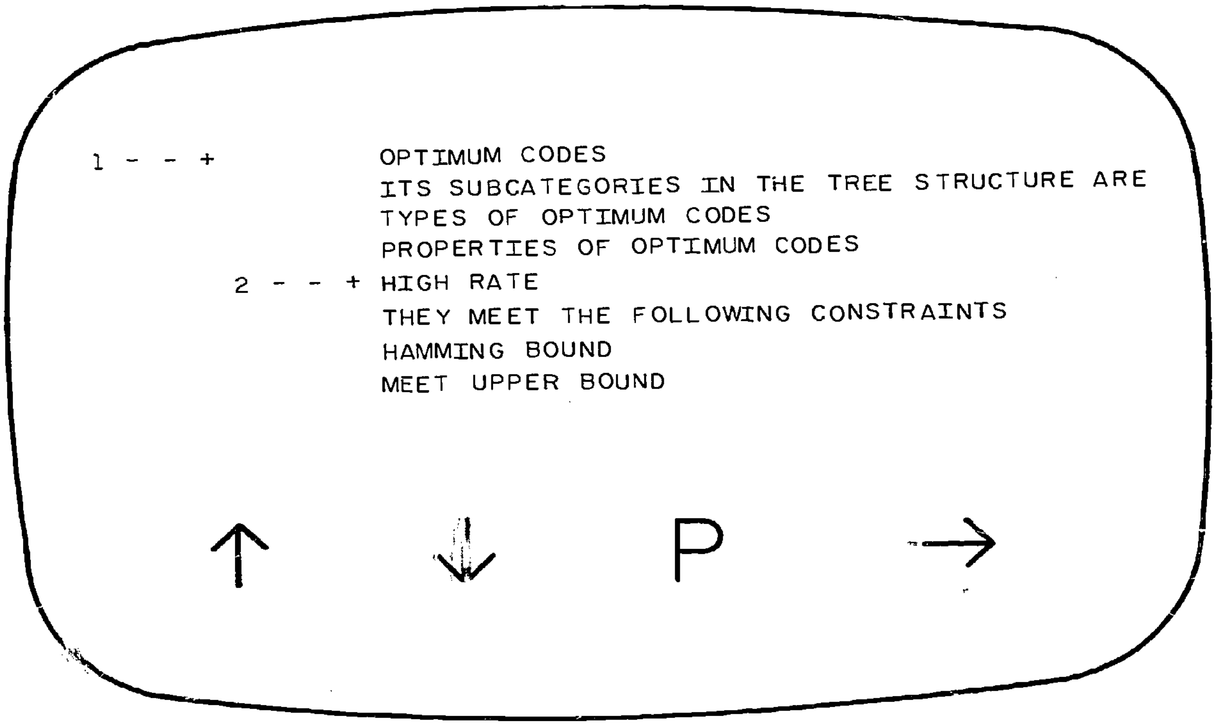
FP-2375

Figure 5.



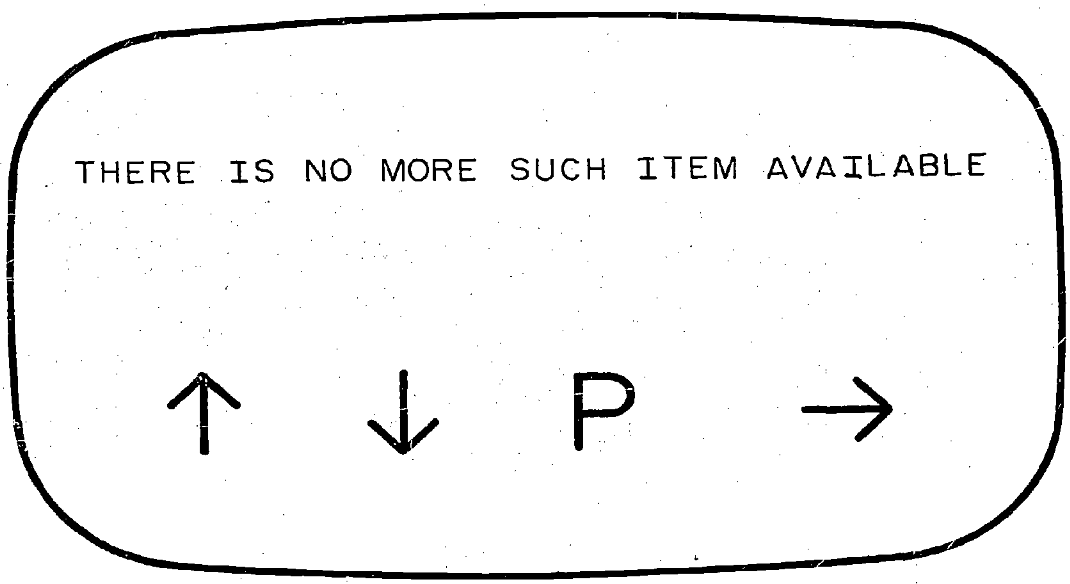
FP-2374

Figure 6.



FP-2376

Figure 7.



FP-2373

Figure 8.

III. THE RELATIONAL STRUCTURE DESIGN

In order to best illustrate how the relational information is stored, a representation of the subtree given in Figure 10 will be given. Three structure representations are descri ' here.

A. Node Representation

Each model node consists of two parts as shown in Figure 9. In part one, there are seven fields. Field 1, "NEXT", contains the word address of the next node whose name starts with the same character as this node; field 2, "END", contains a pointer pointing to the byte address of the end of the character string of this node; field 3, "TYPE", contains the information which indicates the type of lateral link function that applies to this node; field 4, "I#", contains the item number of this node; field 5, "UPPER" contains the item number of the node which is at one level up in the hierarchic tree structure; field 6 and 7, "LOWER 1" and "LOWER 2", contain the item numbers of the first and last nodes, respectively, which are at one level down in the hierarchic tree structure. Part two of the node is a variable length string that contains the name of the topic represented by this node.

Figure 11 shows how this information would look for the node given in Figure 10.

B. Lateral Link Representation

These structures consist of three to eight fields depending on which type of lateral link function applies. Field 1 contains the ite

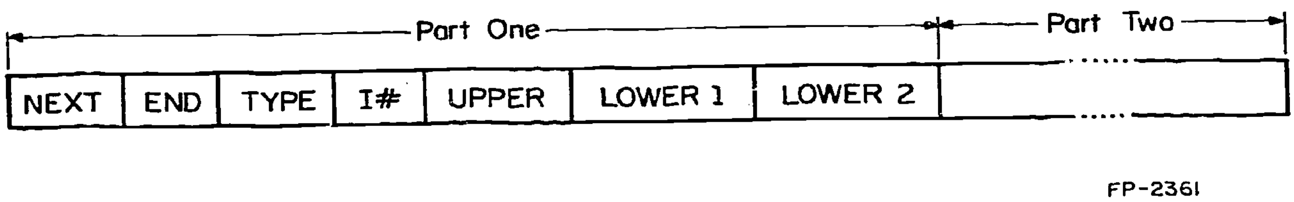


Figure 9.

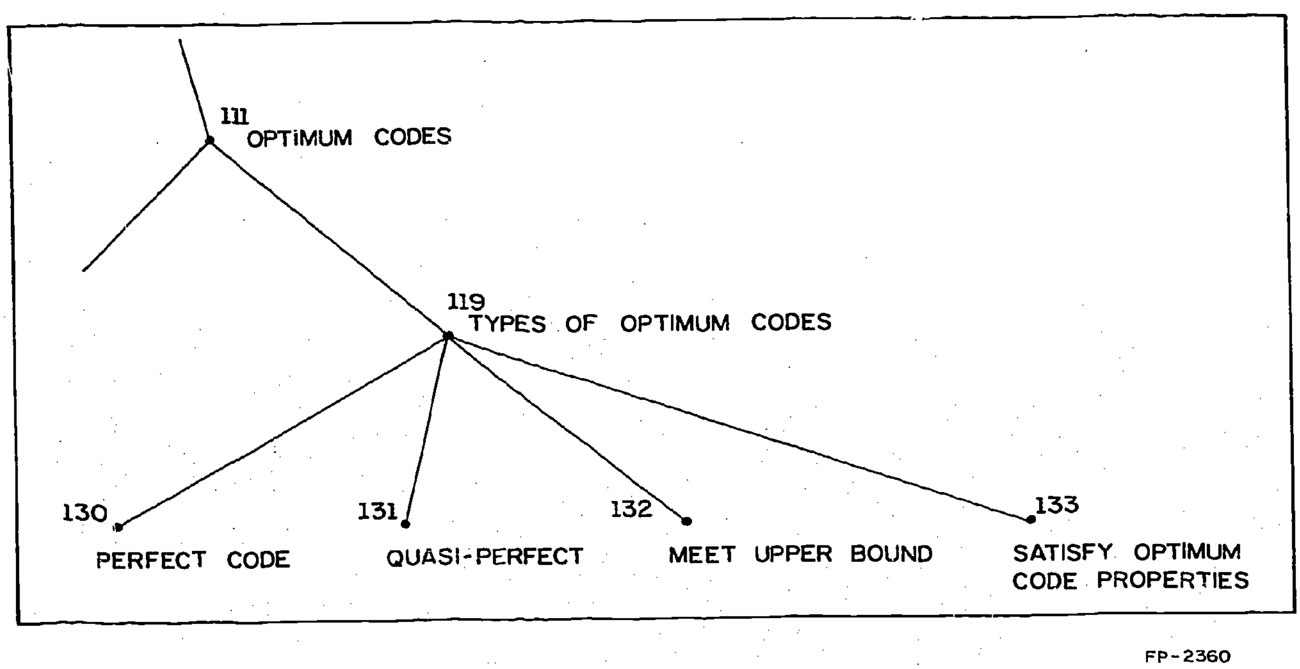


Figure 10. Part of the tree structure about the node whose name is "TYPES OF OPTIMUM CODES".

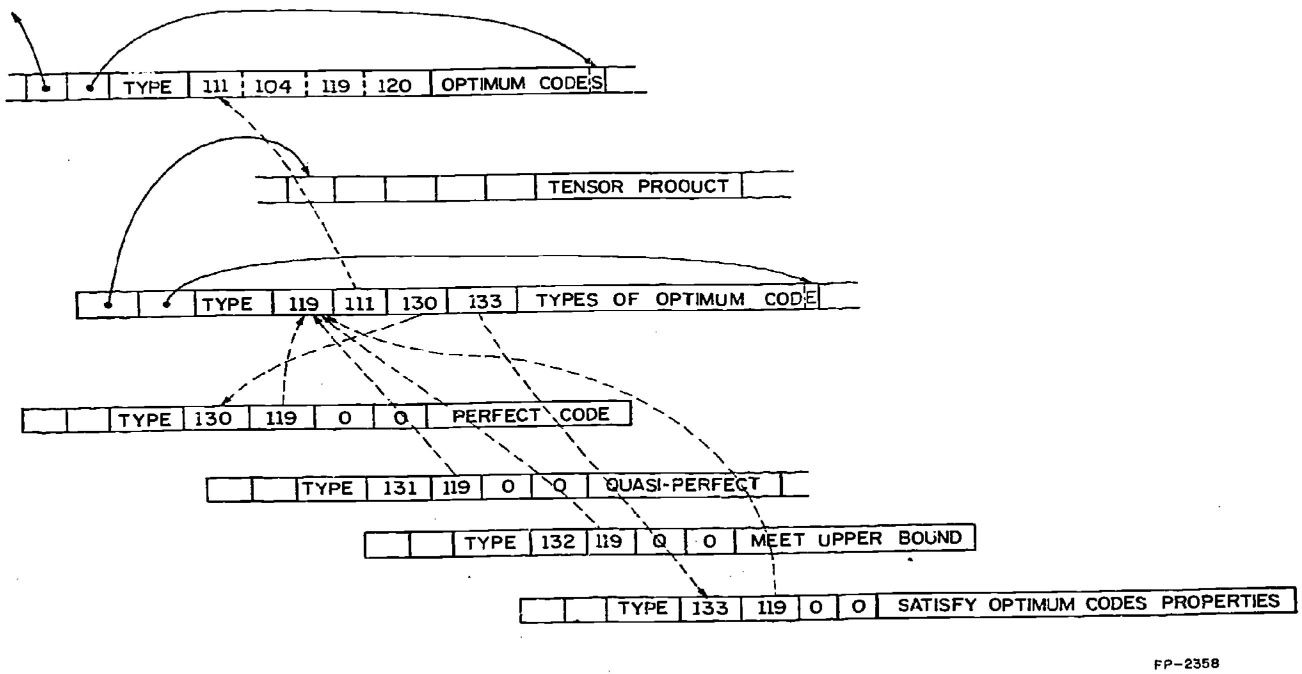


Figure 11. Relations between nodes.
——————> related by pointer
– – – –> related by item number

number of the major node, and the rest of the fields contain item numbers of those nodes which required by the lateral link function. For example, for the node "OPTIMUM CODES", the lateral link representation will be as shown in Figure 12, since the lateral link function LLB9 requires 7 item numbers.

C. Representation of Synonyms

These structures have the same form as the regular node representation. The differences are:

1) Field 3 in part one indicates the synonym property.

2) Field 5 in part one contains the item number of its synonym node.

3) Field 6 and 7 in part one contain zeros, and

4) Part two contains the name of the item which is not in the tree structure but is a synonym.

For example, "MAX. CODES" is not in the tree structure, but its synonym "MAX. DISTANCE SEPARABLE CODES" is. So its representation is as shown in Figure 13.

111	84	85	86	123	122	121	132

FP-2359

Figure 12. Lateral link representation for node "OPTIMUM CODES".

•	•	EQUIVALE	371	208	0	0	MAX. CODE	S

FP-2357

Figure 13. Synonym representation for "MAX. CODES".

IV. MAJOR FUNCTIONS NECESSARY FOR THE USE OF RELATIONAL STRUCTURES

The retrieval action of this program is initiated whenever the name of a topic or the leading portion of it is given. There are four major functions in this implementation.

A. The node is located by its name or the leading portion which is given. Nodes which have the same name or the leading portion, or which are related to the node found either by the hierarchy tree structure or by the lateral link functions will also be suggested, printed, and shown on the display console.

B. In any displayed list of nodes two movable pointers are provided which can move up and down independently for use in performing manipulative actions.

C. A lateral link function will be performed upon command on the nodes pointed to by the pointer 1 (PTR 1) if one record is required by that lateral link function, or on the two records pointed to by the pointers (PTR 1 and PTR 2) if two records are required by a lateral function. Lateral functions which require more than two records will be performed on records in the whole list.

D. Nodes which are not in the tree structure but have synonyms will be located. Its synonym will be printed and displayed as described in A.

