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ON-LINE RETRIEVAL

Informatics, Incorporated

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ON-LINE RETRIEVAL

Thomas C. Lowe
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FOREWORD

This document is the final report on Contract F30602-69-C-0038, Project 4594, Task 459401, by Informatics, Inc., 4720 Montgomery Lane, Bethesda, Maryland, for Rome Air Development Center, Griffiss Air Force Base, New York. Murray A. Burke, FMIDB, was the RADC Project Engineer. Informatics' number is TR-69-1090-2.

The report summarizes the overall design of an information storage and retrieval system utilizing automatic document characterization and interactive retrieval through man-machine dialogue, and documents in detail the implementation of a portion of that system.

This report has been reviewed by the Information Office (EMLS) and is releasable to the Clearinghouse for Scientific and Technical Information.

This report has been reviewed and is approved.

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ABSTRACT

This report is concerned with the implementation of an on-line information storage and retrieval system for the Rome Air Development Center. This system is to incorporate techniques of automatic document classification for a large document collection in an interactive environment. Following a review of the system design, the implementation of the system executive is described in detail. Because this executive program also governs communications between the user and the system, it must be a communications package, a training aid, a file building program and an executive program all in one.

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SECTION I

INTRODUCTION

This document is the final report on the development of an on-line information storage and retrieval system for the Rome Air Development Center, Air Force Systems Command, Griffiss Air Force Base, New York. Under this contract, an on-line storage and retrieval system, called for brevity in this report the On-Line System, has been designed, and its executive, called in this report the dialogue processor, has been programmed. The dialogue processor has been provided with routines to simulate the rest of the On-Line System, so that to the user, the entire System appears to be implemented.

An overview of the design of the On-Line System is first presented, along with a summary of the present status of the dialogue processor and its supporting programs. The operation of the dialogue processor is then described in detail, and two examples of actual user dialogues with the dialogue processor are presented to illustrate the discussion. Construction techniques for the files it accesses are presented. A description of the subprograms that make up the dialogue processor and a discussion of useful areas for further work conclude the report.

SECTION II

CURRENT STATUS OF THE SYSTEM

This section presents the current status of the On-Line System. An overview of the design of the System is presented, including a discussion of the user and System actions that take place during a query sequence. The section concludes by discussing in detail the present status of both the System design and the dialogue processor.

II.1 HISTORICAL BACKGROUND AND INTRODUCTION

The computer is a potentially powerful tool for browsing through vast quantities of information. The speed and storage capacity of modern computer systems promise to make the resources of a library available without the huge investment of time required to establish, maintain, and use the manual searching aids usually associated with a library.

Much work has been done in the development of on-line systems, and additional background on other systems is provided in other papers (1, 2, 3, 4, 6, 7, 9). However, all of these systems retrieve by means of simple coordinate indexing and various embellishments on it. Only one type of ranking exists in such systems--the identification of relative relevance of retrieved documents. It is obtained from a tally of the number of elements of "or" clauses retrieving each document. This form of ranking is crude in that it does not give a very sensitive measure of relevance.

Most such systems rely on manual indexing of documents and retrieve on descriptors. Some allow the use of an on-line thesaurus; some also allow retrieval on title or author's name. A few allow searching on partial words and word phrases. Thus, most present on-line systems rely on manual indexing (except for title and author information) and perform retrieval based on logical connectives. Except for provision of thesauri, little is done to assist the user's synonym problems.

The size of collections presently being encountered, their growth rate, the scarcity of competent indexing personnel, and the cost of manual indexing have promoted the search for automated methods of document classification for retrieval (8). This includes not only the actual indexing of documents, but the development of thesauri. Naturally, the development of new retrieval techniques is intimately linked with work in classification methods.

II. 2 OBJECTIVES OF THE RADC ON-LINE RETRIEVAL SYSTEM

The RADC On-Line Retrieval System is an attempt to overcome many of the difficulties that have been associated with information storage and retrieval systems through the use of a new approach to the problem of on-line retrieval--the concept vector technique. This System is to enable classification of documents to be performed automatically; the correlation that can be performed on documents indexed by concept vectors should be far superior to that which can be achieved with coordinate indexing. The use of the concept vector technique will also permit retrieval based on similarity to any specified document in the collection.

Concept vector indexing is performed in batch mode for use within the framework of a fully interactive on-line system. The on-line nature of the retrieval System operation imposes fundamental constraints on the entire System design, if the result is to be useful.

Batch system queries are frequently written by a system "expert" who interprets the information requests submitted by users. However, in interactive systems, the user himself formulates queries and operates the system. Therefore, for successful operation, the on-line dialogue must be easy and natural to use.

A user must be able to concentrate on the problems of retrieving information, and not be required to second-guess the designers of the System. Users with differing levels of familiarity are to be expected. The inexperienced user must be led through the System step-by-step, whereas the

experienced user should be able to exercise a great deal of flexibility in employing the System. The messages from the experienced user to the System would be expected to be terse, whereas those from the neophyte would be more verbose and tutorial.

Consider the additional power of an on-line system if the user is given the ability to locate documents that are in some way like a known document. This can be illustrated by considering the problem of finding documents in the stacks of a conventional library. Suppose that one could only request documents by their classification numbers and that one were not allowed to enter the stacks. Depending on the user's familiarity with the classification system and with the document collection, he might or might not be able to retrieve all of the documents relevant to his needs.

Now, if the user can enter the stacks of the library and browse about, his chances of finding useful documents are increased. They are likely to be physically near the documents specified initially (and, of course, may include those documents). The hierarchical classification scheme of the library has been mapped into one-dimensional space: the ordering of the books in the stacks. An on-line system can be built in such a way that the user is free from the constraints of a space of limited dimensionality and can search for documents "like" a given document. This is known as document-document searching and is analogous to browsing in a library where every intellectual area (or "concept") corresponds to a different dimension.

A further novelty of the RADC On-Line System concerns the size of the data base to be indexed and accessed; it will eventually contain more than 100 million characters of text. The size of the data base presents particular problems in the design of the off-line programs that perform indexing. The indexing processes must be designed to avoid rapid growth of core requirements as the data base size increases. For example, whereas storage of a similarity matrix for 100 documents requires 10,000 similarity coefficients to be computed and stored, the same matrix for 1,000

documents would have 1,000,000 elements. Thus, many processes that are useful for small document collections simply cannot be used with a large data base.

II.3 AN OVERVIEW OF THE ON-LINE SYSTEM

This subsection presents a highlight of the most significant design features of the RADC On-Line Retrieval System. It is noted that the present System does not include all the designed features.

II.3.1 Indexing and Retrieval Sequences

Although the On-Line System operates on concept vectors, it must use a thesaurus. The thesaurus contains word stems rather than words, and is automatically developed from the document file. First, common words (e.g. a, an, the) are removed and stem analysis is employed in order to select the distinct noncommon stems occurring in the document collection. This large group of stems is reduced to a smaller collection of so-called content stems, which constitutes the thesaurus. This selection of the content stems from the collection of raw stems is to be performed by the statistical filtering program, which selects those word stems most promising for the characterization of documents. It does this by analysis of both the stem rank-frequency distribution and the variation of that distribution over the document collection.

With every document is associated its concept vector. This vector consists of concept-weight pairs. A concept vector can be formed from any body of text; therefore, in order to perform a retrieval query, it is only necessary to derive the concept vector for the query and correlate it with concept vectors for the documents in the collection. Those documents with vectors producing the highest correlation are then retrieved.

The concepts themselves could, of course, be word stems. However, this would not allow the System to account for the use of words that are similar in meaning, and would introduce one of the worst drawbacks of simple coordinate indexing--the need for the user of the System to consult a thesaurus of "use" and "used for" terms. Instead of this stem-per-concept approach, the System is to cluster stems into about 1500 groups. Each group contains stems of similar semantic value, and each group corresponds to a concept. The clustering is to be performed on a basis of statistical stem co-occurrence analysis.

An ordinary retrieval on the basis of a text query is performed in the following manner. First, the user's request is processed by the routines which reject common words and perform stem analysis, reducing the query to a sequence of stems. Each concept stem is then mapped by a dictionary processor into one or more clusters. Since each cluster is associated with a concept, this process produces the concept vector corresponding to the query. This vector can be correlated against the concept vectors for the document collection in order to perform the retrieval. In order to avoid comparison with all the concept vectors for a large collection, say, 40,000 documents, the document concept vectors themselves are clustered about centroids. This materially reduces the search time.

As mentioned in the last section, document-document correlation can also be performed by the On-Line System. This form of searching simply employs the concept vector of a known document in order to retrieve similar documents. (It is also possible for the user to construct and modify query concept vectors directly, working only with numeric concept codes and weights.)

During the retrieval process, the user can be expected to try a number of queries. Some will retrieve desirable documents, and some will not. The user is given the capability to build a file of documents, retaining those which he finds desirable.

II.3.2 Structure of the On-Line System

Figure II-1 shows the overall structure of the On-Line System. Files are represented by symbols with rounded sides; rectangles represent programs. An arrow from A to B indicates that A calls B, if A and B are programs. If B is a file and A is a program, the arrow indicates that A writes on B; if A is a file and B is a program, then B reads from A.

The dialogue program keeps track of the status of the present query sequence by maintaining the query sequence status file. Because this file contains the information needed to direct the operation of the other programs in the On-Line System, the dialogue program performs the executive function and is resident in core at all times while the on-line system is in operation. For this reason, the core requirements of the dialogue program must be minimized; therefore, the only file that DIALOGUE will keep in core is the query sequence status file which will contain the current query words, stems, concept numbers, weights, and various flags that specify the status of the query.

The four program modules that are loaded into core by the dialogue program are shown in Figure II-1 as the four blocks immediately below the dialogue program. Each of the program modules will be loaded with the subprograms that it calls. With one exception, CHOOSE, only one of the four program modules will be resident in core at once.

II.3.2.1 Files. The entities shown as files in Figure II-1 are not necessarily distinct files that will be stored on auxiliary storage devices; rather, every sizable data structure is identified here as a file so that an explicit decision concerning its residence can be made.

The four files shown on the left margin of Figure II-1 are arranged hierarchically in order of increasing minimum access time requirements. Exactly which file is resident on what type of auxiliary storage device is a decision to be based upon both the amount of auxiliary storage available

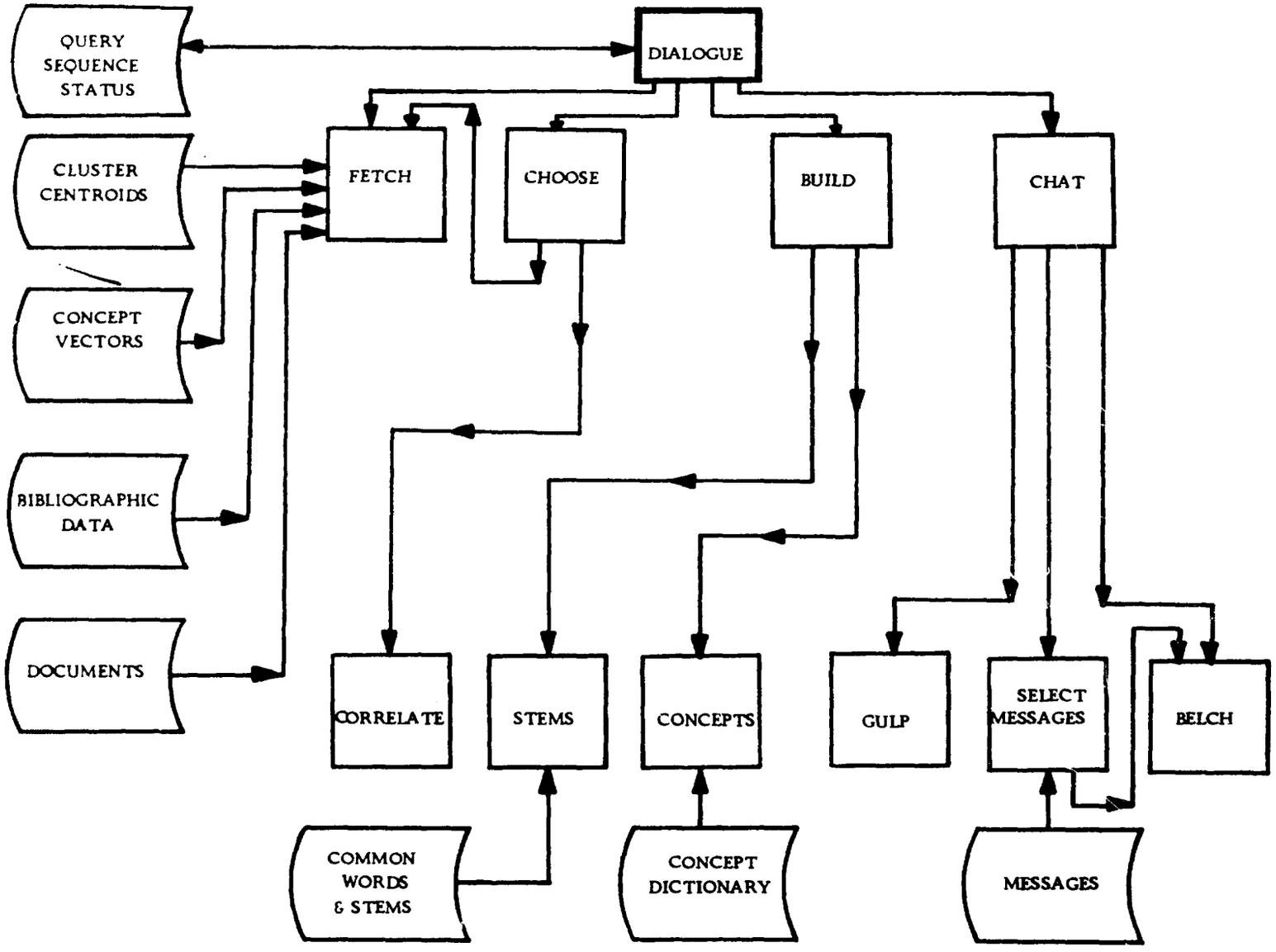


Figure II-1 On-Line System Structure

and response time requirements. For the System to interact conversationally with the user, at least the cluster centroids and concept vectors must be stored on a high-speed, direct-access storage device. The document file can be allocated to tape or disk storage.

The file structure has been designed to accommodate the widest possible variation in data base characteristics. The main contributor to this flexibility is the use of variable-length records in every file. This not only removes the need for some arbitrary limit on the size of each type record, it also greatly increases the efficiency with which the available disk storage space is used, because every record will occupy only the amount of space it requires.

The on-line files that will be accessed by program module FETCH are:

1. Documents
2. Bibliographic data
3. Concept vectors
4. Centroids.

Before the on-line system can be used, these data must be loaded into four distinct GECOS III permanent files by SHOVEL. Four separate files are used in order to permit all the records that are associated with a given document in the data base to be obtained by using only the accession number of the generating document. Because of this, no separate directory will be necessary, and cross-referencing from a concept vector to a bibliographic record to the document itself can be performed without intermediate accesses to a directory.

Figure II-2 illustrates the organization of the on-line files. The solid arrows represent an explicit "pointing" relationship; the dashed arrows represent an implicit "pointing" relationship that arises because

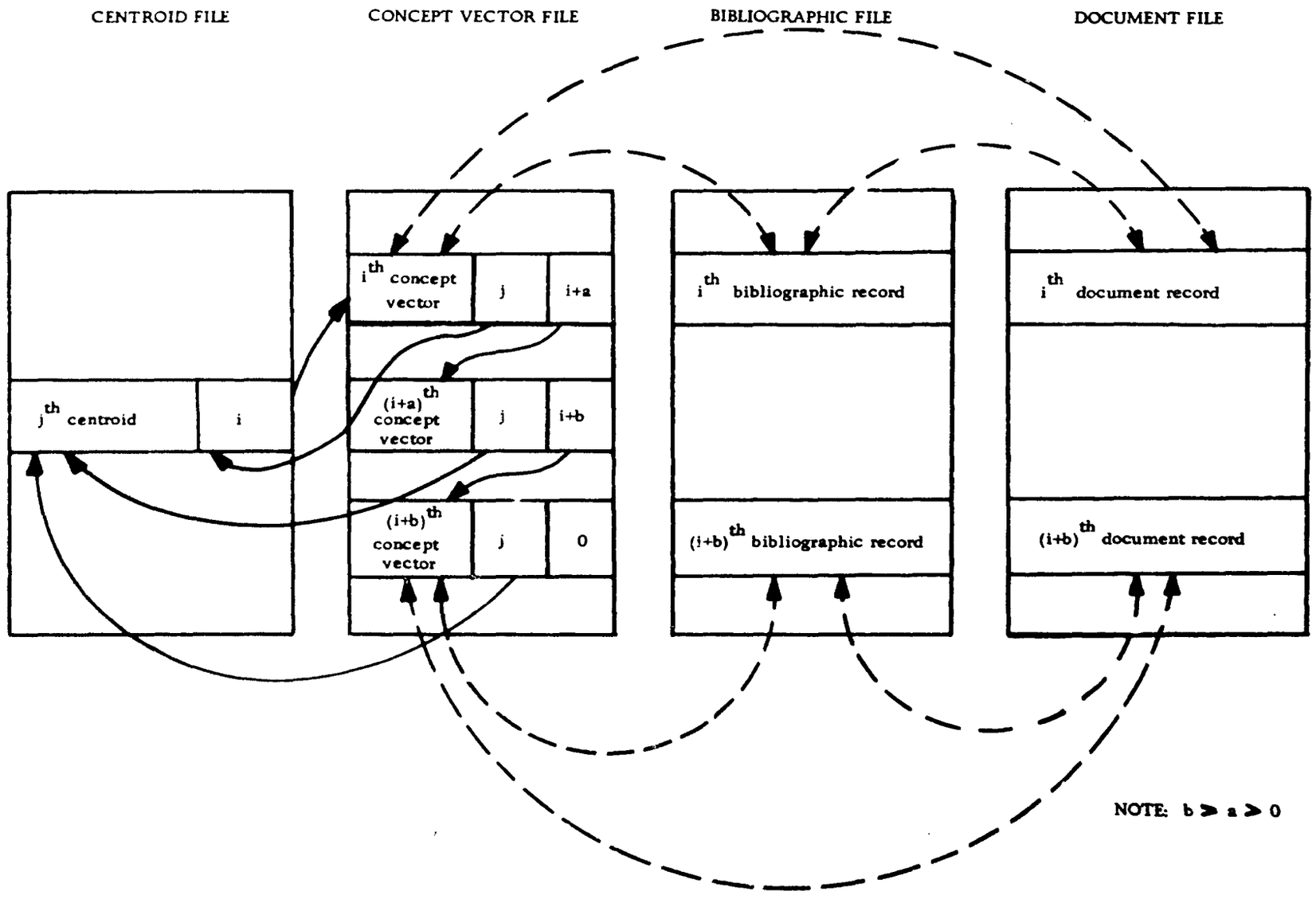


Figure II-2 On-Line File Structures

the concept vector, bibliographic, and document files are all ordered by accession number. Thus, the arrows indicate all the possible methods of cross-referencing the various files.

In order that the files can be organized efficiently by accession number, it is required that the accession numbers be a compact set of positive integers starting with one. If the data base is supplied without these integral accession numbers, it is a simple matter to number all the documents.

The use of a distinct file for each class of data also permits the selective loading of the various files. The On-Line System might be used for experiments that would not access all of the files. In this case, the selective loading of the on-line files, by reducing disk usage, will increase operational economy beyond that which might otherwise be associated with experimentation with the full On-Line System.

2.3.2.2 Program Modules. This subsection introduces each program module and gives a brief description of its function.

The primary function of DIALOGUE is to keep track of the user's status and direct user-system interaction. Therefore, DIALOGUE maintains the information needed to direct the sequence of operation of the other program modules and also serves as the executive of the On-Line Retrieval System.

Program module FETCH performs all accesses to the on-line data base. Given a record number and a file designation, FETCH returns the record and size of the record. FETCH obtains only one record at a time; to obtain all the records in a file, FETCH must be called repeatedly.

FETCH will be loaded by itself or together with CHOOSE. FETCH will be loaded by itself when a file access is being performed that does not require selection of concept vectors based on their correlation with some query vector, such as when scanning of the bibliographic data or document file is taking place.

Program module CHOOSE, given a query vector by DIALOGUE, returns to DIALOGUE the accession numbers of the documents whose concept vectors have the highest correlation coefficients with the query vector. In order to do this, CHOOSE calls FETCH to obtain the centroids of all clusters, and then calls CORRELATE to determine which clusters to scan. When this is complete, FETCH is called to obtain the selected clusters, and the concept vectors in these clusters are similarly processed by CORRELATE. CHOOSE then returns to DIALOGUE the accession numbers of the documents whose concept vectors correlate most highly with the query.

Program module BUILD operates on a list of words and produces a concept vector. It does this by first performing stem analysis by calling STEMS, then mapping the stems into concepts by calling CONCEPTS. Program STEMS includes within it the list of common words and the list of stems to be removed; program CONCEPTS includes within it the dictionary of content stems and the concept numbers and weights into which each is mapped.

Each word in a query can fall into one of three categories. It may be a common word that is deleted by STEMS, a word that generates a noncontent stem, and, therefore, is not mapped into a concept, or a word that generates a content stem, and, therefore, is mapped into one or more concepts. BUILD will recognize and differentiate between these three cases and report this information to DIALOGUE along with the generated concept vector and stems.

BUILD will be called to process a query before calling CHOOSE. When document-document correlation is being performed, BUILD will not be used, since the query vector in that case will be obtained by using FETCH to access the concept vector file.

Program module CHAT communicates with the user. Standard On-Line System messages are sent to the user by calling SELECT. Given a message number, SELECT accesses the file of messages, selects one, and calls BELCH to transmit the message. BELCH transmits one line to the remote terminal; GULP reads a line from the terminal.

When documents are being printed at the remote terminal, SELECT will not be used. DIALOGUE will obtain the data to be sent by calling FETCH, and then call BELCH to transmit. Data obtained from other program modules, such as BUILD, will also be transmitted without a call to SELECT.

II.3.2.3 Examples of System Operation. Figure II-3 illustrates the roles played by the various program modules by showing the sequence of events that might take place during the processing of a query. This example shows only the gross features of query processing and document-document correlation; a sophisticated user would cause a much more complex process to occur.

During operation of the system, DIALOGUE performs a function in addition to those shown explicitly in the flowchart; it directs the loading of the other program modules.

The user begins the sequence by entering a query which is read by CHAT. BUILD is then loaded and performs stem and concept analysis, producing a concept vector if the query contains any words that generate content stems. DIALOGUE stores this concept vector as the query vector, and loads CHOOSE and FETCH together. By calling FETCH and CORRELATE,

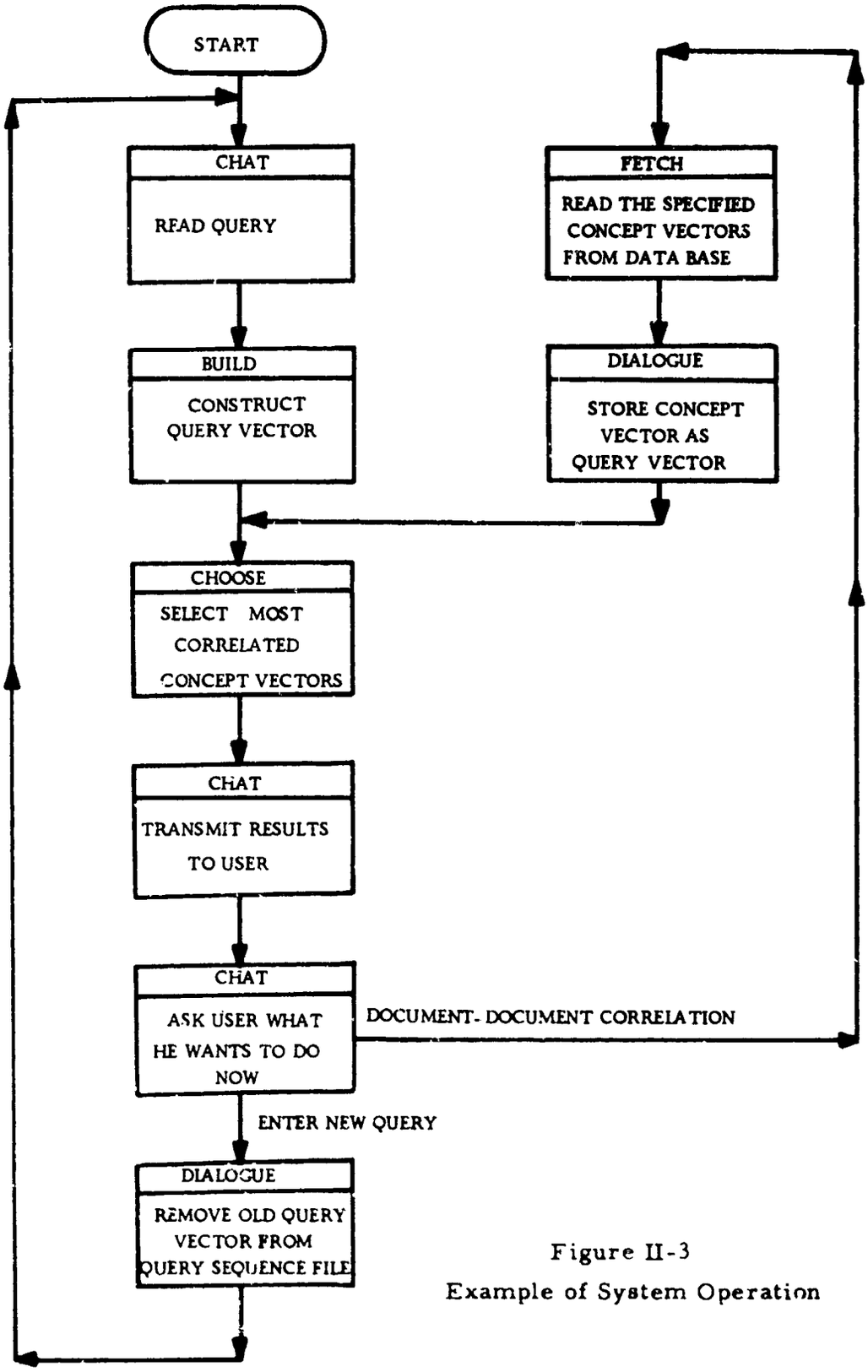


Figure II-3
Example of System Operation

CHOOSE determines the accession numbers of the documents whose concept vectors correlate most highly with the query vector. This list is passed to DIALOGUE.

When DIALOGUE has received the query results, it loads CHAT to transmit the results to the user. At this point, the user might elect to enter a new query, in which case DIALOGUE clears QUERY SEQUENCE STATUS, or he might elect document-document correlation. He also has several other options which are not shown in this example.

Document-document correlation is performed by using FETCH to obtain the concept vectors that are to be used as query vectors, and then calling CHOOSE in the same fashion as when processing a user-generated plain text query.

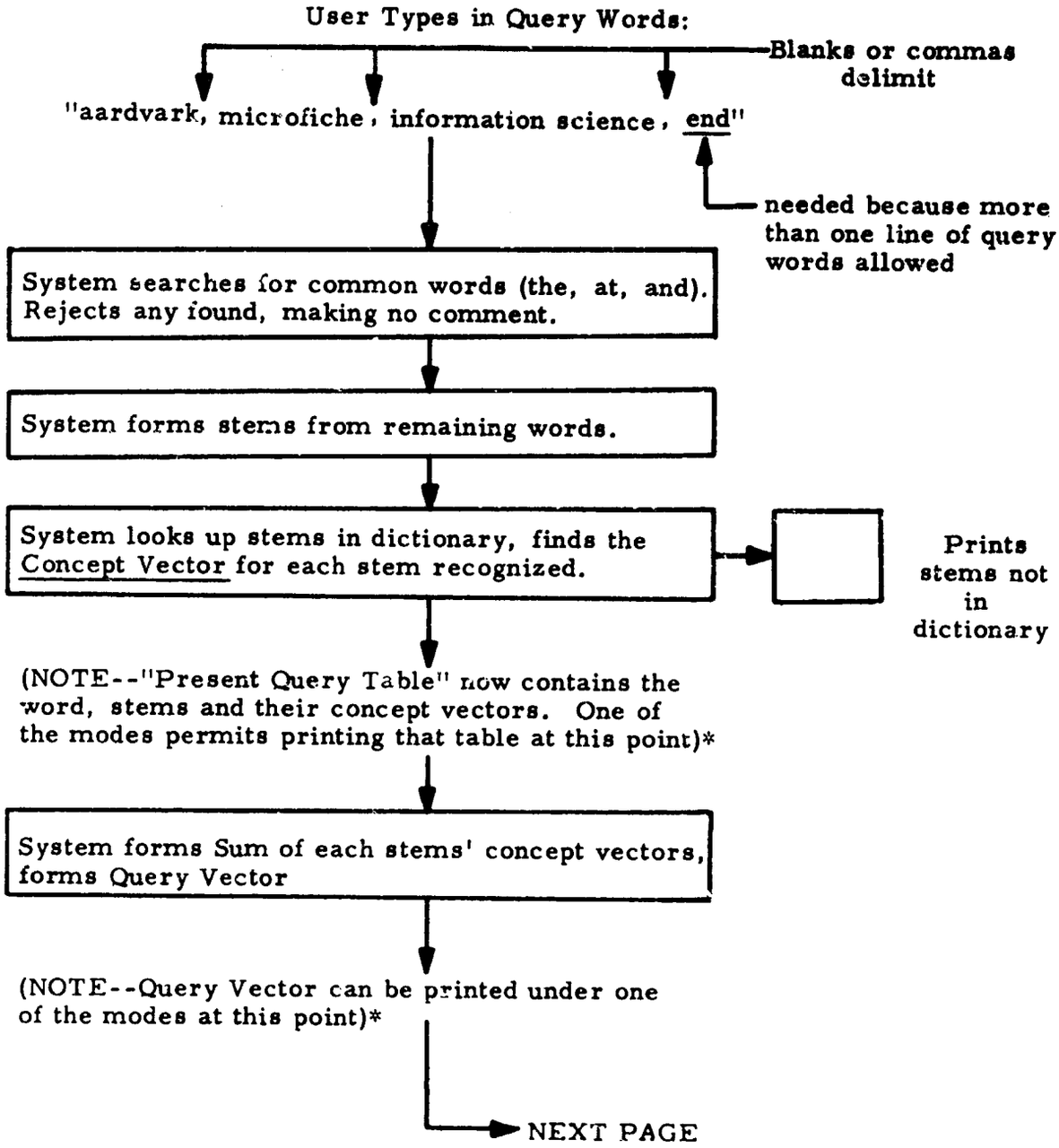
Figure II-4 shows the sequence of events that might transpire during the processing of a simple query. This figure emphasizes the System and user actions, whereas Figure II-3 identifies the specific program modules that perform each action.

The sequence begins when the user enters his initial query.* The System first identifies and removes any common words from the query, without comment. The System then performs stem analysis on the remaining words, mapping each word into a sort of "canonical form" for its morpheme.

Each stem is then looked up in the stem-concept dictionary, and the concept codes and weights thus obtained are added to form the query concept vector. The stems from the query that were not found in the dictionary are printed, so that the user can decide whether he wishes to perform retrieval with his query as it stands, or add more words.