V. CONCLUSION

The work presented in this paper is concerned with the hierarchy tree structure and lateral link functions in relational document retrieval systems. Fast access and processing have been carefully considered. The flexibility of this implementation is such that it is possible to apply these principles equally well to any other relational document retrieval data base which possesses hierarchy tree structures and lateral link function relations without any modification of the program.

REFERENCES

1. Esser, N. M., Jr., A Relational Structure for Document Retrieval, Coordinated Science Laboratory Report R-469, University of Illinois, 1970.

2. Kelley, K. C., Ray, S. R., and Stahl, F. A., INFORMATION SEARCH LANGUAGE File No. 735, Dept. of Computer Science, University of Illinois, Urbana, Illinois, September, 1967.

3. Kelley, K. C., Ray, S. R., Stahl, F. A., ISL - A String Manipulating Language, Report R-407, Coordinated Science Laboratory, University of Illinois, Urbana, Illinois, February, 1969.

4. Carroll, D. E., Chien, R. T., Kelley, K. C., Preparata, F. P., Reynolds, P., Ray, S. R., Stahl, F. A., An Interactive Document Retrieval System, Report R-309, Coordinated Science Laboratory, University of Illinois, Urbana, Illinois, December, 1968.

5. Chien, R. T., Ray, S. R., Stahl, F. A., ISL - A New Programming Language for Information Retrieval, Report R-449, Coordinated Science Laboratory, University of Illinois, Urbana, Illinois, December 1969.

6. Chien, R. T., Ray, S. R., Stahl, F. A., "ISL - A New Information Retrieval Language," in Proceedings of the Third International Symposium of Computer and Information Science, edited by Julius Tou, Academic Press, New York, (to appear) 1970.

7. Bennet, E., Haines, E., Summers, J. AESOP: A prototype for outline user control of organizational data storate, retrieval and processing. AFIPS Conf. Proc. Vol. 27, part 1. 1965.

8. Burnaugh, H. P., Introduction to the BOLD Retrieval System, SDC, Santa Monica, Calif. Oct. 1965 (TM-2306/000/03).

9. Ide, E., Salton, G., Interatcive Search Strategies and Dynamic File Organization in Information Retrieval, Report ISR-16, Cornell Univ., 1969.

APPENDIX A

DESCRIPTIONS OF PROGRAMS

Appendix A contains the following information in the order listed below:

(1) MAIN PROGRAM

(2) SUBPROGRAMS

(3) FLOW CHARTS

1. Main Program

This implementation has been programmed on the Control Data 1604 computer at the Coordinated Science Laboratory of the University of Illinois. The main program and the subprograms comprising this implementation were written in the Information Search Language (ISL) [2,3,4,5,6].

There are three portions of the main program in the implementation which will be briefly described here.

a. The first portion of the main program serves to set up the files in the computer memory in the appropriate sequential form. For easy and fast access, directories are built in which the leading addresses of groups and the addresses with respect to item numbers are kept. Twenty-two lateral function directories are also built, each for one of the twenty-two categories of lateral link functions.

b. The second portion of the main program accepts commands from the user and makes a list of the required topic and synonyms and then suggests topics which may be of further interest to the user.

c. The remaining portion of the main program performs further manipulations of the information and executes the desired lateral link functions upon the user's demand.

2. SUBROUTINES

There are 13 subprograms:

a. SETUP: This subprogram arranges the records in the appropriate sequence and sets up the directories and the links.

b. SEARCHA: This subprogram analyzes a given character string and locates where in the relational file it is located.

c. SEARCHB: This subprogram locates a given character string in the portion of the relational file after a given address.

d. COMPARE: This subprogram compares two character strings of a given length to see if they are the same.

e. LFTN: This subprogram serves to perform the 22 lateral functions, to suggest new related nodes or to suggest the deleted of the node found.

f. SETLL: This subprogram puts all the item numbers which will be used in the particular lateral function into the corresponding directory.

g. MOVPTR: This subprogram moves the pointer specified from position 1 (pos1) to position 2 (pos2).

h. CHKINO: This subprogram checks for the item number specified to see if it is in the list DIRECT. The value 0 in accumulator A indicates success. Fail otherwise.

i. GETINO: This subprogram gets the item number of the topic in the record with leading address given and stores it at ITNO.

j. MOVTV1: This subprogram puts the statement with given leading address and ending address in the scope buffer and adjusts the list DIRECT.

k. MOVTV2: When the leading address of the record is given, this subprogram moves the topic title of that record to the scope buffer and sets both lists DIRECT and DIRTTV.

l. GETRT1: This subprogram moves the statement between the two given addresses to the scope buffer. Then, for the record with leading address at RCDADR, it finds all the related records and puts their topic titles in the scope buffer.

m. GETRT2: This subprogram gets the item numbers pointed to by both pointer 1 (1--*) and pointer 2 (2--*), and checks to see if the condition of the lateral link function involved is satisfied. On success, it moves the statement between the two given addresses and the related topic names to the scope buffer.

3. FLOW CHARTS

In the flow charts, the following symbols are used:

a. b : Index designator,

b. B^b: Deisgnated index register,

c. ( ) : Contents of a register or storage location,

d. (a1,a2) : Contents between byte locations a1 and a2.

APPENDIX B

USER'S MANUAL

1. To start the program:

   (a) Mount tape C-140 (ISL MASTER) on logic unit 1, and tape F-137 (MAIN) on logic unit 2.

   (b) Mount tape F-138 (DATAMAIN) on logic unit 8.

   (c) Press "AUTO-LOAD" button to initiate the program.

   (d) Type "LOAD,2" followed by a carriage return.

   (e) Type "GO,MAIN" followed by a carriage return.

2. To start the retrieval process:

The program will be ready when "STATE YOUR REQUEST" is typed on the typewriter, and at the same time shown on display console.

Type a topic name or its leading portion which you are interested in. Follow this by a carriage return. What you have typed will also be shown on the display console.

Another "carriage return" will give you the opportunity to terminate the program by typing "ABORT" or change the name by typing "ERASE"; and then a "carriage return".

Your command will be accepted each time the display console is showing information. There are 15 simple commands available:

   (a) PTR1UP: To move pointed 1 (1--*) up the list one step.

   (b) PTR1DWN: To move the pointer 1 down the list one step.

   (c) PTR2UP: To move pointer 2 (2--*) up the list one step.

   (d) PTR2DWN: To move pointer 2 down the list one step.

   (e) DELETE: To delete the topic title pointed to by pointer 1.

(f) ADD: To add a new title at the end of the list.

(g) UPTREE: To find the title of the node one level higher than the one pointed to by pointer 1 in the tree structure.

(h) DWNTREE: To find the title of the node one level lower than the one pointed to by pointer 1 in the tree structure.

(i) RESTART: To erase the whole list and start the program over again.

(j) GO-ON: To keep the list in the memory and go on the retrieval process.

(k) LATLINK: To apply the lateral function on the topics pointed to by pointer 1 and also pointer 2 or of the whole list if function requires.

(l) LISTALL: To restore the part of the list kept in the memory and show them all on the TV screen.

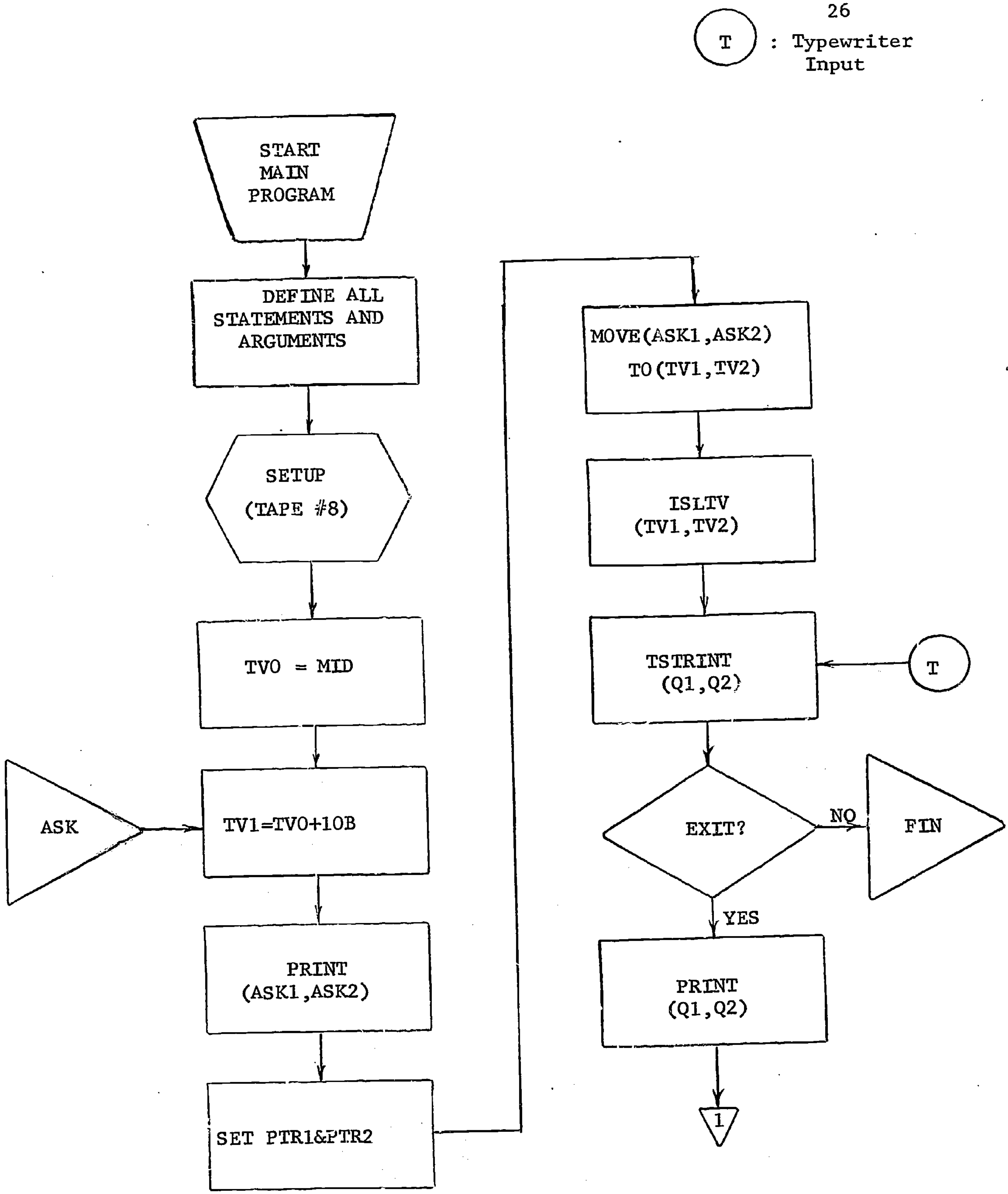
(m) PRINT: To print out whatever shown in the TV screen.

(n) THATSALL: To terminate the program.

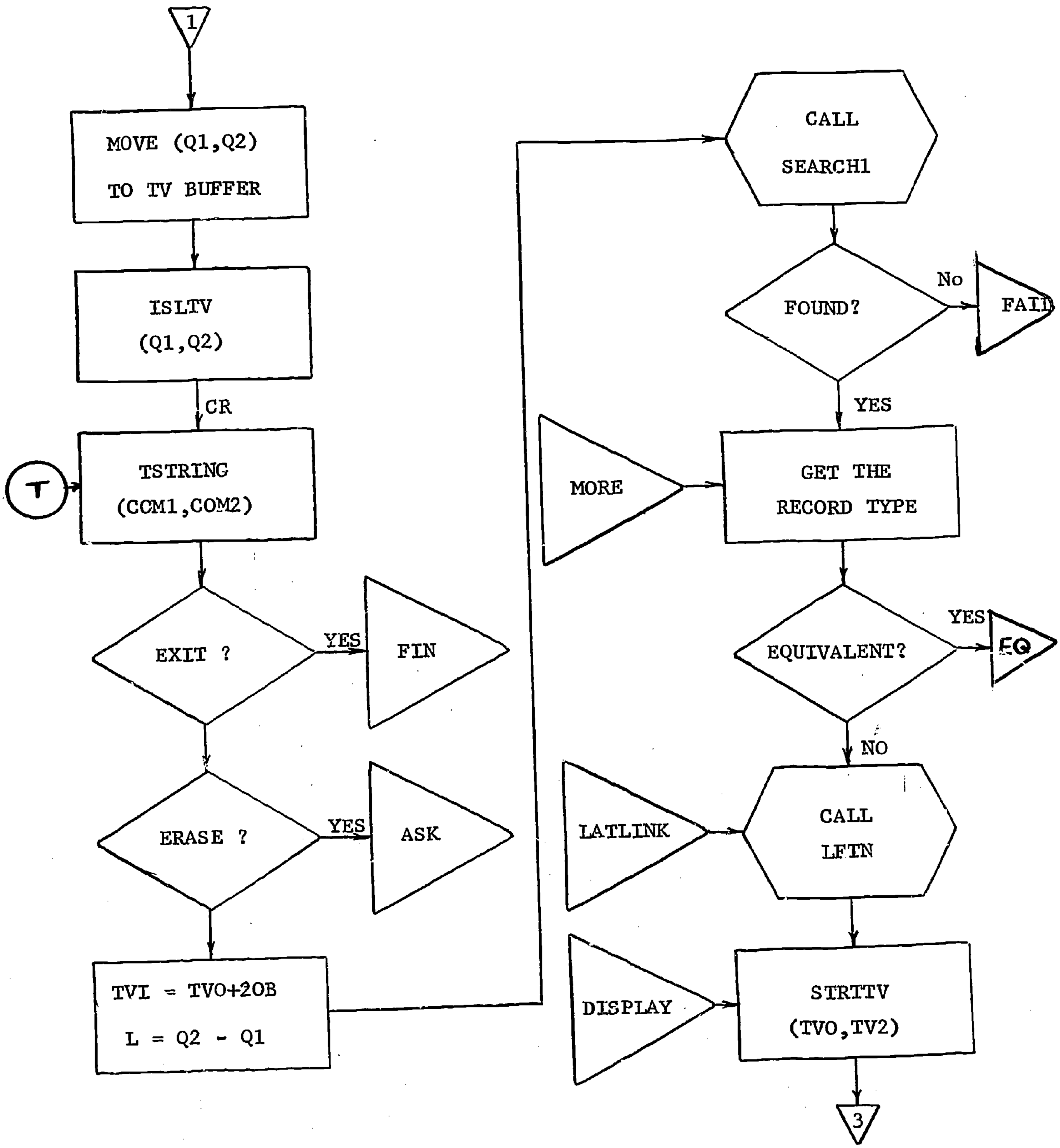
(o) RETRIEVAL: (Not included in this program).