---

* An experienced user might start differently.



* "Normal Mode" Suppresses this--average user probably does not want it.

Figure II-4 SIMPLE QUERY (cont'd)

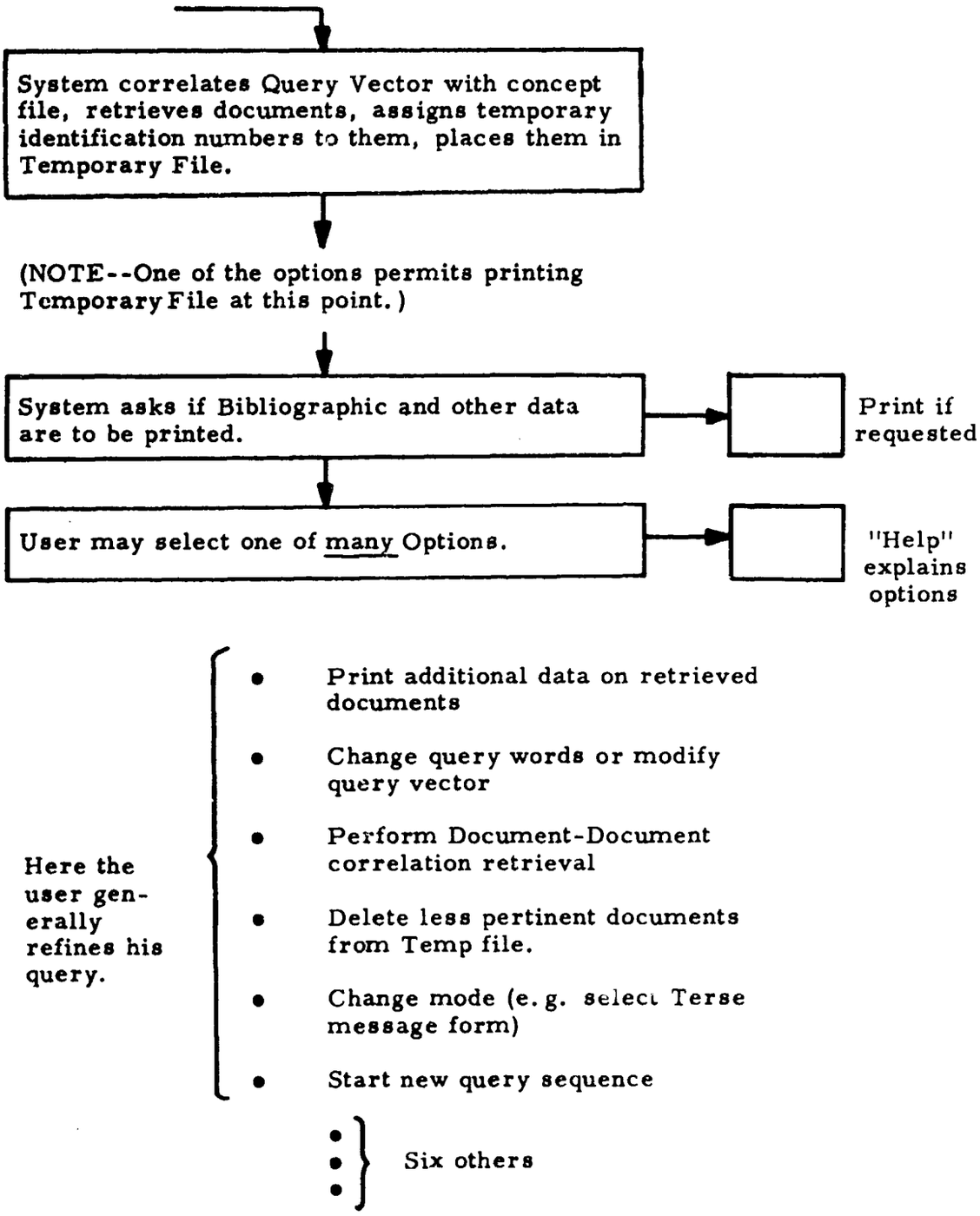


Figure II-4 SIMPLE QUERY (concluded)

Once the user decides to retrieve with his query, the System correlates the query vector with the concept vector for each document in the collection. The System places a ranked list of the highest-correlated documents in the collection in a temporary file, for access by the user.

The System then informs the user that the retrieval is complete. He may then print the contents of the temporary file, which will tell him not only which documents were retrieved, but also their correlations with the query concept vector and their rank by correlation. Also, a temporary identification number is assigned to each document, so that the user may refer to documents without typing in a lengthy accession number.

Once the temporary file of results from a retrieval has been formed, the user has a number of ways in which he can use the results. He can print bibliographic data for all, some, or one of the retrieved documents; he can print any of the documents themselves, or he can use the retrieved documents to find other similar documents in the collection.

II. 4 CURRENT STATUS OF THE ON-LINE RETRIEVAL SYSTEM

The System design, including the design of the off-line indexing programs, is complete and is presented in detail in the Interim Report (5). Although the present System design does not exhaust the potential capabilities of automatic indexing, and further study can still produce significant results, nevertheless the implementation of the full On-Line System is clearly feasible for a document collection containing over 100 million characters of text.

The heart of the On-Line System, the dialogue processor, has been programmed, in GECOS III Time-Sharing FORTRAN, and has been provided with additional routines to perform other System functions in order

to permit experimentation with the user-System interface. The dialogue processor is thus completely operational, and successful query sequences have been accomplished, using a test collection of 50 documents provided by RADC.

In its present configuration, all features of the user-System interface are present. Therefore, to the user, the presently operating portion of the System appears to be the entire System. Several detail refinements of the user-System interface have been made as a result of experiments conducted with the dialogue processor. This prototype will still be useful as an easily-modified test bed even when the entire System has been implemented.

SECTION III

MAN-MACHINE DIALOGUE

The heart of the On-Line System is the software module which governs communications between the user and the System. This module--the dialogue processor--also performs the executive function of the On-Line System. It calls on the routines which perform stem analysis, retrieval, ranking, dictionary lookup and all the other functions. It solicits queries and commands from the remote user, causes search queries to be executed, and reports and stores the results and generally leads the user through the array of tools available to him in his searching of the data base. The dialogue processor is, therefore, a communications package, a training aid, a file building program and an executive program all in one.

The dialogue processor has been programmed, and is fully operational. Although the other program modules that are called by the dialogue processor (see section II.3.2) have not been programmed, the dialogue processor has been provided with supporting routines that simulate the operation of these modules. In this manner, to the user, the entire On-Line System appears to be implemented. Thus, the two sample dialogues included in this section are essentially identical to dialogues that will be conducted with the full On-Line System.

This section presents a functional description of the dialogue processor in subsection III.1. The discussion is then illustrated by two actual retrieval dialogues, as might be conducted by two users of differing experience levels. These two examples show how the novice and the experienced user might use the same query to obtain information with the System.

Crucial to the operation of the dialogue processor are the various files that it accesses; in subsection III.2, the format and method of construction of each file is discussed.

Section III.3 contains a flowchart of The Dialogue Processor, in Figure III-13.

III.1 FUNCTIONAL DESCRIPTION

The dialogue processor is designed, insofar as its functional characteristics appear to the user, with the overriding concept that different users of differing ability, needs, familarity and goals will at various times attempt to use the System. In order for these attempts to succeed, the System must be geared to the user. The experienced user will not tolerate the delays incurred as lengthy tutorial messages are printed at the Teletype terminal; the inexperienced user will flounder without them. The inexperienced user wants to be led through the operation of the System; he does not, however, wish to be asked questions about optional employment of System functions with which he is not familiar. On the other hand, the experienced user wants to be able to marshal every last resource of the System. Finally, the inexperienced user should not be kept in a cocoon forever, and he must be at least given the opportunity to obtain an explanation of the various available features of the System.

III.1.1 The Query Sequence

The fundamental method of operation is embodied in the concept of a query sequence. Initially, the user sets up a retrieval command based on words. He is then given the opportunity to inspect the results of the retrieval, to modify the query or to discontinue the query sequence. During such a query sequence, a file of retrieved documents is built up. The three basic options available to the inexperienced user are:

"END"	Terminate this search query sequence in order to start a new sequence or sign off.
"MOD"	Modify or replace the present query and continue the present query sequence.
"DOC"	Print data for documents retrieved during this sequence, or any documents of known accession number. The user is given a choice of the data to be printed.

"HELP"	Not truly an option, this aids the user in the selection of the appropriate option name.

Ten other options exist, and those indicated by "*" are actually entered automatically for the inexperienced user.

"OFF"	Generates file for printing bibliographic data and documents off-line.
"CHG"	Changes the mode of operation (sequence termination not required).
"CON"	Inspects the concept vectors of documents.
* "RET"	Executes the present retrieval request.
* "DEL"	Deletes unwanted documents retrieved during the present query sequence.
* "SEE"	Inspects the existing query.
* "CLR"	Erases the existing query.
* "WRD"	Adds or deletes query words.
* "DDC"	Performs document-document correlation.
* "WGT"	Performs direct manipulation of query concept vectors.

In addition to the options selected during a query sequence, a user may set various modes. The inexperienced user will take the default specification in which all modes are deselected, while the more experienced user may select one or more of the following:

1. Select terse dialogue.
2. Skip formation of initial query from words in query sequence.
3. Make available statistical analysis of query.
4. Make available statistical analysis of retrieval.
5. Assume sophisticated user.

Selection of the first mode results in terse, ther than verbose, messages being addressed from the System to the user. Most messages exist in two forms, and the terse form is used by experienced users. The second mode skips initial query formation, and lets the user select an option name immediately after signing onto the System.

If the third mode is selected, the user is asked if he wishes to see the words, stems and concept-weight pairs forming a word-based query. These data are available for printing before the query is executed. Also, he can elect the printing of the query concept vector itself. Although these options also exist under MOD, mode 3 makes them available for analysis of the initial query. Note that this mode does not cause the data to be printed, but simply gives the user the option of printing them.

Similarly, mode 4 is provided so that the user may be asked if he wants the contents of the temporary file (accession number, temporary identification number, rank and correlation when last retrieved, print suppression and whether or not the last executed retrieval retrieved the document) immediately after each retrieval. These data are otherwise available, but mode 4, like mode 3, provides a convenience for the serious student of the System.

Mode 5 simply causes "HELP" to result in the printing of the descriptions of all options, not just the basic three.

While building the temporary file, the user can delete irrelevant documents. Since the file is built up by the process of executing different retrieval requests, the re-retrieval of documents already retrieved once during the sequence may be inhibited at the user's choice.

If bibliographic data for a document have been printed once during a single query sequence, it is unlikely that the user will want these data printed again. Such printing is inhibited, but the user (even the inexperienced user) can override this inhibition.

If any words in the initial query are neither common nor found in the dictionary, and therefore do not enter into the retrieval process, they are listed for the user's information. If either none of the query words are in the dictionary or the query results in the retrieval of no documents, the user is so informed and asked to enter another query.

When a successful retrieval takes place, the user is told how many documents were retrieved. The accession numbers of the documents are placed in the temporary file. The System then, if the user so desires, starts to print more detailed information about the documents in the temporary file. For each document, the accession number and temporary identification number are printed. Then a check is made to see if bibliographic data for the document have been printed previously during the query sequence--if not, the bibliographic data are printed. In the former case the output for a document occupies only a single line.

Clearly, users will infrequently want such data printed for the entire set of documents in the temporary file. On the other hand, in order to modify his query intelligently, the user must have some idea of what he has retrieved. After the data for five documents have been printed, the user is asked if more documents are wanted. If they are, five more are printed.

When either all the data for the documents in the temporary file have been printed or the user has decided he has seen enough, he is asked to enter an option name or, in order to get a brief explanation of the options, "HELP". A cry of "HELP" from the user results in the printing of descriptions of MOD, DOC and END options. Now, since it is not the desire to keep the inexperienced user from learning more about the System, he is asked if he wishes to see similar explanations of the remaining ten options, and if he does these are printed. (Similarly, if he attempts to use the option CHG, he is asked if he wishes to see a list of the modes available.)

The user is again asked to enter an option name. Although any legitimate option name will be accepted, the basic three will be used most frequently. An illegal option name will result in an error message and a request for an option name or "HELP", so that a user who misremembers a name is taken back to the point where aid is available.

The END option causes the user to be asked if he is through with the retrieval System. If he is, the System is shut down; if not, an entire new query sequence is initiated.

The DOC option allows the user to obtain more information about the documents presently in the temporary file, or any other documents for which the accession number is known. The user is first asked if he wants only bibliographic information for documents in the present temporary file, with information previously printed suppressed--just as results after an initial query. If he answers "YES", these data and the temporary file data are made available, with the question "MORE" following every five documents in the bibliographic section. It is expected that this would be done by a user who printed only a small part of the bibliographic data immediately following a retrieval and then wants to obtain more of it.

If the last-mentioned question is answered "NO", the user is asked to specify a document or document set of interest to him. He may do so by entering a single accession number or temporary identification number, or a range of temporary identification numbers, or the word "ALL" to signify all the documents in the temporary file. An illegal entry results in a more detailed explanation of the format required and a request that the user try again.

For each document specified, the accession number is first printed. If the document is in the temporary file, the following are printed: its temporary identification number, rank and correlation on its last retrieval, whether or not the last executed retrieval retrieved the document, and wehther or not the bibliographic data for the document have already been printed.

If the document is suppressed from future retrieval, this fact is stated. Bibliographic data are printed if they have not been printed before; if they have, the operator is asked if they are to be printed again and appropriate action is taken. Next the operator is asked if the abstract is to be printed, and the System prints it in response to an answer of "YES".

If there was only one document specified by accession number or temporary identification, the user is given the opportunity to specify more. The process continues as above if he does, or requests an option name if he does not.

Printing an entire abstract may take some time, so even if a set of documents has been specified the user is asked if he wishes to continue after the printing of an abstract. Similarly, the user is asked if he wishes to continue after the printing of any information from five documents. A negative reply in either case results in a request for an option name, or the specification of other documents to be examined.

The MOD option not only allows the user to modify or replace his query, but it also automatically transfers the inexperienced user to sections of other options in order to delete* entries from the temporary file (if desired or required) and perform retrieval**. Upon entrance to MOD, the user is first asked if document-document correlation is to be used as the retrieval method. (Recall that he has started with query words and already retrieved some documents.)

If both document-document correlation is chosen and the last retrieval performed was also based on document-document correlation, the user is given the option of building on the concept vector used in the previous retrieval or starting afresh. He then builds or adds to a query vector by specifying any number of documents by means of single accession number,

---

* DEL

** RET

single or ranges of temporary identification numbers, or all the documents in the tempotary file. After indicating that no more documents are to be used for the search, the user is asked if he desires to initiate the retrieval.

The point at which the user is asked about starting the retrieval can be reached by another path, which is started when the user rejects document-document correlation. The words forming the last query performed on a query word basis have been retained (with their stems and concept-weight mappings), so the user is given the choice of retaining and building on them or erasing them and building a new set of query words. The System is so designed that a user can inspect, modify and again inspect the set of query words, and so the user is asked if he wishes to inspect or modify the set or not. A negative answer causes the user to be asked if he wishes to initiate retrieval.

If the user indicates that he does wish to inspect or modify the set of query vector words, the present set (with stems and concept-weight pairs) is printed and he is then asked if he wants to add or replicate any words. If he does, he is asked to enter the words. Any noncommon, nondictionary words are reported to the user if they are entered, and he is again given the chance to add or replicate words. The user is then given the opportunity to delete words, and informed if he attempts to delete any words not present and allowed to try again.

Next the user is given the opportunity to inspect the query concept vector directly, and if he so elects it is printed. He may add signed concept number-weight pairs, and is informed of any illegal concept numbers that he attempts to enter.

Use of the above three methods of query vector modification, or some combination of them, eventually leads the user to the point where he is asked if he wants a retrieval performed. It is possible that he wants to return to the point of entering an option name--for example, he might want

to have some additional document information printed, and then return to building a document-document correlation query. In such an event, he would answer the question about initiating retrieval in the negative.

When the user indicates that he does want to perform a retrieval, the dialogue processor determines if the query concept vector is null. If it is, the user has obviously become confused, and he is given the opportunity of either starting a new query sequence or resuming the present sequence with a new option name.

Assuming that a retrieval is requested and the query vector is not null, the user is informed if the temporary file is empty. He is asked to specify if documents previously retrieved during the query sequences are to be excluded from re-retrieval or not, and he is asked if printing of bibliographic data already printed once should be allowed or suppressed.

If the temporary file is full, the user is told that he must make space for the documents to be retrieved; if it is partially filled he is given the opportunity to delete documents. Documents to be deleted are specified by accession number, temporary identification number or range of temporary identification numbers. Alternatively, the entire temporary file may be deleted.

Then, in order that the user may identify contents of the temporary file with the particular queries retrieving them, he is informed of the starting temporary identification of the documents to be retrieved, and the retrieval is performed.

If no documents are retrieved, the user is so informed and asked to enter an option name or "HELP". If the retrieval is successful, the system continues just as it does after a successful initial retrieval.

III. 1. 2 The Temporary File

Every time a retrieval is successfully executed during a query sequence, information concerning the documents retrieved is added to the temporary file, continuing until all retrieved documents have been placed in the file or until the file is full. The file capacity is 50 documents, but it may contain results of previous retrievals. Before a retrieval is executed, the user is informed that the file is presently empty, or informed of the remaining space and asked if additional space is required, or told that the file is full and that additional space must be created. If he retrieves more documents than there are spaces in the file, only the highest correlated documents are placed in the file.

During any query sequence, each retrieved document is assigned a temporary identification number. This number is used only for convenience, since it is potentially much shorter than the document's accession number. The user may need to specify a document for deletion from the temporary file, for the printing of bibliographic data or of the document itself, or for document-document correlation.

The temporary file contains only the following information:

1. Accession number;
2. Temporary identification number;
3. Flag indicating if the last executed retrieval retrieved the document;
4. Flag indicating if the bibliographic data for the document have been printed and the printing inhibition not removed;
5. Correlation obtained during the last retrieval of the document;
6. Rank obtained during the last retrieval of the document.

Subsection III. 2. 7 discusses the manner in which the temporary file is stored in detail.

In addition to the temporary file, there is a list of documents whose retrieval is excluded. These are documents which have been retrieved at least once during the retrieval process, that the user does not want to re-retrieve.

III.1.3 Query Types

Initially, a set of query words is entered by the user.* A file containing these words, their stems and weighted mapping into concepts is established. For additional retrievals during the query sequence, the file may be cleared and a new query entered. Or words may be deleted, added or replicated, building on the initial query.

After a retrieval, the query concept vector is retained. If the next retrieval is based on query words, the query concept vector is simply cleared and a new vector constructed from the query word file. The query word file itself may be entirely new or formed by adding and deleting words from the previous query word file. In the case of document-document correlation, the user may either build on the existing query concept vector or generate an entirely new one.

It is also possible for the user to manipulate the query concept vector directly.

III.1.4 Levels of Document Information

Information concerning documents is available on three levels. First is the temporary file information, obviously available only for documents retrieved during the present query sequence. The only permanent information in the file is the document's accession number.

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* The experienced user may skip this activity.

There are also the bibliographic data, with such elements as author, title, date, etc. These data may be printed in a relatively short time, and the user may obtain them for either documents in the temporary file or for any other document whose accession number is known.

Finally, there are the documents themselves. These can be obtained in the same manner as the bibliographic data, and, of course, are comparatively lengthy. (In the presently contemplated data base, the "documents" are in fact abstracts of other documents.)

III.1.5 Two Retrieval Dialogues

Figure III-1 contains two actual dialogues with the dialogue processor, as might result from use of the System by users of two different experience levels. For purposes of illustration, both users begin with the same query, and perform similar actions. The inexperienced user, whose query appears in Figure III-1(a), is guided extensively by the dialogue processor, and is not offered the display of various internal information that would only confuse him. On the other hand, the experienced user is permitted to display data that give great insight into the workings of the System. Thus, Figure III-1(a) emphasizes the tutorial operation of the system, while Figure III-1(b) shows in some detail the operation of the System.

III.1.5.1 Dialogue with Inexperienced User. This discussion refers to the dialogue of Figure III-1(a). This user knows what the System does, but has neither the need nor inclination to find out how the System works. He knows, for instance, that he should start a query by answering "yes" to the question, "Is normal operation desired?". This gives him the verbose form of all messages, and the simplest sequence of questions.

His initial query concerns information processing and information engineering. Three of the words in his query, "representation", "boradest", and "sense" are not in the stem dictionary, and are therefore not useful for retrieval from the collection. One of these, "boradest", is a

```
THIS IS THE RADC ØN-LINE DIALØGUE PRØCESSØR SIGNING ØN.

IS NØRMAL ØPERATIØN DESIRED?:
= YES
ENTER WØRDS FØR INITIAL SEARCH QUERY, FØLLØWED BY "END":
= THE INFØRMATIØN PRØCESSING REVØLUTIØN AND THE EMERGENCE ØF
= THE PRØFESSIØN ØF INFØRAØMATIØN ENGINEERING, DEALING WITH THE
= PRØCESSING AND REPRESENTATIØN ØF INFØRMATIØN IN THE BØRADEST SENSE END
THE FØLLØWING WØRDS ARE NØT USEFUL FØR RETRIEVAL FRØM THIS
CØLLECTIØN:
REPRESENTATIØN
BØRADEST
SENSE
THE NUMBER ØF DØCUMENTS MEETING YØUR SPECIFICATIØNS FØR THE
QUERY IS   31.
DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED
-DØCUMENTS?:
= YES


ACC. NØ.    49.
TEMP. ID.     31.
& DESCRIPTIVE & CATALØGING & GUIDE .
& U. & S. & ATØMIC & ENERGY & CØMMISSIØN .


ACC. NØ.    48.
TEMP. ID.     30.
& MANUAL FØR THE & ANALYSIS ØF & LIBRARY & SYSTEMS .
& TAYLØR , & RØBERT & S. * & HIEBER , & CARØLINE & E.
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
ACC. NØ.     47.
TEMP. ID.      29.
& PUSH & BUTTØN & BIBLIØGRAPHY .. & TØDAY AND & TØMØRRØW .
& SHAFFER , & KENNETH & R. * & SICKMAN , & LUDWIG * & PARKER ,
& RALPH & H.


ACC. NØ.     46.
-TEMP. ID.      28.
& BIBLIØGRAPHIC & INFØRMATIØN & EXCHANGE .
& PØPECKI , & JØSEPH & T.


ACC. NØ.     43.
TEMP. ID.      27.
**AUTHØR
& LAMKIN , & BURTØN & E.
& LAMKIN , & BURTØN & E.

MØRE?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= DØC
PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR
DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING
BIBLIØGRAPHIC DATA ALREADY PRINTED?
= YES-
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

ACCESSIØN NUMBER	TEMPØRARY IDENT.	CØRRELATIØN [WHEN LAST RETRIEVED]	RANK	BIB. DATA PRINTED/ RET'VD LAST QUERY
49	31	0.1414E+00	16	T/T
48	30	0.7036E-01	22	T/T
47	29	0.2917E+00	8	T/T
46	28	0.1741E+00	13	T/T
43	27	0.6244E-01	24	T/T
40	26	0.2958E-01	29	F/T
36	25	0.3659E-01	27	F/T
33	24	0.2428E+00	10	F/T
32	23	0.1387E+00	17	F/T
31	22	0.2572E+00	9	F/T
30	21	0.3257E+00	6	F/T
29	20	0.2946E-01	30	F/T
28	19	0.1462E+00	15	F/T
26	18	0.5390E-01	25	F/T
25	17	0.5285E-01	26	F/T
22	16	0.3769E+00	4	F/T
21	15	0.6510E-01	23	F/T
17	14	0.2357E-01	31	F/T
16	13	0.7087E-01	21	F/T
15	12	0.3658E+00	5	F/T
14	11	0.3113E+00	7	F/T
13	10	0.5595E+00	1	F/T
11	9	0.5280E+00	2	F/T
9	8	0.7180E-01	20	F/T
8	7	0.8165E-01	19	F/T
6	6	0.4857E+00	3	F/T
5	5	0.2157E+00	11	F/T
4	4	0.1591E+00	14	F/T
3	3	0.2000E+00	12	F/T
2	2	0.8980E-01	18	F/T
1	1	0.3178E-01	28	F/T

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED
DØCUMENTS?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= DØC
PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR
DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING
BIBLIØGRAPHIC DATA ALREADY PRINTED?
= NØ
SPECIFY FIRST DØCUMENT ØR DØCUMENT GRØUP TØ PRINT.
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= A13

ACC. NØ.     13.  ID. 10. CØRR. 0.559. RANK  1.RETRIEVED BY LAST QUERY
& WILL & THERE & BE A & PRØFESSIØN ØF & INFØRMATIØN & ENGINEERING .--
& SHUEY , & RICHARD & L.
-PRINT ABSTRACT?:
= YES
IF THE ENGINEERING PRØFESSIØN IS TØ PLAY THE SAME RØLE IN THE
CURRENT INFØRMATIØN REVØLUTIØN THAT IT PLAYED IN THE INDUSTRIAL
REVØLUTIØN , IT MUST BØTH MØDIFY ITSELF AND MERGE WITH ØTHER
PRØFESSIØNS , IN ØRDER TØ ASSIMILATE KNØWLEDGE ØF , AND ACQUIRE
THE ABILITY TØ DESIGN , SYSTEMS IN WHICH THE PRIMARY CØMMØDITY IS
INFØRMATIØN % NØT ENERGY ØR MATERIAL ] . WHETHER THE MEN RESPØNSIBLE
FØR CREATING FUTURE INFØRMATIØN SYSTEMS WILL CØNSIDER THEMSELVES
MEMBERS ØF THE ENGINEERING PRØFESSIØN REMAINS TØ BE SEEN . % $ CLB ]
MØRE?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= HELP
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
ØPTIØNS AVAILABLE ARE:

  "END" - TERMINATE THIS SEARCH QUERY SEQUENCE FØR STARTING
          A NEW SEQUENCE ØR SIGNING ØFF.

  "MØD" - MØDIFY ØR REPLACE THE PRESENT QUERY AND CØNTINUE
          THE PRESENT QUERY SEQUENCE.

  "DØC" - PRINT DATA FØR DØCUMENTS RETRIEVED DURING THIS
          SEQUENCE ØR ANY DØCUMENTS ØF KNØWN ACCESSIØN NUMBER.

ØTHER ØPTIØNS ARE AVAILABLE.  DØ YØU WANT A LIST?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= MØD
DØ YØU WANT TØ ERASE THE PRESENT QUERY AND DØ DØCUMENT-DØCUMENT
SEARCHING?:
= YES
NØW SPECIFY THE DØCUMENTS FØR CØRREALTIØN.
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= A13
MØRE?:
= NØ
DØ YØU WANT TØ INSPECT ØR DIRECTLY MØDIFY THE QUERY CØNCEPT
VECTØR?:
= NØ
DØ YØU WANT A RETRIEVAL PERFØRMED WITH THE PRESENT QUERY VECTØR?:
= YES
SHØULD DØCUMENTS RETRIEVED PREVIØUSLY DURING THIS QUERY SEQUENCE
BE EXCLUDED FRØM RE-RETRIEVAL?:
= NØ
SHØULD PRINTING ØF BIBLIØGRAPHIC DATA PREVIØUSLY PRINTED BE
SUPPRESSED?:
= YES
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
THERE ARE 19 SPACES IN THE TEMPØRARY FILE.
 SPACES EXIST IN THE TEMPØRARY FILE FØR NEW RETRIEVALS. IS MØRE
SPACE DESIRED?:
= YES
SØME DØCUMENTS ARE TØ BE DELETED FRØM THE TEMPØRARY FILE--
BEFØRE THE PRESENT RETRIEVAL IS PERFØRMED.
YØU MUST SELECT THE DØCUMENTS TØ BE DELETED.
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= ALL
DØCUMENTS FØUND BY THIS RETRIEVAL WILL HAVE TEMP. NØS.
STARTING WITH  32.
THE NUMBER ØF DØCUMENTS MEETING YØUR SPECIFICATIØNS FØR THE
QUERY IS   44.
DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED
DØCUMENTS?:
= NØ
ENTER ØPTIØN NAME (ØR    LP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= DØC
PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR
DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING
BIBLIØGRAPHIC DATA ALREADY PRINTED?
= YES
```

ACCESSION NUMBER	TEMPØRARY IDENT.	CØRRELATIØN [WHEN LAST RETRIEVED]	RANK	BIB. DATA PRINTED/ RET'VD LAST QUERY
49	75	0.1187E+00	18	F/T
48	74	0.1535E+00	12	F/T
47	73	0.2571E+00	6	F/T
46	72	0.1461E+00	16	F/T
45	71	0.1088E-01	44	F/T
44	70	0.2575E-01	36	F/T
43	69	0.3144E-01	34	F/T
41	68	0.5843E-01	29	F/T

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

40	67	0.1489E-01	41	F/T
39	66	0.1465E+00	15	F/T
38	65	0.2806E-01	35	F/T
37	64	0.9174E-01	20	F/T
36	63	0.1842E-01	40	F/T
35	62	0.4263E-01	32	F/T
34	61	0.6924E-01	25	F/T
33	60	0.1334E+00	17	F/T
32	59	0.9310E-01	19	F/T
31	58	0.1727E+00	9	F/T
30	57	0.2343E+00	7	F/T
29	56	0.7417E-01	24	F/T
28	55	0.8832E-01	21	F/T
27	54	0.3707E-01	33	F/T
26	53	0.6106E-01	27	F/T
25	52	0.6209E-01	26	F/T
24	51	0.4350E-01	31	F/T
23	50	0.1164E-01	43	F/T
22	49	0.3289E+00	4	F/T
21	48	0.5463E-01	30	F/T
19	47	0.1327E-01	42	F/T
17	46	0.2374E-01	37	F/T
16	45	0.8028E-01	23	F/T
15	44	0.3575E+00	3	F/T
14	43	0.2090E+00	8	F/T
13	42	0.1000E+01	1	F/T
11	41	0.3706E+00	2	F/T
10	40	0.2006E-01	39	F/T
9	39	0.1687E+00	10	F/T
8	38	0.8222E-01	22	F/T
7	37	0.2050E-01	38	F/T
6	36	0.2890E+00	5	F/T
5	35	0.1629E+00	11	F/T
4	34	0.1469E+00	14	F/T
3	33	0.1511E+00	13	F/T
2	32	0.6029E-01	28	F/T

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED
DØCUMENTS?:
= YES

ACC. NØ.     49.
TEMP. ID.     75.
& DESCRIPTIVE & CATALØGING & GUIDE .
& U. & S. & ATØMIC & ENERGY & CØMMISSIØN .

ACC. NØ.     48.
TEMP. ID.     74.
& MANUAL FØR THE & ANALYSIS ØF & LIBRARY & SYSTEMS .
& TAYLØR , & RØBERT & S. * & HIEBER , & CARØLINE & E.

ACC. NØ.     47.
TEMP. ID.     73.
& PUSH & BUTTØN & BIBLIØGRAPHY .. & TØDAY AND & TØMØRRØW .
& SHAFFER , & KENNETH & R. * & SICKMAN , & LUDWIG * & PARKER ,
& RALPH & H.