APPENDIX C

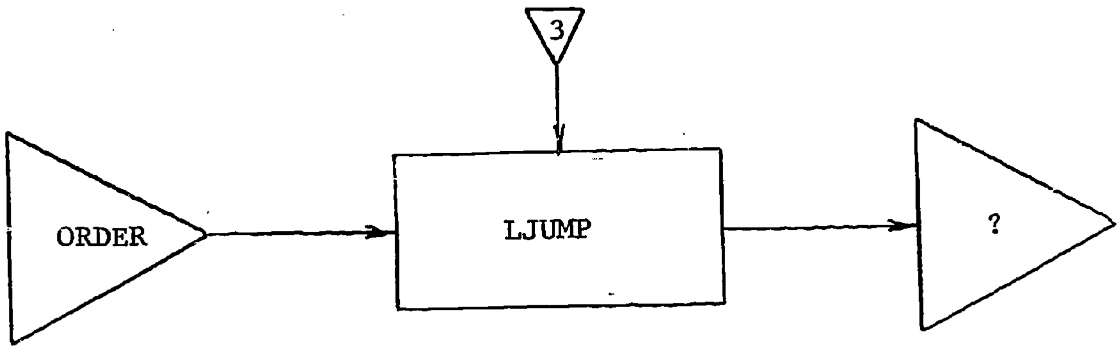
SAMPLE OF THE HIERARCHIC TREE STRUCTURE USED TO TEST THE PROGRAM


T : Typewriter Input
START MAIN PROGRAM
DEFINE ALL STATEMENTS AND ARGUMENTS
SETUP (TAPE #8)
TV0 = MID
ASK
TV1=TV0+10B
PRINT (ASK1,ASK2)
SET PTR1&PTR2
MOVE(ASK1,ASK2) TO(TV1,TV2)
ISLTV (TV1,TV2)
TSTRINT (Q1,Q2)
T
EXIT?
NO
FIN
YES
PRINT (Q1,Q2)
1

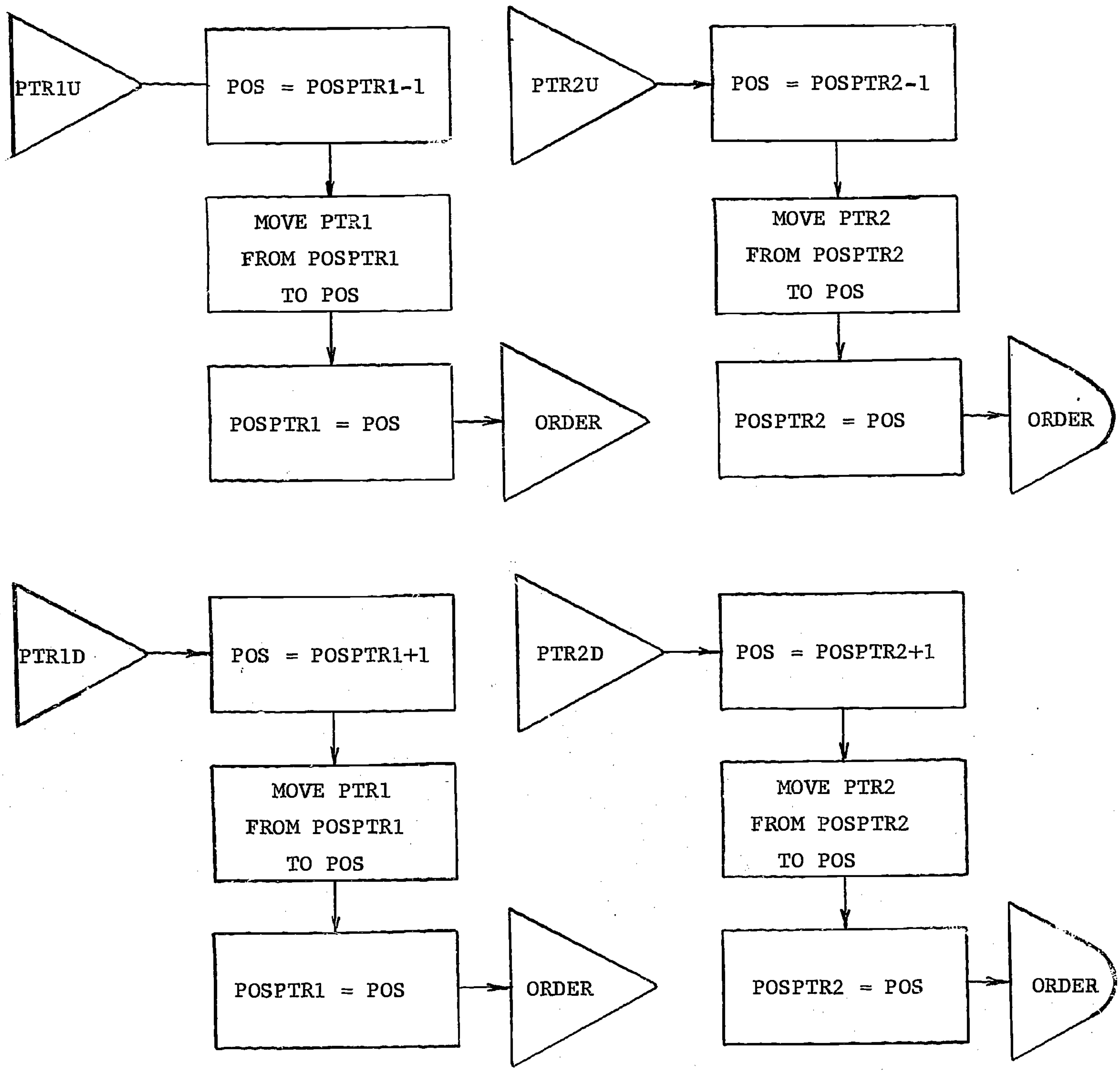
MAIN PROGRAM CONTINUE



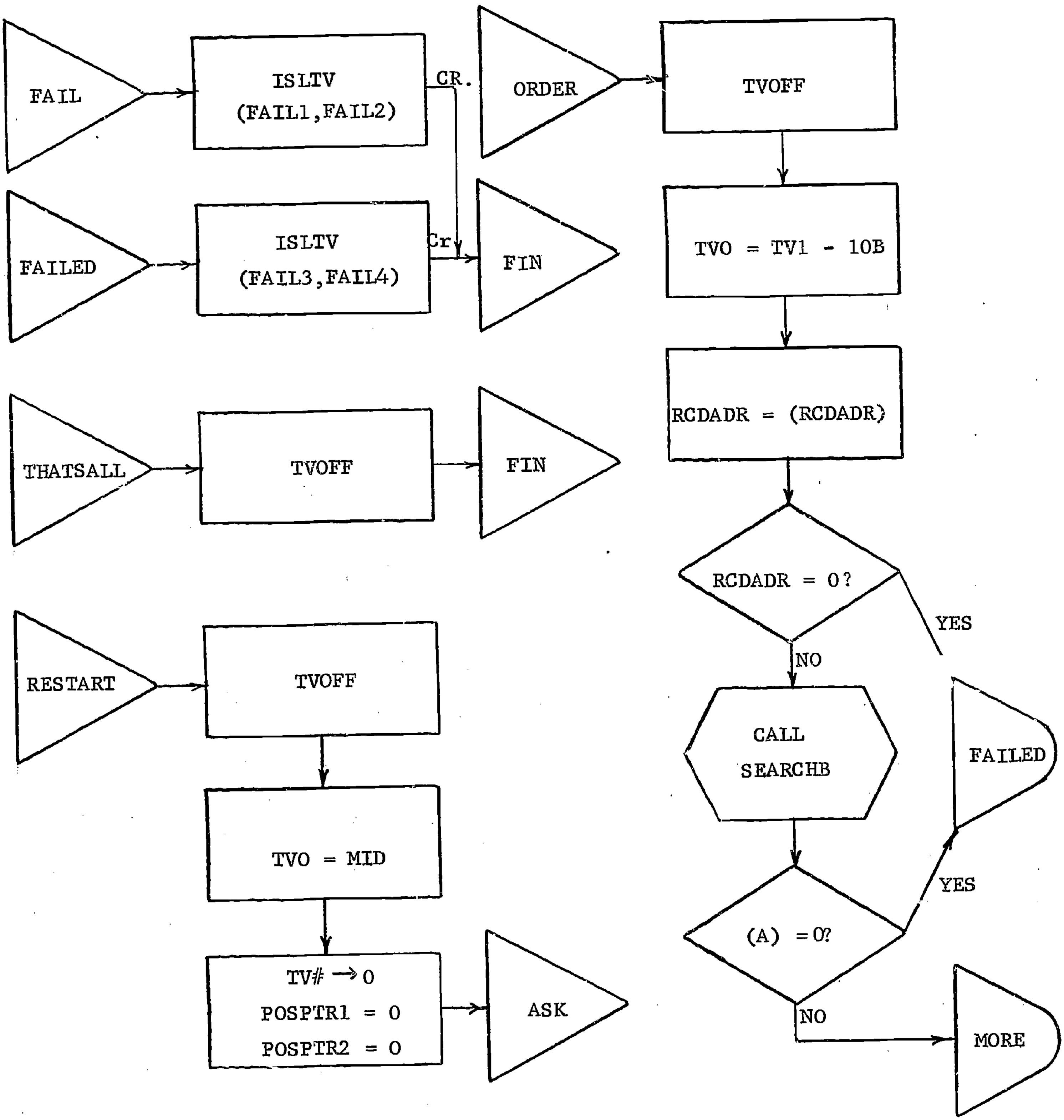
MAIN PROGRAM CONTINUE

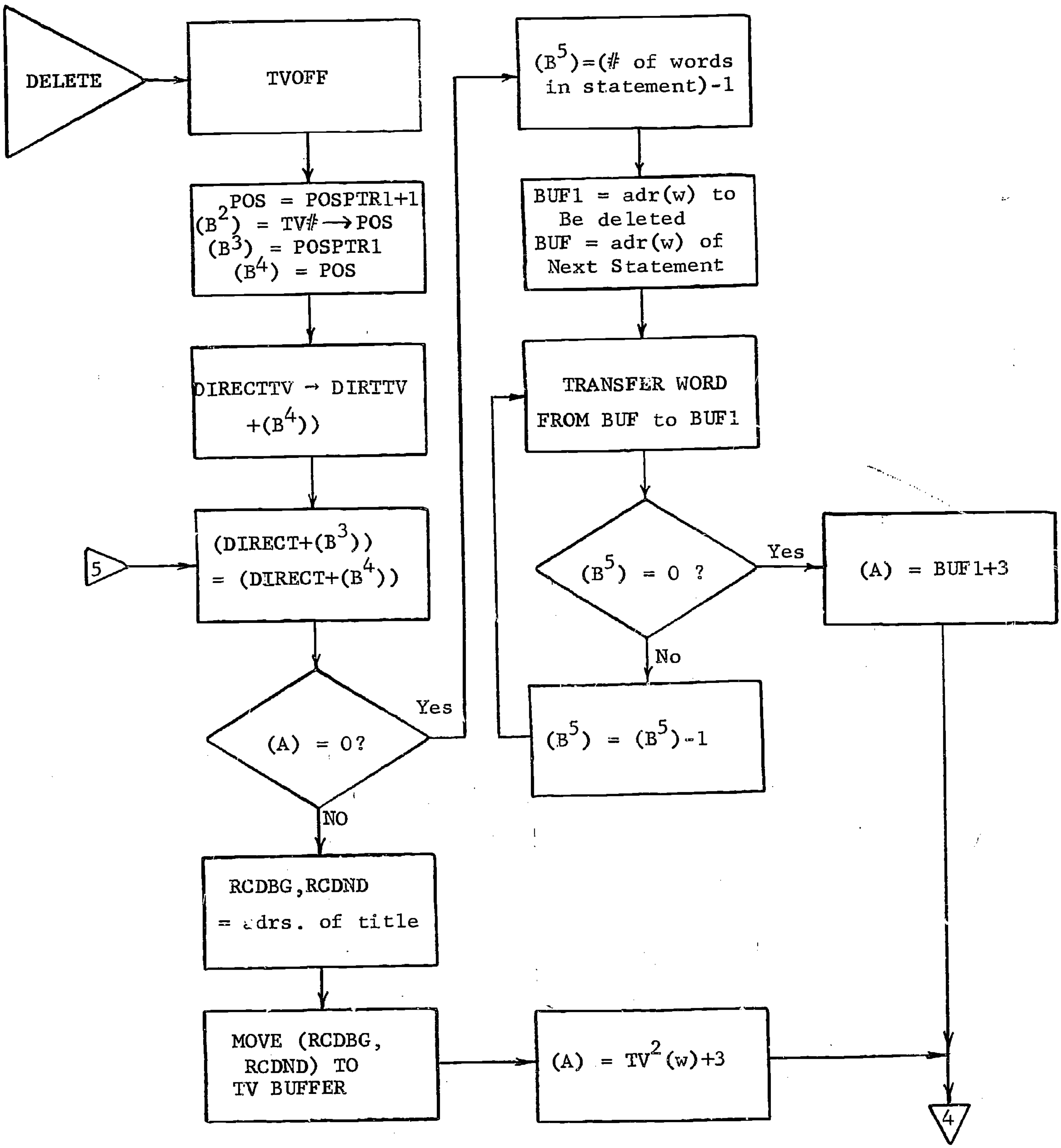


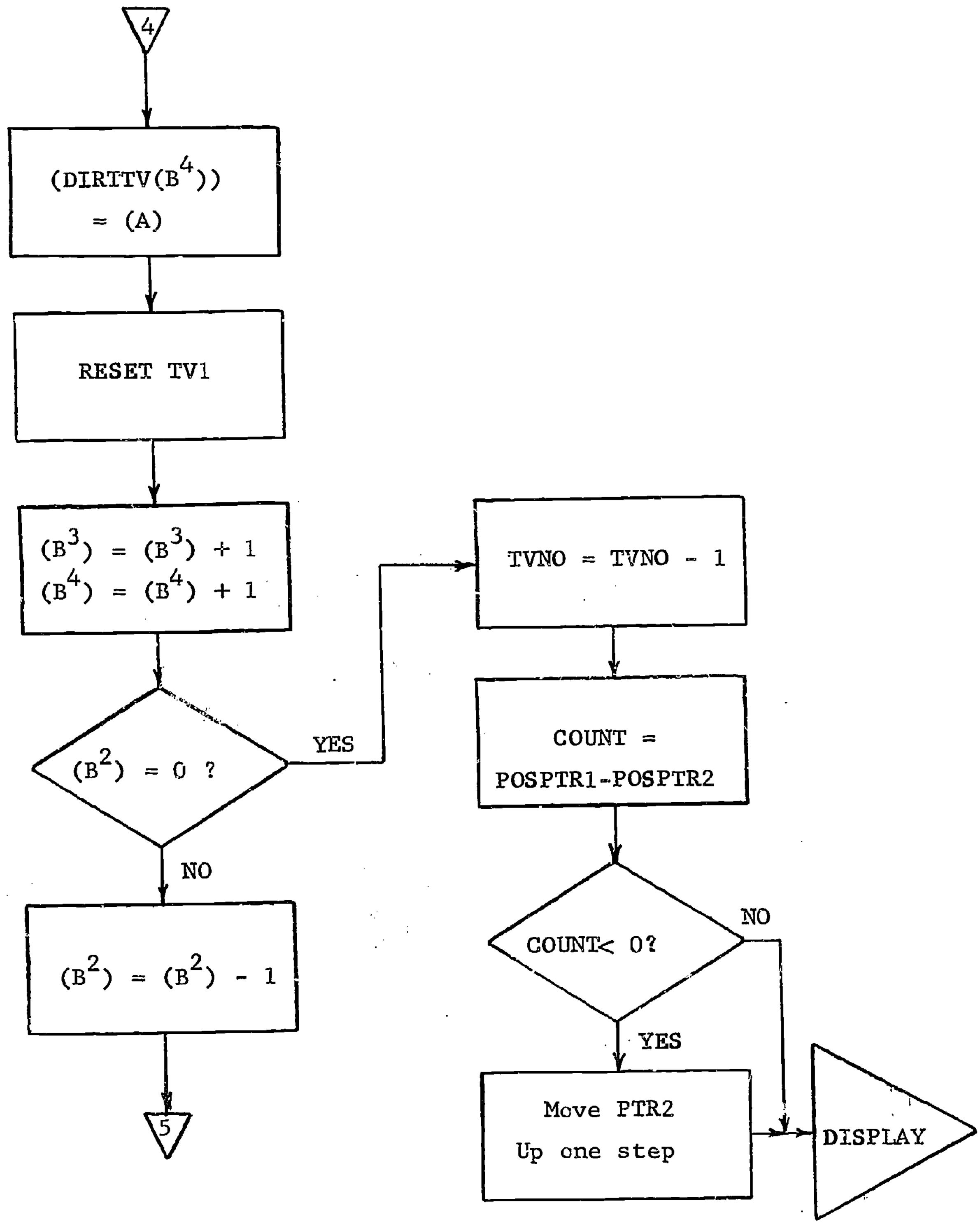
SELECT WITH LIGHT-PEN	GOTO ?
1. - PTR1UP	1. PTR1U
2. - PTR1DWN	2. PTR1D
3. - PTR2UP	3. PTR2U
4. - PTR2DWN	4. PTR2D
5. - DELETE	5. DELETE
6. - ADD	6. ADD
7. - UPTREE	7. UPTREE
8. - DWNTREE	8. DWNTREE
9. - RESTART	9. RESTART
10. - GO-ON	10. STOR
11. - LATLINK	11. LLINK
12. - LISTALL	12. LISTALL
13. - PRINT	13. PRT
14. - THATSALL	14. THATSALL
15. - RETRIEVE	15. THATSALL


PTR1U
POS = POSPTR1-1
MOVE PTR1
FROM POSPTR1
TO POS
POSPTR1 = POS
ORDER
PTR2U
POS = POSPTR2-1
MOVE PTR2
FROM POSPTR2
TO POS
POSPTR2 = POS
ORDER
PTR1D
POS = POSPTR1+1
MOVE PTR1
FROM POSPTR1
TO POS
POSPTR1 = POS
ORDER
PTR2D
POS = POSPTR2+1
MOVE PTR2
FROM POSPTR2
TO POS
POSPTR2 = POS
ORDER

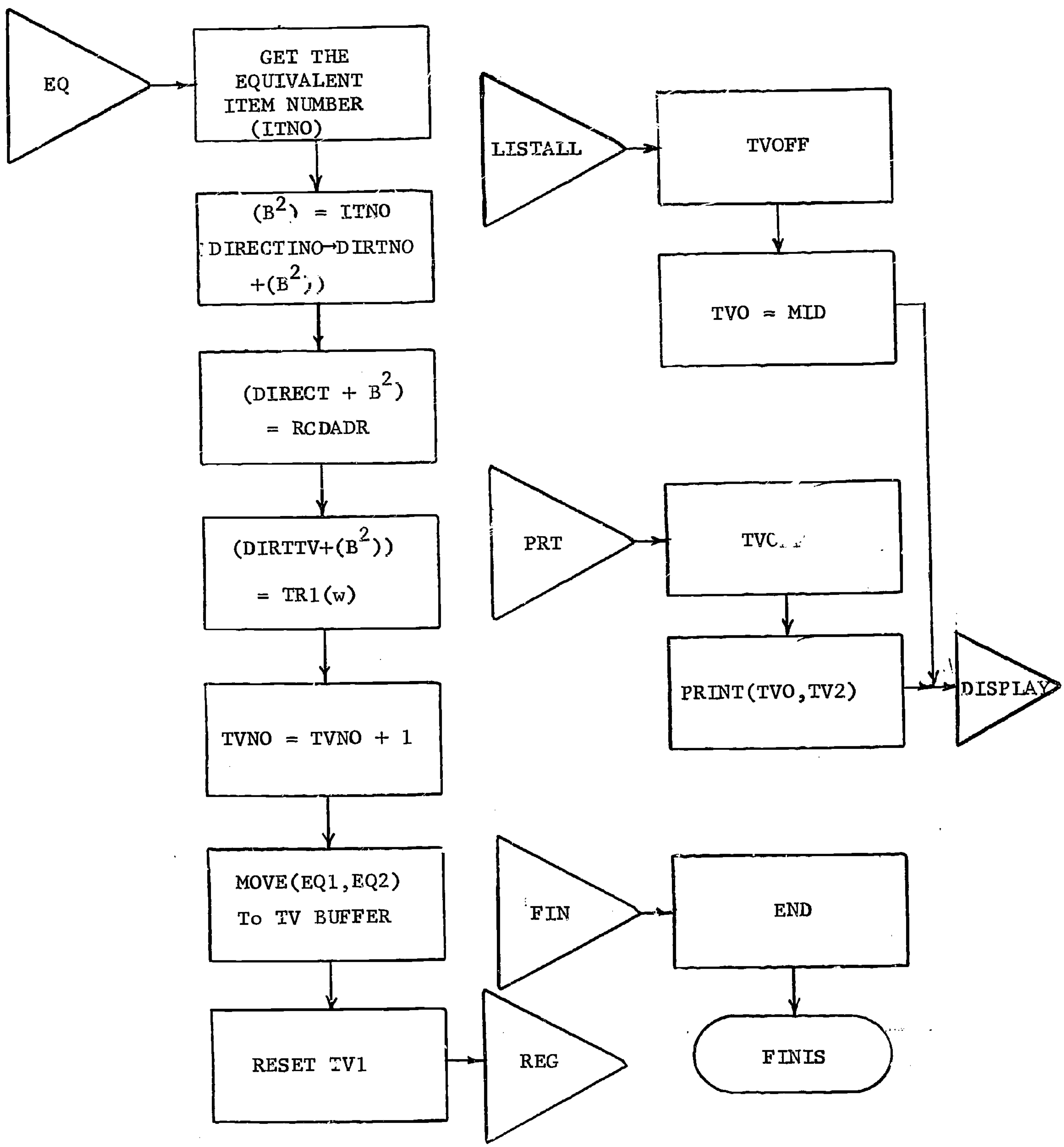
MAIN PROGRAM CONTINUE

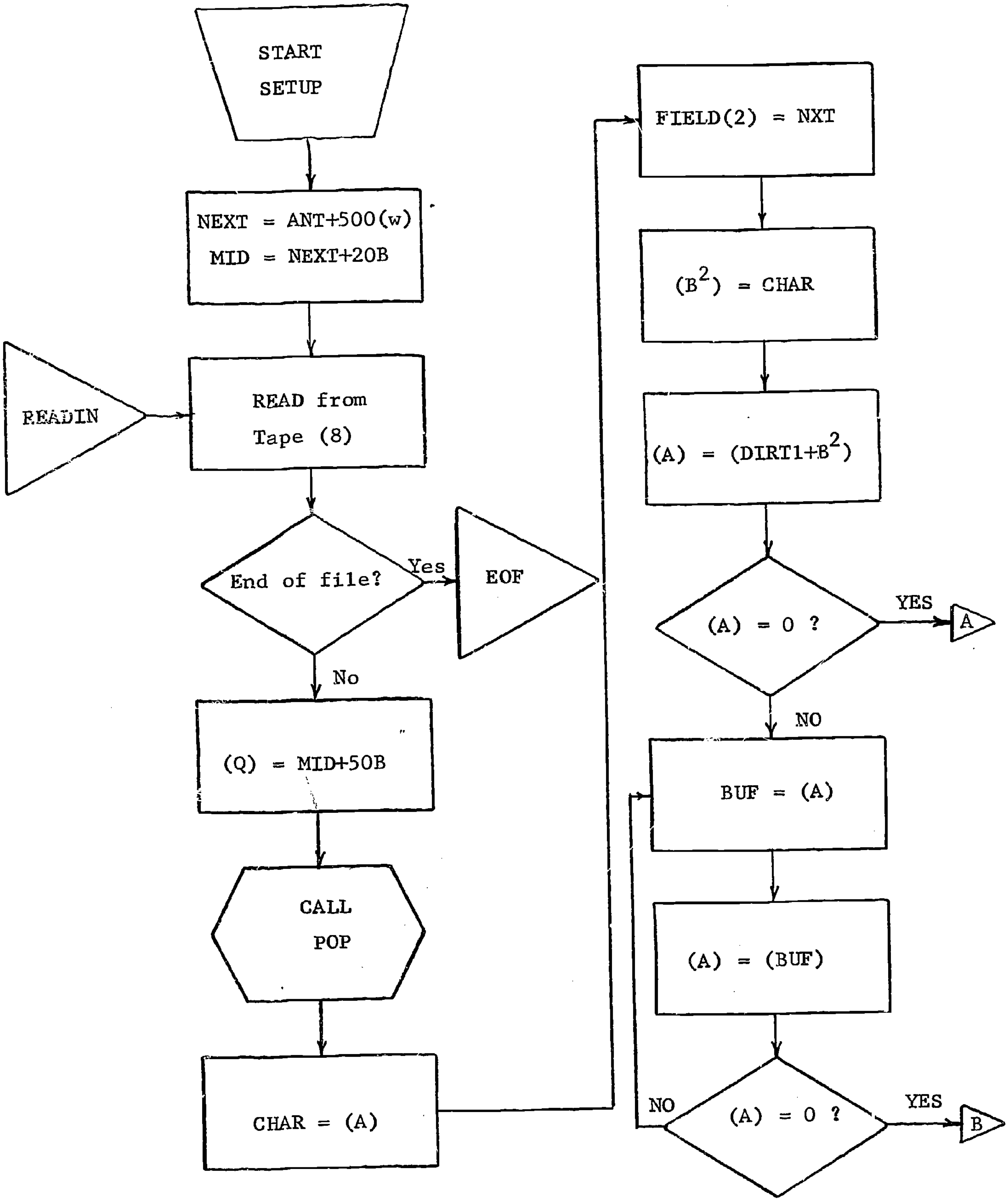


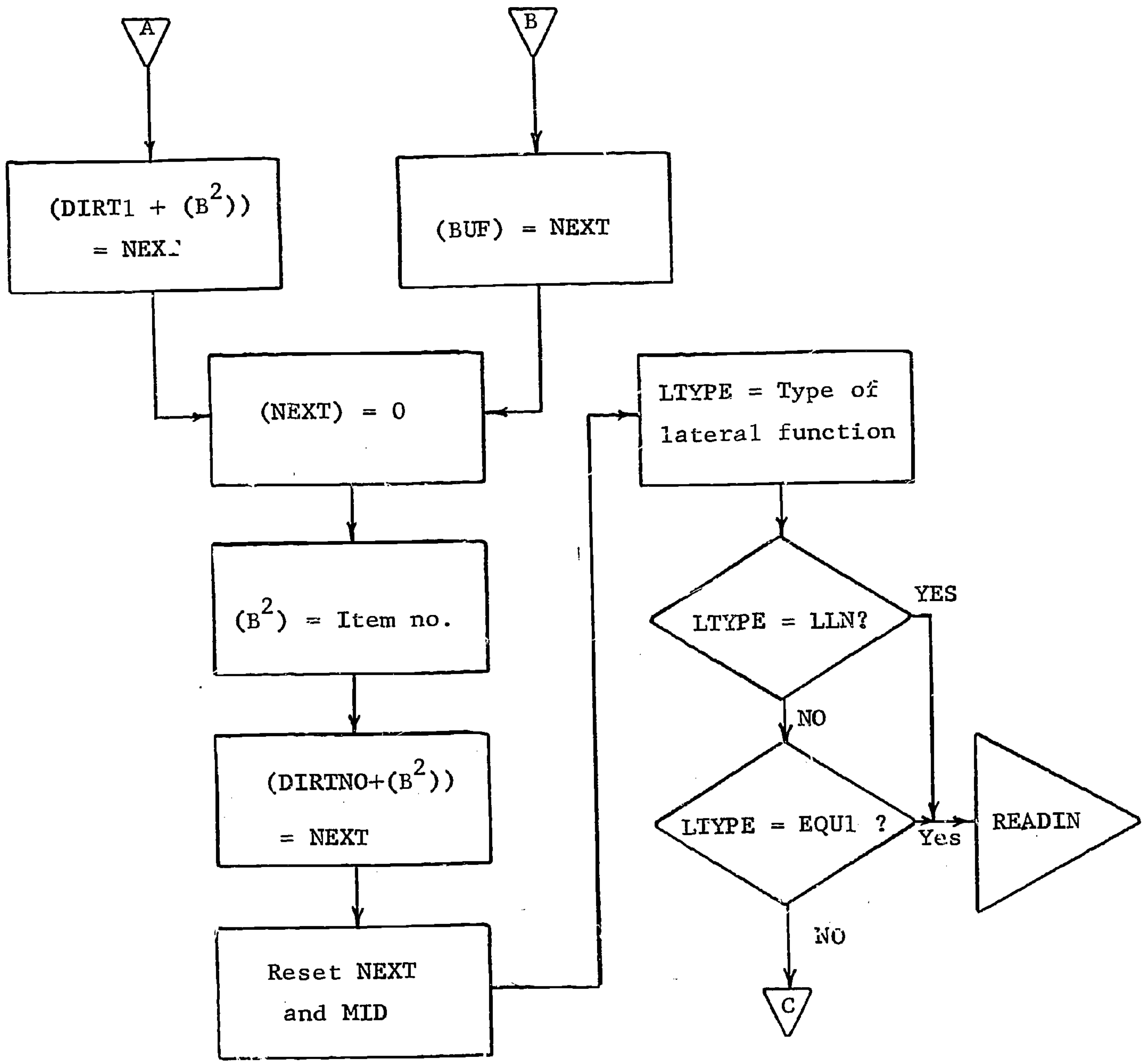

DELETE
TVOFF
POS = POSPTR1+1
(B2) = TV# → POS
(B3) = POSPTR1
(B4) = POS
DIRECTTV → DIRTTV +(B4))
5
(DIRECT+(B3)) = (DIRECT+(B4))
(A) = 0?
Yes
NO
RCDBG, RCDND = adrs. of title
MOVE (RCDBG, RCDND) TO TV BUFFER
(B5)=(# of words in statement)-1
BUF1 = adr(w) to Be deleted
BUF = adr(w) of Next Statement
TRANSFER WORD FROM BUF to BUF1
(B5) = 0 ?
Yes
No
(B5) = (B5)-1
(A) = BUF1+3
(A) = TV2(w)+3
4