ACC. NØ.     46.
TEMP. ID.     72.
& BIBLIØGRAPHIC & INFØRMATIØN & EXCHANGE .
& PØPECKI , & JØSEPH & T.

ACC. NØ.     45.
TEMP. ID.     71.
& BØØK & CATALØGS VERSUS & CARD & CATALØGS .
& PIZER , & IRWIN & H.
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
MØRE?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= DØC
PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR
DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING
BIBLIØGRAPHIC DATA ALREADY PRINTED?
= NØ
SPECIFY FIRST DØCUMENT ØR DØCUMENT GRØUP TØ PRINT.
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= All

ACC. NØ.     11.  ID. 41. CØRR. 0.371. RANK  2.RETRIEVED BY LAST QUERY
& THE & ART ØF & TEACHING & INFØRMATIØN & SCIENCE .
& REES , & ALAN & M.
PRINT ABSTRACT?:
= YES
IN THE ABSENCE ØF AN ADEQUATE AND AGREED DEFINITIØN ØF INFØRMATIØN
SCIENCE , TEACHING MUST ESSENTIALLY BE BASED UPØN A HIGHLY SUBJECTIVE
VIEWPØINT . THE HETERØGENEØUS ØRIGINS ØF WØRKERS IN THE FIELD ØF
INFØRMATIØN SCIENCE--MATHEMATICS , LINGUISTICS , LIBRARY SCIENCE ,
LØGIC , PSYCHØLØGY , CØMPUTER TECHNØLØGY , ETC.--FURTHER CØNTRIBUTE
TØ A LACK ØF CØMMØN AGREEMENT AS TØ THE PARAMETERS ØF THE FIELD . THE
LACK ØF ADEQUATE TEXTBØØKS IS BØTH A RESULT AND A CAUSE ØF THE
SHIFTING DEFINITIØN ØF THE FIELD .
THE SUBJECTIVE APPRØACH IS PREDØMINANT IN TEACHING . THE TEACHERS ØF
INFØRMATIØN SCIENCE ARE IN MANY INSTANCES THE ØØ STARS ØØ ØF THE
FIELD WHØ HAVE ACHIEVED EMINENCE AND ACCLAIM FØR THEIR INVENTIVENESS
AND INGENUITY IN SYSTEMS DESIGN , ØPERATIØN , MANAGEMENT AND
EXPERIMENTATIØN . CØURSES CØNSTITUTE THE SUM TØTAL ØF AN INDIVIDUALØS
ESSENTIALLY PARØCHIAL VIEWPØINT AND ARE ANALØGØUS TØ THE HIGHLY
INDIVIDUALISTIC INTERPRETATIØN ØF ARTISTICS PERFØRMERS . ØØ ØNE-SEMESTER
STANDS , ØØ WITH LITTLE INTEGRATIØN WITH THE REST ØF THE CURRICULUM
ØF THE TEACHING INSTITUTIØN , ARE QUITE CØMMØN .
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
THE AUTHØR@S EXPERIENCE IN APPRØACHING THE TEACHING ØF INFØRMATIØN
SCIENCE WITH AN ACADEMIC AND ELECTRIC APPRØACH AT & WESTERN & RESERVE
& UNIVERSITY AND ELSEWHERE IS DESCRIBED IN DETAIL . THE DESIGN AND
TEACHING ØF TWØ CØURSES , @@ & INTRØDUCTIØN TØ & INFØRMATIØN
& RETRIEVAL & SYSTEMS @@ AND @@ & INFØRMATIØN & CENTERS AND
& INFØRMATIØN & SERVICES , @@ ARE ANALYZED . TØPICS DISCUSSED
INCLUDE .. DELINEATIØN ØF THE @@ INFØRMATIØN PRØBLEM @@ .. STRUCTURE
AND ANALYSIS ØF INFØRMATIØN SYSTEMS .. PARØCHIAL AND EXTERNAL
RESEARCH .. RESEARCH METHØDØLØGY IN INFØRMATIØN SCIENCE .. SYNTHESIS
ØF RESEARCH AND ØPERATIØNAL ACTIVITIES . THE MATTER ØF TIMING AND
SEQUENCE ØF PRESENTATIØN IN THE TEACHING ØF AN INTERDISCIPLINARY
SUBJECT TØ STUDENTS WITH INTERDISCIPLINARY BACKGRØUNDS IS ILLUSTRATED .
THE USE ØF GUEST LECTURES IS DESCRIBED IN TERMS ØF SHØWING AND
APPLICATIØN ØF GENERAL PRINCIPLES TØ SPECIFIC SITUATIØNS . % $ AUTHØR ]
MØRE?:
= YES
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= A15

ACC. NØ.     15.  ID. 44. CØRR. 0.358. RANK  3.RETRIEVED BY LAST QUERY
& TØWARD AN & EDUCATIØNAL & BASE FØR THE & INFØRMATIØN & SCIENCES AND
& INFØRMATIØN & ENGINEERING .
& TAYLØR , & RØBERT & S.
PRINT ABSTRACT?:
= YES
THIS PAPER DEFINES AND DISCUSSES THE EDUCATIØN AND CØMPETENCES FØR
TWØ MAJØR AREAS ØF AN AS YET UNNAMED SUBJECT , WHICH IN THIS
PAPER IS LABELED @@ & SUBJECT & X . @@ THIS @@ & SUBJECT & X @@
PERTAINS TØ THE THEØRETICAL , EXPERIMENTAL , AND ØPERATIØNAL STUDY ØF
THE INTERFACE BETWEEN MAN AND SYSTEMATIZED KNØWLEDGE . THE TWØ AREAS
ARE INFØRMATIØN ENGINEERING AND THE INFØRMATIØN SCIENCES . THE FØRMER
IS CØNCERENED WITH THE DEVELØPMENT ØF ØPERATING SYSTEMS .. THE LATTER ,
WITH THE EXPLICATIØN ØF SYSTEMS AND THEIR CØMPØNENTS . FØR A VIABLE
AND EFFECTIVE ACADEMIC DISCIPLINE , IT IS NECESSARY TØ ESTABLISH AN
ENVIRØNMENT FØR FRUITFUL DIALØGUE BETWEEN ØPERATIØNAL PERSØNNEL AND
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
RESEARCH PERSØNNEL . THIS DØES NØT ØCCUR , PRIMARILY BECAUSE THE
STUDY ØF ØPERATING INFØRMATIØN SYSTEMS HAS NØT DEVELØPED A FØRMAL
SET ØF TØØLS AND SYMBØLS BY WHICH THESE PRØCESSES CAN BE
QUANTITATIVELY DESCRIBED . % & AUTHØR ]
MØRE?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= MØD
DØ YØU WANT TØ PERFØRM MØRE DØCUMENT-DØCUMENT SEARCHING?:
= NØ
DØ YØU WANT TØ ERASE CØMPLETELY YØUR PRESENT QUERY AND ENTER
NEW QUERY WØRDS?:
= NØ
DØ YØU WANT TØ SEE ØR MØDIFY THE WØRDS FØRMING THE QUERY?:
= SEE
ANSWER "YES" ØR "NØ":
= NØ
DØ YØU WANT TØ ADD ØR REPLICATE ANY WØRDS?:
= ADD
ANSWER "YES" ØR "NØ":
= YES
ENTER WØRDS, FØLLØWED BY "END":
= TEACHING ØF INFØRMATIØN SCIENCE.  THE INTERFACE BETWEEN MAN AND
= SYSTEMATIZED KNØWLEDGE.  THE SYNTHESIS AND ANALYSIS ØF INFØRMATIØN
= SYSTEMS.  THE LØGICAL FØUNDATIØNS ØF INFØRMATIØN SCIENCE AND
= INFØRMATIØN ENGINEERING.          END.
THE FØLLØWING WØRDS ARE NØT USEFUL FØR RETRIEVAL FRØM THIS
CØLLECTIØN:
FØUNDATIØNS
DØ YØU WANT TØ DELETE ANY WØRDS?:
= NØ
DØ YØU WANT TØ ERASE CØMPLETELY YØUR PRESENT QUERY AND ENTER
NEW QUERY WØRDS?:
= NØ
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
DØ YØU WANT TØ SEE ØR MØDIFY THE WØRDS FØRMING THE QUERY?:
= NØ-Ø
DØ YØU WANT TØ INSPECT ØR DIRECTLY MØDIFY THE QUERY CØNCEPT
VECTØR?:
= NØ
DØ YØU WANT A RETRIEVAL PERFØRMED WITH THE PRESENT QUERY VECTØR?:
= YES
SHØULD DØCUMENTS RETRIEVED PREVIØUSLY DURING THIS QUERY SEQUENCE
BE EXCLUDED FRØM RE-RETRIEVAL?:
= NØ
SHØULD PRINTING ØF BIBLIØGRAPHIC DATA PREVIØUSLY PRINTED BE
SUPPRESSED?:
= YES
THERE ARE  6 SPACES IN THE TEMPØRARY FILE.
 SPACES EXIST IN THE TEMPØRARY FILE FØR NEW RETRIEVALS. IS MØRE
SPACE DESIRED?:
= YES
SØME DØCUMENTS ARE TØ BE DELETED FRØM THE TEMPØRARY FILE--
BEFØRE THE PRESENT RETRIEVAL IS PERFØRMED.
YØU MUST SELECT THE DØCUMENTS TØ BE DELETED.
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= ALL
DØCUMENTS FØUND BY THIS RETRIEVAL WILL HAVE TEMP. NØS.
STARTING WITH  76.
THE NUMBER ØF DØCUMENTS MEETING YØUR SPECIFICATIØNS FØR THE
QUERY IS   35.
DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED
DØCUMENTS?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= DØC
PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR
DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING
BIBLIØGRAPHIC DATA ALREADY PRINTED?
= YES
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

ACCESSIØN NUMBER	TEMPØRARY IDENT.	CØRRELATIØN [WHEN LAST RETRIEVED]	RANK	BIB. DATA PRINTED/ RET'VD LAST QUERY
49	110	0.1461E+00	15	F/T
48	109	0.1272E+00	17	F/T
47	108	0.3013E+00	9	F/T
46	107	0.1798E+00	14	F/T
44	106	0.1980E-01	32	F/T
43	105	0.2418E-01	31	F/T
41	104	0.4495E-01	28	F/T
39	103	0.1127E+00	18	F/T
38	102	0.1439E-01	35	F/T
37	101	0.6049E-01	25	F/T
35	100	0.3279E-01	30	F/T
34	99	0.5326E-01	27	F/T
33	98	0.2223E+00	11	F/T
31	97	0.3321E+00	8	F/T
30	96	0.3484E+00	7	F/T
28	95	0.9058E-01	19	F/T
26	94	0.4175E-01	29	F/T
25	93	0.5459E-01	26	F/T
22	92	0.3892E+00	6	F/T
21	91	0.6723E-01	24	F/T
16	90	0.6862E-01	23	F/T
15	89	0.5500E+00	2	F/T
14	88	0.4501E+00	4	F/T
13	87	0.4767E+00	3	F/T
12	86	0.6870E-01	22	F/T
11	85	0.5577E+00	1	F/T
10	84	0.1543E-01	34	F/T
9	83	0.7415E-01	21	F/T
8	82	0.8433E-01	20	F/T
7	81	0.1577E-01	33	F/T
6	80	0.4104E+00	5	F/T
5	79	0.2227E+00	10	F/T
4	78	0.1849E+00	13	F/T
3	77	0.2066E+00	12	F/T
2	76	0.1391E+00	16	F/T

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED
DØCUMENTS?:
= NØ
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= DØC
PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR
DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING
BIBLIØGRAPHIC DATA ALREADY PRINTED?
= NØ
SPECIFY FIRST DØCUMENT ØR DØCUMENT GRØUP TØ PRINT.
ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":
= A14

ACC. NØ.     14.  ID. 83. CØRR. 0.450. RANK  4.RETRIEVED BY LAST QUERY
& ØN THE & NATURE ØF & INFØRMATIØN & SCIENCE AND THE & RESPØNSIBILITY
ØF & INSTITUTIØNS ØF & HIGHER & EDUCATIØN .
& SLAMECKA , & VLADIMIR .
PRINT ABSTRACT?:
= YES
INFØRMATIØN SCIENCE IS DESCRIBED AS AN INTERDISCIPLINARY FIELD
CØNCERNED WITH THE NATURE , PRØPERTIES , CØNTRØL , AND USE ØF
INFØRMATIØN . THIS INTERDISCIPLINARY NATURE HAS AN IMPØRTANT BEARING
ØN EDUCATIØN IN THE FIELD .. THE TIME REQUIRED TØ ATTAIN A SCHØLARLY
ØR RESEARCH LEVEL IS LØNGER THAN IN MØRE HØMØGENEØUS AREAS , SUCH
AS MATHEMATICS . INSTITUTIØNS ØF HIGHER EDUCATIØN ARE , THEREFØRE ,
IN GØØD PØSITIØN TØ SUPPØRT RESEARCH AND EDUCATIØN IN INFØRMATIØN
SCIENCE BECAUSE THEY PØSSESS CAPABILITIES IN THE MANY DISCIPLINES WHICH
CØMPRISE THE FIELD . PRØGRAMS IN INFØRMATIØN SCIENCE SHØULD BE
ØRGANIZED SØ AS TØ UTILIZE FULLY THE RESØURCES AND CAPABILITIES ØF
THE ENTIRE INSTITUTIØN . % & AUTHØR ]
MØRE?:
= NØ
```

Figure III-1(a) Dialogue with Inexperienced User (cont'd)

```
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= END
PRESENT SEARCH QUERY SEQUENCE TERMINATED. A NEW QUERY MAY
BE INITIATED AT THIS TIME ØR YØU MAY SIGN ØFF.
DØ YØU WISH TØ CØNTINUE IN THE SAME MØDE?:
= NØ
DØ YØU WISH TØ TERMINATE USE ØF THE SYSTEM?:
= YES
ØN-LINE RETRIEVAL SYSTEM SIGNING ØFF.
```

Figure III-1(a) Dialogue with Inexperienced User (concluded)

misspelling of "broadest", but for simplicity, he is not asked if he wants to change his query; an experienced user would be able to correct his spelling at this point, by modifying his query.

The processor performs a retrieval, placing 31 documents in the temporary file. The user indicates that he would like bibliographic information for some documents; he is given this for five documents. He then decides, on the basis of this data, that he would like to see the entire ranking table of documents retrieved. He enters option "DOC" to print this query. To print selected documents from the table, he again enters option "DOC". He bypasses printing of the table to print selectively. The title, "Will there be a profession of information engineering?" appears to be very similar to his query, so he prints the abstract. Satisfied that this document is very nearly what he wanted, he decides to find others like it. But he has used only option "DOC", and does not know how to perform document-document searching. His cry of "HELP" produces a list of the options he can select at this point. Seeing that he can use "MOD", he suppresses printing of further options.

The highest-ranked document alone is used for document-document searching, without modifying the query vector. The user does not exclude from re-retrieval documents retrieved during this sequence; he wishes to observe changes in the ranking, and use this information to guide his browsing. But he will not require re-printing of bibliographic data that he has in front of him, so he suppresses it. Since he has only one document he knows to be of interest, he deletes all entries from the temporary file. Following the retrieval, he prints the ranking table, entering option "DOC" to do so.

From the table, note that document A13 (accession number 13) correlates with itself with a correlation of 1.0, as would be expected. Document A11 has remained second-ranked, while A15 has risen from fifth to third. The user decides to print bibliographic data for these. After obtaining five sets of bibliographic data, he enters option "DOC" to print selected data. He finds both A11 and A15 of interest, and decides to modify his query, adding material from these documents.

After entering option "MOD" to change his query vector, the user incorrectly answers "SEE" to indicate that he wants to see his query words. The System corrects him, and asks him to answer again. Because no words were entered for this query (because document-document searching was performed) there are presently no words in the query. An experienced user would also be able to list the concept numbers and weights in his query. He adds to his query words dealing with information science. He then performs another retrieval. Once again, because of the small size of the collection, he clears the temporary table before retrieving.

He once again enters option "DOC" to print the ranking table. In this table, A13 is no longer top-ranked; the changes have made the query more like A11 than A13. Documents A15 and A13, which are now second and third, have already been printed; so the user decides to inspect A14, which in three retrievals has ranked seventh, eighth, and fourth. The bibliographic data confirms his interest, and he prints the abstract.

The user now has found four apparently relevant documents. At this point, he would probably look at the actual documents, to make a final relevance judgment. Then, if he was not completely satisfied with these four, he might initiate another query sequence. Thus, in addition to the browsing that takes place during a query sequence as illustrated by this example, there could exist another higher level of browsing, as the user converged upon the desired documents by successive query sequences, alternating with inspecting documents.

III.1.5.2 Dialogue with More Experienced User. Figure III-1(b) shows a dialogue that might be conducted by a more experienced user, who has used the System several times and who was becoming proficient in its use. For purposes of this discussion, the initial query entered by this user is the same as the one entered in the dialogue of Figure III-1(a).

```
IS NØRMAL ØPERATIØN DESIRED?:
= NØ
DØ YØU WANT AN EXPLAINATIØN ØF THE AVAILABLE MØDES?:
= NØ
MØDE FLAGS ALL ØFF. IDENTIFY NUMBERS ØF FLAGS TØ BE SET ØN,
FØLLØWED BY "END":
= WHAT?
ILLEGAL SELECTIØN; REQUEST IGNØRED.
DØ YØU WANT AN EXPLAINATIØN ØF THE AVAILABLE MØDES?:
= YES
MØDES ARE NØRMALLY "ØFF" AND CAN BE TURNED ØN BY TYPING IN A FLAG
NUMBER ØR SEQUENCE ØF NUMBERS, SUCH AS "1,3,5,END". THE FØLLØWING
MØDES ARE AVAILABLE:
    FLAG NUMBER    ACTIØN

         1         SELECT TERSE DIALØGUE.
         2         SKIP FØRMATIØN ØF INITIAL QUERY IN QUERY
                   SEQUENCE FRØM WØRDS.
         3         MAKE AVAILABLE QUERY WØRDS, STEMS AND CØNCEPTS
                   BEFØRE RETRIEVAL.
         4         MAKE AVAILABLE TEMP TABLE CØNTENTS AFTER
                   RETRIEVAL.
         5         ASSUME ANY ØPTIØN MAY BE USED.
MØDE FLAGS ALL ØFF. IDENTIFY NUMBERS ØF FLAGS TØ BE SET ØN,
FØLLØWED BY "END":
= 1,3,4,END
ØPTIØNS:
= HELP
ØPTIØNS: "END", "MØD", "DØC".
MØRE?:
= YES
"ØFF","CHG","CØN","RET","DEL","SEE","CLR","WRD","DDC","WGT".
ØPTIØNS:
= CHG
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
DØ YØU WANT AN EXPLAINATIØN ØF THE AVAILABLE MØDES?:
= NØ
MØDE FLAGS ALL ØFF. IDENTIFY NUMBERS ØF FLAGS TØ BE SET ØN,
FØLLØWED BY "END":
= END
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= HELP
ØPTIØNS AVAILABLE ARE:

  "END" - TERMINATE THIS SEARCH QUERY SEQUENCE FØR STARTING
          A NEW SEQUENCE ØR SIGNING ØFF.

  "MØD" - MØDIFY ØR REPLACE THE PRESENT QUERY AND CØNTINUE
          THE PRESENT QUERY SEQUENCE.

  "DØC" - PRINT DATA FØR DØCUMENTS RETRIEVED DURING THIS
          SEQUENCE ØR ANY DØCUMENTS ØF KNØWN ACCESSIØN NUMBER.

ØTHER ØPTIØNS ARE AVAILABLE.  DØ YØU WANT A LIST?:
= YES
"ØFF" - CREATE FILE FØR ØFFLINE DØCUMENT PRINTING
 "CHG" - CHANGE MØDE ØF ØPERATIØN (QUERY SEQUENCE TERMINATIØN
         NØT REQUIRED.) A LIST ØF MØDES IS PRØVIDED.
 "CØN" - INSPECT THE CØNCEPT VECTØRS ØF DØCUMENTS.
 *"RET" - EXECUTE THE PRESENT RETRIEVAL REQUEST.
 *"DEL" - DELETE UNWANTED DØCUMENTS RETRIEVED DURING THE
          PRESENT QUERY SEQUENCE.
 *"SEE" - INSPECT THE EXISTING QUERY.
 *"CLR" - ERASE THE EXISTING QUERY.
 *"WRD" - ADD ØR DELETE QUERY WØRDS.
 *"DDC" - PERFØRM DØCUMENT-DØCUMENT CØRRELATIØN.
 *"WGT" - PERFØRM DIRECT MANIPULATIØN ØF QUERY CØNCEPT VECTØRS.

(ØPTIØNS MARKED WITH "*" ARE NØRMALLY CALLED AUTØMATICALLY FØR
THE USER BY THE SYSTEM.)
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= CHG
DØ YØU WANT AN EXPLAINATIØN ØF THE AVAILABLE MØDES?:
= NØ
MØDE FLAGS ALL ØFF. IDENTIFY NUMBERS ØF FLAGS TØ BE SET ØN,
FØLLØWED BY "END":
= 1,3,4,END
ØPTIØNS:
= MØD
DØC.-DØC.?:
= NØ
TØTALLY REPLACE PRESENT QUERY?:
= NØØØØYES
ENTER WØRDS:
= THE INFØRMATIØN PRØCESSING REVØLUTIØN AND THE EMERGENCE ØF THE
= PRØFESSIØN ØF INFØRMATIØN ENGINEERING, DEALING WITH THE PRØCESSING
= AND REPRESENTATIØN ØF INFØRMATIØN IN THE BØRADEST SENSE.   END
WØRDS NØT IN DICTIØNARY:
REPRESENTATIØN
BØRADEST
SENSE
DELETE?:
= NØ
TØTALLY REPLACE PRESENT QUERY?:
= NØ
QUERY WØRD ACTIØN?:
= YES
PRESENT:
INFØRMATIØN
PRØCESSING
REVØLUTIØN
EMERGENCE
PRØFESSIØN
INFØRMATIØN
ENGINEERING
DEALING
PRØCESSING
INFØRMATIØN
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
ADD WØRDS?:
= YES
ENTER WØRDS:
= BRØADEST
= END
WØRDS NØT IN DICTIØNARY:
BRØADEST
DELETE?:
= NØ
TØTALLY REPLACE PRESENT QUERY?:
= NØ
QUERY WØRD ACTIØN?:
= NØ
DIRECT CØN. VECT. ACTIØN?:
= YES

CØN-  WEIGHT   CØN-  WEIGHT   CØN-  WEIGHT   CØN-  WEIGHT  CØN-  WEIGHT
CEPT           CEPT           CEPT           CEPT          CEPT

  0   0.         0   0.         0   0.       209   1.00000 283   1.00000
653   1.00000  272   1.00000  727   1.00000  648   2.00000 421   3.00000

MØDIFY?:
= NØ
RETRIEVE?:
= YES
TEMP. FILE EMPTY TØ START.
EXCLUDE PREVIØUS?:
= NØ
SUPPRESS PREV. PRINTED?:
= NØ
TEMP ID. STARTS WITH  1.
PRINT PRSNT?:
= YES
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

WØRD	STEM	CØNCEPT-WEIGHT PAIRS					
INFØRMATIØN	INFØRMA	421	1.00000	0	0.	0	0.
PRØCESSING	PRØCE	648	1.00000	0	0.	0	0.
REVØLUTIØN	REVØLU	727	1.00000	0	0.	0	0.
EMERGENCE	EMERG	272	1.00000	0	0.	0	0.
PRØFESSIØN	PRØFE	653	1.00000	0	0.	0	0.
INFØRMATIØN	INFØRMA	421	1.00000	0	0.	0	0.
ENGINEERING	ENGINE	283	1.00000	0	0.	0	0.
DEALING	DEALING	209	1.00000	0	0.	0	0.
PRØCESSING	PRØCE	648	1.00000	0	0.	0	0.
INFØRMATIØN	INFØRMA	421	1.00000	0	0.	0	0.

```
PRINT QUERY VECTØR?:
= NØ
NØ. ØF HITS=    31.
PRINT TEMP?:
= YES
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

ACCESSIØN NUMBER	TEMPØRARY IDENT.	CØRRELATIØN [WHEN LAST RETRIEVED]*	RANK	BIB. DATA PRINTED/ RET'VD LAST QUERY
49	31	0.1414E+00	16	F/T
48	30	0.7036E-01	22	F/T
47	29	0.2917E+00	8	F/T
46	28	0.1741E+00	13	F/T
43	27	0.6244E-01	24	F/T
40	26	0.2958E-01	29	F/T
36	25	0.3659E-01	27	F/T
33	24	0.2428E+00	10	F/T
32	23	0.1387E+00	17	F/T
31	22	0.2572E+00	9	F/T
30	21	0.3257E+00	6	F/T
29	20	0.2946E-01	30	F/T
28	19	0.1462E+00	15	F/T
26	18	0.5390E-01	25	F/T
25	17	0.5285E-01	26	F/T
22	16	0.3769E+00	4	F/T
21	15	0.6510E-01	23	F/T
17	14	0.2357E-01	31	F/T
16	13	0.7087E-01	21	F/T
15	12	0.3658E+00	5	F/T
14	11	0.3113E+00	7	F/T
13	10	0.5595E+00	1	F/T
11	9	0.5280E+00	2	F/T
9	8	0.7180E-01	20	F/T
8	7	0.8165E-01	19	F/T
6	6	0.4857E+00	3	F/T
5	5	0.2157E+00	11	F/T
4	4	0.1591E+00	14	F/T
3	3	0.2000E+00	12	F/T
2	2	0.8980E-01	18	F/T
1	1	0.3178E-01	28	F/T

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
PRINT BIBLIØ.?:
= NØ
ØPTIØNS:
= DØC
TEMP. DØCS. ØNLY, SHØRT FØRM?:
= NØ

IDENTIFY DØCUMENTS:
= A13

ACC. NØ.     13.  ID. 10. CØRR. 0.559. RANK  1.RETRIEVED BY LAST QUERY
& WILL & THERE , BE A & PRØFESSIØN ØF & INFØRMATIØN & ENGINEERING .--
& SHUEY , & RICHARD & L.
PRINT ABSTRACT?:
= YES
IF THE ENGINEERING PRØFESSIØN IS TØ PLAY THE SAME RØLE IN THE
CURRENT INFØRMATIØN REVØLUTIØN THAT IT PLAYED IN THE INDUSTRIAL
REVØLUTIØN , IT MUST BØTH MØDIFY ITSELF AND MERGE WITH ØTHER
PRØFESSIØNS , IN ØRDER TØ ASSIMILATE KNØWLEDGE ØF , AND ACQUIRE
THE ABILITY TØ DESIGN , SYSTEMS IN WHICH THE PRIMARY CØMMØDITY IS
INFØRMATIØN % NØT ENERGY ØR MATERIAL ] . WHETHER THE MEN RESPØNSIBLE
FØR CREATING FUTURE INFØRMATIØN SYSTEMS WILL CØNSIDER THEMSELVES
MEMBERS ØF THE ENGINEERING PRØFESSIØN REMAINS TØ BE SEEN . % $ CLB ]
MØRE?:
= NØ
ØPTIØNS:
= DDC
DØC.-DØC.?:
= YES

IDENTIFY DØCUMENTS:
= A13
MØRE?:
= NØ
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
DIRECT CØN. VECT. ACTIØN?:
= YES

CØN-  WEIGHT  CØN-  WEIGHT  CØN-  WEIGHT  CØN-  WEIGHT  CØN-  WEIGHT
CEPT          CEPT          CEPT          CEPT          CEPT

  0   0.      813   0.50000 748   0.25000 733   0.25000 729   0.25000
727   0.50000 721   0.25000 705   0.25000 654   0.25000 653   0.75000
641   0.25000 620   0.25000 619   0.25000 583   0.25000 547   0.25000
536   0.25000 534   0.25000 533   0.25000 518   0.25000 463   0.25000
461   0.25000 421   1.00000 419   0.25000 358   0.25000 283   0.75000
282   0.25000 227   0.25000 203   0.25000 201   0.25000 177   0.25000
161   0.25000 145   0.25000  67   0.25000  14   0.25000   2   0.25000

MØDIFY?:
= NØ
RETRIEVE?:
= YES
EXCLUDE PREVIØUS?:
= NØ
SUPPRESS PREV. PRINTED?:
= YES
THERE ARE 19 SPACES IN THE TEMPØRARY FILE.
 SPACES IN TEMP. WANT MØRE?:
= YES
DELETE ACTIVE.
BEFØRE RETRIEVING.
SELECT.
IDENTIFY DØCUMENTS:
= ALL
TEMP ID. STARTS WITH 32.
PRINT PRSNT?:
= YES

WØRD                    STEM            CØNCEPT-WEIGHT PAIRS

>>>>>>>>>>>>> NØ WØRDS USED TØ FØRM THIS QUERY <<<<<<<<<<<<
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
PRINT QUERY VECTØR?:
= NØ
NØ. ØF HITS=    44.
PRINT TEMP?:
= YES
```

ACCESSIØN NUMBER	TEMPØRARY IDENT.	CØRRELATIØN [WHEN LAST RETRIEVED]	RANK	BIB. DATA PRINTED/ RET'VD LAST QUERY
49	75	0.1187E+00	18	F/T
48	74	0.1535E+00	12	F/T
47	73	0.2571E+00	6	F/T
46	72	0.1461E+00	16	F/T
45	71	0.1088E-01	44	F/T
44	70	0.2575E-01	36	F/T
43	69	0.3144E-01	34	F/T
41	68	0.5843E-01	29	F/T
40	67	0.1489E-01	41	F/T
39	66	0.1465E+00	15	F/T
38	65	0.2806E-01	35	F/T
37	64	0.9174E-01	20	F/T
36	63	0.1842E-01	40	F/T
35	62	0.4263E-01	32	F/T
34	61	0.6924E-01	25	F/T
33	60	0.1334E+00	17	F/T
32	59	0.9310E-01	19	F/T
31	58	0.1727E+00	9	F/T
30	57	0.2343E+00	7	F/T
29	56	0.7417E-01	24	F/T
28	55	0.8832E-01	21	F/T
27	54	0.3707E-01	33	F/T
26	53	0.6106E-01	27	F/T
25	52	0.6209E-01	26	F/T
24	51	0.4350E-01	31	F/T

Figure III-1(b) Dialogue With Experienced User (cont'd)