4
(DIRITV(B4))
= (A)
RESET TV1
(B3) = (B3) + 1
(B4) = (B4) + 1
(B2) = 0 ?
YES
NO
(B2) = (B2) - 1
5
TVNO = TVNO - 1
COUNT =
POSPTR1-POSPTR2
COUNT< 0?
NO
YES
Move PTR2
Up one step
DISPLAY

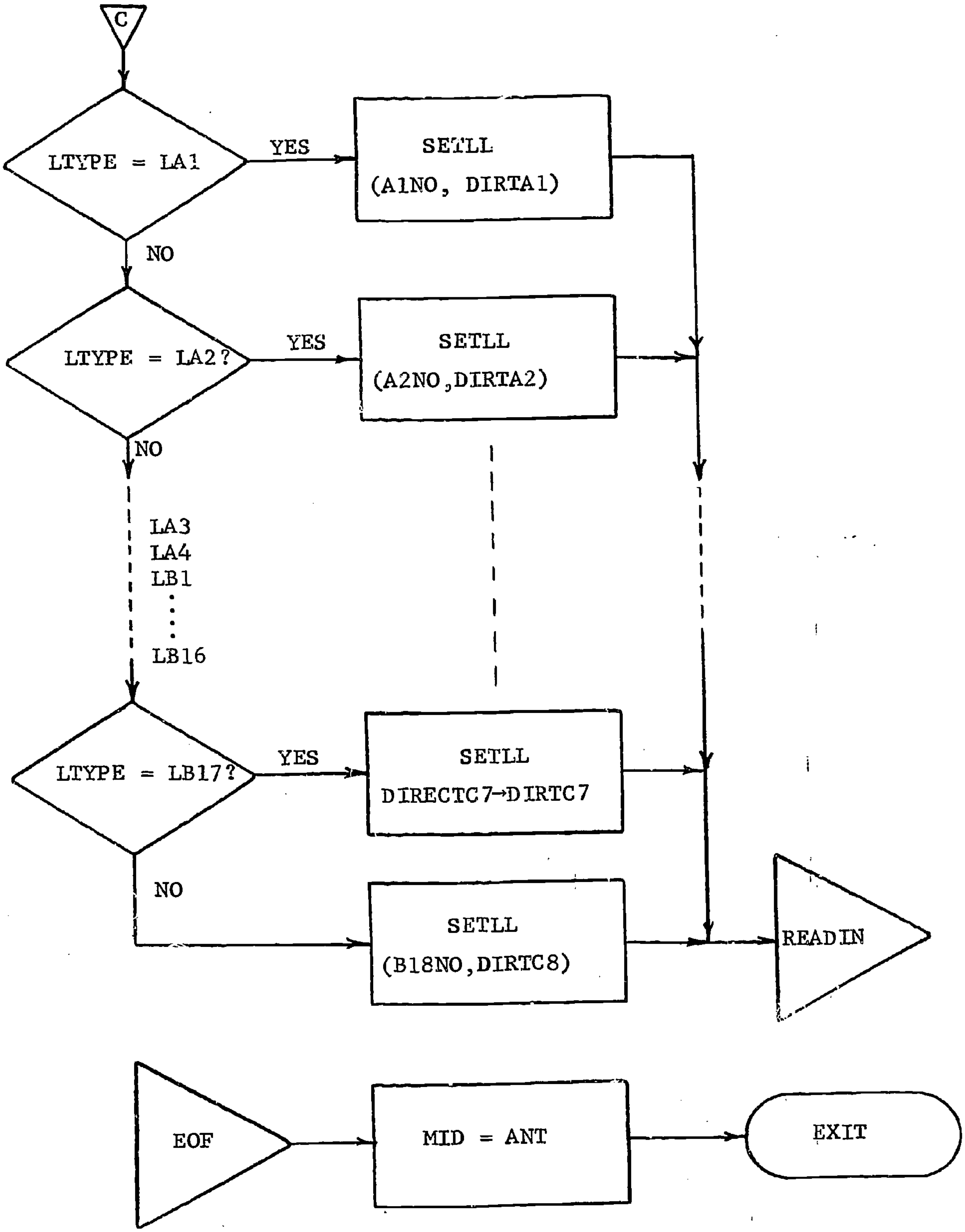
MAIN PROGRAM CONTINUE

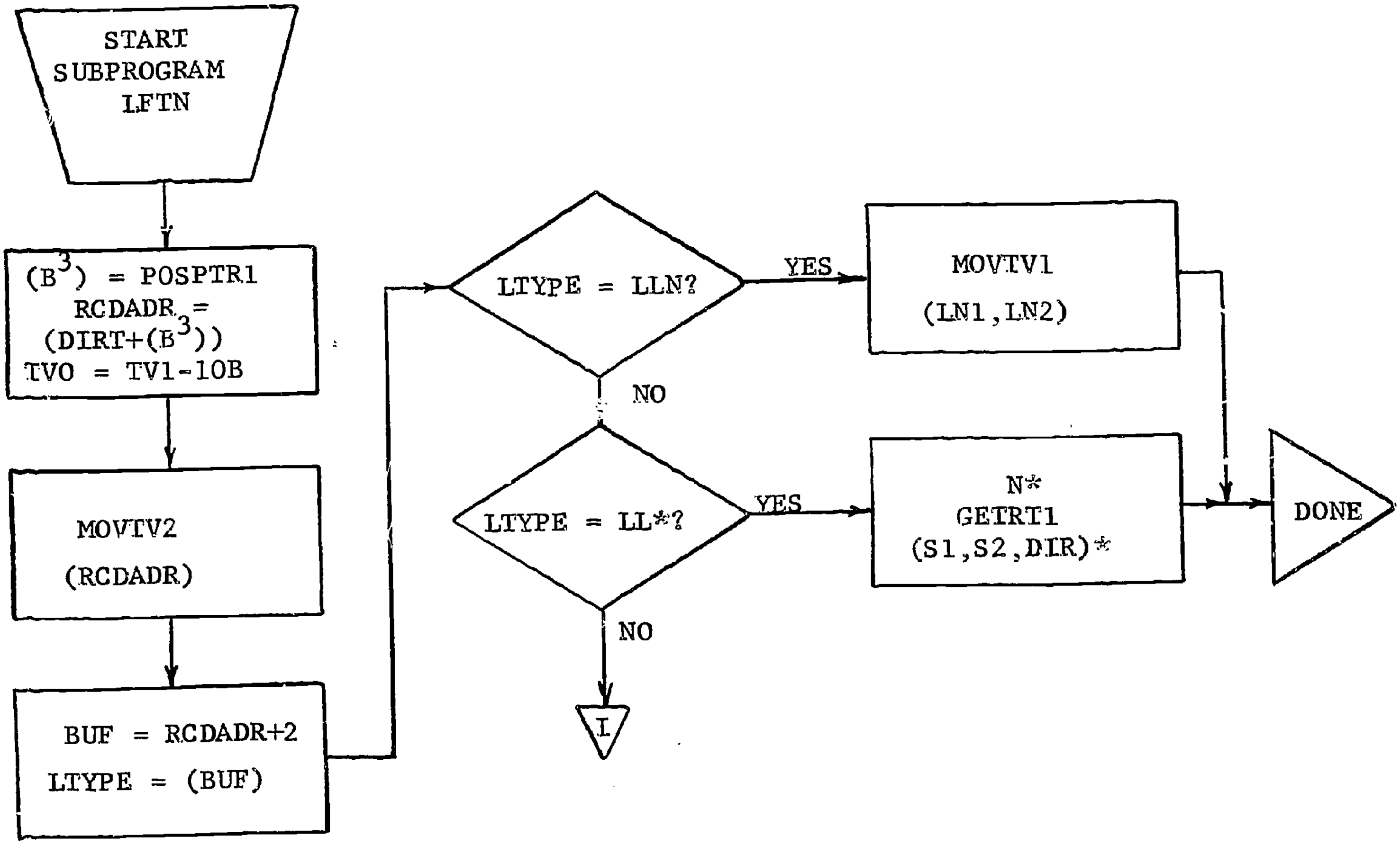



START
SETUP
NEXT = ANT+500(w)
MID = NEXT+20B
READIN
READ from
Tape (8)
End of file?
Yes
EOF
No
(Q) = MID+50B
CALL
POP
CHAR = (A)
FIELD(2) = NXT
(B²) = CHAR
(A) = (DIRT1+B²)
(A) = 0 ?
YES
A
NO
BUF = (A)
(A) = (BUF)
NO
(A) = 0 ?
YES
B


A
B
(DIRT1 + (B^2))
= NEX.
(BUF) = NEXT
(NEXT) = 0
LTYPE = Type of
lateral function
(B^2) = Item no.
LTYPE = LLN?
YES
NO
(DIRTNO+(B^2))
= NEXT
LTYPE = EQU1 ?
Yes
READIN
NO
Reset NEXT
and MID
C

SUBPROGRAM SETUP CONTINUE





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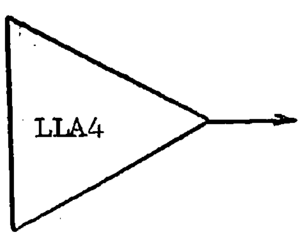
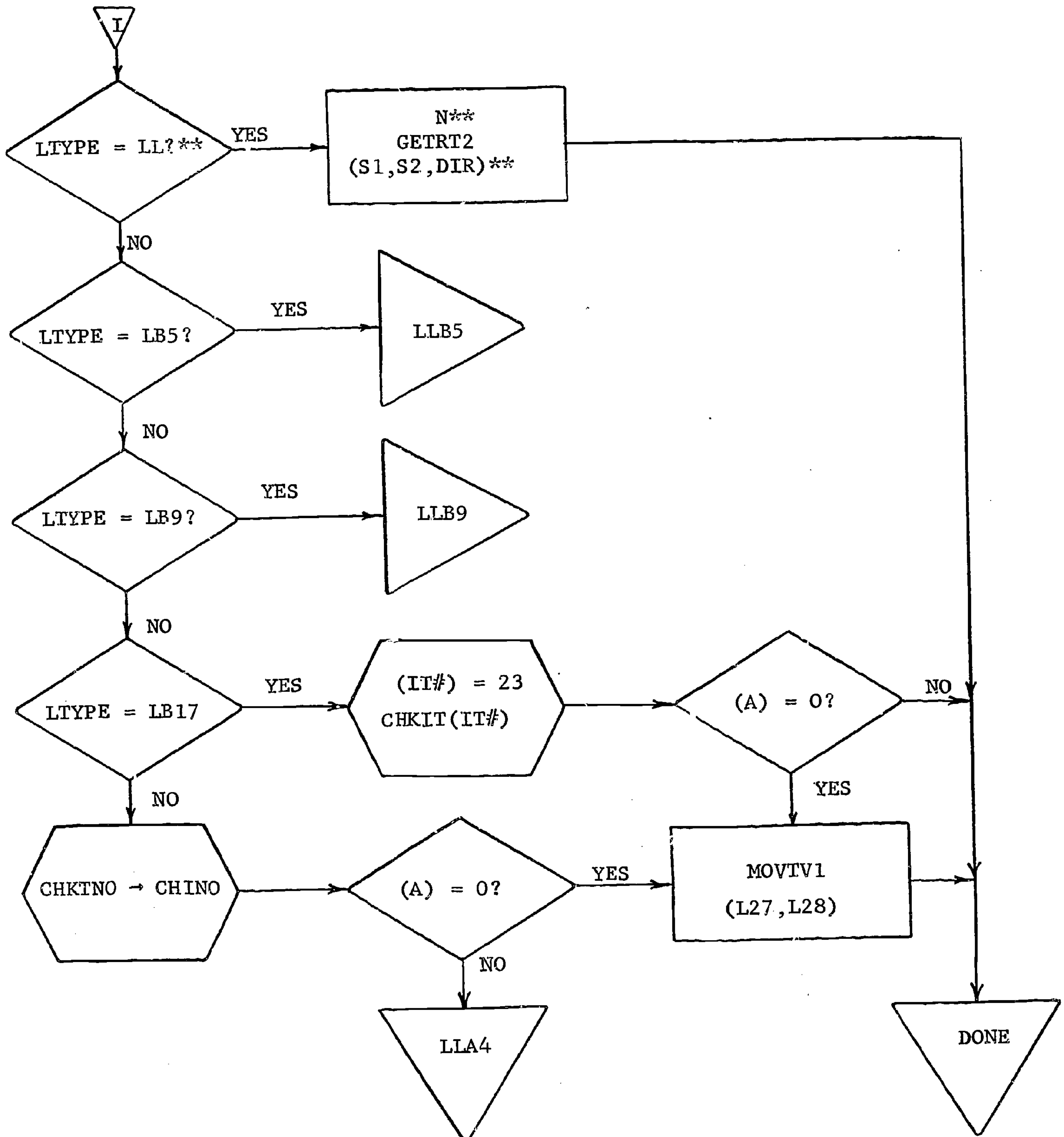


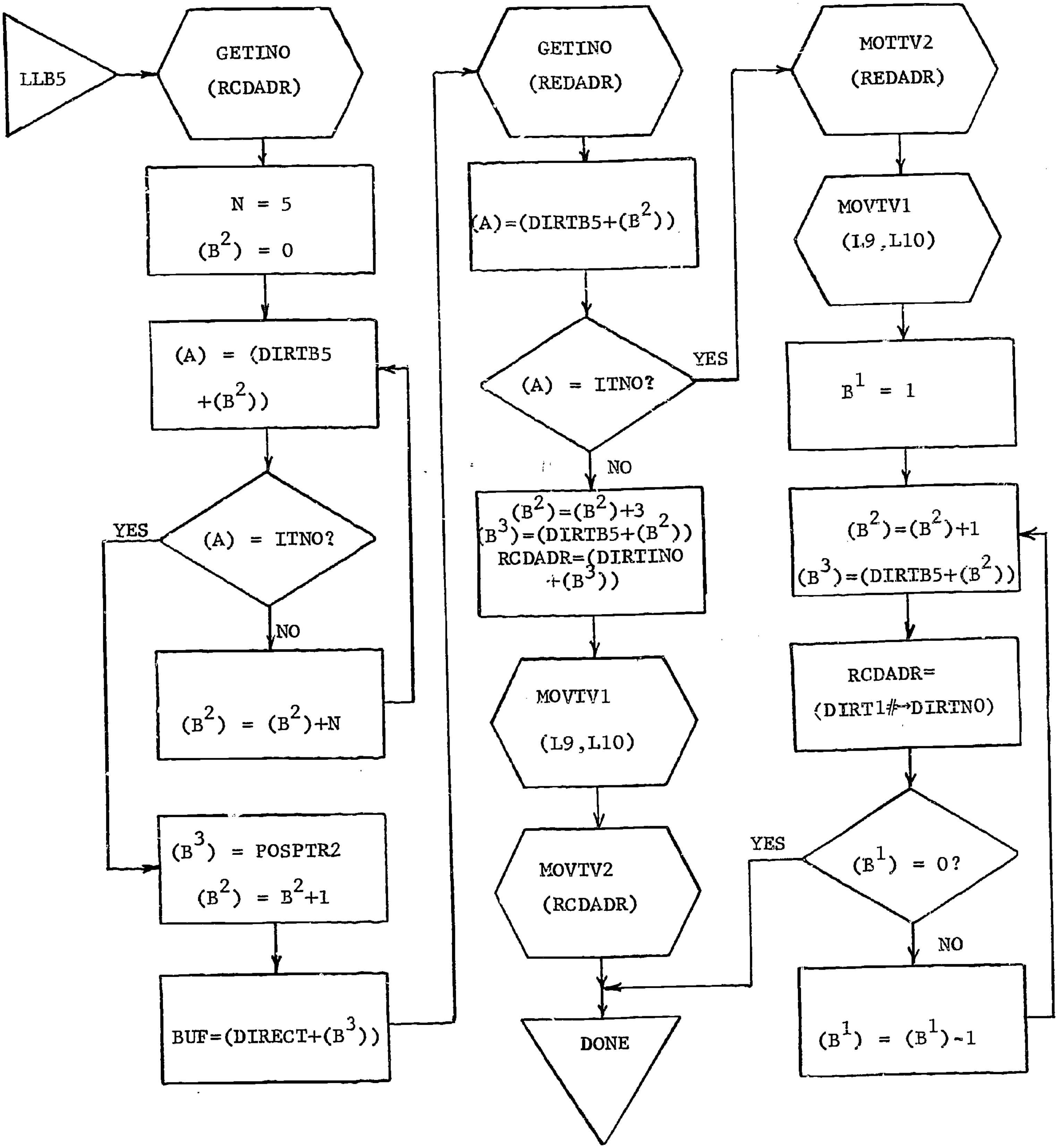
LL =	N =	(S1, S2, DIR) =
LA1	2	(L1, L2, DIRTA1)
LA2	2	(L3, L4, DIRTA2)
LA3	5	(L3, L4, DIRTA3)
LA4	3	(L3, L4, DIRTA4)
LB1	2	(L5, L6, DIRTB1)
LB2	3	(L5, L6, DIRTB2)
LB3	2	(L7, L8, DIRTB3)
LB4	3	(L7, L8, DIRTB4)
LB6	2	(L9, L10, DIRTB6)
LB7	3	(L9, L10, DIRTB7)
LB8	3	(L11, L12, DIRTB8)
LB10	3	(L15, L16, DIRTC0)
LB11	7	(L17, L18, DIRTC1)
LB12	8	(L17, L18, DIRTC2)
LB14	2	(L21, L22, DIRTC4)

SUBPROGRAM LFTN CONTINUE

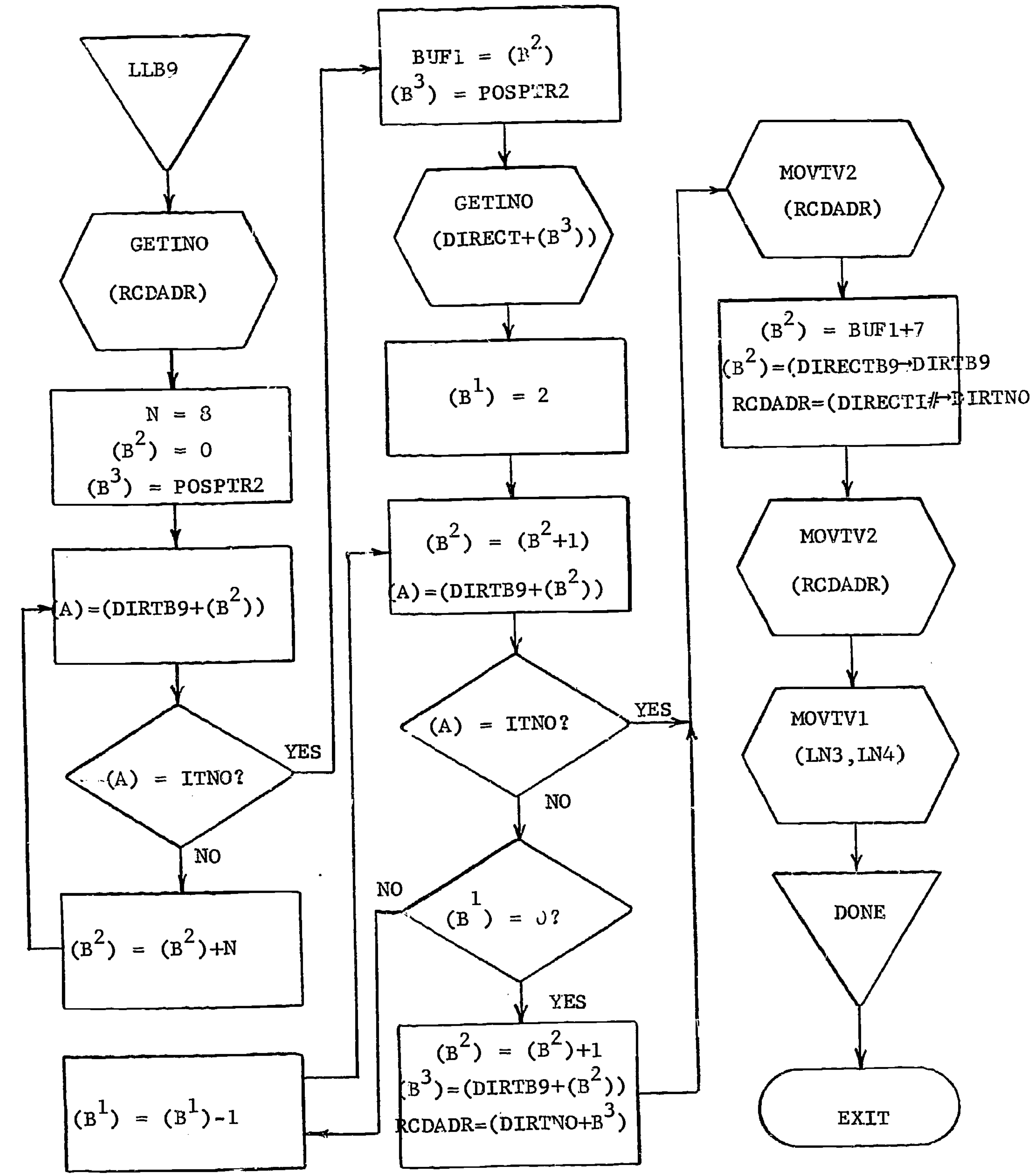


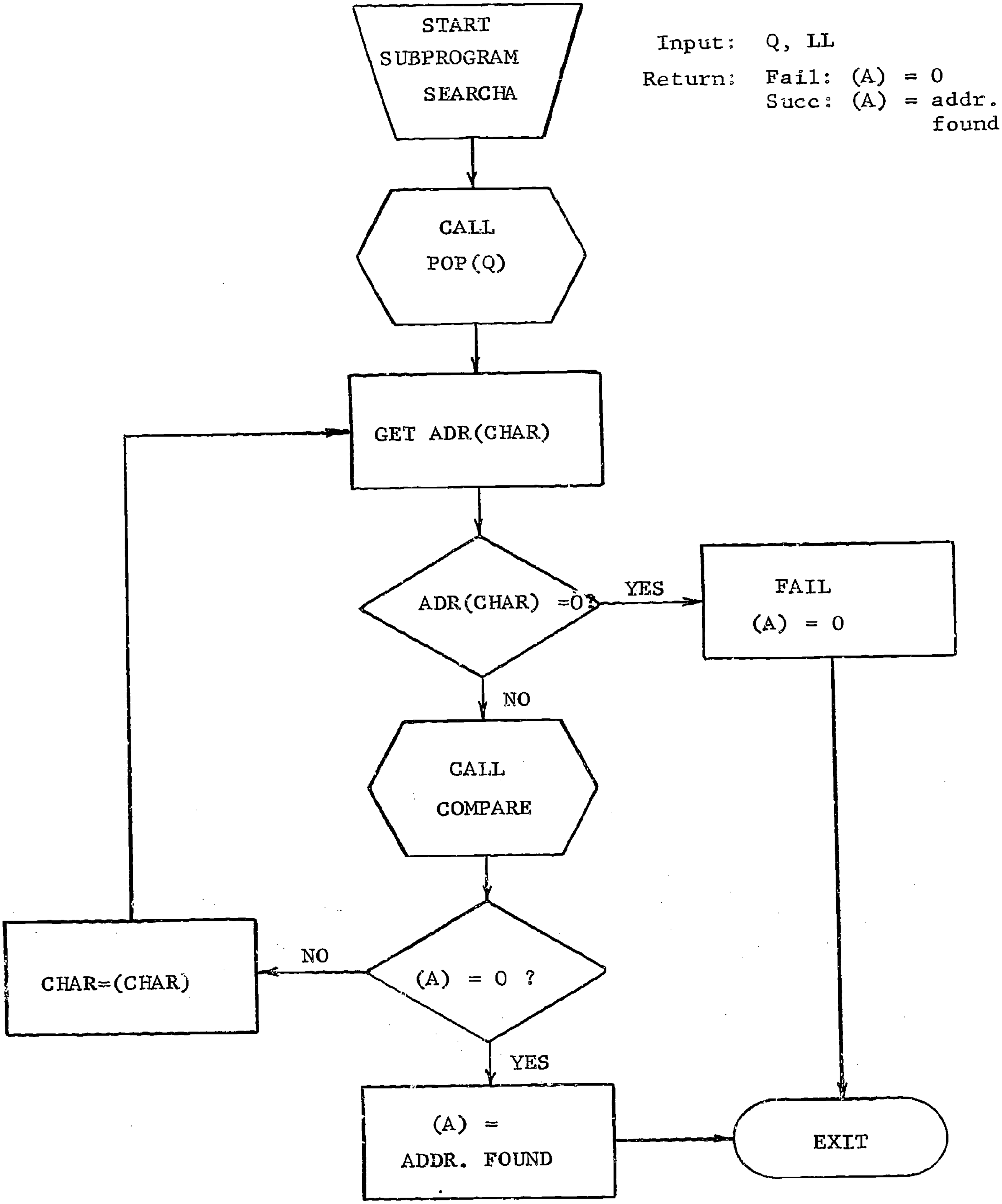
**

LL =	N =	(S1,S2,DIR)
LB13	3	(L19, L20, DIRTC3)
LB15	3	(L23, L24, DIRTC5)
LB16	3	(L25, L26, DIRTC6)

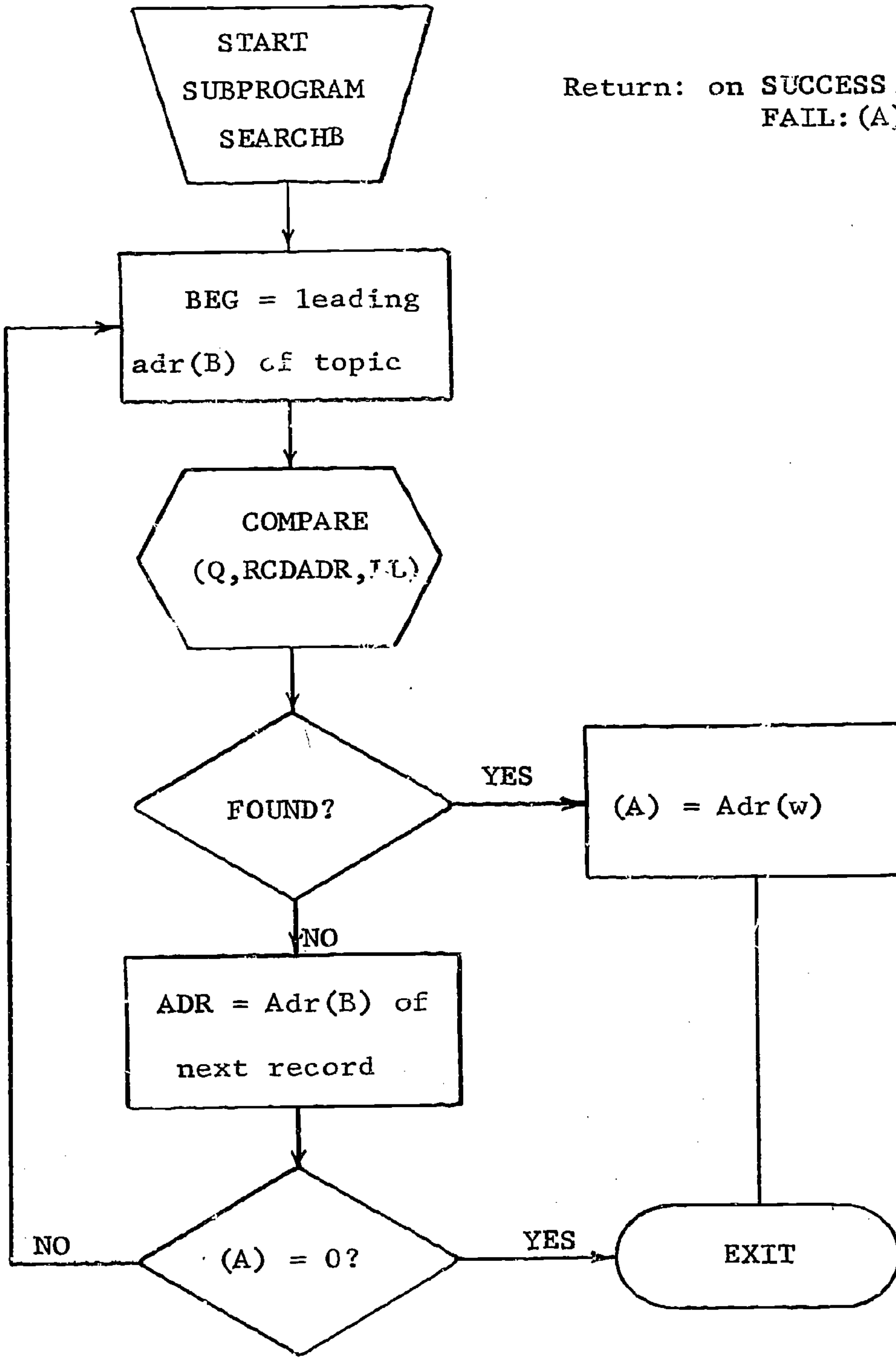

LLB5
GETINO
(RCDADR)
N = 5
(B2) = 0
(A) = (DIRTB5
+(B2))
(A) = ITNO?
YES
NO
(B2) = (B2)+N
(B3) = POSPTR2
(B2) = B2+1
BUF=(DIRECT+(B3))
GETINO
(REDADR)
(A)=(DIRTB5+(B2))
(A) = ITNO?
YES
NO
(B2)=(B2)+3
(B3)=(DIRTB5+(B2))
RCDADR=(DIRTINO
+(B3))
MOVTV1
(L9,L10)
MOVTV2
(RCDADR)
DONE
MOTTV2
(REDADR)
MOVTV1
(L9,L10)
B1 = 1
(B2)=(B2)+1
(B3)=(DIRTB5+(B2))
RCDADR=
(DIRT1#→DIRTNO)
(B1) = 0?
YES
NO
(B1) = (B1)-1