23	50	0.1164E-01	43	F/T
22	49	0.3289E+00	4	F/T
21	48	0.5463E-01	30	F/T
19	47	0.1327E-01	42	F/T
17	46	0.2374E-01	37	F/T
16	45	0.8028E-01	23	F/T
15	44	0.3575E+00	3	F/T
14	43	0.2090E+00	8	F/T
13	42	0.1000E+01	1	F/T
11	41	0.3706E+00	2	F/T
10	40	0.2006E-01	39	F/T
9	39	0.1687E+00	10	F/T
8	38	0.8222E-01	22	F/T
7	37	0.2050E-01	38	F/T
6	36	0.2890E+00	5	F/T
5	35	0.1629E+00	11	F/T
4	34	0.1469E+00	14	F/T
3	33	0.1511E+00	13	F/T
2	32	0.6029E-01	28	F/T

```
PRINT BIBLIO.?:
= NØ
ØPTIØNS:
= DØT
INVALID.
ØPTIØNS:
= DØC
TEMP. DØCS. ØNLY, SHØRT FØRM?:
= NØ

IDENTIFY DØCUMENTS:
= All

ACC. NØ.    11.  ID. 41. CØRR. 0.371. RANK  2.RETRIEVED BY LAST QUERY
& THE & ART ØF & TEACHING & INFØRMATIØN & SCIENCE .
& REES , & ALAN & M.
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
PRINT ABSTRACT?:
= NØ
MØRE?:
= YES
IDENTIFY DØCUMENTS:
= A15

ACC. NØ.     15.  ID. 44. CØRR. 0.358. RANK  3.RETRIEVED BY LAST QUERY
& TØWARD AN & EDUCATIØNAL & BASE FØR THE & INFØRMATIØN & SCIENCES AND
& INFØRMATIØN & ENGINEERING .
& TAYLØR , & RØBERT & S.
PRINT ABSTRACT?:
= NØ
MØRE?:
= NØ
ØPTIØNS:
= MØD
MØRE DØC.-DØC.?:
= NØ
TØTALLY REPLACE PRESENT QUERY?:
= NØ
QUERY WØRD ACTIØN?:
= NØ
DIRECT CØN. VECT. ACTIØN?:
= NØ
RETRIEVE?:
= NØ
MØRE DØC.-DØC.?:
= YES
CØNTINUE PREV.?:
= YES

IDENTIFY DØCUMENTS:
= A15
MØRE?:
= YES
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
IDENTIFY DØCUMENTS:
= All
MØRE?:
= NØ
DIRECT CØN. VECT. ACTIØN?:
= NØ
RETRIEVE?:
= YES
TEMP. FILE EMPTY TØ START.
EXCLUDE PREVIØUS?:
= NØ
SUPPRESS PREV. PRINTED?:
= NØ
TEMP ID. STARTS WITH  1.
PRINT PRSNT?:
= YES

WØRD                    STEM            CØNCEPT-WEIGHT PAIRS

>>>>>>>>>>>> NØ WØRDS USED TØ FØRM THIS QUERY <<<<<<<<<<<<

PRINT QUERY VECTØR?:
= YES

CØN-  WEIGHT  CØN-  WEIGHT  CØN-  WEIGHT  CØN-  WEIGHT  CØN-  WEIGHT
CEPT          CEPT          CEPT          CEPT          CEPT

 76  0.09091   75  0.29091   62  0.09091   51  0.27273   50  0.09091
 46  0.09091   44  0.09091   43  0.09091   34  0.09091   33  0.09091
 23  0.18182   17  0.09091   13  0.09091   10  0.09091    7  0.29091
  5  0.09091  813  1.10000  748  0.25000  733  0.25000  729  0.25000
727  0.50000  721  0.25000  705  0.25000  654  0.25000  653  0.75000
641  0.25000  620  0.25000  619  0.25000  583  0.25000  547  0.25000
536  0.25000  534  0.25000  533  0.25000  518  0.25000  463  0.25000
461  0.45000  421  3.00000  419  0.25000  358  0.25000  283  1.15000
282  0.25000  227  0.43182  203  0.25000  201  0.25000  177  0.25000
161  0.25000  145  0.25000   67  0.25000   14  0.25000    2  0.25000

NØ. ØF HITS=    45.
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

PRINT TEMP?:
= YES

ACCESSIØN NUMBER	TEMPØRARY IDENT.	CØRRELATIØN (WHEN LAST RETRIEVED)	RANK	BIB. DATA PRINTED/ RET'VD LAST QUERY
49	45	0.1690E+00	16	F/T
48	44	0.1659E+00	17	F/T
47	43	0.3553E+00	7	F/T
46	42	0.2109E+00	14	F/T
45	41	0.1506E-01	43	F/T
44	40	0.3922E-01	33	F/T
43	39	0.5102E-01	31	F/T
41	38	0.8902E-01	23	F/T
40	37	0.2239E-01	36	F/T
39	36	0.1882E+00	15	F/T
38	35	0.3325E-01	34	F/T
37	34	0.1181E+00	19	F/T
36	33	0.1596E-01	40	F/T
35	32	0.7768E-01	27	F/T
34	31	0.8342E-01	26	F/T
33	30	0.2444E+00	11	F/T
32	29	0.6581E-01	30	F/T
31	28	0.2895E+00	9	F/T
30	27	0.3712E+00	6	F/T
29	26	0.5007E-01	32	F/T
28	25	0.1222E+00	18	F/T
27	24	0.2030E-01	38	F/T
26	23	0.7181E-01	29	F/T
25	22	0.7286E-01	28	F/T
24	21	0.2082E-01	35	F/T
23	20	0.2120E-01	37	F/T
22	19	0.4623E+00	5	F/T
21	18	0.8692E-01	25	F/T

Figure III-1(b) Dialogue With Experienced User (cont'd)

19	17	0.7266E-02	45	F/T
18	16	0.1260E-01	44	F/T
17	15	0.2009E-01	39	F/T
16	14	0.8837E-01	24	F/T
15	13	0.5133E+00	3	F/T
14	12	0.3500E+00	8	F/T
13	11	0.8803E+00	1	F/T
11	10	0.6480E+00	2	F/T
10	9	0.1538E-01	42	F/T
9	8	0.1029E+00	21	F/T
8	7	0.1165E+00	20	F/T
7	6	0.1572E-01	41	F/T
6	5	0.4664E+00	4	F/T
5	4	0.2629E+00	10	F/T
4	3	0.2261E+00	13	F/T
3	2	0.2438E+00	12	F/T
2	1	0.9905E-01	22	F/T

```
PRINT BIBLIØ.?:
= NØ
ØPTIØNS:
= DØC
TEMP. DØCS. ØNLY, SHØRT FØRM?:
= NØ
IDENTIFY DØCUMENTS:
= A6

ACC. NØ.      6.
& SØME & REFLECTIØNS ØN THE & RELATIØN BETWEEN & INFØRMATIØN & SCIENCE
AND & DIGITAL & PRØCESSØRS .
& CHEYDLEUR , & BENJAMIN & F.
PRINT ABSTRACT?:
= YES
```

Figure III-1(b) Dialogue With Experienced User (cont'd)

THESE REFLECTIØNS ARE CØNCERNED WITH THE GRØWING IMPØRTANCE FØR
EDUCATIØN ØF THE REQUIREMENTS ØN TØMØRRØWØS APPLIED RESEARCH
PRØFESSIØNALS IN THE FIELD ØF INFØRMATIØN PRØCESSING TECHNØLØGY .
DETAILED EXEMPLIFICATIØN ØF APPLIED RESEARCH AS A BRIDGE BETWEEN
BASIC AND DEVELØPMENTAL ACTIVITIES IS PRESENTED AS NECESSARY FØR
SPECIFIC BREAKTHRØUGHS IN DIGITAL PRØCESSING . FØR DEFINITENESS ,
INFØRMATIØN SCIENCE IS INTERPRETED AS ENTAILING CØMBINATØRICS ,
ANALØGICS , AND FØRMAL SYSTEMS . ITS ESSENTIAL RØLE IN MEDIATING
TRADEØFFS IN THE DESIGN ØF HARDWARE AND EQUIVALENT SØFTWARE
% PRØGRAMMING] SYSTEMS IS PRESENTED . THE VALUE ØF INFØRMATIØN
SCIENCE TØ INDUSTRIAL RESEARCH AND DEVELØPMENT MANAGEMENT IS
ILLUSTRATED . SEVEN ØØ PØSITIØN STATEMENTS ØØ DEVELØPED AT A RECENT
MEETING ØF INFØRMATIØN SCIENTISTS ARE THEN QUØTED TØ ILLUSTRATE
THEIR NØTIØN ØF THE GRØWING MATURATIØN ØF INFØRMATIØN SCIENCE AND THE
PRØBLEMS ØF FØSTERING IT IN EDUCATIØNAL AND INSTITUTIØNAL
ENVIRØNMENTS . % & AUTHØR]
MØRE?:
= YES
IDENTIFY DØCUMENTS:
= A22

ACC. NØ. 22.
& THE & LIBRARY AS A & PARTNER IN & SCIENTIFIC & CREATIVITY .
& GARDNER , & JØHN & L.
PRINT ABSTRACT?:
= YES
IN THIS AGE ØF Ø INFØRMATIØN EXPLØSIØN Ø THE LIBRARY IS NØT DØING ITS
JØB IF IT IS MERELY PASSIVE .. ACQUIRING , LISTING AND DISPLAYING
MATERIAL BUT FAILING TØ EXPLØIT . THE LIBRARIAN CØNTRIBUTES TØ
SCIENTIFIC CREATIVITY BY DRAWING THE SCIENTISTØS ATTENTIØN TØ THE
INFØRMATIØN CØNTAINED IN HIS CØLLECTIØN , BY SEEKING TØ KNØW WHAT THE
SCIENTIST NEEDS AND BY PRØVIDING TWØ PARTICULAR KINDS ØF SERVICE ..
CURRENT AWARENESS AND RETRØSPECTIVE SEARCH FACILITIES . IT PRØVIDES THE
FØRMER BY CIRCULATING TITLES ØF PAPERS IN CURRENT JØURNALS , LISTS ØF
NEW BØØKS AND REPØRTS ADDED TØ STØCK , NEWS ØF SCIENTIFIC CØNFERENCES ,

Figure III-1(b) Dialogue With Experienced User (cont'd)

```
ETC. . THE SECØND SERVICE CAN ØNLY BE PRØVIDED IF INFØRMATIØN
SPECIALISTS % LITERATURE SCIENTISTS ] ARE EMPLØYED IN THE LIBRARY .
THESE MEN NEED TECHNIQUES AND EQUIPMENT DESIGNED TØ EXTRACT RELEVANT
INFØRMATIØN AO REQUIRED . TRANSLATIØN SERVICES WILL FREQUENTLY BE
NEEDED . THE WRITER , AS MANAGER ØF THE & TECHNICAL & INFØRMATIØN
& CENTRE AT & GENERAL & PRECISIØN & AERØSPACE , & LITTLE & FALLS ,
& N. & J. , BRIEFLY DESCRIBES THE ØRGANIZATIØN ØF HIS ØWN DEPARTMENT
IN THE CØNCERN . % $ LSCA ]
MØRE?:
= NØ
ØPTIØNS:
= END
PRESENT SEARCH QUERY SEQUENCE TERMINATED. A NEW QUERY MAY
BE INITIATED AT THIS TIME ØR YØU MAY SIGN ØFF.
DØ YØU WISH TØ CØNTINUE IN THE SAME MØDE?:
= ØPTIØNS
ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE
ØPTIØNS):
= END
PRESENT SEARCH QUERY SEQUENCE TERMINATED. A NEW QUERY MAY
BE INITIATED AT THIS TIME ØR YØU MAY SIGN ØFF.
DØ YØU WISH TØ CØNTINUE IN THE SAME MØDE?:
= END
ANSWER "YES" ØR "NØ":
= NØ
DØ YØU WISH TØ TERMINATE USE ØF THE SYSTEM?:
= YES
ØN-LINE RETRIEVAL SYSTEM SIGNING ØFF.
```

Figure III-1(b) Dialogue With Experienced User (concluded)

The start of the dialogue illustrates the manner in which the System assists the user when he has trouble; even an experienced user will occasionally rely on this feature. In this case, the user indicates that he does not want normal operation, and refuses an explanation of the modes that are available to him. But when he is asked to identify flags to be turned on, he realizes that he has forgotten how the flags are used. When he enters "WHAT?" to the question about flags to be set, he is given a second opportunity to see the list of modes, which he uses.

The user elects to set flags 1, 3, and 4. Flag 1 selects the terse form of System messages to the user; flag 3 enables the user to obtain a complete analysis of his query before performing a retrieval, and flag 4 permits the user to print the ranking table after a retrieval.

Once the user has selected mode flags, he must choose an option. He enters "HELP" to see the list of options; but he has selected terse dialogue, and therefore does not receive a complete explanation of their purposes. To get this explanation, he uses option "CHG" to cancel his selection of terse dialogue, gets the explanation of all options, restores his previous flag selections, and continues.

The query the user enters is identical to the previous user's query, as discussed above, including the misspelling of "broadest" as "boradest". Realizing his typing error, the user corrects his mistake by entering the word, typed correctly. It is not necessary for him to delete the misspelled version, since words whose stems are not in the stem-concept dictionary are not retained in the query. In order to observe the System's processing of his query, the user prints the query concept vector and present table. His query contained ten content-stem-producing words. "Information" appeared three times, accounting for the weight of 3.0 assigned to concept number 421 in the query vector. "Processing" occurred twice, giving a weight of 2.0 to concept number 648.

The retrieval produces the same result obtained in the earlier dialogue, since the same query was used. The user moves directly into option "DOC" to print the abstract of A13, the highest-ranked document retrieved. This document is very similar to his query; therefore, he decides to use document-document searching to find another document similar to A13. It is expected that most query sequences will be conducted in this way, since document-document searching is a rapid way to construct a complex query vector.

In the results of the document-document search, A13 is of course ranked highest, since it correlates perfectly with itself. The user prints bibliographic data for A11 and A15, which are ranked 2 and 3. Satisfied that these documents are of interest, he decides to perform document-document searching based on both of these documents, and A13. Note that the number of concepts in the query concept vector has grown from 7, for the initial query, to 34, for the first document-document search, to 50, for the present document-document search based on three documents. In this manner, the user is building an increasingly complex query vector, that describes more and more precisely the concept vector of the document he seeks. In this case, the experienced user, by using the multiple-document facility of document-document searching, has developed a much more sophisticated concept vector than the beginning user, who merely modified his previous query by adding a few words.

At this point, the user decides to inspect the abstracts of the highest-ranked documents in the latest retrieval that have not yet been printed, namely A6 and A22. At this point, he has read abstracts of five documents that are apparently of interest, so he signs off the System. Presumably he would obtain hard-copy (or microimage) versions of the documents. If these documents did not fulfill his need, he might browse further by initiating another query sequence.

III. 2 FILES ACCESSED BY THE ON-LINE SYSTEM

This section discusses in some detail each of the files accessed by the On-Line System. Figure III-2 names these files and describes their contents. The word "file" is used here to refer to a collection of data that is logically distinct, rather than to indicate any sort of programming method. Thus, some of these "files" are actually GECOS III quick-access files, as shown in Figure III-2(a), while others might be called "pseudo-files", since they are stored as part of the dialogue processor (Figure III-2(b)).

III. 2.1 Document File--DATA1

The document file, DATA1, consists of fifty abstracts, with bibliographic data, furnished by RADC for purposes of testing the dialogue processor. Figure III-3 shows the beginning and end of DATA1.

III. 2.2 File Words

This file contains five types of information: common words and suffixes of one, two, three and four characters. The file is indexed by line number, with the first digit of the line number indicating the type of information stored on that line. This digit is 0 for common words and 1, 2, 3, or 4 for stems of the corresponding length. The next three digits are for sequencing only. Figure III-4 is a listing of WORDS.

III. 2.3 Dictionary File

The stem-concept dictionary consists of a list of stems and concept vectors. With each stem is stored a three-component concept vector. The first component is a unique concept number with a weight of unity, and the second and third components are null. This dictionary is used to map a query or document into a concept vector.

File Name	Contents	When Printed
DATA1	For each document: • Title • Author • Abstract	Selective printing for retrieved documents.
WORDS	Common words and suffixes for stem analysis.	Not printed.
DICTNRY	Dictionary--for each content stem, the stem and its corresponding concept-weight pairs.	Not printed.
CONCEPTS	One concept vector for each document in DATA1.	Printed by option "CON".
MESSAGES	Catalog of user messages that can be transmitted by the On-Line System.	Printed as required.
OFFLINE	Abstracts to be printed off-line.	Not printed by the Dialogue Processor. (see III. 2. 6)

Figure III-2(a) Files Accessed by the On-Line System: GECOS III Files

File Name	Contents	When Printed
QUERY VECTOR	Concept-weight pairs for the present query.	When requested under option MOD, or under mode number 2.
PRESENT QUERY	For each word in the present query: • the word • its stem • the concept-weight pairs for the stem	When requested under option MOD, or under mode number 3.
TEMPORARY FILE	For each document retrieved: • accession number • temporary identification number • correlation when last retrieved • rank when last retrieved • flag indicating whether bibliographic data has been printed during this query sequence • flag indicating whether there was a "hit" during the last retrieval in this sequence	When requested under option DOC or under mode number 4.

Figure III-2(b) Files Accessed by the On-Line System: Core-Resident Files

```
**TITLE
& IDENTIFYING AND & LØCATING & STANDARDS .
**AUTHØR
& ASTALL, & R.
**ABSTRACT
% INITIAL MICRØFICHE FØR EACH REPØRT ] , % 4 ] IMAGE AREA REQUIREMENTS
LIBRARIANS HAVE TØ DEAL WITH THREE MAIN TYPES ØF STANDARD--MATERIAL
SPECIFICATIØNS , STANDARDS ØF QUALITY AND CØDES ØF PRACTICE . THEY CAN
CØVER PRACTICALLY ANY SUBJECT AND CAN BE PRØDUCED BY INTERNATIØNAL ØR
NATIØNAL ØRGANIZATIØNS , TRADE ASSØCIATIØNS ØR INDIVIDUAL FIRMS .
ØNE ØF THE GREATEST DIFFICULTIES ENCØUNTERED IN DEALING WITH STANDARDS
IS IDENTIFICATIØN , AS A PRØLIFIC NUMBER ØF SYMBØLS ARE USED BY
ØRIGINATØRS ØF STANDARDS . % $ LSCA ]
**END
**TITLE
& FEDERAL & MICRØFICHE & STANDARDS .
**AUTHØR
& FEDERAL & CØUNCIL FØR & SCIENCE AND & TECHNØLØGY .
**ABSTRACT
THE GENERAL CHARACTERISTICS ØF THE $ CØSATI % & CØMMITTEE ØN
& SCIENTIFIC AND & TECHNICAL & INFØRMATIØN ] MICRØFICHE ARE GIVEN .
THE SPECIFICATIØNS HAVE SECTIØNS CØNCERNING % 1 ] FILMING REQUIREMENTS
ØF THE MICRØIMAGE AREA , % 2 ] REQUIREMENTS IN THE TITLE AREA % INITIAL
MICRØFICHE FØR EACH REPØRT ]", % 3 ] DØCUMENT IMAGE AREA REQUIREMENTS
TRAILER MICRØFICHE ] , AND % 5 ] QUALITY . % $ XRDR ]

MATIØN & RETRIEVAL ØR & THE & BIRTH ØF A & MYTH .

ILL EFFECTS ØF THE
YEARS AND
ATES
```

Figure III-3 DATA1 (cont'd)

```
**END
**TITLE
& DESCRIPTI
**AUTHØR
& U. & S. & ATØMIC
**ABSTRACT
DETAILED DIRECTIØNS ARE
THE PREPARATIØN ØF DESCRIPTIV
PERMITS CØMPUTER MANIPULATIØN
PRØVIDE A VARIETY ØF SERVICES
**END
**TITLE
**AUTHØR
& ADAMS , & SCØTT .
**ABSTRACT
ØPERATIØNAL EXPERIENCE DURING THE FIRST YEAR ØF & MEDLARS IS
DESCRIBED IN RELATIØN TØ THE & LIBRARY@S PRIMARY ØBJECTIVES ØF IN
PUBLICATIØN , RECURRING BIBLIØGRAPHIES , AND DEMAND SEARCH SERVICES
PRØGRESS TØWARD THE IMPLEMENTATIØN ØF TWØ SECØNDARY ØBJECTIVES--THE
INPUT ØF CATALØGING CØPY AND THE DECENTRALIZATIØN ØF THE SYSTEM--IS
ALSØ REPØRTED $ MEDLARS HAS BEEN INTENSIVELY TESTED DURING ITS FIRST
ØPERATIØNAL YEAR , ITS STRENGTHS AND WEAKNESSES HAVE BEEN IDENTIFIED ,
AND IT IS NØW PREPARED TØ DEVELØP ITS SERVICE PØTENTIAL . % $ AUTHØR ]
**END
```

Figure III-3 DATA! (concluded)

0001 ABØUT
0002 ABØVE
0003 ACRØSS
0004 AFTER
0005 AGAINST
0006 ALL
0007 ALMØST
0008 ALØNE
0009 ALØNG
0010 ALSØ
0011 ALTHØUGH
0012 ALWAYS
0013 AMØNG
0014 AM
0015 AND
0016 ANØTHER
0017 AN
0018 ANYBØDY
0019 ANYØNE
0020 ANY
0021 ANYTHING
0022 ANYWHERE
0023 APART
0024 ARE
0025 ARØUND
0026 A
0027 ASIDE
0028 AS
0029 AT
0030 AWAY
0031 AWFULLY
0032 BECAUSE
0033 BEEN
0034 BEFØRE
0035 BEHIND
0036 BEING
0037 BELØW
0038 BE
0039 BETWEEN
0040 BEYØND
0041 BØTH
0042 BUT
0043 BY
0044 CANNØT
0045 CAN
0046 CØULD
0047 DID
0048 DØES
0049 DØING
0050 DØNE
0051 DØ
0052 DØWN
0053 DURING
0054 EACH
0055 EITHER
0056 ELSE
0057 ELSEWHERE
0058 ENØUGH
0059 ETC
0060 EVEN
0061 EVER
0062 EVERYØNE
0063 EVERY
0064 EVERYTHING
0065 EVERYWHERE
0066 EXCEPT
0067 FEW
0068 FØR
0069 FØRTH
0070 FRØM
0071 FURTHERMØRE
0072 GET
0073 GETS
0074 GØT
0075 HAD
0076 HARDLY
0077 HAS
0078 HAVE
0079 HAVING
0080 HENCE
0081 HEREIN
0082 HERE
0083 HER
0084 HERSELF
0085 HE
0086 HIM
0087 HIMSELF
0088 HIS
0089 HITHER
0090 HØWBEIT
0091 HØWEVER
0092 HØW
0093 IF
0094 INASMUCH
0095 INDEED
0096 INNER
0097 IN
0098 INSØFAR
0099 INSTEAD
0100 INTØ
0101 INWARD
0102 I
0103 IS
0104 IT
0105 ITSELF
0106 ITS
0107 JUST
0108 KEEP
0110 LEAST
0111 LESS
0112 LEST
0113 MANY
0114 MAY
0115 ME
0116 MIGHT
0117 MINE
0118 MØREØVER
0119 MØRE
0120 MØST
0121 MUCH
0122 MUST
0123 MY
0124 MYSELF
0125 NEITHER
0126 NEVERTHELESS
0127 NEXT
0128 NØBØDY
0129 NØNE
0130 NØR
0131 ØR
0132 NØ
0133 NØTHING
0134 NØT
0135 NØWHERE
0136 ØF
0137 ØH
0138 ØNE
0139 ØNES
0140 ØNLY
0141 ØN
0142 ØNTØ
0143 ØTHER
0144 ØTHERS
0145 ØTHERWISE

Figure III-4 WORDS Listing
(continued)

0146	ØUGHT	0194	THØUGH	1002	E	3028	MEN
0147	ØUR	0195	THRØUGHØUT	1003	S	3029	MAN
0148	ØURSELVES	0196	THUS	1004	Y	3030	NØT
0149	ØURS	0197	TØGETHER	2001	'S	3031	ØDE
0150	ØUTSIDE	0198	TØØ	2002	AL	3032	ØSE
0151	ØVER	0199	TØ	2003	AN	3033	ØUS
0152	ØWN	0200	TØWARD	2004	AR	3034	PLY
0153	PER	0201	TWØ	2005	CY	3035	STY
0154	PLEASE	0202	UNDERNEATH	2006	ED	3036	TAL
0155	PLUS	0203	UNDER	2007	ED	3037	TER
0156	QUITE	0204	UNLESS	2008	EN	3038	TIC
0157	RATHER	0205	UNTIL	2009	ER	3039	TLE
0158	REALLY	0206	UNTØ	2010	ET	3040	ULE
0159	RIGHT	0207	UPØN	2011	IC	3041	URE
0160	SELF	0208	UP	2012	LY	3042	VAR
0161	SELVES	0209	US	2013	ØN	3043	WAY
0162	SEVERAL	0210	VERY	2014	ØR	4001	ABLE
0163	SHALL	0211	WAS	2015	ØU	4002	ANCE
0164	SHE	0212	WELL	2016	RY	4003	CANT
0165	SHØULD	0213	WERE	2017	S'	4004	CIDE
0166	SINCE	0214	WE	2018	TH	4005	DUCE
0167	SIX	0215	WHATEVER	3001	AGE	4006	ENCE
0168	SØMEBØDY	0216	WHAT	3002	ANT	4007	EVER
0169	SØME	0217	WHENCE	3003	ARY	4008	HAND
0170	SØMETHING	0218	WHENEVER	3004	ATE	4009	IENT
0171	SØMETIMES	0219	WHEN	3005	BAR	4010	ITIE
0172	SØMEWHAT	0220	WHERE	3006	CAN	4011	LENT
0173	SØ	0221	WHEREVER	3007	DER	4012	LERT
0174	STILL	0222	WHETHER	3008	EED	4013	LESS
0175	SUCH	0223	WHICH	3009	ENT	4014	MATE
0176	TEN	0224	WHILE	3010	EST	4015	MENT
0177	THAN	0225	WHØM	3011	ETH	4016	MITY
0178	THAT	0226	WHØ	3012	FUL	4017	NESS
0179	THEIR	0227	WHØSE	3013	GEN	4018	PEAR
0180	THEIRS	0228	WHY	3014	IAL	4019	SERT
0181	THEM	0229	WILL	3015	IAN	4020	SERT
0182	THEMSELVES	0230	WITHIN	3016	IED	4021	SHIP
0183	THENCE	0231	WITHØUT	3017	IES	4022	SING
0184	THEN	0232	WITH	3018	ING	4023	SØRB
0185	THEREBY	0233	WØULD	3019	ISH	4024	TEEN
0186	THEREFØRE	0234	YES	3020	ISM	4025	THER
0187	THERE	0235	YET	3021	IØN	4026	TIAL
0188	THE	0236	YØUR	3022	IST	4027	TIØN
0189	THESE	0237	YØURSELF	3023	ITY	4028	TIZE
0190	THEY	0238	YØURSELVES	3024	IVE	4029	TURB
0191	THIS	0239	YØURS	3025	IZE	4030	VICE
0192	UPWARD	0240	YØU	3026	LAY	4031	WISE
0193	THØSE	1001	'	3027	LEL		

Figure III-4 WORDS Listing
(concluded)

This file is generated by program DICGEN, which reads from the test file of 50 documents. It reads a record and skips the rest of the record if the record is title, author, end or corporate information. If the record is the beginning of an abstract, the abstract is searched for stems. Words which do not begin with an alphabetic character are excluded from consideration. The stem analysis routine is employed, so that common words are rejected. The program generates a table of up to 5000 stems.

The program first calls for the maximum number of dictionary entries. It then processes abstracts from the DATA1 file until the specified number of unique stems has been found, or the end of the file has been reached. A PLUCK delimiter parameter of two is used, so words containing hyphens are not split. It is required that the first character of any stem be alphabetic, and stems not meeting this requirement are rejected. The dictionary is alphabetized.

The program PLUCKs from DATA1 until the beginning of an abstract is found. It then PLUCKs and STEMs, rejecting common words through STEM and stems that do not start with a letter of the alphabet directly. A stem that meets these requirements is checked against the dictionary, and if it is not already in the dictionary, it is added in the correct order.

Programs that generate little or no Teletype output can go dead owing to computer failure, like any other programs. But if there is no expected output, the user cannot detect the error. To avoid this, a bell is rung at the Teletype when a stem is entered into the dictionary.

The program was first written to produce only a list of stems. Once this had been produced, then the program was modified to generate the stem-concept dictionary. Figure III-5 shows the 900 stems presently included; the program can generate up to 5000 stems. Figure III-6 contains the flowchart and Figure III-7 is a listing of the first twenty dictionary entries. A listing of the program itself appears in Section VI.

AO	ABILIT	ABLE	ABREAST	ABSENC
ABSTRACT	ACADEM	ACCEPT	ACCES	ACCLAIM
ACCØUNT	ACCREDITA	ACHIEV	ACQUIR	ACQUISI
ACTIV	ACTIVIT	ACTUAL	ADAPT	ADDED
ADDIT	ADDS	ADEQU	ADMINISTRA	ADMINISTRAT
ADVANC	ADVANT	AERØSPAC	AFFAIR	AFFECT
AGE	AGENC	AGREE	AGREED	AID
AIDS	AIMED	AIMS	ALICE	ALLEG
ALLØW	AMERI	ANALØG	ANALYSI	ANALYST
ANALYZ	ANNUAL	APPEAR	APPLI	APPLICA
APPRØACH	APT	ARCHIV	AREA	AREAS
ARGUE	ARISE	ARRANG	ARRIV	ARTICL
ARTICULA	ARTIS	ASKED	ASPECT	ASSES
ASSIGN	ASSIMIL	ASSIST	ASSØCIA	ATTAIN
ATTEMPT	ATTEN	ATTEND	ATTITUD	AUTHØR
AUTHØRØ	AUTØMA	AVAIL	AVAILABIL	AWARE
BACHELØRØ	BACK	BACKGRØUND	BACKLØG	BALANC
BAR	BASED	BASIC	BASIS	BEARING
BEARS	BECØM	BEGIN	BEGUN	BENEFIT
BETTER	BIBLIØGRAPH	BIØLØG	BLØØMQU	BLUR
BØDY	BØØK	BØØKMØBIL	BØØKS	BØUND
BRANCH	BREAKTHRØUGH	BRIDG	BRIEF	BRIEFL
BRIEFLI	BRØWS	BRYANØ	BUILT	BURDEN
CANAD	CAPABILIT	CARD	CARDS	CARRI
CARRY	CATALØG	CATALØGU	CAUSE	CENTER
CENTR	CENTRALIZ	CERTAIN	CHALLENG	CHANG
CHARACTERIS	CHECK	CHEMIC	CHIEF	CHURCH
CIRCULA	CIRCULAT	CITAT	CITY	CLAIM
CLAS	CLASSIC	CLASSIF	CLASSIFICA	CLB
CLIENT	CLIENTEL	CØ-ØPER	CØ-ØPERA	CØ-ØPERAT
CØ-ØRDINAT	CØDES	CØLLEC	CØLLECT	CØLLEG
CØMBINATØR	CØMED	CØMING	CØMMENC	CØMMIT
CØMMØD	CØMMØN	CØMMUNICA	CØMPET	CØMPETIT
CØMPIL	CØMPILA	CØMPL	CØMPLEX	CØMPØN
CØMPRI	CØMPU	CØNCENTR	CØNCER	CØNCERN
CØNFER	CØNSI	CØNSIDERA	CØNSIST	CØNST
CØNSTITUT	CØNSULT	CØNTAIN	CØNTENT	CØNTINU
CØNTRACT	CØNTRIBU	CØNTRIBUT	CØNTRØL	CØNVER
CØØRDIN	CØØRDINAT	CØPE	CØPYING	CØRE
CØRRELA	CØSATI	CØST	CØURS	CØVER
CREAT	CREATIV	CURRENT	CURRICULUM	DARLING
DATE	DAYS	DEAL	DEALING	DEARTH
DECENTR	DECID	DECRE	DEFICIENC	DEFIN
DEFINI	DEFINIT	DEGRE	DELAY	DELIMITA
DELINEA	DEPART	DEPLØ	DEPØSIT	DESCRIB
DESCRIP	DESIGN	DESIGNAT	DESIRABIL	DETAIL
DETERMIN	DEVELØP	DEVIC	DIALØGU	DICTI

Figure III-5 (cont'd)

Stem Dictionary

DIFFER	DIFFICULT	DIGIT	DIMIN	DIRECT
DIRECTØ	DISAGR	DISCHARG	DISCIPLIN	DISCØV
DISCU	DISCUS	DISPLA	DISPUT	DØCUM
DØCUMEN	DØCUMENTA	DØLLAR	DØUBL	DRAWING
DRAWN	DUE	DUPLIC	DUPLICAT	E
EARLY	EASIER	ECØNØM	EDITED	EDITING
EDUCA	EFFECT	EFFIC	EFFØRT	ELECTR
ELEMENT	EMERG	EMINENC	EMPHAS	EMPHASI
EMPLØ	ENCØUN	ENCØUR	ENCØURAG	END
ENDS	ENERG	ENGINE	ENTAIL	ENTER
ENTIR	ENVIR	ENVIRØN	EQUIP	EQUIVA
ERA	ERRØR	ESSEN	ESTABL	EVENT
EVENTU	EVIDENC	EXAMPL	EXCEL	EXCEP
EXEMPLIFICA	EXIST	EXPAND	EXPECT	EXPEN
EXPERI	EXPERIMENTA	EXPLICA	EXPLØ	EXPLØIT
EXPLØRA	EXPRE	EXTEN	EXTENT	EXTERN
EXTRACT	F	FACILIT	FACTS	FACULT
FAILING	FAILUR	FALLS	FAMILI	FAVØUR
FEATUR	FEDER	FEEL	FIELD	FIL
FILED	FILMING	FINAL	FINANC	FIND
FINDING	FIRMS	FIRST	FISCAL	FIVE
FLØW	FØLLØW	FØRCE	FØRM	FØRMAL
FØRMED	FØRMER	FØRMS	FØRMUL	FØSTER
FØUR	FREQU	FRUIT	FULLY	FUNCT
FUNDING	FURTH	FUTUR	G	GAINED
GAVRILØV	GENER	GEØGRAPH	GEØRGIA	GETTING
GIVEN	GØALS	GØØD	GØVERN	GRADU
GRAVE	GREAT	GRØUP	GRØWING	GRØWTH
GUEST	GUIDANC	GUIDE	GUIDELIN	HABIT
HALTED	HAND	HARDER	HARDW	HARØLD
HELD	HELP	HETERØGEN	HIGHER	HIGHL
HØMES	HØMØGEN	HØMØMØRPH	HØPE	HØSPI
IDENTIFICA	IGNØR	II	III	IL
ILLUSTR	ILLUSTRAT	IMAGE	IMPING	IMPLE
IMPLEMENTA	IMPØRT	IMPØS	IMPRØV	INADEQU
INCLUD	INCØMPET	INCREA	INDEX	INDISPEN
INDIVIDU	INDIVIDUALØ	INDIVIDUALI	INDUSTR	INFØRM
INFØRMA	INGENU	INHIBIT	INITI	INSERT
INSTANC	INSTITU	INSTRU	INSTRUC	INTEGR
INTEGRA	INTER	INTERDISCIPL	INTERFAC	INTERFIL
INTERMEDI	INTERNA	INTERPR	INTERPRETA	INTRØDUC
INVENT	INVENTØ	INVESTIGA	INVØLV	ISØLAT
ISØMØRPH	ISSUE	ITEM	ITEMS	IV
J	JØB	JØURN	JUDGING	JUNIØR
JUSTIF	KEPT	KEY	KINDS	KNØW
KNØWLEDG	KNØWN	L	LABEL	LACK
LACKS	LARGE	LARGER	LATER	LATTER
LAW	LC	LEANS	LECTUR	LEGAL

Figure III-5 (cont'd)

Stem Dictionary

LEISUR	LENGTH	LETTER	LEVEL	LIAIS
LIBER	LIBRA	LIBRAR	LIBRARIANSØ	LIBRARIANSHI
LIBRARYØ	LIMIT	LIMITA	LINES	LINGUIS
LINK	LISTED	LISTING	LISTS	LITERAT
LITTL	LIVEL	LØAD	LØCAL	LØCAT
LØGIC	LØNGER	LØUIS	LØWER	LSCA
MACHIN	MAIN	MAINTAIN	MAJØR	MAKE
MAKING	MAN	MANAG	MANNER	MARKET
MASTER	MASTERØ	MATER	MATHEMA	MATTER
MATURA	MAXIMUM	MEANING	MEANS	MEASUR
MECHAN	MEDIA	MEDIAT	MEDIC	MEDICIN
MEDLAR	MEETING	MEMBER	MEN	MEREL
MERGE	METHØD	METHØDØLØG	MICRØFICH	MICRØFILM
MICRØFØRM	MICRØIM	MINØR	MISCØNCEP	MISPLAC
MØBIL	MØDIF	MØNEY	MØVING	MYTH
N	NAME	NAMEL	NARRØW	NATIØN
NATUR	NECES	NEED	NEEDED	NEEDING
NEEDS	NETWØRK	NEW	NEWNE	NEWS
NØN-ACADEM	NØN-SUBJECT	NØTED	NØTIØN	NØW
NUMBER	NUMER	ØBJECT	ØBLIGA	ØBTAIN
ØCCUR	ØFFIC	ØFTEN	ØNE-SEME	ØPEN
ØPERA	ØPERAT	ØRDER	ØRGANIZ	ØRGANIZA
ØRIGIN	ØRIGINAT	ØUT	ØUTLET	ØUTLIN
ØVERLAP	PAGE	PAGING	PAPER	PAPERBACK
PARAME	PARENT	PARØCH	PART	PARTICIPA
PARTICUL	PARTS	PASSIV	PAST	PATENT
PATRØNØ	PATTERN	PEØPL	PERFØRM	PERIØDIC
PERSØN	PERSØNNEL	PERTAIN	PHARMA	PHYSIC
PLACE	PLACED	PLAN	PLAY	PLAYED
PØINT	PØLIC	PØLIT	PØPUL	PØSES
PØSIT	PØSSE	PØSSIBIL	PØSSIBL	PØSTS
PØTEN	PØWER	PRACT	PRACTIC	PRECI
PREDØMIN	PREPAR	PRESENT	PRESENTA	PREVENT
PRIMA	PRIMAR	PRINCIP	PRINCIPL	PRINT
PRØBAB	PRØBLEM	PRØCE	PRØCES	PRØCUR
PRØDUC	PRØDUCT	PRØFE	PRØFES	PRØFESSIØN
PRØGRAM	PRØJECT	PRØLIF	PRØLIFERA	PRØPERT
PRØPØS	PRØSPECT	PRØVI	PRØVID	PRØXI
PSYCHØLØG	PUBLIC	PUBLICA	PUBLICATIØN-	PUBLISH
PURPØ	PURPØS	QUALIF	QUALIFICA	QUALIT
QUANTITAT	QUEST	QUESTIØNNAIR	QUØTA	QUØTED
RADIØ	RANGING	RE-PRØGRAM	READ	READING
REAL	REALIZ	REASØN	RECATALØGU	RECEIV
RECENT	RECLASSIFICA	RECØGNIZ	RECØMMENDA	RECØRD
RECUR	REDUC	REFER	REFLEC	REGARD
REGIØN	REINFØRC	RELAT	RELEV	REMAIN
REMØV	REØRGANIZA	REPACKAG	REPLI	REPLY
REPØRT	REPRESENTAT	REPRØDUC	REQUIR	REQUIRE

Figure III-5 (cont'd)

Stem Dictionary

RESEARCH	RESEARCN	RESERV	RESØURC	RESPØN
RESPØNSIBL	REST	RESULT	RETRIEV	RETRØSPECT
REVIEW	REVØLU	RISE	RØLE	RØLES
RØØT	S	SAME	SANCT	SCALE
SCHEM	SCHØL	SCHØØL	SCIENC	SCIENCE--MAT
SCIENT	SCIENTIF	SCIENTISTØ	SEARCH	SECØND
SECTI	SEEKING	SEEN	SELEC	SELECT
SENT	SEQUENC	SERIØU	SERVE	SERVIC
SERVING	SET	SEVEN	SHELV	SHIFT
SHØP	SHØWING	SITUA	SKIL	SMAL
SØ-CAL	SØCIET	SØCIØLØG	SØFTW	SØØN
SØURC	SØVIET	SPECI	SPECIAL	SPECIALIZA
SPECIF	SPECIFICA	SPENT	STAF	STAND
STANDARD	STANDARD--MA	STARS	STATE	STATI
STATIS	STEAD	STEM	STEMS	STEPS
STØCK	STØREH	STØRING	STRATEG	STRØNG
STRUCT	STUDENT	STUDI	STUDY	SUBJECT
SUBSEQU	SUGGES	SUGGEST	SUM	SUPERF
SUPPL	SUPPØRT	SURPRI	SURVE	SWERV
SYMBØL	SYNTHESI	SYSTEM	SYSTEMØ	SYSTEMATIZ
TAKE	TAKEN	TAPES	TASKS	TEACH
TEAM	TEAMS	TECHN	TECHNIQU	TECHNIQUES--
TECHNØLØG	TELEVI	TENTAT	TERMS	TEXTBØØK
THEØRE	THINK	THREE	THRØUGH	THURSTØNEØ
TIME	TIMING	TITLE	TØMØRRØWØ	TØØLS
TØPIC	TØTAL	TØWARD	TRADE	TRADEØF
TRADI	TRAIL	TRAIN	TRANSLA	TRAVEL
TREND	TRIVI	TRYING	TWICE	TYPES
U	UCLA	UNCATALØG	UNDECID	UNDERGRADU
UNFAVØUR	UNINFØRMAT	UNIØN	UNIQU	UNITED
UNIVER	UNIVERSIT	UNNAM	UPHEAV	USA
USE	USED	USER	USERS	UTILIZ
V	VALUE	VARIET	VARIØU	VI
VIABL	VIEWPØINT	VIGØR	VØLUM	WARREN
WATERED-DØWN	WAY	WAYS	WESTERN	WIDEL
WIDER	WØRD	WØRK	WØRKER	WØRKING
WØRTH	WRITER	X	XRØR	YEARS

Figure III-5 (concluded)

Stem Dictionary

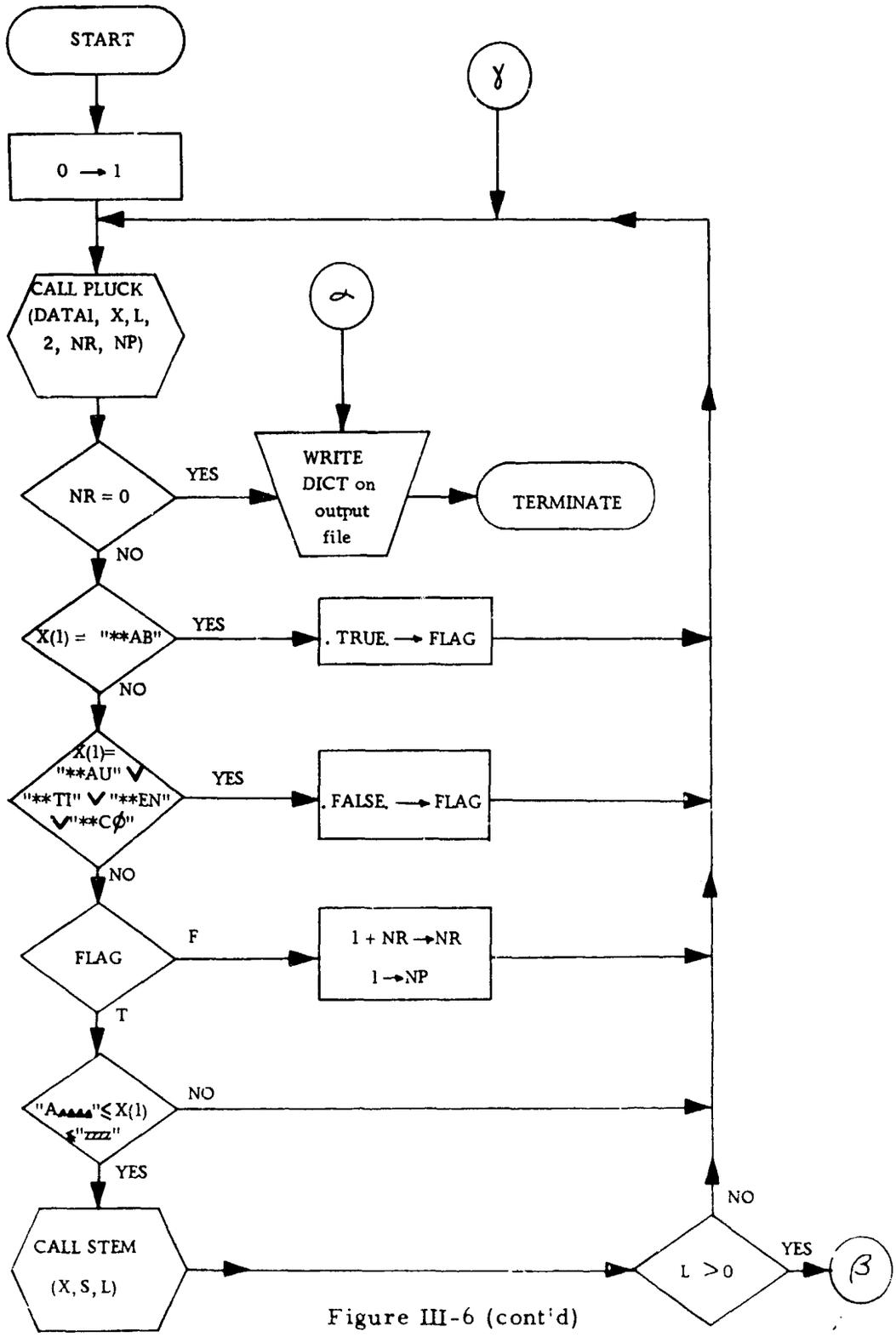


Figure III-6 (cont'd)

DICTIONARY GENERATOR

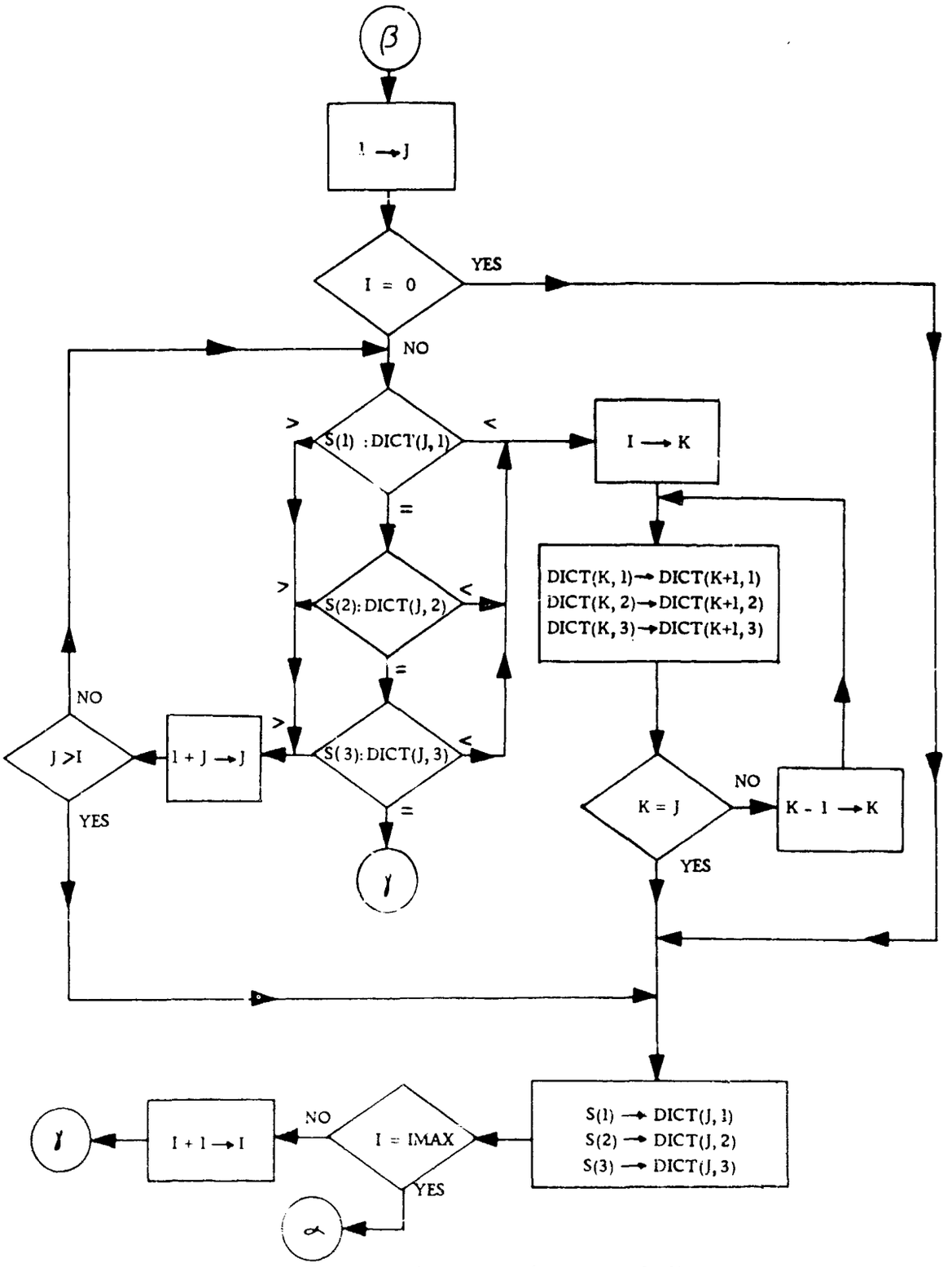


Figure III-6 (concluded)

DICTIONARY GENERATOR

AO	1	1.00000	0	0.	0	0.
ABILIT	2	1.00000	0	0.	0	0.
ABLE	3	1.00000	0	0.	0	0.
ABREAST	4	1.00000	0	0.	0	0.
ABSENC	5	1.00000	0	0.	0	0.
ABSTRACT	6	1.00000	0	0.	0	0.
ACADEM	7	1.00000	0	0.	0	0.
ACCEPT	8	1.00000	0	0.	0	0.
ACCES	9	1.00000	0	0.	0	0.
ACCLAIM	10	1.00000	0	0.	0	0.
ACCØUNT	11	1.00000	0	0.	0	0.
ACCREDITA	12	1.00000	0	0.	0	0.
ACHIEV	13	1.00000	0	0.	0	0.
ACQUIR	14	1.00000	0	0.	0	0.
ACQUISI	15	1.00000	0	0.	0	0.
ACTIV	16	1.00000	0	0.	0	0.
ACTIVIT	17	1.00000	0	0.	0	0.
ACTUAL	18	1.00000	0	0.	0	0.
ADAPT	19	1.00000	0	0.	0	0.
ADDED	20	1.00000	0	0.	0	0.
	21	1.00000	0	0.	0	0.
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure III-7

Dictionary

It should be remembered that there are several parameters of the program that can be varied at will, and it is through inspection of the results such as those in this report that the parameters can be refined.

Adjustable are:

- Common words in the file WORDS, by adding or deleting.
- Specific stems in the file WORDS, by adding and deleting.
- Treatment of the hyphen as a delimiter or not, by selecting 3 or 2 as a parameter of PLUCK.
- Varying the minimum stem length generated by removal (exclusive of treatment of double consonants and "i" before "ly"), by varying a single number in STEM.
- Varying the number of passes allowed, by varying a single number in STEM.

Figure III-5 gives considerable insight into the operation of the stem analyzer. Inspection of the Figure reveals that the stem analyzer has done a good job; there are very few adjacent stems that are forms of the same word. An investigation of the number of artificial homographs created by stem analysis would require a side-by-side comparison of words and the stems they generate; thus, no evaluation of this aspect of stem analyzer performance can be based on Figure III-5 alone.

An important use of Figure III-5 is in determination of the settings of the various parameters of the stem analysis process. For example, it appears that the minimum stem length should be set at four characters, rather than five, which is the present setting. This would reduce the size of the stem dictionary. For example, the words "need", "needed", "needing", and "needs" would all be mapped into "need" if the minimum stem length were reduced to four characters. Other examples of four-letter stems that would each be produced from several entries presently in the stem dictionary are "stud", "form", and "item".

It is not clear from Figure III-5 how the hyphen should be treated during stem analysis--as an alphabetic character or as a word delimiter. The indication is that dictionary size would be reduced by this change, and that few artificial homographs would be created.

III. 2. 4 File CONCEPTS

File CONCEPTS contains one concept vector for each document in the collection. This File is generated by program CONGRA.

Program CONGRA first reads the dictionary file, DICTNRY. It then processes the data base (DATA1), finding the stem for each word, and looking up the stem in the dictionary. The weight of each stem in the document is the number of its occurrences, normalized so that the largest weight in each document is unity. Up to fifty components of the concept vector are entered for each document.

Since statistical filtering and document clustering are not performed by the presently operating experimental prototype of the System, some doubt existed whether this simple concept vector file would be sufficient for testing the dialogue processor. Figure III-8 shows both the number of lines of text processed as the program proceeded through the document collection, and the number of components in the concept vectors for fifty documents, and illustrates that the present file will be sufficient for testing purposes. Figure III-9 is a listing of part of CONCEPTS, and Figure III-10 is a flowchart of CONGRA.

III. 2. 5 File MESSAGES

File MESSAGES contains the list of System-user messages, with five-digit line numbers. For each message, the terse form is stored in the file before the verbose form. Within either form, the lines of multiple-line messages appear in the order in which they are printed. The line numbers identify the messages as follows:

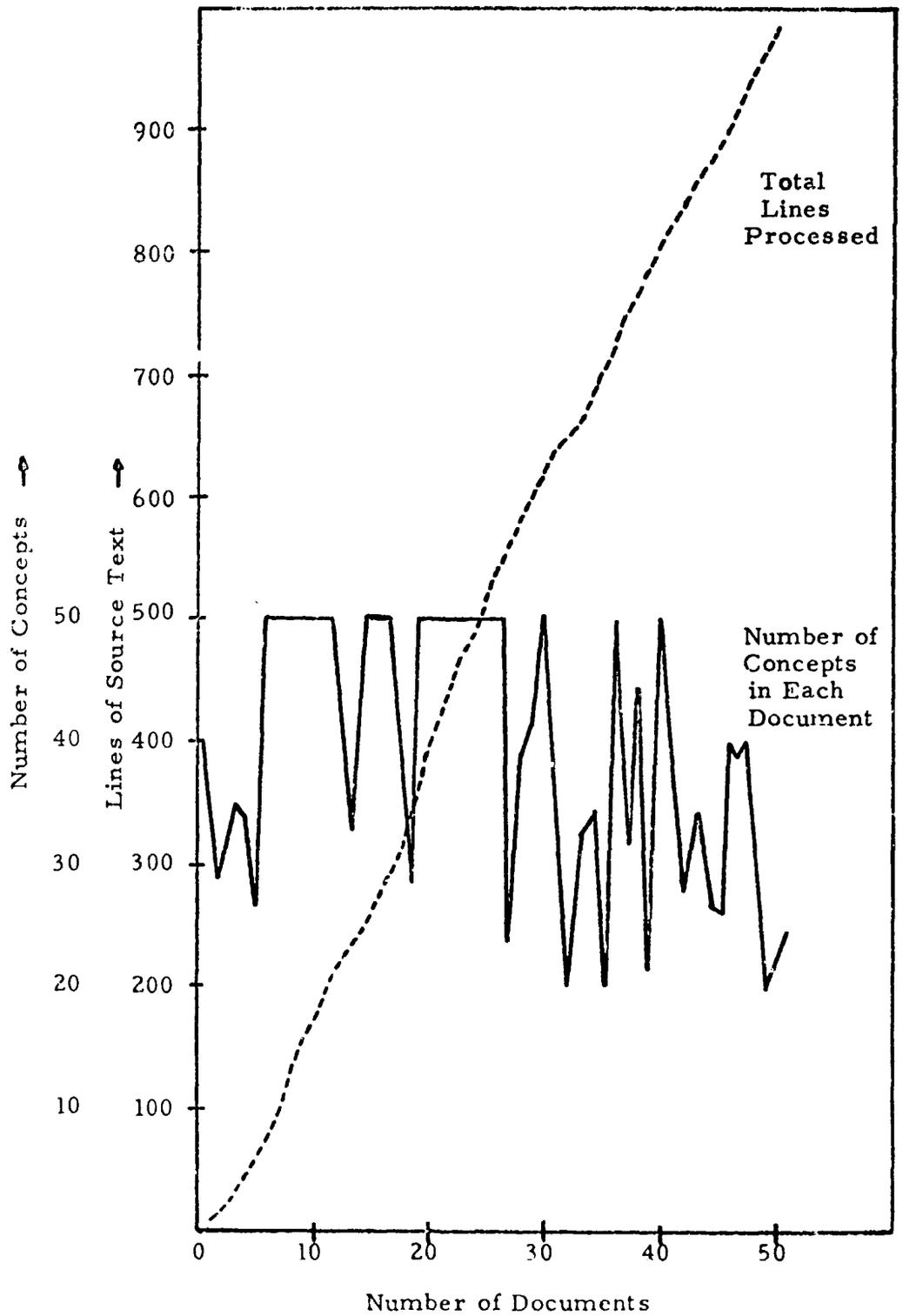


Figure III-8
Characteristics of Test Document Collection

1	54	0.25000	69	0.25000	152	0.25000	200	0.25000	208	0.25000
1	209	0.25000	237	0.25000	277	0.25000	337	0.25000	372	0.25000
1	396	0.25000	403	0.25000	416	0.25000	424	0.25000	437*	0.25000
1	483	0.25000	500	0.25000	505	0.25000	507*	0.25000	539	0.25000
1	555	0.25000	571	0.25000	585	0.25000	587	0.25000	633	0.25000
1	634	0.25000	651	0.25000	658	0.25000	675	0.25000	711	0.25000
1	715	0.25000	777	0.25000	781	1.00000	782	0.25000	800	0.25000
1	811	0.25000	833	0.25000	844	0.25000	855	0.25000	872	0.25000
2	54	0.75000	131	0.25000	160	0.25000	175	0.25000	197	0.25000
2	250	0.25000	327	0.50000	332	0.25000	362	0.25000	366	0.25000
2	403	0.25000	421	0.25000	424	0.25000	539	1.00000	542	0.25000
2	675	0.25000	711	0.25000	715	0.75000	739	0.25000	742	0.25000
2	746	0.25000	777	0.25000	781	0.25000	823	0.25000	826	0.25000
2	838	0.25000	847	0.25000	899	0.25000	0	0.	0	0.
3	40	0.33333	46	0.33333	75	0.33333	157	0.33333	175	0.33333
3	203	0.33333	253	0.33333	258	0.33333	261	0.33333	267*	0.33333
3	292	0.33333	309	0.33333	340	0.33333	352	0.33333	359	0.33333
3	400	0.33333	421	0.66667	426	0.33333	462	0.33333	550	1.00000
3	670	0.33333	677	0.33333	680	0.33333	722	0.33333	723	0.66667
3	724	0.33333	766	0.33333	772	0.33333	774	0.33333	778	0.33333
3	784	0.33333	808	0.33333	852	0.33333	863	0.33333	865	0.33333
3	900	0.33333	0	0.	0	0.	0	0.	0	0.
4	35	0.33333	43	0.16667	58	0.16667	68	0.16667	75	0.16667
4	112	1.00000	172	0.16667	247	0.16667	266	0.33333	278	0.16667
4	279	0.16667	311	0.16667	333	0.16667	358	0.16667	414	0.16667
4	421	0.33333	423	0.16667	443	0.16667	481	0.16667	527	0.16667
4	557	0.16667	594	0.16667	638	0.16667	639	0.16667	640	0.16667
4	649	0.16667	650	0.16667	671	0.16667	677	0.16667	724	0.16667
4	742	0.16667	761	0.16667	813	0.16667	850	0.16667	855	0.16667
5	43	0.50000	75	0.50000	140	0.50000	220	0.50000	226	0.50000
5	266	1.00000	292	0.50000	371	0.50000	393	0.50000	407*	0.50000
5	421	1.00000	446	1.00000	545	1.00000	560	0.50000	581	0.50000
5	694	0.50000	697	0.50000	703	1.00000	724	1.00000	729	0.50000
5	757	0.50000	794	0.50000	862	0.50000	891	0.50000	896	0.50000

Figure III-9 (cont'd)
CONCEPTS File

6	17	0.16667	43	0.16667	49	0.33333	75	0.16667	88	0.16667
6	107	0.16667	108	0.16667	156	0.16667	175	0.16667	217	0.16667
6	227	0.16667	230	0.16667	232	0.50000	238	0.33333	266	0.33333
6	284	0.16667	288	0.16667	290	0.16667	293	0.16667	301	0.16667
6	317	0.16667	329	0.16667	345	0.16667	350	0.16667	374	0.33333
6	384	0.16667	401	0.16667	402	0.16667	407	0.16667	419	0.16667
6	421	1.00000	427	0.16667	438	0.16667	513	0.16667	521	0.16667
6	528	0.16667	532	0.16667	557	0.16667	569	0.16667	626	0.16667
6	638	0.33333	647	0.16667	648	0.33333	649	0.16667	655	0.16667
6	656	0.16667	680	0.16667	691	0.16667	699	0.33333	703	0.16667
7	26	0.14286	38	0.14286	55	0.14286	61	0.28571	64	0.14286
7	88	0.14286	101	0.14286	130	0.14286	162	0.14286	180	0.14286
7	195	0.71429	199	1.00000	203	0.14286	204	0.28571	216	0.14286
7	232	0.28571	236	0.14286	294	0.14286	362	0.14286	385	0.14286
7	389	0.14286	407	0.28571	410	0.14286	439	0.14286	457	0.14286
7	460	0.14286	461	0.14286	462	0.14286	469	0.14286	482	0.14286
7	483	0.14286	491	0.14286	505	0.14286	516	0.14286	520	0.14286
7	524	0.14286	557	0.14286	575	0.14286	599	0.14286	700	0.14286
7	723	0.14286	726	0.14286	738	0.14286	773	0.14286	775	0.14286
7	776	0.14286	788	0.14286	797	0.14286	842	0.14286	848	0.14286
8	17	0.33333	18	0.33333	22	0.33333	24	1.00000	61	0.33333
8	75	0.33333	85	0.33333	120	0.33333	124	0.33333	125	0.33333
8	169	0.33333	184	0.33333	187	0.33333	196	0.33333	222	0.33333
8	237	0.66667	240	0.33333	249	0.33333	252	0.33333	266	1.00000
8	282	0.33333	319	0.33333	334	0.33333	407	0.33333	415	0.33333
8	421	0.33333	427	0.33333	433	0.33333	451	0.33333	466	0.33333
8	498	0.33333	507	0.33333	508	0.33333	510	0.33333	520	0.33333
8	548	0.33333	564	0.33333	566	0.33333	574	0.33333	597	0.33333
[illegible]	602	0.33333	646	0.33333	647	0.33333	654	0.33333	656	0.66667
[illegible]	[illegible]	0.33333	688	0.33333	703	0.33333	714	0.33333	716	0.66667
[illegible]	[illegible]	[illegible]	[illegible]	0.20000	42	0.20000	56	0.20000	68	0.20000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.20000	92	0.20000	109	0.20000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.20000	199	0.20000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.20000	333	0.20000
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.20000

Figure III-9 (concluded)

CONCEPTS File

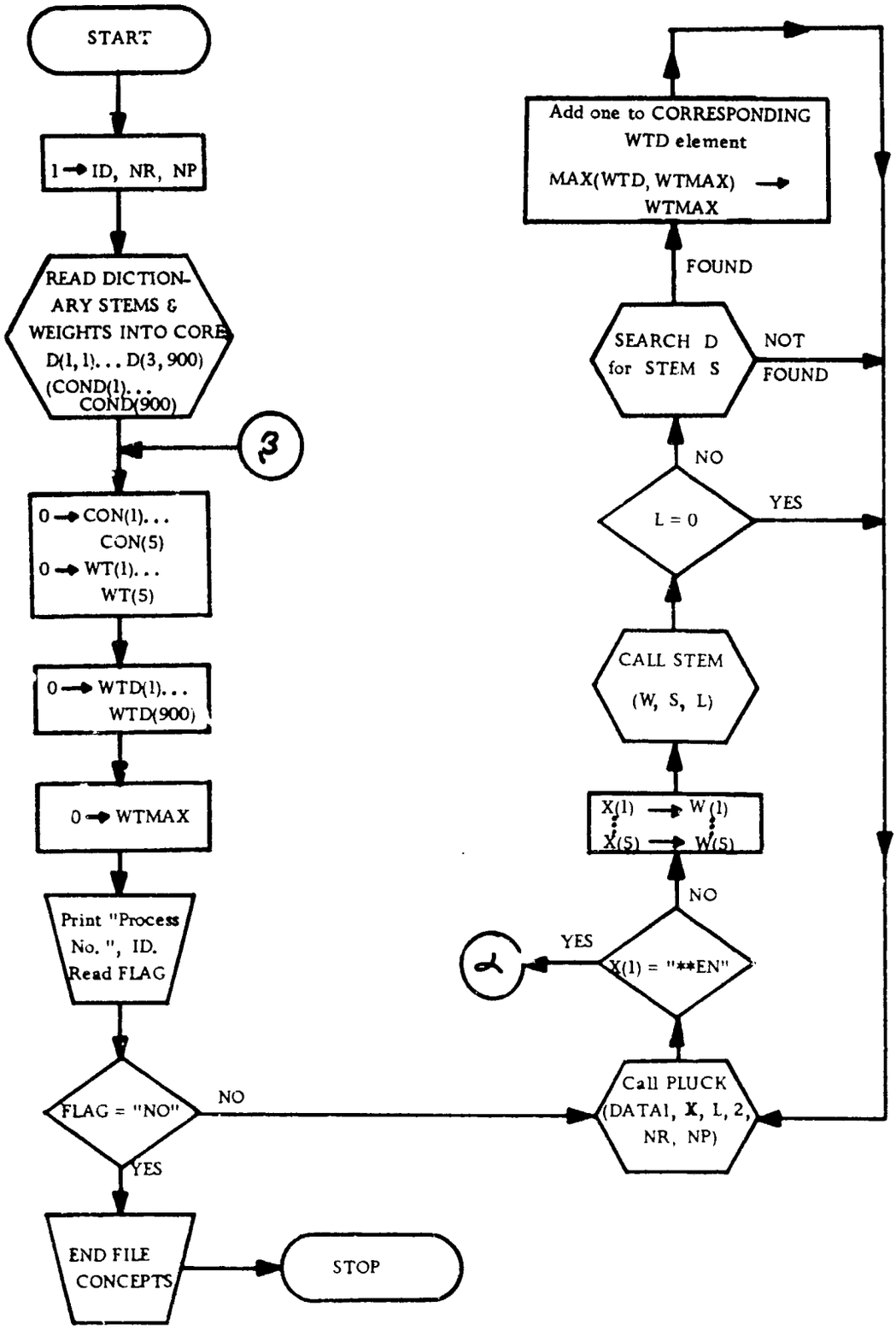


Figure III-10 (cont'd)
Program CONGRA

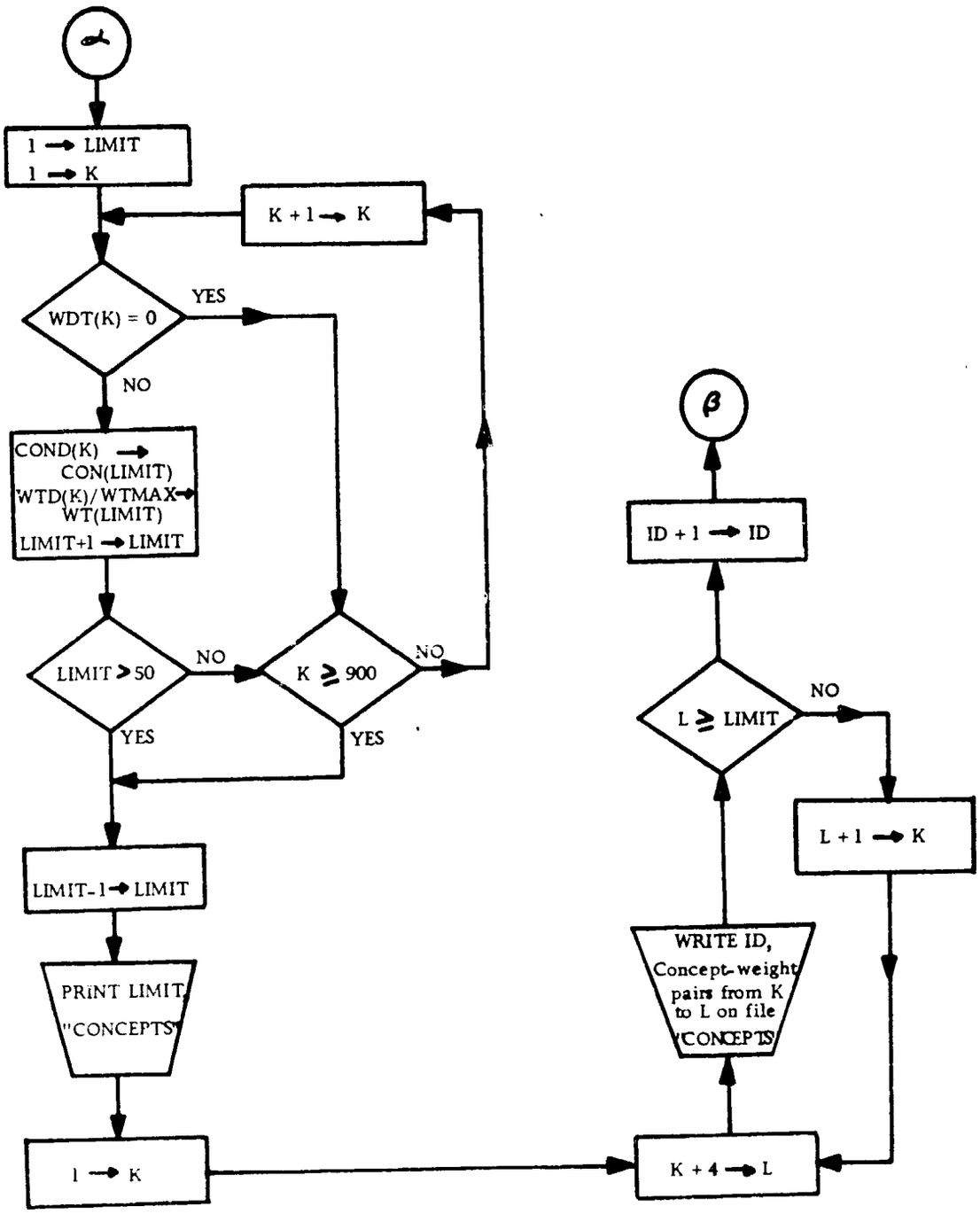


Figure III-10 (concluded)
Program CONGRA

Let the five digits of a line number be represented as NNTLL. Then:

NN	=	message number
T	=	0 if the line is a component of the terse form
T	=	1 if the line is a component of the verbose form
LL	=	the number of the line within a multiple-line message.

In order to distinguish between blanks that fill out a line and blanks that are important for spacing, each line of a message is terminated by a vertical arrow.

Figure III-11 is a listing of file MESSAGES.

III. 2. 6 File OFFLINE

File OFFLINE is used to store documents temporarily for later printing offline on a high-speed printer. If offline printing is requested, file OFFLINE is created, with the desired contents, but it is not printed automatically. The user may "PERM" the file, however.

III. 2. 7 Core-Resident Files

This subsection first defines the use of certain major variables, arrays and families of arrays, and then shows how several of them are allocated to common storage. Figure III-12(a) lists the families of arrays; Figure III-12(b) lists all the main program variables, and Figure III-12(c) the common variables and arrays.