SUBPROGRAM LFTN CONTINUE

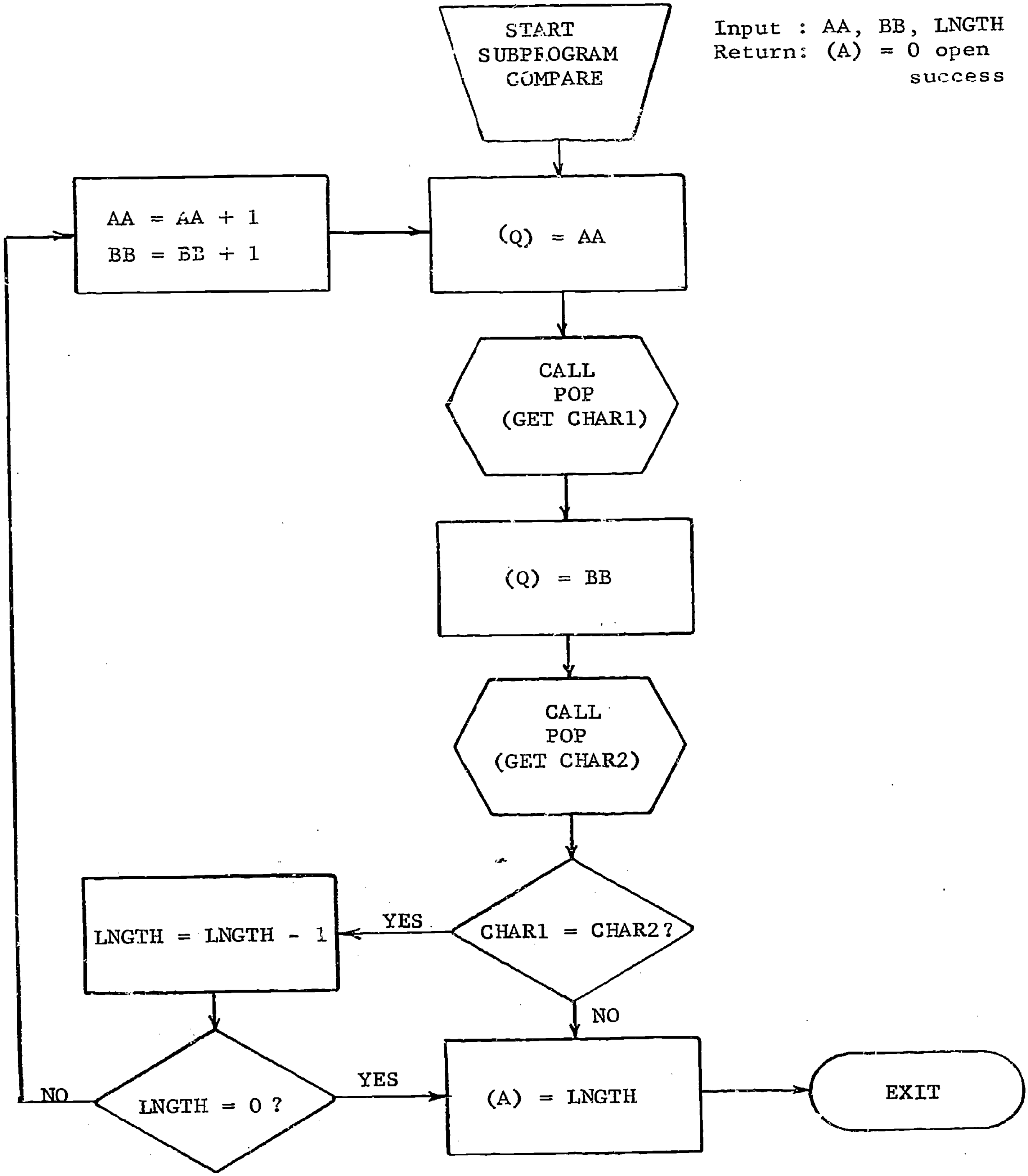


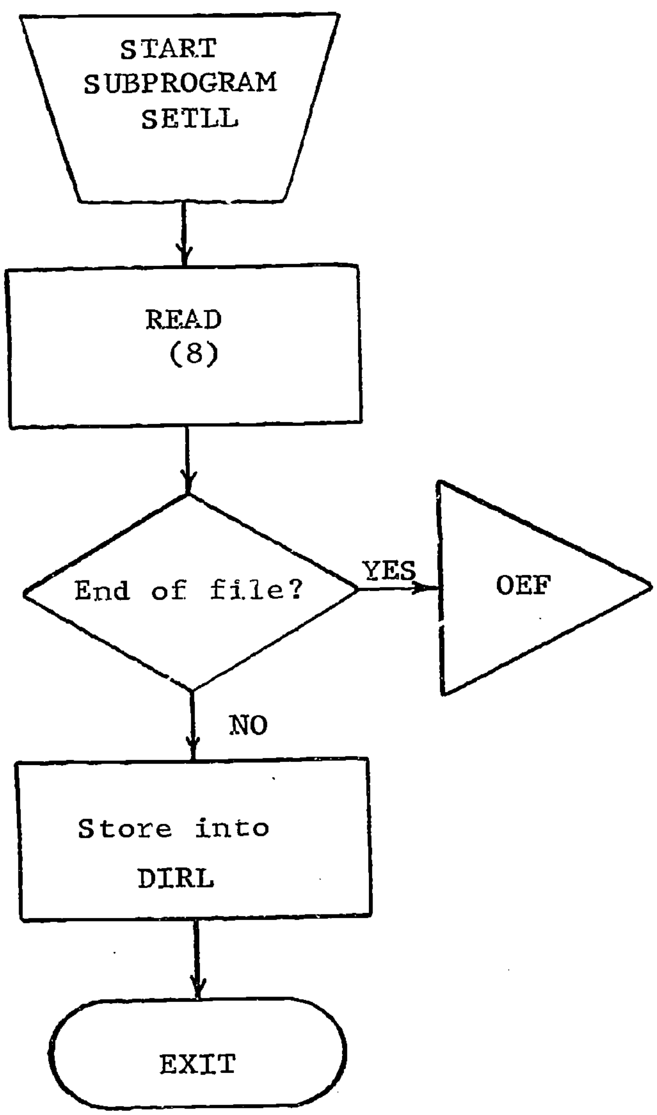

START
SUBPROGRAM
SEARCHA
Input: Q, LL
Return: Fail: (A) = 0
Succ: (A) = addr. found
CALL
POP(Q)
GET ADR(CHAR)
ADR(CHAR) =0?
YES
FAIL
(A) = 0
NO
CALL
COMPARE
(A) = 0 ?
NO
CHAR=(CHAR)
YES
(A) =
ADDR. FOUND
EXIT

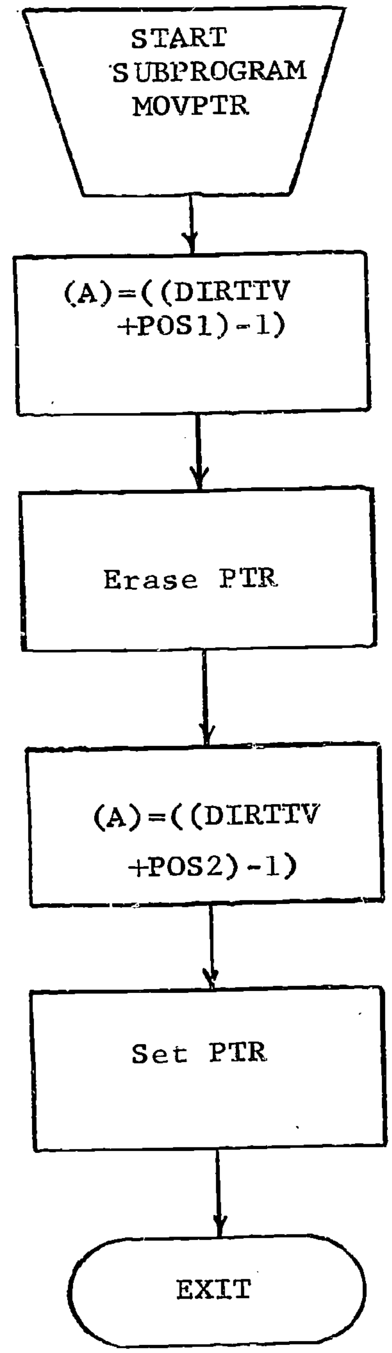
Return: on SUCCESS: (A) = Adr(w)
FAIL: (A) = 0

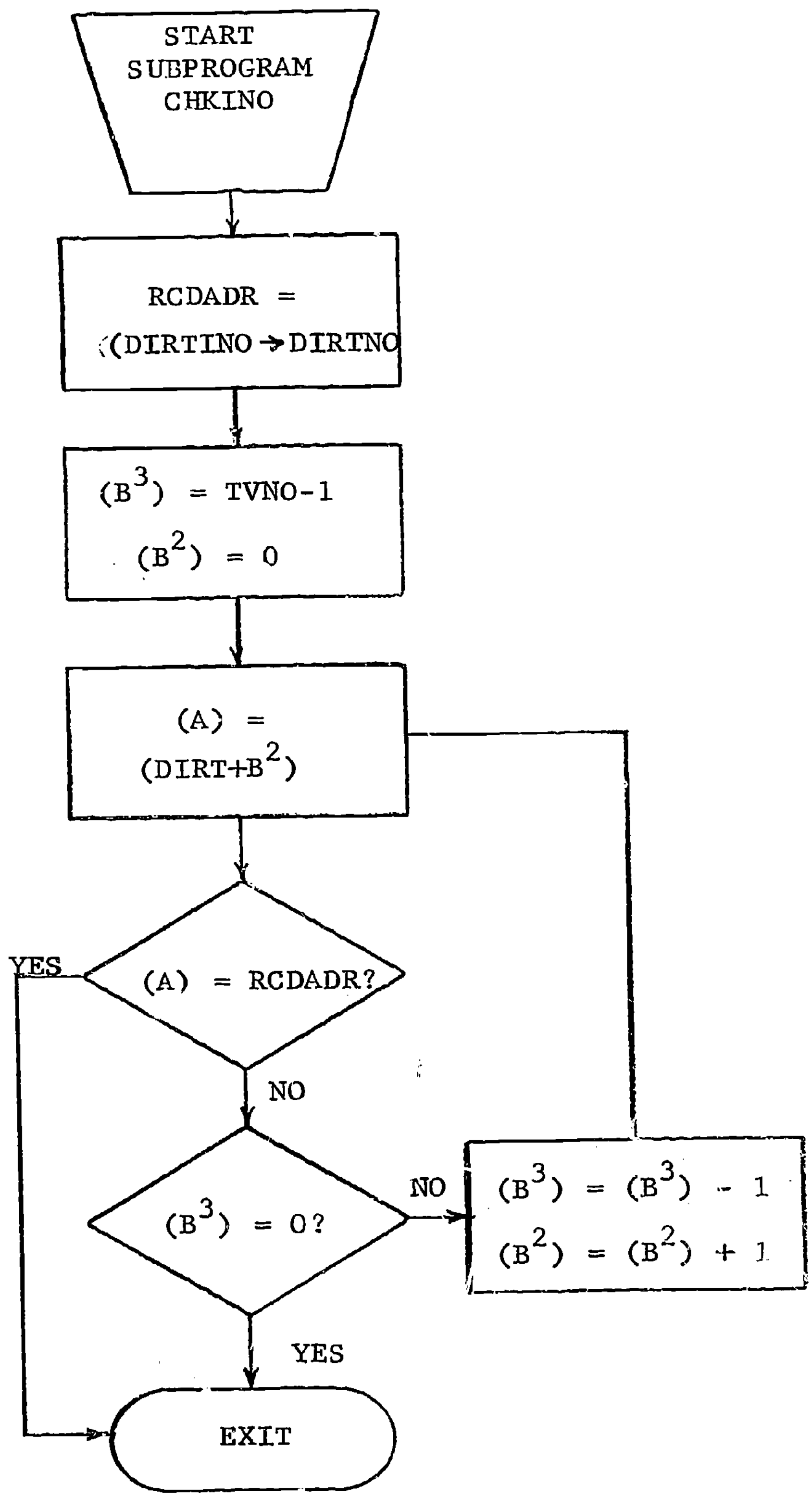


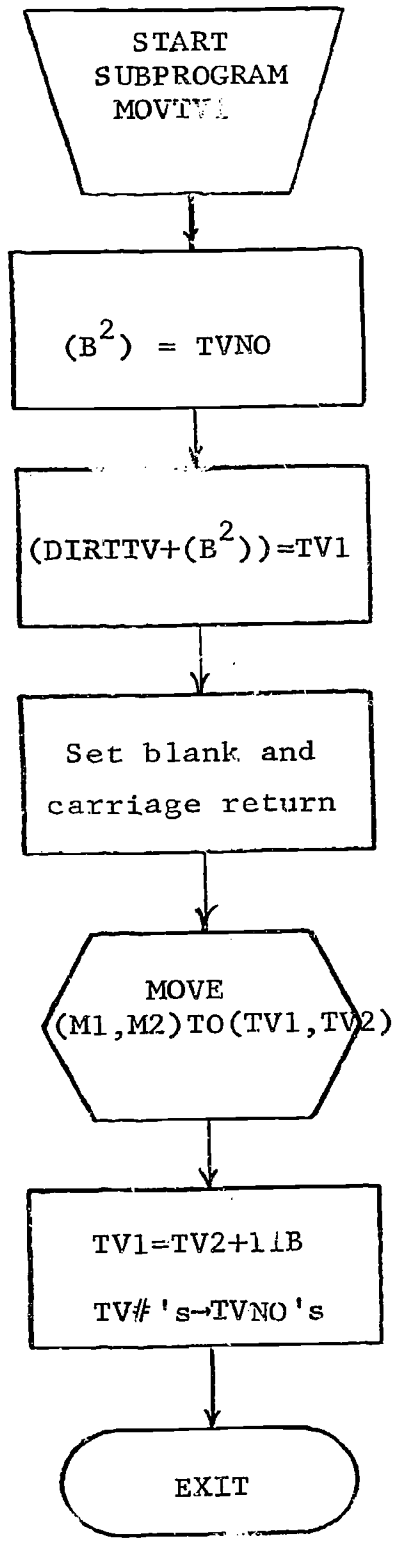
Input : AA, BB, LNGTH
Return: (A) = 0 open
success