```
01001 RETRY:↑
01101 ANSWER "YES" ØR "NØ":↑
02001 IDENTIFY DØCUMENTS:↑
02101 ENTER TEMP ID. (SINGLE ØR RANGE), ACC. NØ. ØR "ALL":↑
03101 MØRE?:↑
04001 INVALID.↑
04101 REFERENCED DØCUMENTS DØ NØT EXIST.↑
05001 FØRMAT ERRØR.↑
05101 INCØRRECT FØRMAT. USE FØR EXAMPLE "13" FØR TEMP. ID. NØ.↑
05102 13; "13-33" FØR TEMP. ID. NØS. 13 THRØUGH 33 INCLUSIVE;↑
05103 "A13" FØR ACCESSIØN NØ. 13; "ALL" FØR ALL DØCUMENTS↑
05104 RETRIEVED DURING THIS QUERY SEQUENCE.↑
06001 TEMP. FILE EMPTY.↑
06101 NØ DØCUMENTS IN TEMPØRARY FILE. THEREFØRE, ØNLY ACCESSIØN↑
06102 NUMBERS CAN BE USED TØ SPECIFY DØCUMENTS.↑
07101 IS NØRMAL ØPERATIØN DESIRED?:↑
08001 SKIP INITIAL?:↑
08101 SKIP INITIAL QUERY?:↑
09101 ENTER WØRDS FØR INITIAL SEARCH QUERY, FØLLØWED BY "END":↑
10001 WØRDS NØT IN DICTIØNARY:↑
10101 THE FØLLØWING WØRDS ARE NØT USEFUL FØR RETRIEVAL FRØM THIS↑
10102 CØLLECTIØN:↑
11001 NØ WØRDS-RETRIEVAL ABØRTED.↑
11101 NØ USEFUL WØRDS REMAIN. ANØTHER INITIAL QUERY IS REQUIRED.↑
12001 SAME MØDE?:↑
12101 DØ YØU WISH TØ CØNTINUE IN THE SAME MØDE?:↑
13001 QUIT?:↑
13101 DØ YØU WISH TØ TERMINATE USE ØF THE SYSTEM?:↑
14101 MØDE FLAGS ALL ØFF. IDENTIFY NUMBERS ØF FLAGS TØ BE SET ØN,↑
14102 FØLLØWED BY "END":↑
15001 PRINT PRSN?:↑
15101 DØ YØU WANT AN ANALYSIS ØF THE WØRDS (IF ANY) IN THE QUERY?:↑
16101 ↑
16102 WØRD                    STEM            CØNCEPT-WEIGHT PAIRS↑
16103 ↑
```

Figure III-11 (cont'd)

MESSAGES File

```
17001 PRINT QUERY VECTØR?:↑
17101 DØ YØU WANT SØ SEE THE QUERY CØNCEPT VECTØR?:↑
18101 ↑
18102 CØN- WEIGHT  CØN- WEIGHT  CØN- WEIGHT  CØN- WEIGHT CØN- WEIGHT↑
18103 CEPT         CEPT         CEPT         CEPT        CEPT↑
18104 ↑
19001 NØ. ØF HITS >= 50.↑
19101 AT LEAST 50 DØCUMENTS MEET THE SPECIFICATIØNS FØR THE PRESENT↑
19102 QUERY.↑
20001 NØ. ØF HITS=↑
20101 THE NUMBER ØF DØCUMENTS MEETING YØUR SPECIFICATIØNS FØR THE↑
20102 QUERY IS↑
21001 PRINT TEMP?:↑
21101 DØ YØU WANT A PRINTØUT ØF THE TEMPØRARY FILE?:↑
22101 ↑
22102 ACCESSIØN   TEMPØRARY   CØRRELATIØN      RANK   BIB. DATA PRINTED/
22103 NUMBER      IDENT.      [WHEN LAST RETRIEVED]   RET'VD LAST QUERY
22104 ↑
23001 PRINT BIBLIØ.?:↑
23101 DØ YØU WANT BIBLIØGRAPHIC INFØRMATIØN FØR SØME ØF THE RETRIEVED↑
23102 DØCUMENTS?:↑
24001 ***↑
24101 PREVIØUSLY PRINTED.↑
25001 THAT'S ALL.↑
25101 BIBLIØGRAPHIC DATA FØR ALL THE TEMPØRARY FILE DØCUMENTS HAVE↑
25102 BEEN PRINTED.↑
26101 ØN-LINE RETRIEVAL SYSTEM SIGNING ØFF.
26102 ↑-
      27001 ØPTIØNS:↑
27101 ENTER ØPTIØN NAME (ØR "HELP" TØ SEE THE LIST ØF AVAILABLE↑
27102 ØPTIØNS):↑
28001 ØPTIØNS: "END", "MØD", "DØC".↑
28101 ØPTIØNS AVAILABLE ARE:↑
28102  ↑
28103   "END" - TERMINATE THIS SEARCH QUERY SEQUENCE FØR STARTING↑
```

Figure III-11 (cont'd)

MESSAGES File

```
28104            A NEW SEQUENCE ØR SIGNING ØFF.↑
28105  ↑
28106   "MØD" - MØDIFY ØR REPLACE THE PRESENT QUERY AND CØNTINUE↑
28107            THE PRESENT QUERY SEQUENCE.↑
28108  ↑
28109   "DØC" - PRINT DATA FØR DØCUMENTS RETRIEVED DURING THIS↑
28110            SEQUENCE ØR ANY DØCUMENTS ØF KNØWN ACCESSIØN NUMBER.
28111 ↑
29001 "ØFF","CHG","CØN","RET","DEL","SEE","CLR","WRD","DDC","WGT".↑
29101 "ØFF" - CREATE FILE FØR ØFFLINE DØCUMENT PRINTING↑
29102  "CHG" - CHANGE MØDE ØF ØPERATIØN (QUERY SEQUENCE TERMINATIØN↑
29103          NØT REQUIRED.) A LIST ØF MØDES IS PRØVIDED.↑
29105  "CØN" - INSPECT THE CØNCEPT VECTØRS ØF DØCUMENTS.↑
29107  *"RET" - EXECUTE THE PRESENT RETRIEVAL REQUEST.↑
29109  *"DEL" - DELETE UNWANTED DØCUMENTS RETRIEVED DURING THE↑
29110           PRESENT QUERY SEQUENCE.↑
29112  *"SEE" - INSPECT THE EXISTING QUERY.↑
29114  *"CLR" - ERASE THE EXISTING QUERY.↑
29116  *"WRD" - ADD ØR DELETE QUERY WØRDS.↑
29119  *"DDC" - PERFØRM DØCUMENT-DØCUMENT CØRRELATIØN.↑
29121  *"WGT" - PERFØRM DIRECT MANIPULATIØN ØF QUERY CØNCEPT VECTØRS.↑
29122  ↑
29123 (ØPTIØNS MARKED WITH "*" ARE NØRMALLY CALLED AUTØMATICALLY FØR↑
29124 THE USER BY THE SYSTEM.)↑
29125 ↑
30001 MØRE?:↑
30101 ØTHER ØPTIØNS ARE AVAILABLE.  DØ YØU WANT A LIST?:↑
31001 INVALID.↑
31101 THE ØPTIØN NAME YØU ENTERED DØES NØT EXIST.↑
32001 SEQUENCE KILLED.↑
32101 PRESENT SEARCH QUERY SEQUENCE TERMINATED. A NEW QUERY MAY↑
32102 BE INITIATED AT THIS TIME ØR YØU MAY SIGN ØFF.↑
33001 CØNTINUE?:↑
33101 CØNTINUE PRINTING FRØM THIS SPECIFIED GRØUP?:↑
34101 DØ YØU WANT AN EXPLAINATIØN ØF THE AVAILABLE MØDES?:↑
```

Figure III-11 (cont'd)
MESSAGES File

```
35001 1=TERSE; 2=SKIP INITIAL; 3=QUERY ANALYSIS; 4=RETRIEVAL ANALYSIS;↑
35002 5=ALL ØPTIØNS.↑
35101 MØDES ARE NØRMALLY "ØFF" AND CAN BE TURNED ØN BY TYPING IN A FLAG↑
35102 NUMBER ØR SEQUENCE ØF NUMBERS, SUCH AS "1,3,5,END". THE FØLLØWING
35103 MØDES ARE AVAILABLE:↑
35104      FLAG NUMBER    ACTIØN↑
35106  ↑
35107          1          SELECT TERSE DIALØGUE.↑
35109          2          SKIP FØRMATIØN ØF INITIAL QUERY IN QUERY↑
35110                     SEQUENCE FRØM WØRDS.↑
35111          3          MAKE AVAILABLE QUERY WØRDS, STEMS AND CØNCEPTS↑
35112                     BEFØRE RETRIEVAL.↑
35113          4          MAKE AVAILABLE TEMP TABLE CØNTENTS AFTER↑
35114                     RETRIEVAL.↑
35115          5          ASSUME ANY ØPTIØN MAY BE USED.↑
36001 DELETE ACTIVE.↑
36101 SØME DØCUMENTS ARE TØ BE DELETED FRØM THE TEMPØRARY FILE--↑
37001 BEFØRE RETRIEVING.↑
37101 BEFØRE THE PRESENT RETRIEVAL IS PERFØRMED.↑
38001 SELECT.↑
38101 YØU MUST SELECT THE DØCUMENTS TØ BE DELETED.↑
39001  ↑
39101 ACCESSIØN NØ. IS↑
40100  [FØRM SPACE ØVER -- ADD LATER]↑
40101 DATA SAVED IN FILE "ØFFLINE".↑
40102 ↑
41001 TEMP. FILE EMPTY TØ START.↑
41101 TEMPØRARY FILE EMPTY PRIØR TØ EXECUTIØN ØF PRESENT QUERY.↑
42001 TEMP ID. STARTS WITH↑
42101 DØCUMENTS FØUND BY THIS RETRIEVAL WILL HAVE TEMP. NØS.↑
42102 STARTING WITH ↑
43001 EXCLUDE PREVIØUS?:↑
43101 SHØULD DØCUMENTS RETRIEVED PREVIØUSLY DURING THIS QUERY SEQUENCE↑
43102 BE EXCLUDED FRØM RE-RETRIEVAL?:↑
44001 SUPPRESS PREV. PRINTED?:↑
```

Figure III-11 (cont'd)
MESSAGES File

```
44101 SHØULD PRINTING ØF BIBLIØGRAPHIC DATA PREVIØUSLY PRINTED BE↑
44102 SUPPRESSED?:↑
45001  SPACES IN TEMP. WANT MØRE?:↑
45101  SPACES EXIST IN THE TEMPØRARY FILE FØR NEW RETRIEVALS. IS MØRE↑
45102 SPACE DESIRED?:↑
46001 TABLE FULL.↑
46101 TABLE ØF DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE IS FULL.↑
46102 SPACE MUST BE MADE BEFØRE EXECUTING ANØTHER QUERY.↑
47001 TEMP. DØCS. ØNLY, SHØRT FØRM?:↑
47101 PRINT ØNLY RANKING AND BIBLIØGRAPHIC DATA (NØ ABSTRACTS) FØR↑
47102 DØCUMENTS RETRIEVED DURING THIS QUERY SEQUENCE, EXCLUDING↑
47103 BIBLIØGRAPHIC DATA ALREADY PRINTED?↑
48001 ØN NØ-NØ LIST.↑
48101 THIS DØCUMENT EXCLUDED FRØM RE-RETRIEVAL DURING PRESENT QUERY↑
48102 SEQUENCE.↑
49001 PRINT BIBLIØGRAPHIC AGAIN?:↑
49101 BIBLIØGRAPHIC DATA PRINTED BEFØRE DURING THIS QUERY SEQUENCE.↑
49102 PRINT AGAIN?:↑
50101 PRINT ABSTRACT?:↑
51010 DØC.-DØC.?:↑
51101 DØ YØU WANT TØ ERASE THE PRESENT QUERY AND DØ DØCUMENT-DØCUMENT↑
51102 SEARCHING?:↑
52001  ↑
52101 NØW SPECIFY THE DØCUMENTS FØR CØRREALTIØN.↑
53001 QUERY WØRD ACTIØN?:↑
53101 DØ YØU WANT TØ SEE ØR MØDIFY THE WØRDS FØRMING THE QUERY?:↑
54001 PRESENT:↑
54101 THE PRESENT QUERY WØRDS ARE:↑
55001 ADD WØRDS?:↑
55101 DØ YØU WANT TØ ADD ØR REPLICATE ANY WØRDS?:↑
56001 ENTER WØRDS:↑
56101 ENTER WØRDS, FØLLØWED BY "END":↑
57001 DELETE?:↑
57101 DØ YØU WANT TØ DELETE ANY WØRDS?:↑
58001 NØT IN QUERY.↑
```

Figure III-11 (cont'd)

MESSAGES File

```
58101 YØU CANNØT DELETE A WØRD THAT IS NØT ALREADY IN THE QUERY.↑
59001 CØNTINUE PREV.?:↑
59101 DØ YØU WANT TØ BUILD ØN THE PREVIØUS DØCUMENT-DØCUMENT SEARCH?:↑
60001 DIRECT CØN. VECT. ACTIØN?:↑
60101 DØ YØU WANT TØ INSPECT ØR DIRECTLY MØDIFY THE QUERY CØNCEPT↑
60102 VECTØR?:↑
61001 MØDIFY?:↑
61101 DØ YØU WANT TØ MØDIFY THIS VECTØR?:↑
62001 ENTER PAIR:↑
62101 ENTER CØNCEPT-WEIGHT PAIR (E.G. "1203, -0.123"):↑
63101 ENTER PAIR:↑
64001 INVALID.↑
64101 INVALID CØNCEPT NUMBER. DØ YØU WANT TØ TRY ANY ↑
65001 RETRIEVE?:↑
65101 DØ YØU WANT A RETRIEVAL PERFØRMED WITH THE PRESENT QUERY VECTØR?:↑
66001 NULL VECTØR.  WANT NEW SEQUENCE?:↑
66101 A RETRIEVAL CANNØT BE PERFØRMED BECAUSE YØUR PRESENT QUERY VECTØR↑
66102 IS NULL.  DØ YØU WANT TØ START A NEW QUERY SEQUENCE?:↑
67001 ØFF LINE PRINT.↑
67101 READY TØ PRINT DØCUMENTS ØFF LINE.↑
68001  ↑
68101 SPECIFY FIRST DØCUMENT ØR DØCUMENT GRØUP TØ PRINT.↑
69001 MØRE DØC.-DØC.?:↑
69101 DØ YØU WANT TØ PERFØRM MØRE DØCUMENT-DØCUMENT SEARCHING?:↑
70001 TØTALLY REPLACE PRESENT QUERY?:↑
70101 DØ YØU WANT TØ ERASE CØMPLETELY YØUR PRESENT QUERY AND ENTER↑
70102 NEW QUERY WØRDS?:↑
71001 PRESENT QUERY:↑
71101 THE PRESENT QUERY CØNCEPT VECTØR IS:↑
72001 CLEARED.↑
72101 THE PAST QUERIES AND QUERY CØNCEPT VECTØRS HAVE BEEN CLEARED.↑
73101 ILLEGAL SELECTIØN; REQUEST IGNØRED.↑
74101 ↑
74102 ↑
74103
```

Figure III-11 (concluded)
MESSAGES File

Name	Contents
TEMP	Temporary file: accession number, temporary identification number, correlation coefficient and rank when last retrieved, print suppression flag and flag indicating if retrieved on last executed retrieval.
PRE	Words for queries: the words, their stems and concept-weight pair mappings.
QUERY	The query concept vector.

Figure III-12(a)

Families of Arrays

Name	Type	Use
IX	I	Next available temporary identification number.
JX	I	Number of entries presently in TEMP.
NEWQ	L	Mode setting precedes initial query.
RFLG	L	Present query not initial.
DEFLG	L	DEL entered through RET.
WFLG	L	MOD has altered PRE.
SEEFLG	L	SEE activated by MOD.
WRDFLG	L	WRD activated by MOD.
DOCDOC	L	Last retrieval in present sequence used document-document correlation.
TERSE *	L	Terse dialogue: Mode 1 selected.
SKIP1	L	Skip initial query: Mode 2 selected.
PRINTQ	L	QUERY available immediately before retrieval: Mode 3 selected.
OPTION	L	HELP prints all options: Mode 5 selected.
LGSTACNO *	I	Largest document accession number in the collection.

* in common storage

Figure III-12(b)

Program Variables and Arrays

Name	Dimension	Type	Use
TEMP1	50	I	accession number of document in temporary file
TEMP2	50	I	temporary identification number of document in temporary file
TEMP3	50	F	correlation coefficient of document in temporary file when last retrieved
TEMP4	50	I	rank of document in temporary file when last retrieved
TEMP5	50	L	set when printing of bibliographic data for document in temporary file is to be suppressed
TEMP6	50	L	set when the last executed retrieval command retrieved this document
QUERY1	50	I	concept number for a component of the present query vector
QUERY2	50	F	concept weight for a component of the present query vector
NONO	100	I	accession number of documents for which retrieval is suppressed
TERSE	---	L	set if terse mode is selected
LGSTACNO	---	I	largest accession number in document file
PRE1	5 x 25	A	present query word
PRE2	3 x 25	A	present query stem
PRE3	3 x 25	I	concept numbers for stem
PRE4	3 x 25	F	concept weights for stem

Figure III-12(c)

Common Storage

III.3 FLOWCHART OF THE DIALOGUE PROCESSOR

Figure III-13 contains a flowchart of the dialogue processor, whose operation is described in subsection III.1.1.

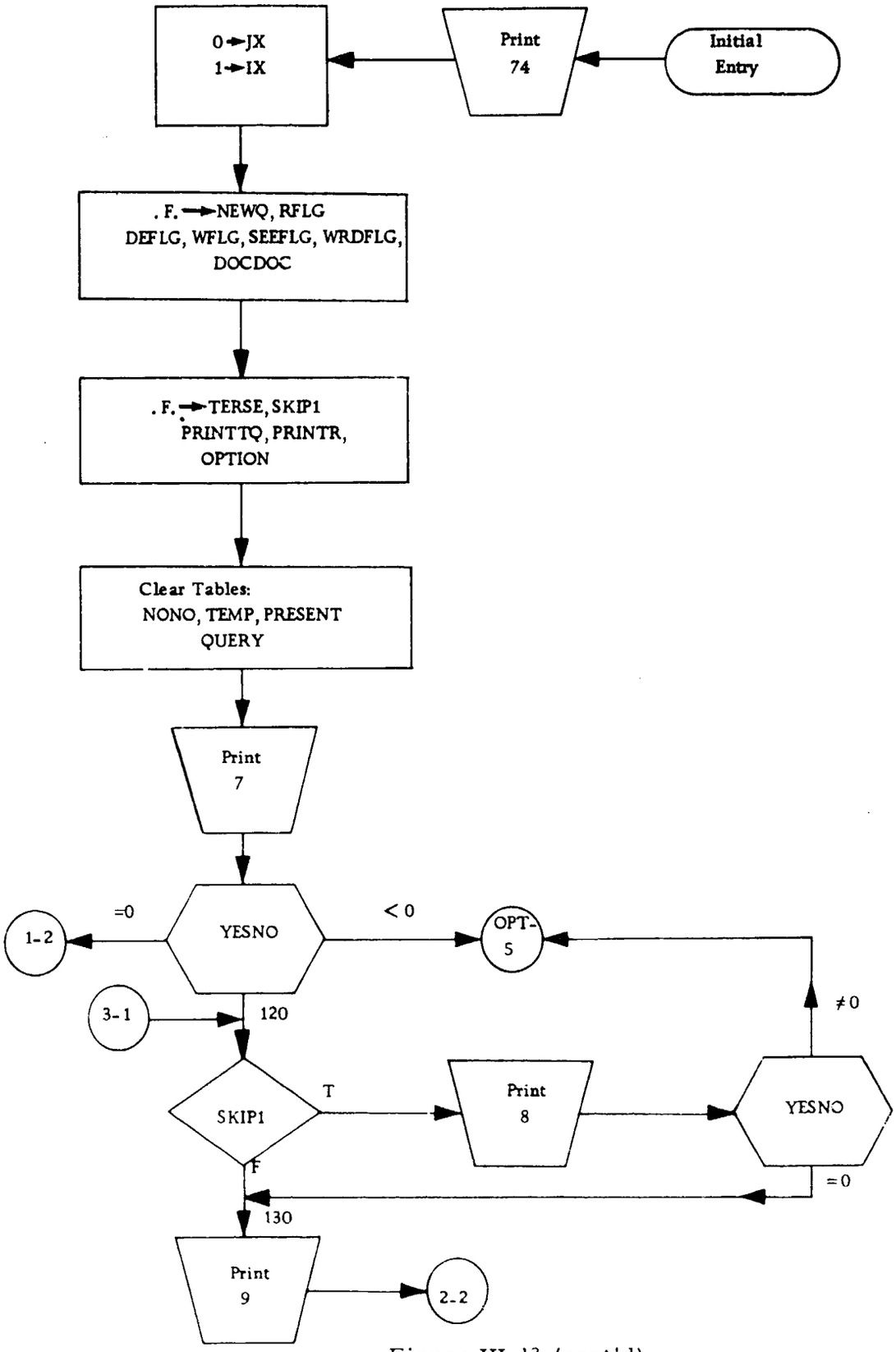


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

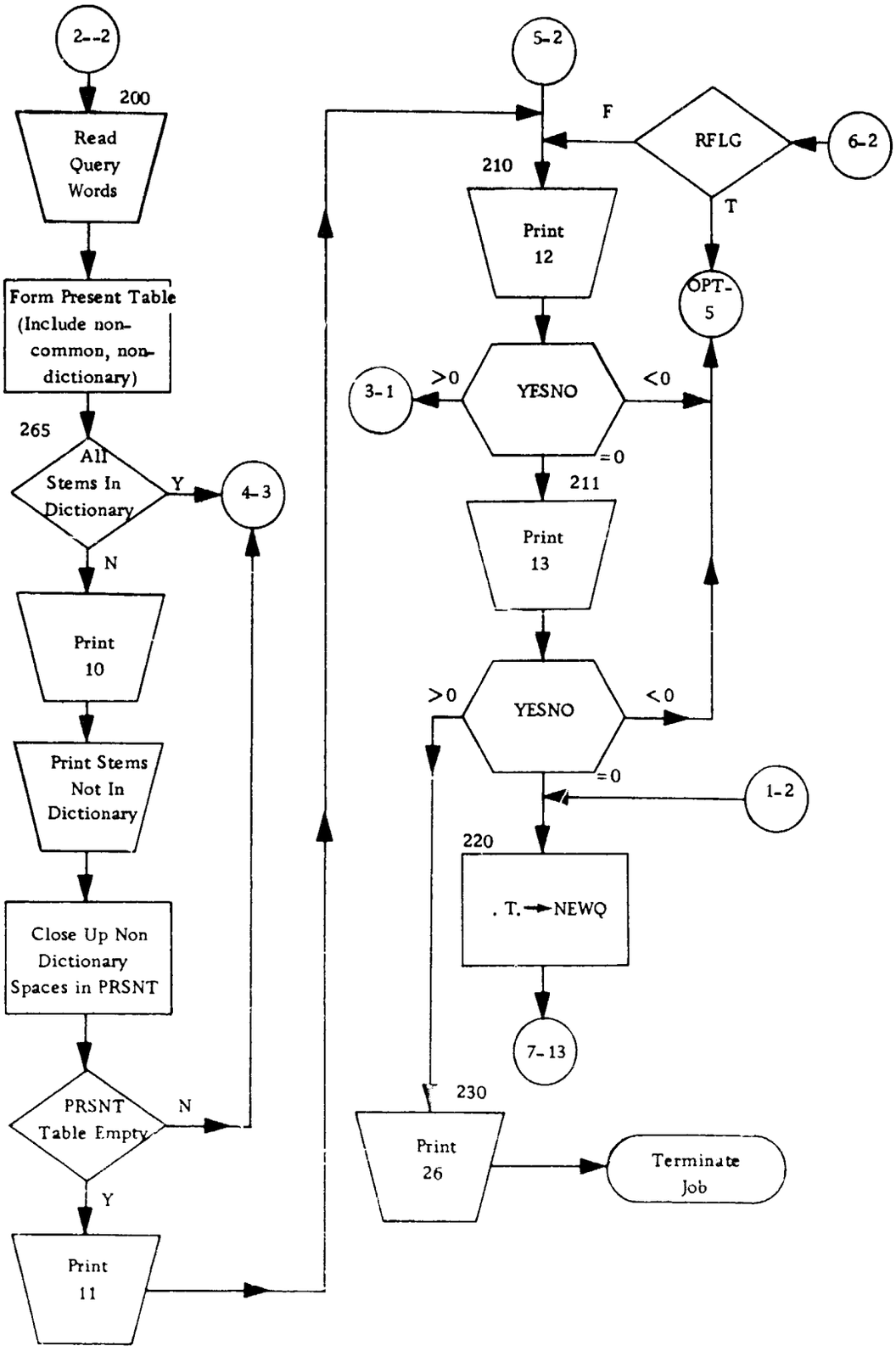


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

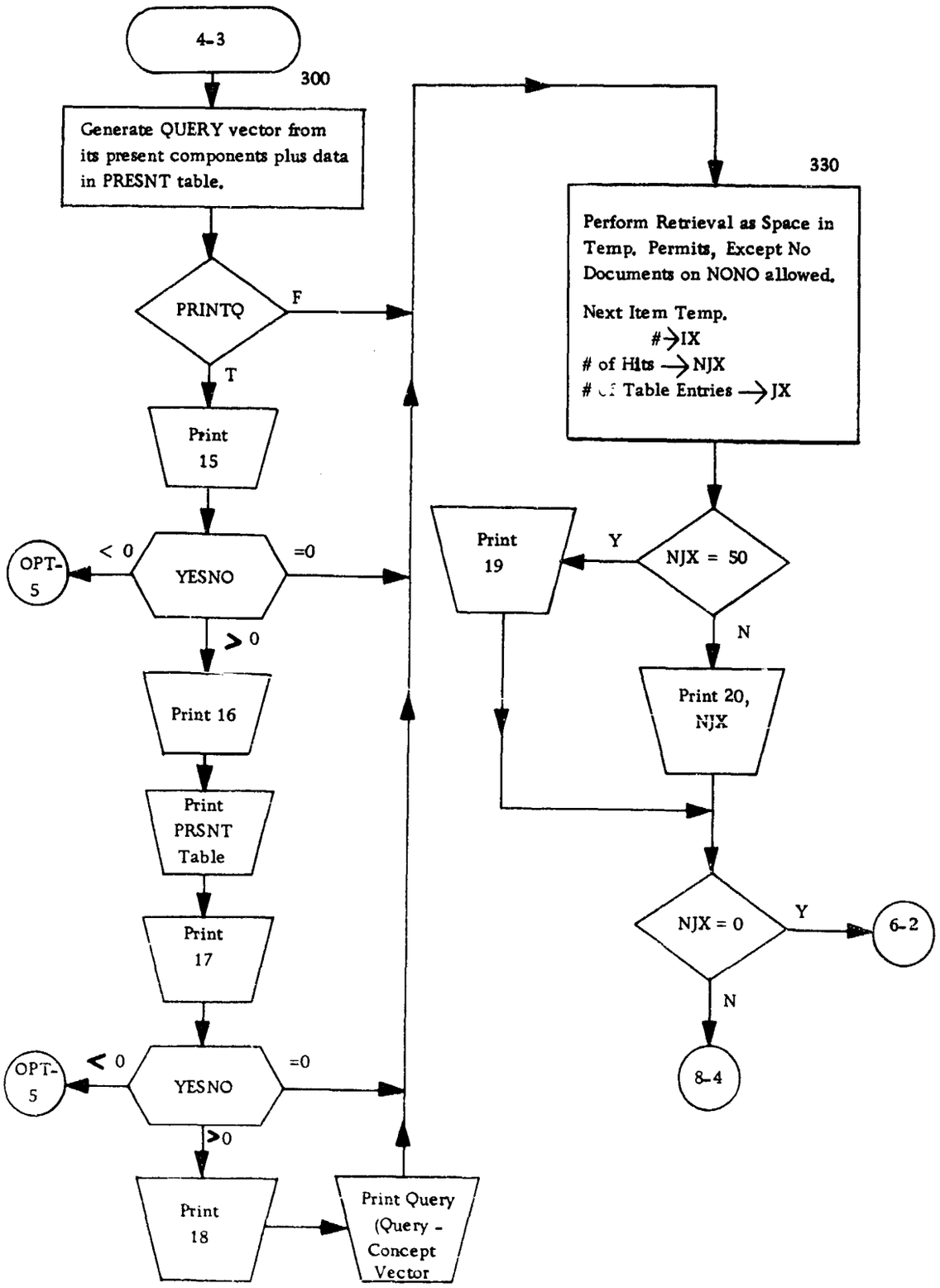


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

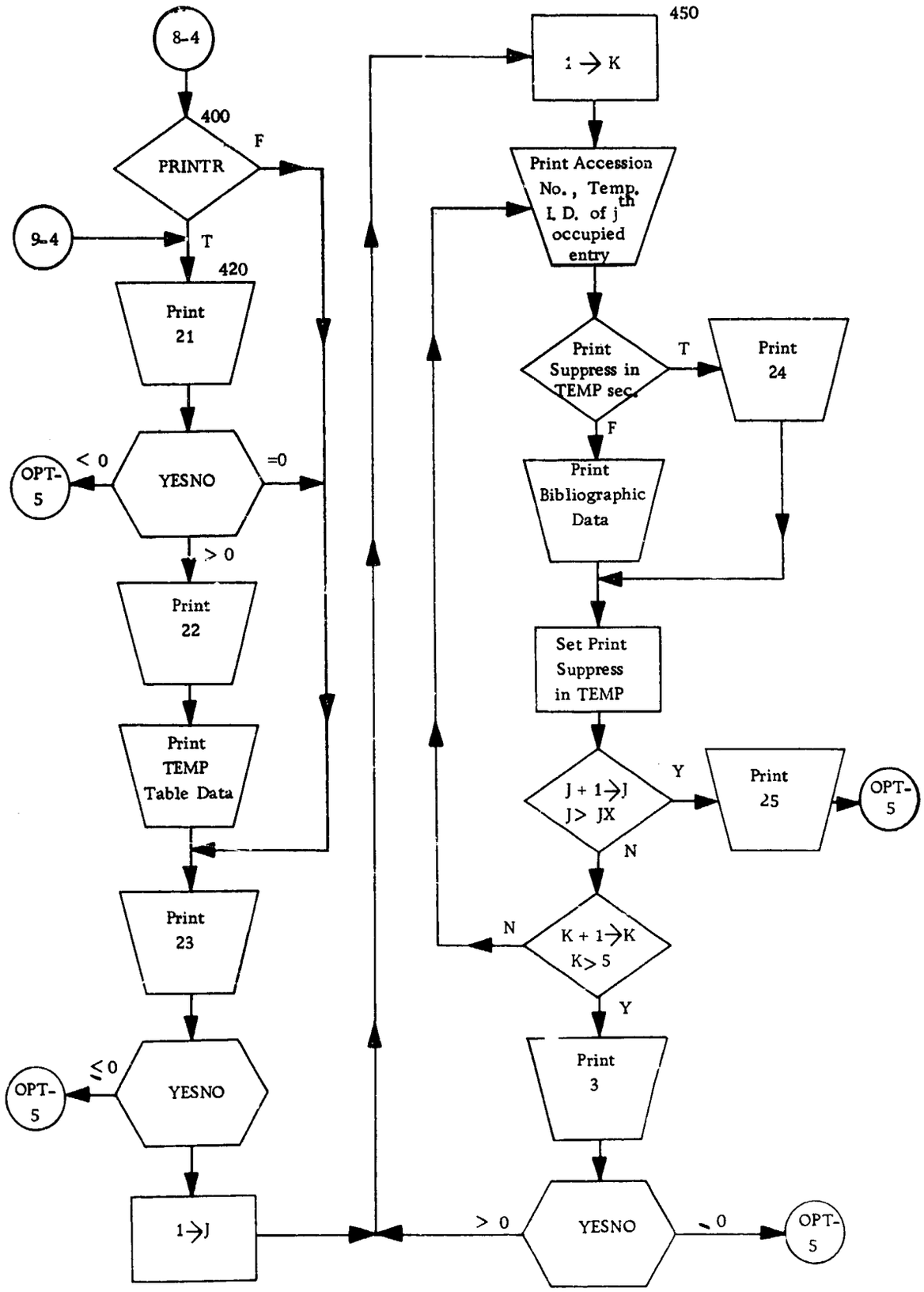


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

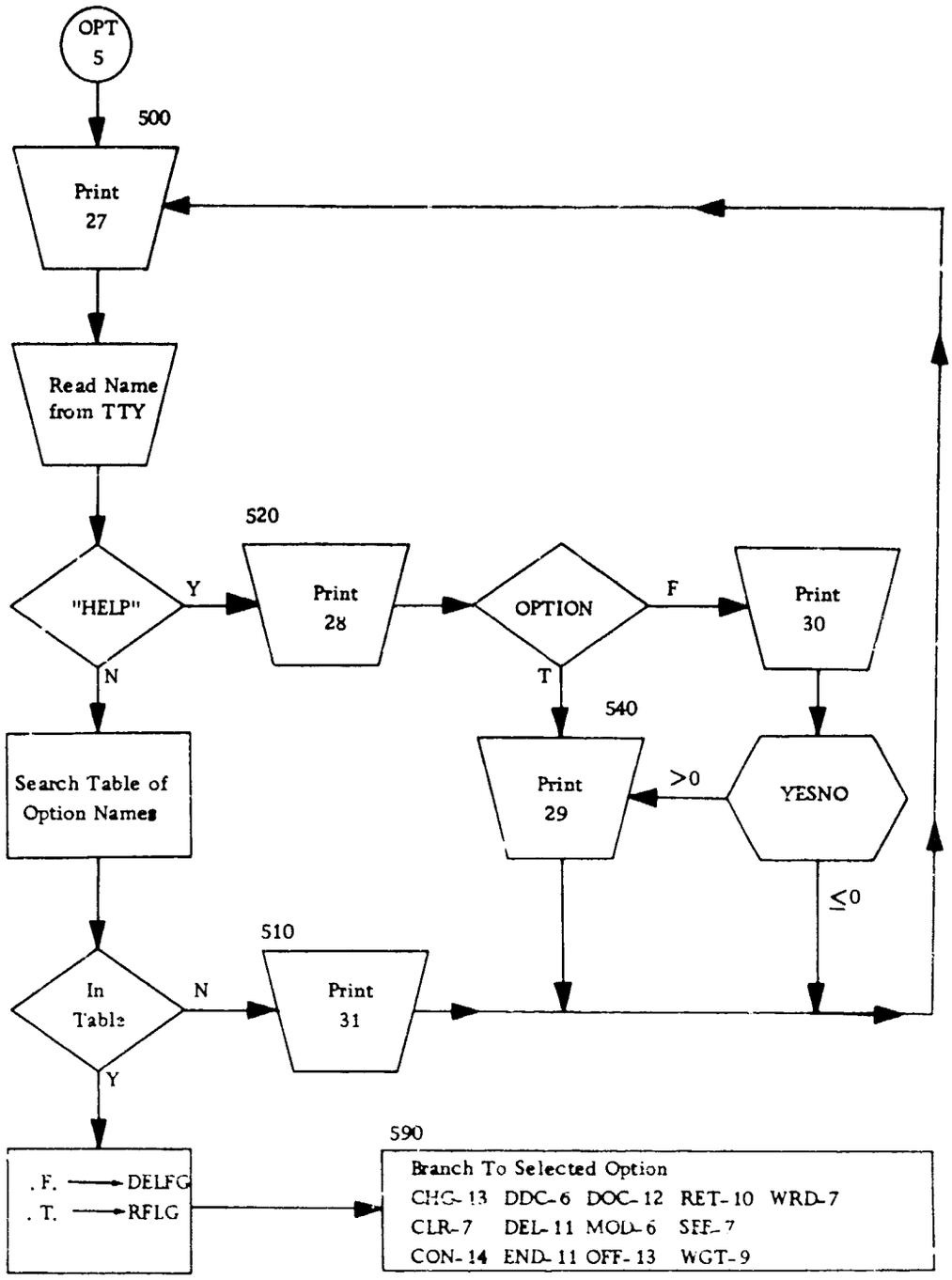


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

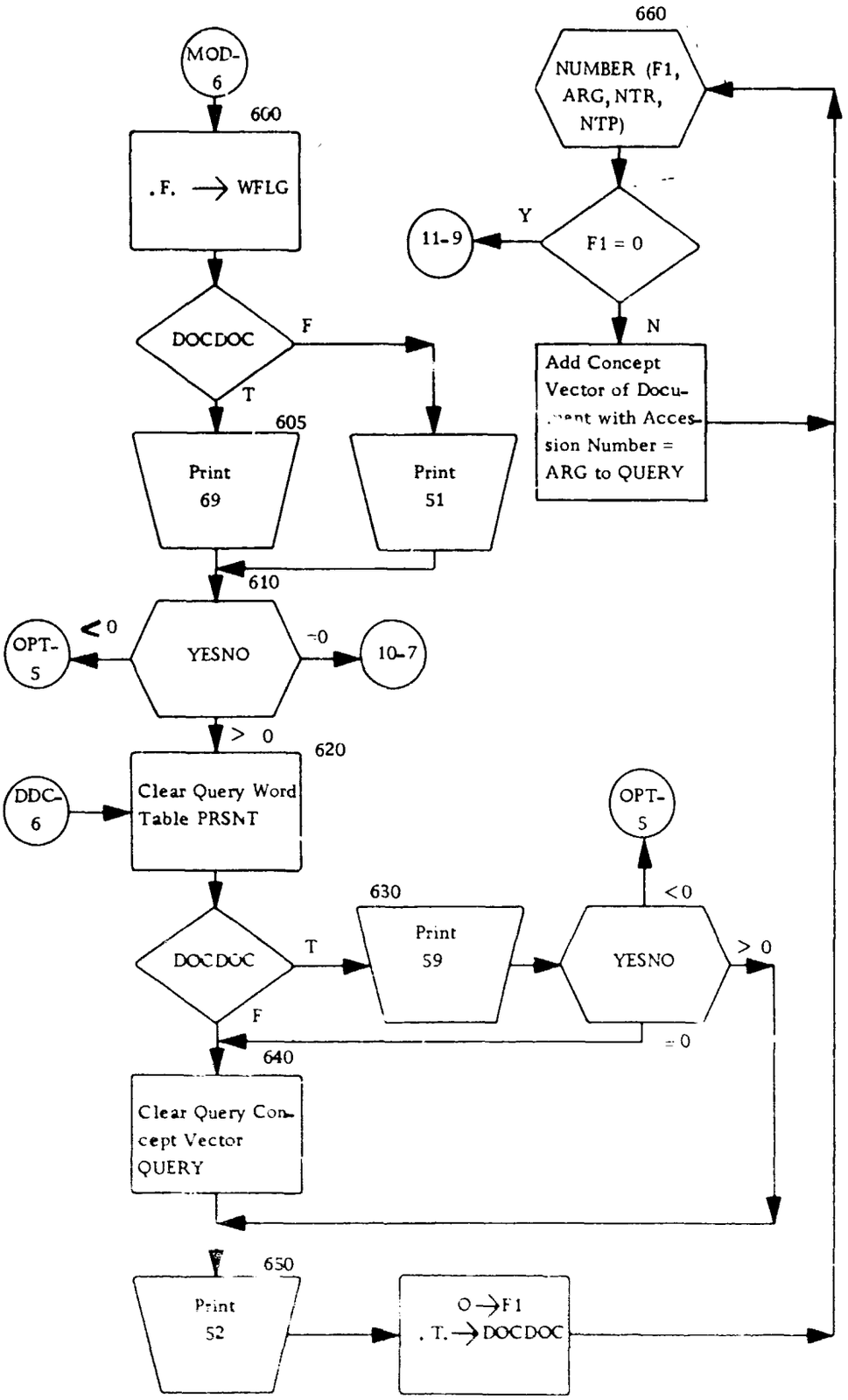


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

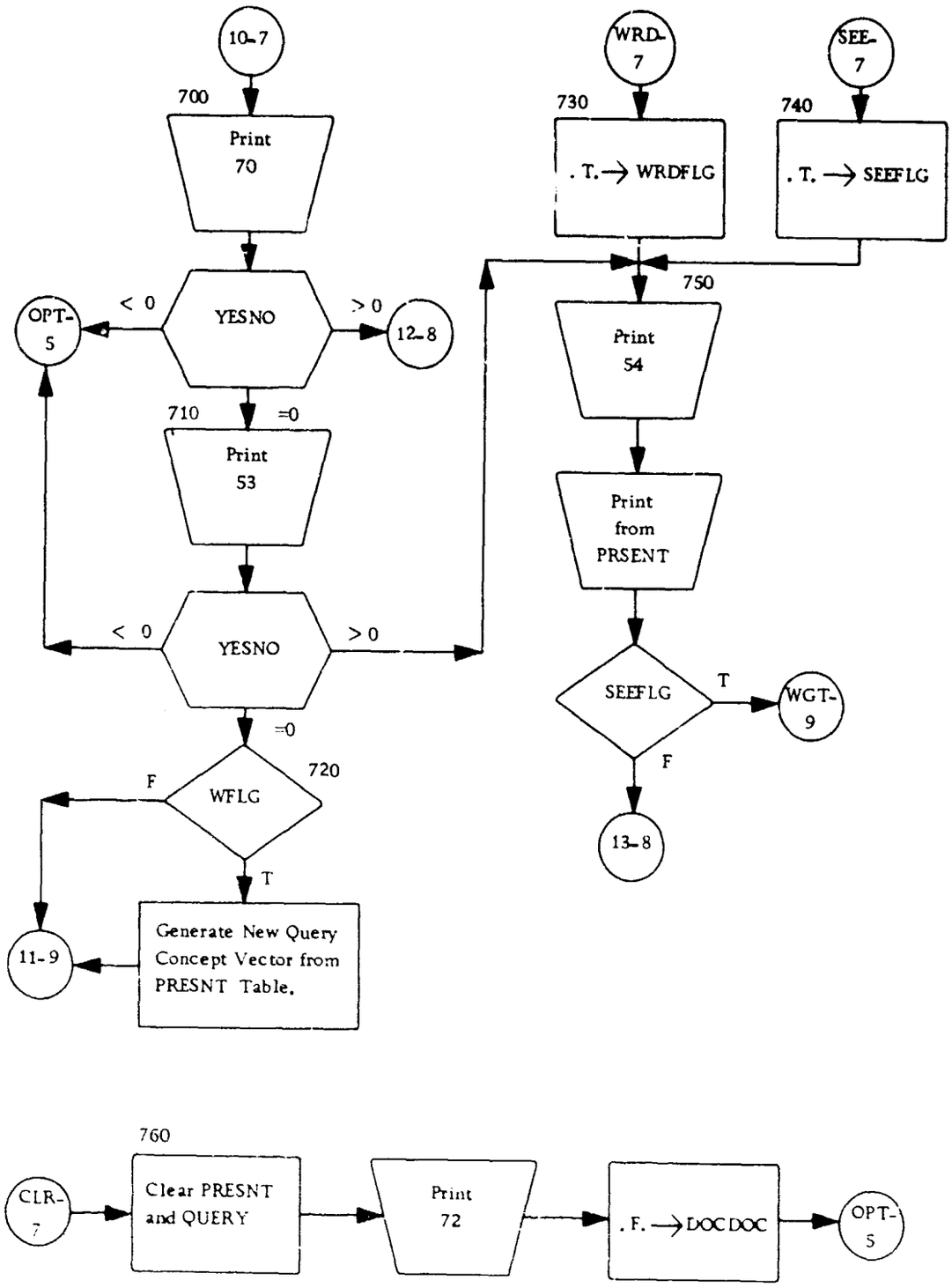


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