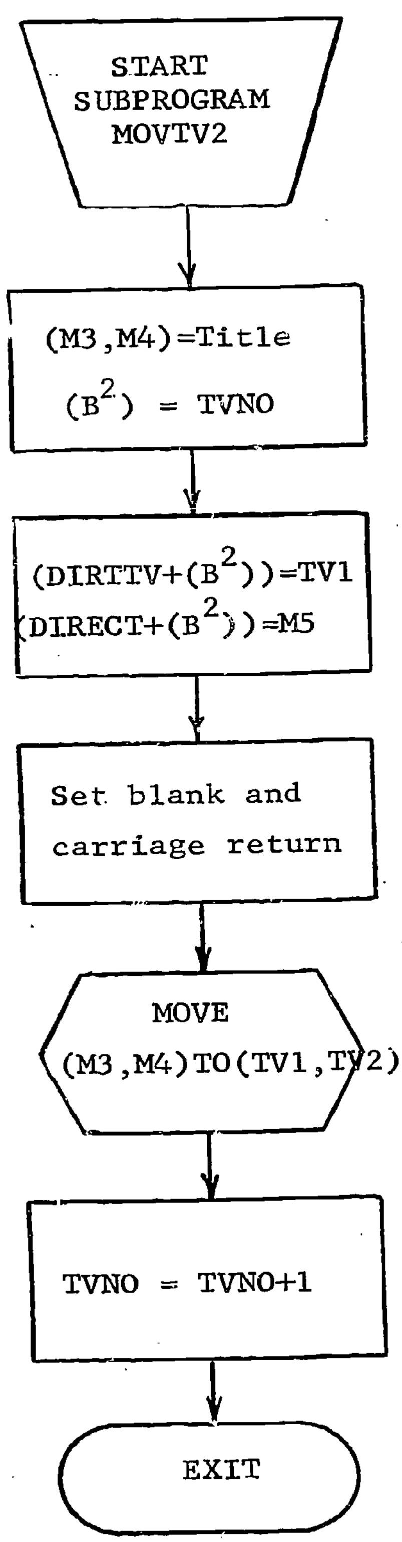


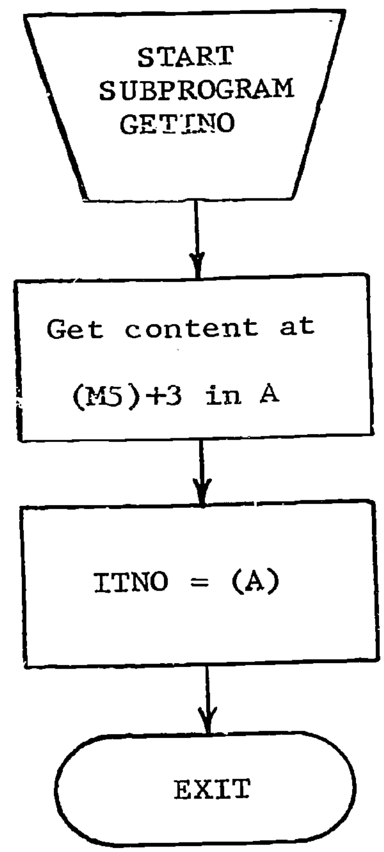

START
SUBPROGRAM
SETLL
READ
(8)
End of file?
YES
OEF
NO
Store into
DIRL
EXIT


START
SUBPROGRAM
MOVPTR
(A)=((DIRTTV
+POS1)-1)
Erase PTR
(A)=((DIRTTV
+POS2)-1)
Set PTR
EXIT


START SUBPROGRAM CHKINO
RCDADR = (DIRTINO→DIRTNO
(B3) = TVNO-1
(B2) = 0
(A) = (DIRT+B2)
YES
(A) = RCDADR?
NO
NO
(B3) = 0?
(B3) = (B3) - 1
(B2) = (B2) + 1
YES
EXIT


START SUBPROGRAM MOVTV
(B2) = TVNO
(DIRTTV+(B2))=TV1
Set blank and carriage return
MOVE (M1,M2)TO(TV1,TV2)
TV1=TV2+11B
TV#'s→TVNO's
EXIT

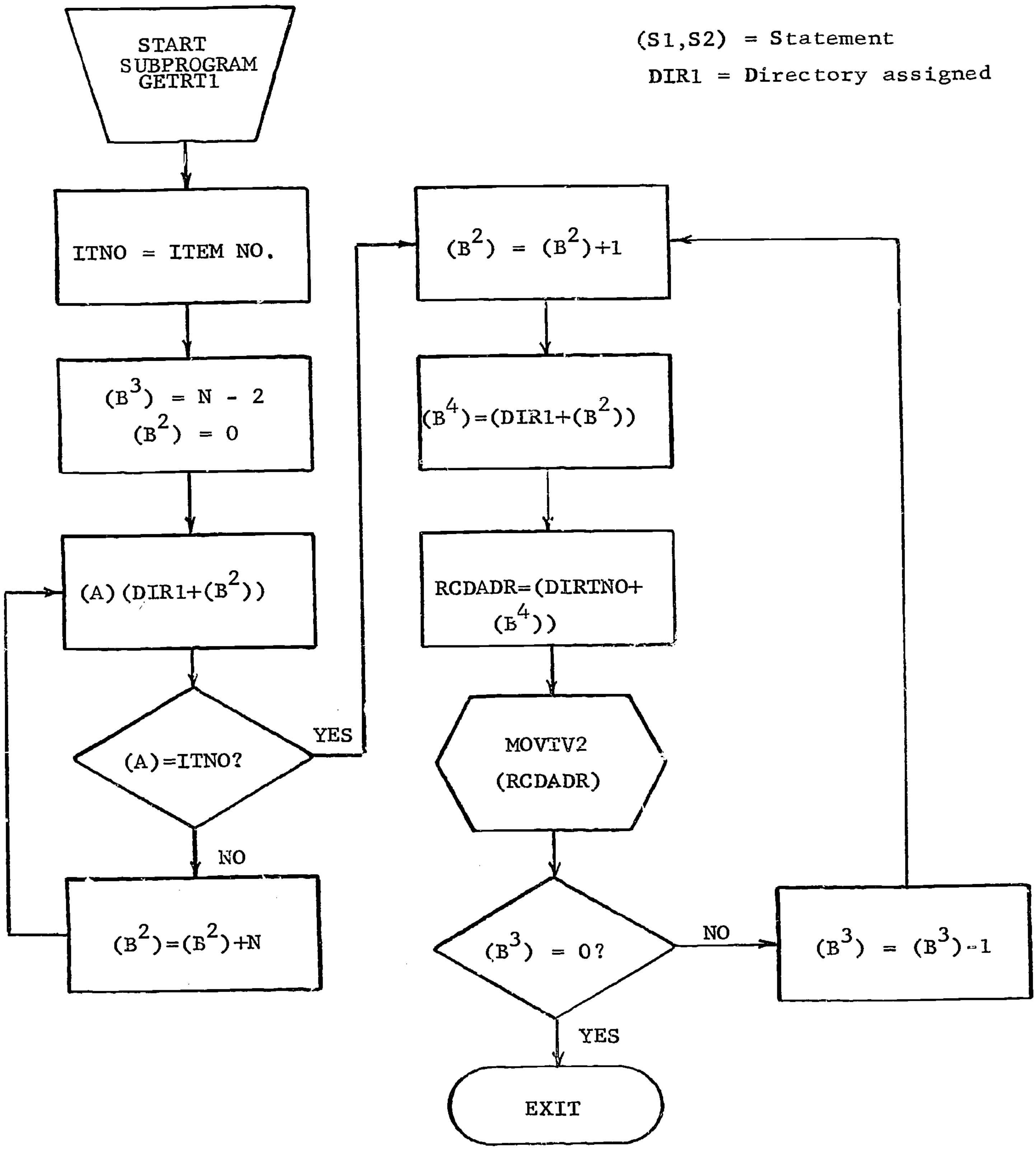


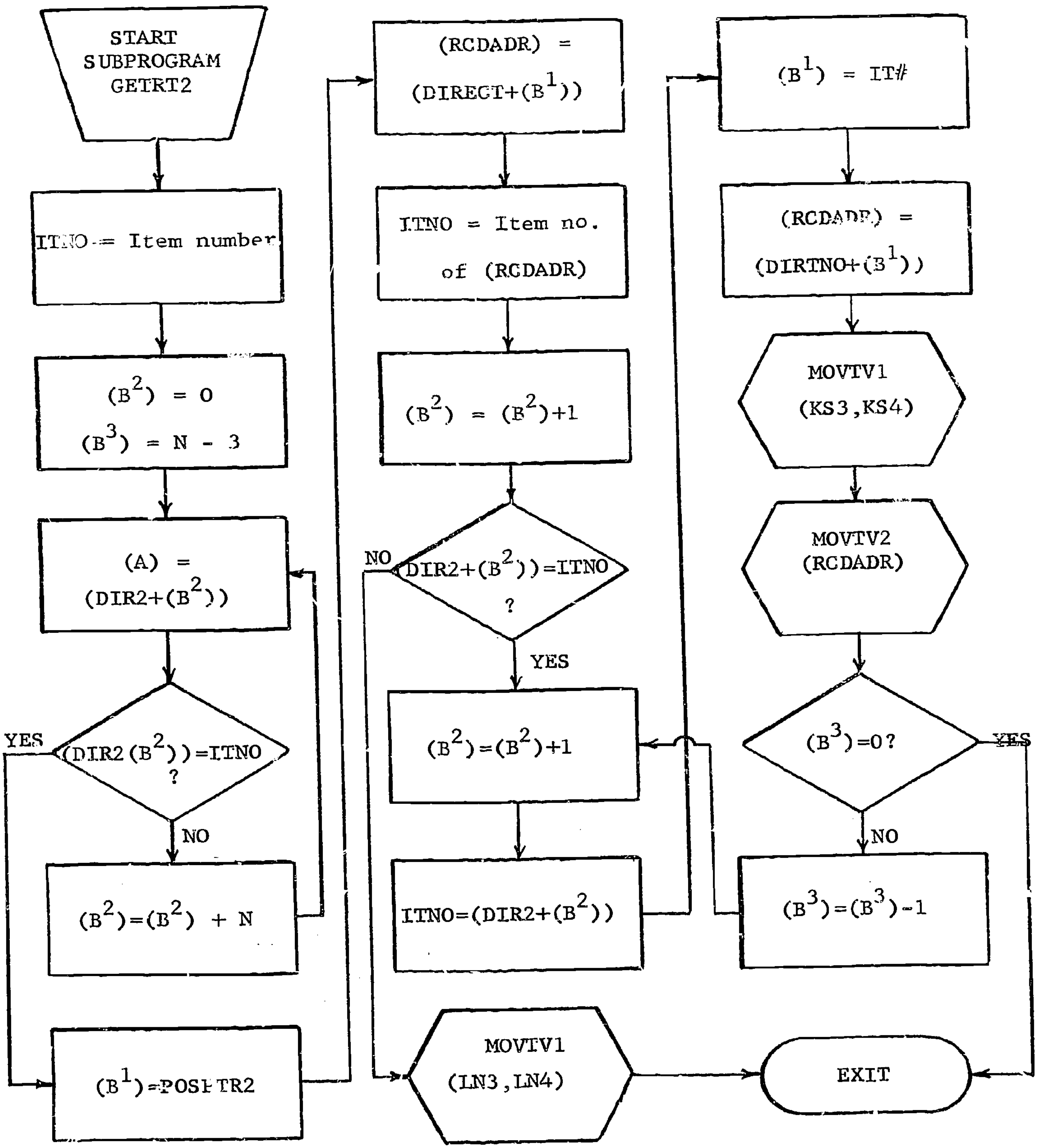


M5 = leading address of record.

(S1,S2) = Statement

DIR1 = Directory assigned




START
SUBPROGRAM
GETRT2
ITNO = Item number
(B²) = 0
(B³) = N - 3
(A) =
(DIR2+(B²))
(DIR2(B²))=ITNO
?
YES
NO
(B²)=(B²) + N
(B¹)=POSI TR2
(RCDADR) =
(DIRECT+(B¹))
ITNO = Item no.
of (RCDADR)
(B²) = (B²)+1
NO
DIR2+(B²))=ITNO
?
YES
(B²)=(B²)+1
ITNO=(DIR2+(B²))
MOVTV1
(LN3,LN4)
(B¹) = IT#
(RCDADR) =
(DIRTNO+(B¹))
MOVTV1
(KS3,KS4)
MOVTV2
(RCDADR)
(B³)=0?
YES
NO
(B³)=(B³)-1
EXIT

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13. ABSTRACT

A relational document retrieval system is developed that is primarily concerned with hierarchic tree structures and lateral links. The lateral linkages are relationships that cannot be represented within the tree structure representation. A number of annotated examples are given along with a detailed description of the relational data structure and the programs that manipulate and search this structure. The system was programmed in ISL, a string manipulating language designed for information retrieval purposes.

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