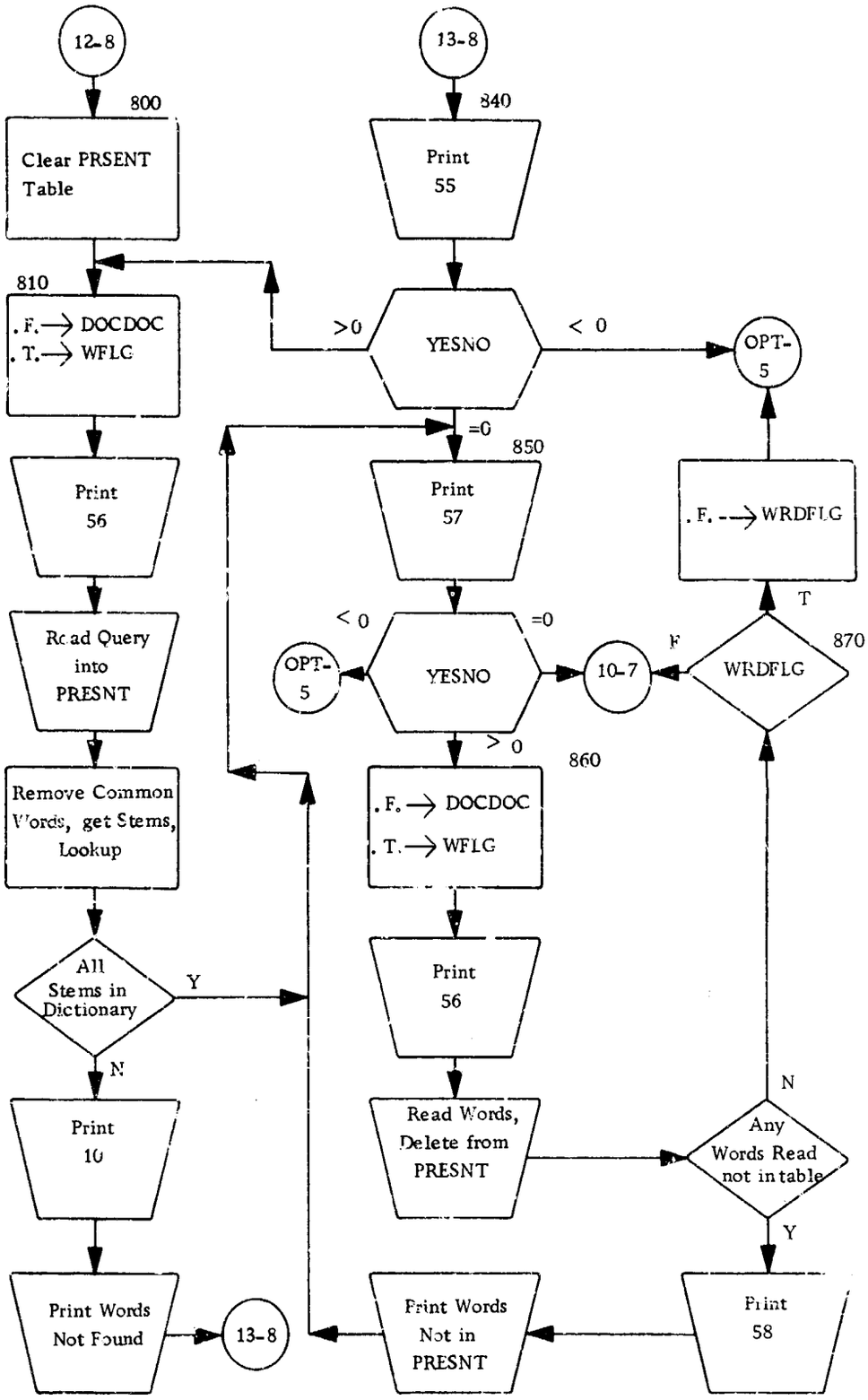


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

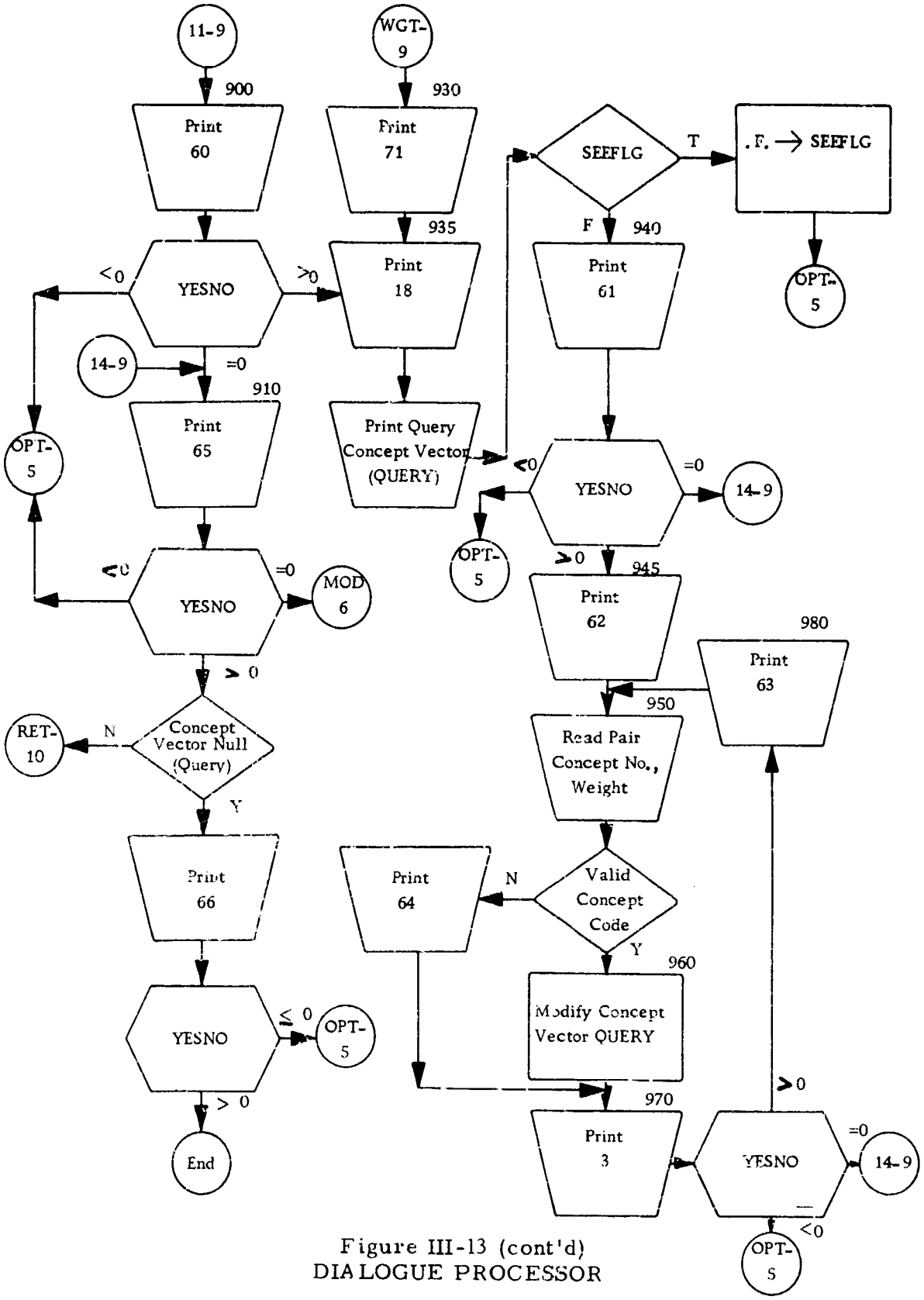


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

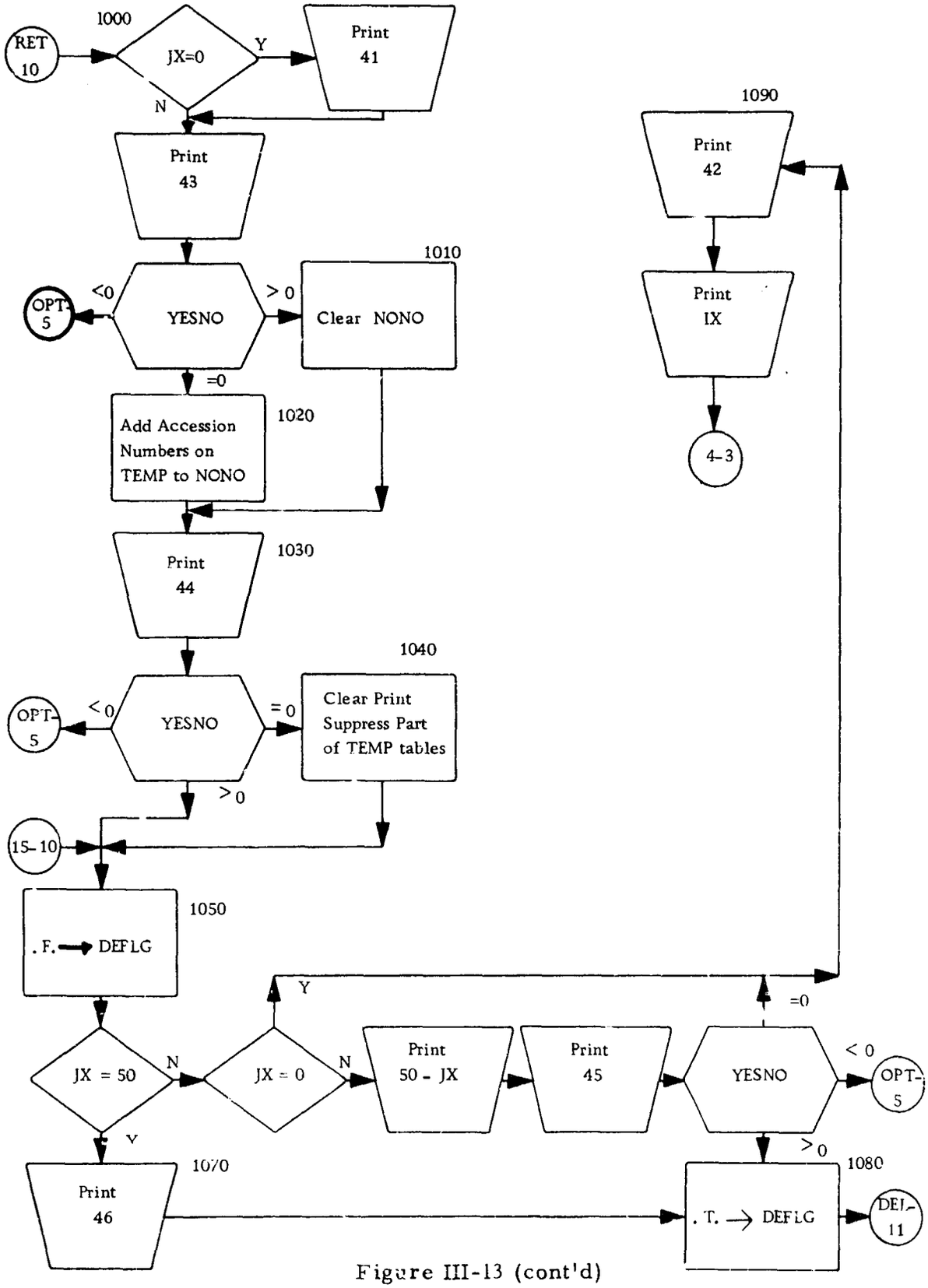


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

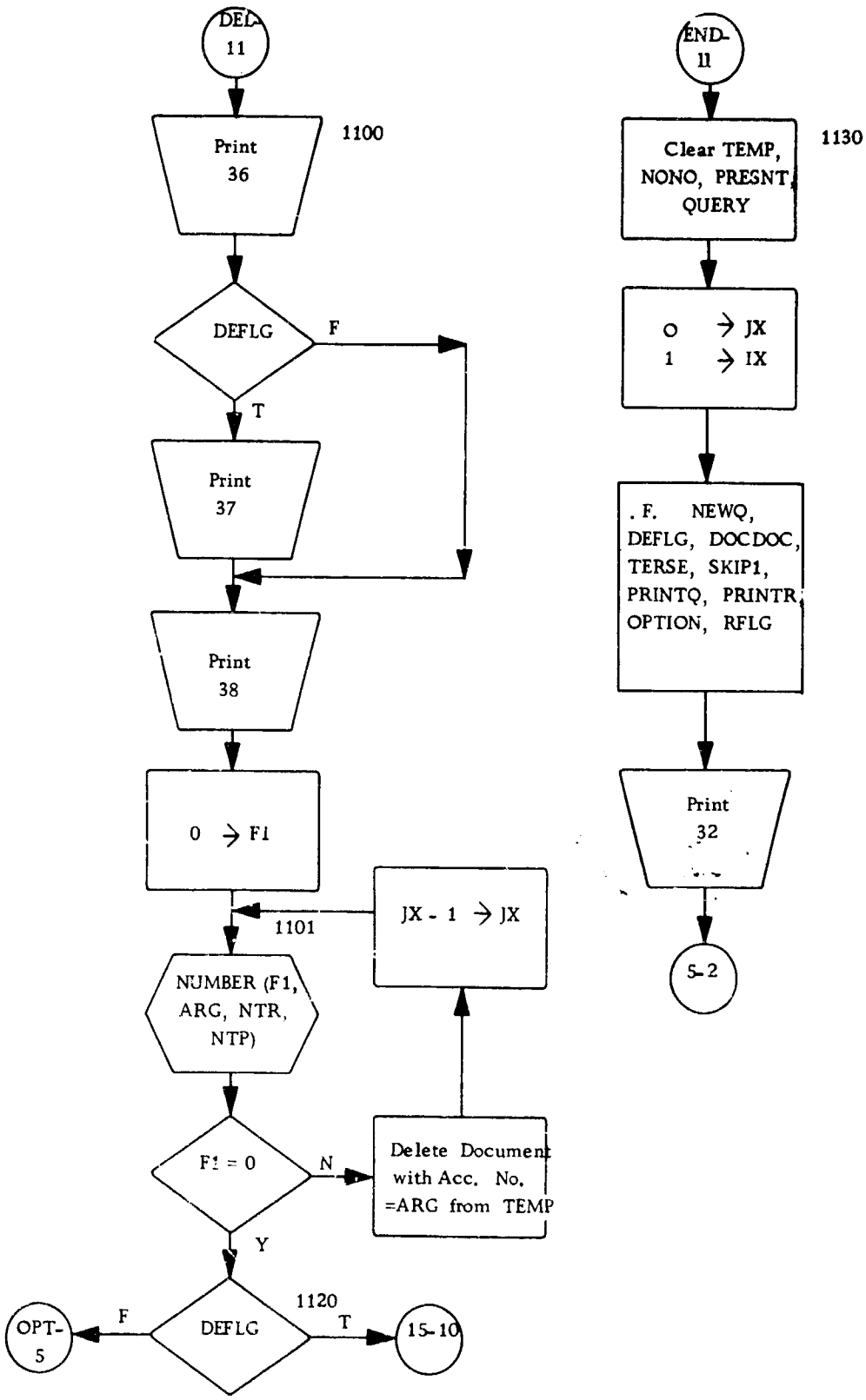


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

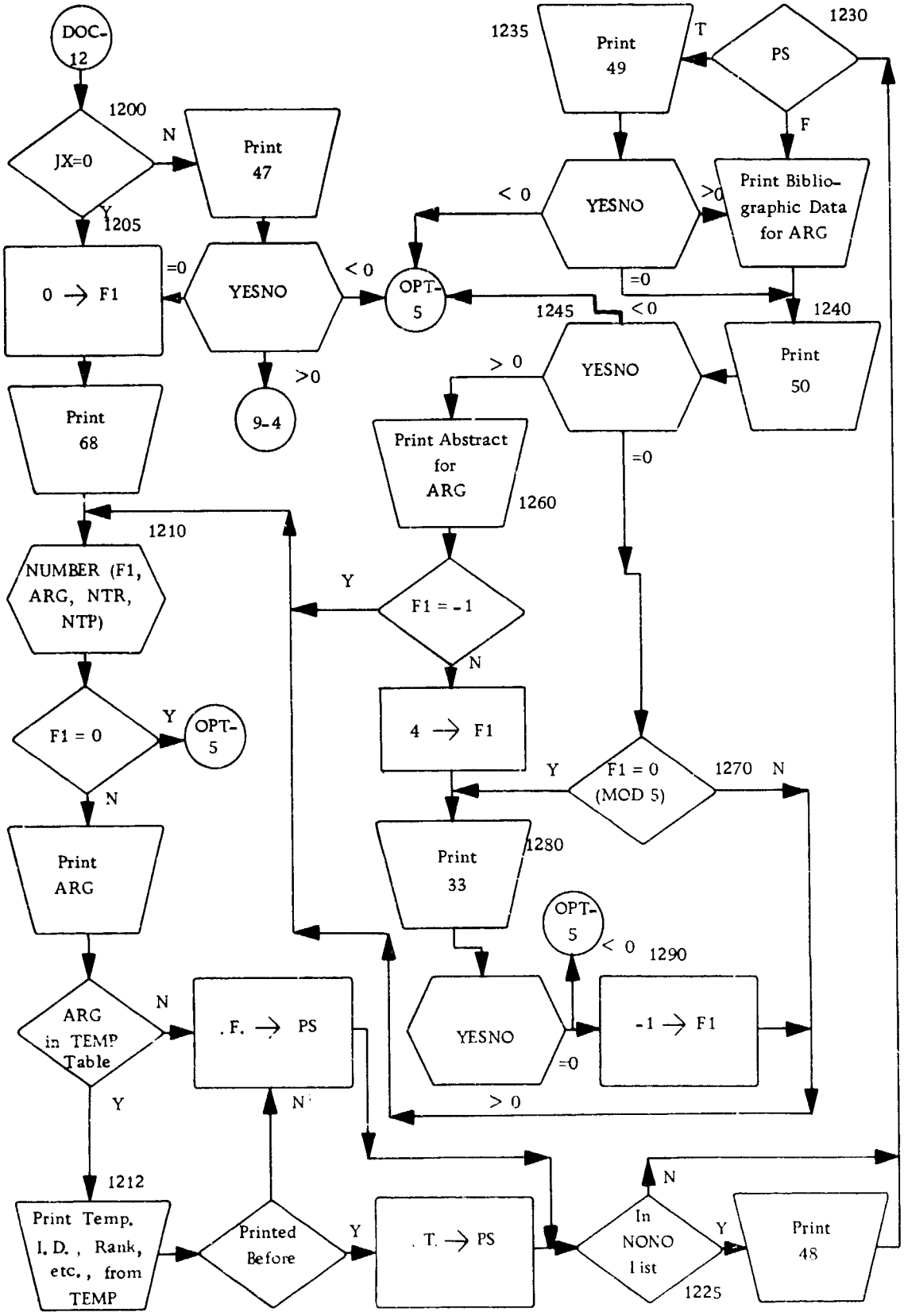


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

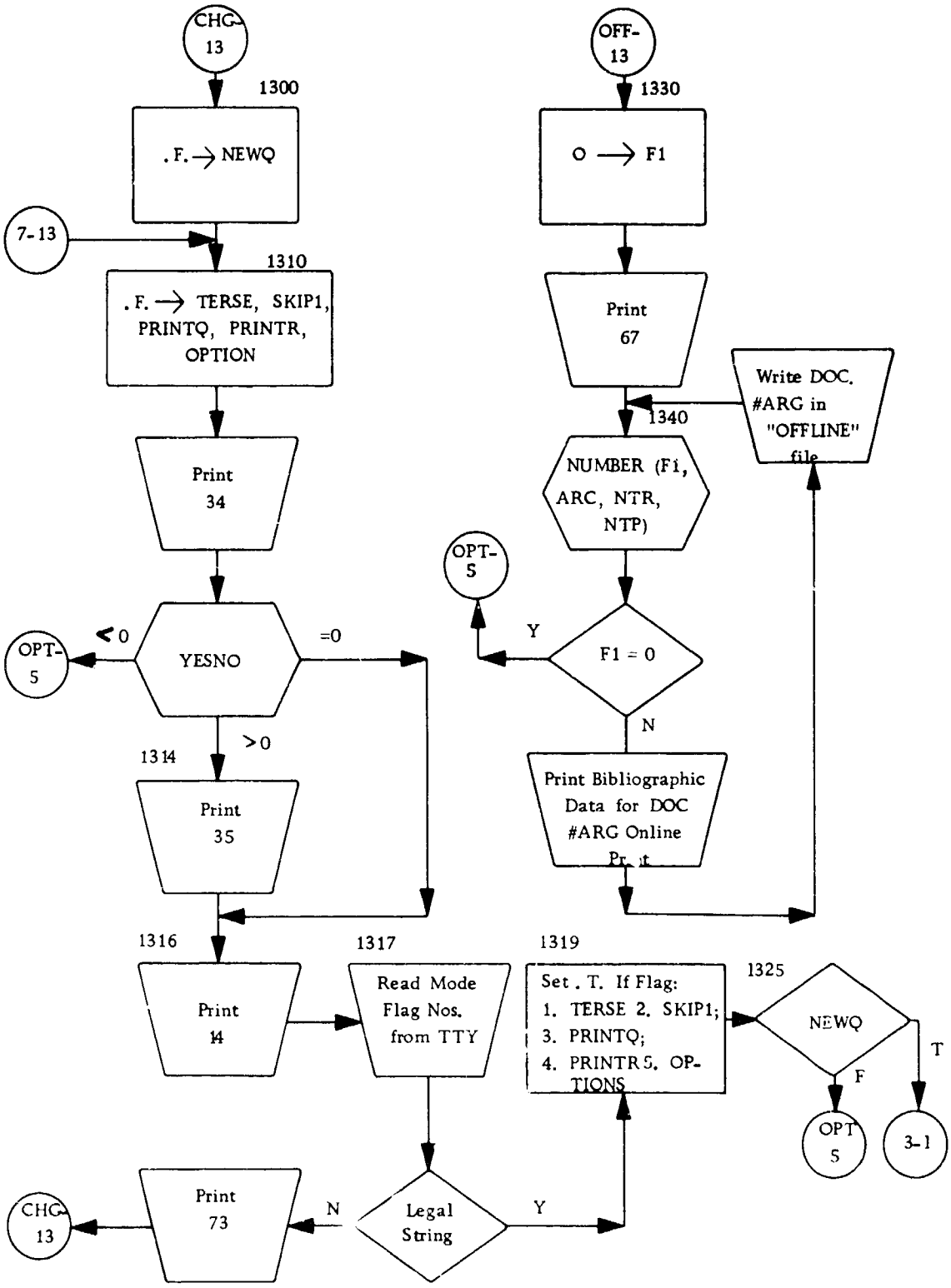


Figure III-13 (cont'd)
DIALOGUE PROCESSOR

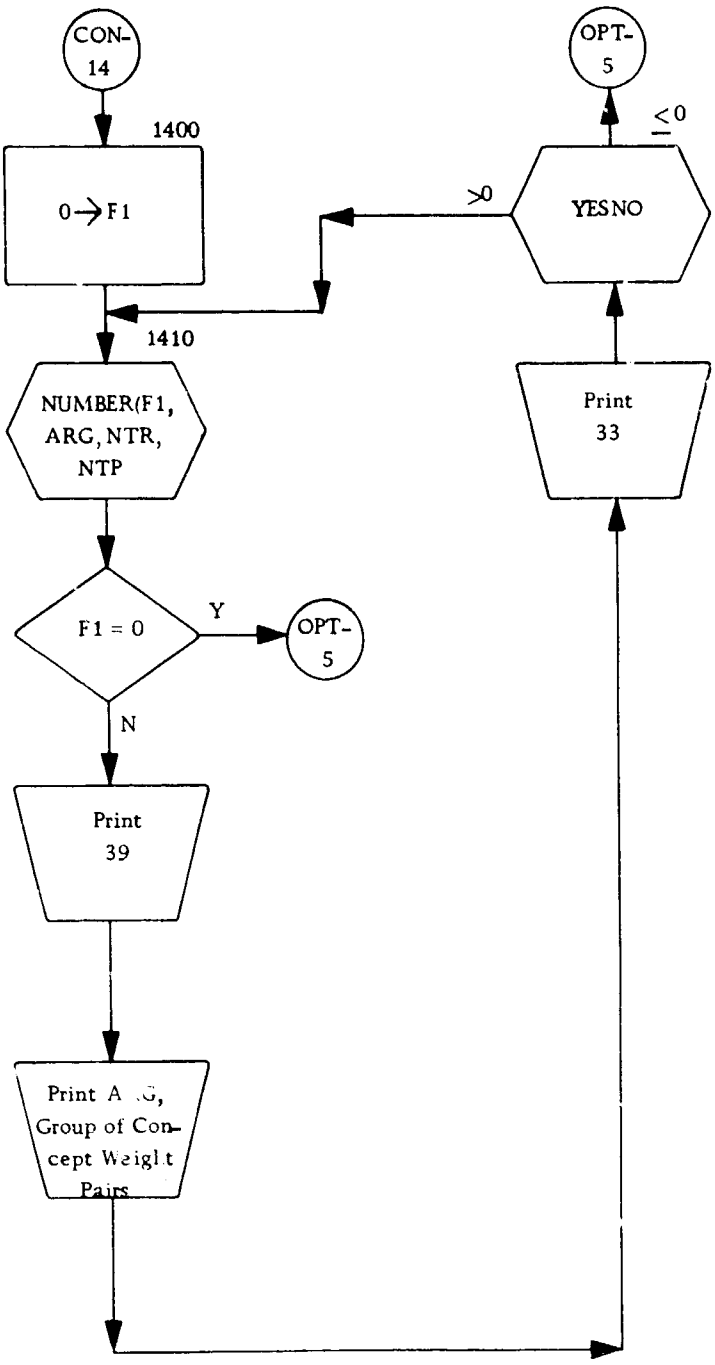


Figure III-13 (concluded)
DIALOGUE PROCESSOR

SECTION IV

SUBROUTINES CALLED BY THE DIALOGUE PROCESSOR

This section briefly describes, and flowcharts, each subprogram called by the dialogue processor.

Figure IV-1 is a directory of all programs and subprograms that comprise the dialogue processor and the file-constructing programs. This directory tabulates the location within this report of the description and listing of each routine. Flowcharts are all co-located with descriptions.

IV.1 FUNCTION DOCK

IV.1.1 Purpose

To fetch authors' names, titles and abstracts from the test data file DATA1 selectively.

IV.1.2 Action

Upon a call to the logical function DOCK (CODE, I, ARRAY, COUNT), the following are input parameters:

CODE, an integer that is 1, 2 or 3 according as titles, authors or abstracts are desired.

I, an integer that specifies the accession number of the desired document.

Output parameters are:

ARRAY, eighteen words of ASCII information representing one line of the returned alphanumeric information.

COUNT, the number of words in ARRAY preceding the point (if any) where all remaining words are filled with blanks. This is used to avoid printing blanks that fill out lines.

	Calls	Called By	Described on page#	Listing on page#
PROGRAMS				
CONGRA	PLUCK, STEM		III-64	VI-41
DIALOGUE	All subroutines, directly or indirectly.		III-1	VI-22
DICGEN	PLUCK, STEM		III-55	VI-43
SUBPROGRAMS				
DOCK	None	DIALOGUE	IV-1	VI-2
LENGTH	None	STEM, NUMBER	IV-3	VI-4
LOOKUP	None	DIALOGUE	IV-6	VI-7
NUMBER	LENGTH, OUT PLUCK, PUT, YESNO, ZORCH	DIALOGUE	IV-11	VI-10
OUT	None	DIALOGUE, NUMBER, YESNO	IV-19	VI-13
PLUCK	PUT	NUMBER, STEM, CONGRA, DICGEN, DIALOGUE	IV-19	VI-14
PUT	None	PLUCK, NUMBER, STEM, CONGRA, DICGEN	IV-23	VI-16
STEM	LENGTH, PLUCK, PUT	DIALOGUE, CONGRA, DICGEN	IV-23	VI-17
WHERE	None	DIALOGUE	IV-28	VI-20
YESNO	OUT	DIALOGUE, NUMBER	IV-34	VI-21
ZORCH	None	NUMBER	IV-11	VI-10

Figure IV-1
Directory of Programs and Subprograms

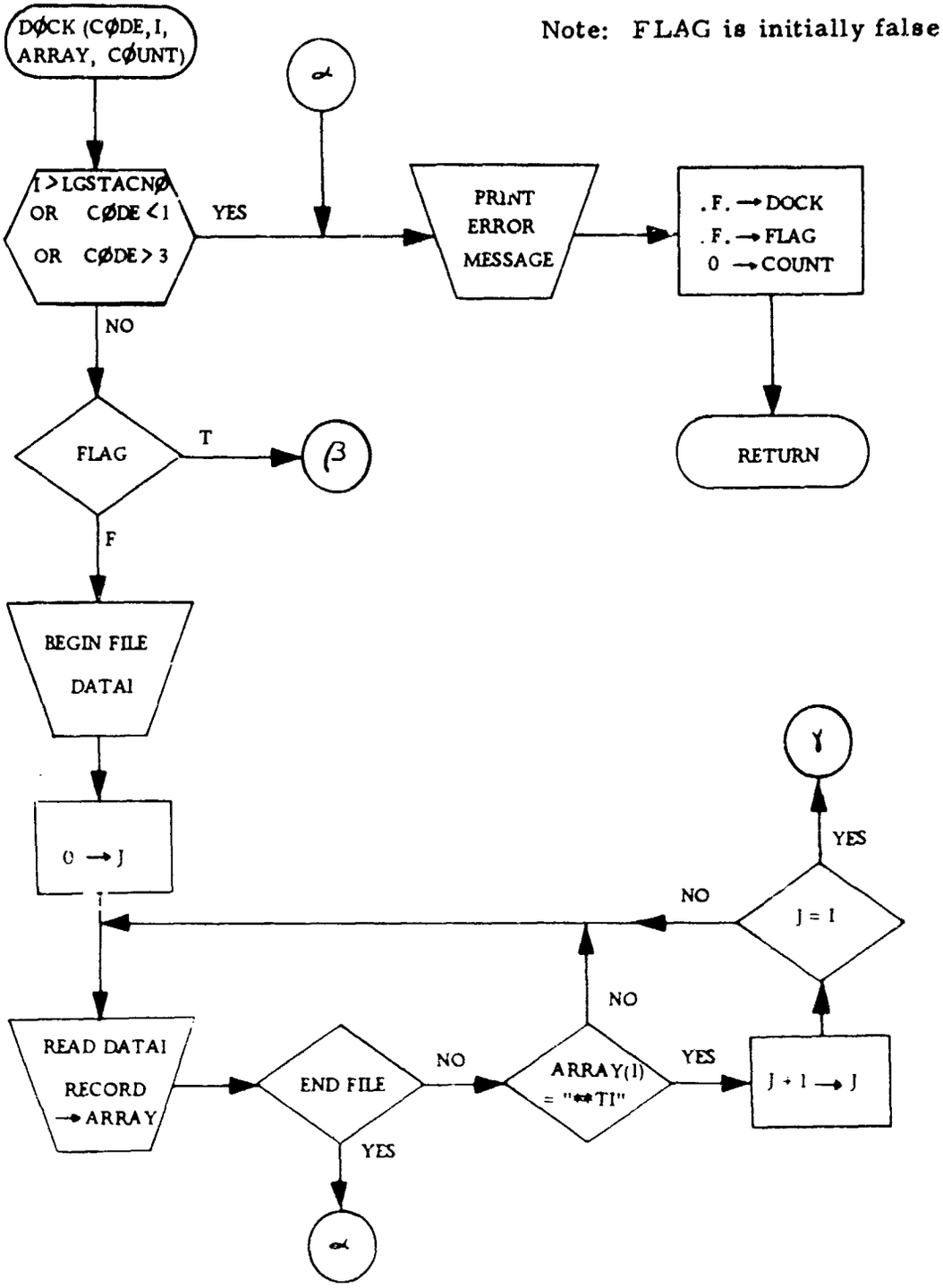


Figure IV-2 (cont'd)

Function DOCK

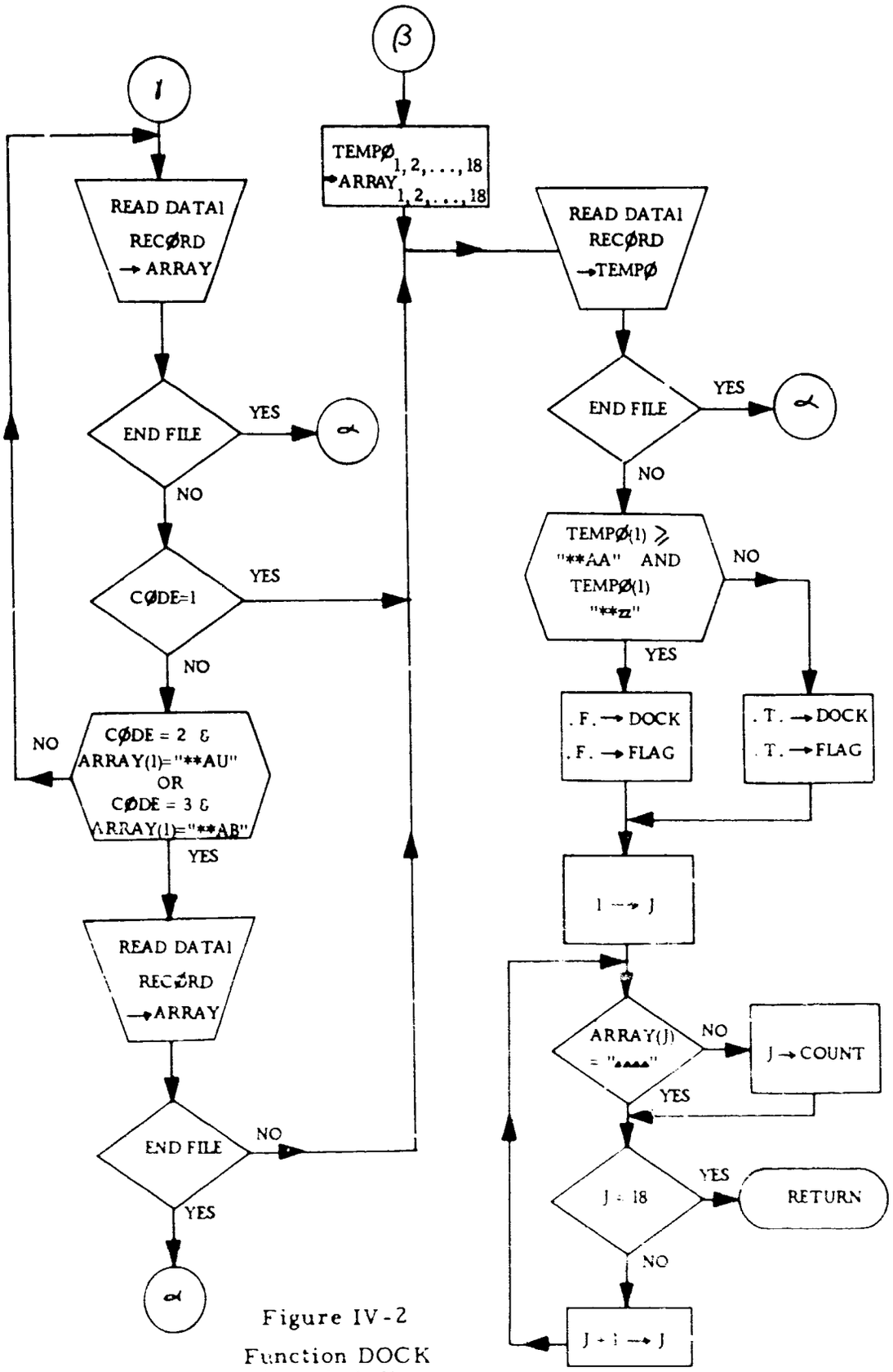


Figure IV-2

Function DOCK
(concluded)

DOCK, the logical value of the function. It is true if more lines of the requested data exist; subsequent calls to DOCK with the same input parameters will return additional lines of the data in ARRAY until the last line is delivered. When the last line has been transmitted, the value of DOCK will be false.

If CODE is different from 1, 2 or 3 or I is greater than the largest accession number, the routine will print an error message and return with DOCK false and COUNT=0. Recall that accession numbers entered by remote users pass through NUMBER, and that subprogram has the task of gracefully informing the user when he specifies an illegal accession number.

IV.1.3 Method

Data are read sequentially, with the first four characters of each line being scanned in order to determine the beginning of documents and fields within documents. Before a line is transmitted, the following line is checked to see if the transmitted line is the last of a sequence. If so, DOCK is made false. If more lines follow, the second line is saved for transmission on the next call.

IV.2 FUNCTION LENGTH

IV.2.1 Purpose

Function LENGTH splits strings and counts their length

IV.2.2 Action

In a call to LENGTH (INPUT, RIGHT, LEFT, CUT), INPUT and CUT are the input parameters. All variables in the calling program are typed alphanumeric except for CUT and the value of the function, which are integers. The alphanumeric variables are stored in arrays of five words, left justified with remaining spaces filled out by blanks.

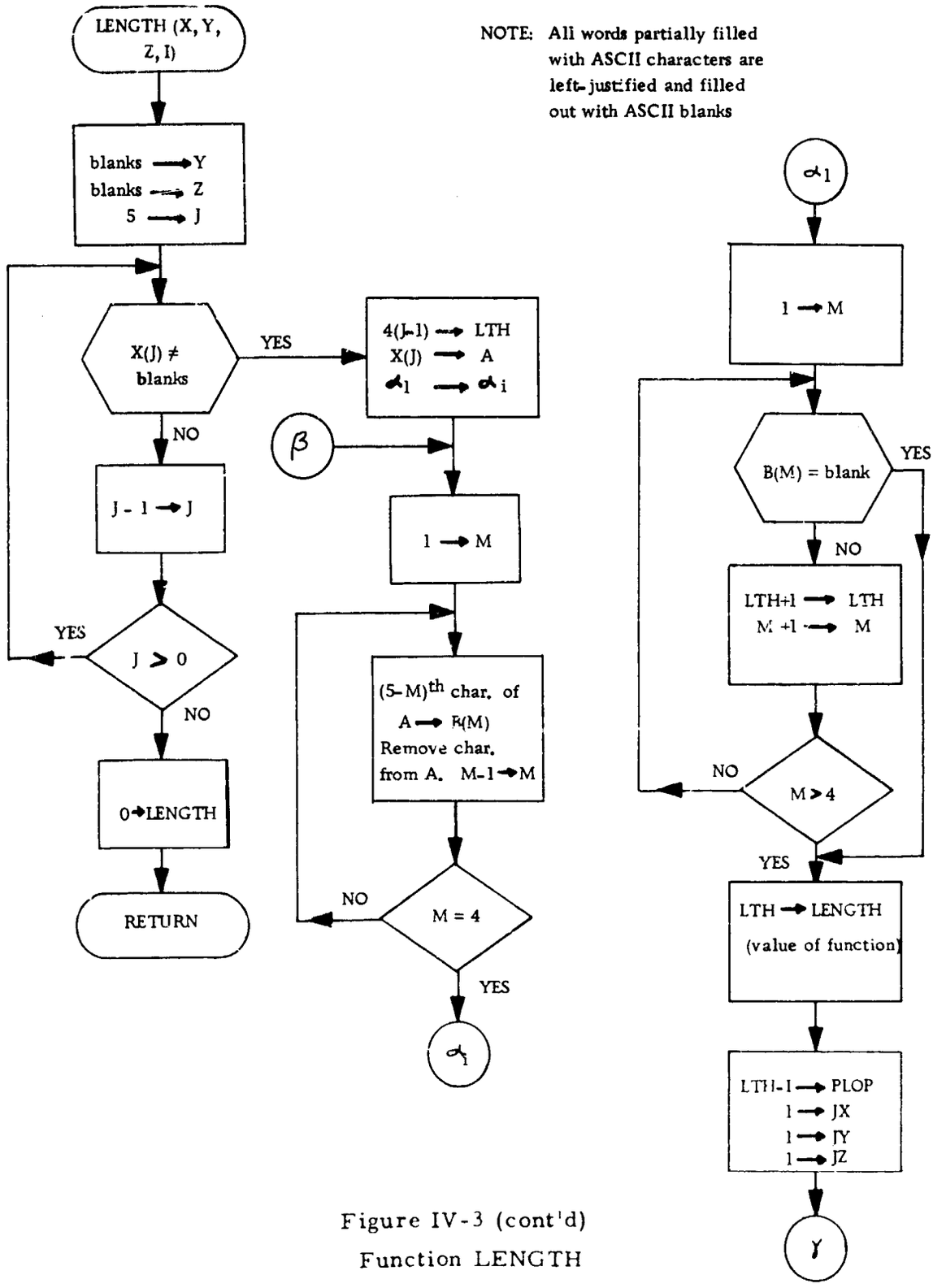


Figure IV-3 (cont'd)
Function LENGTH

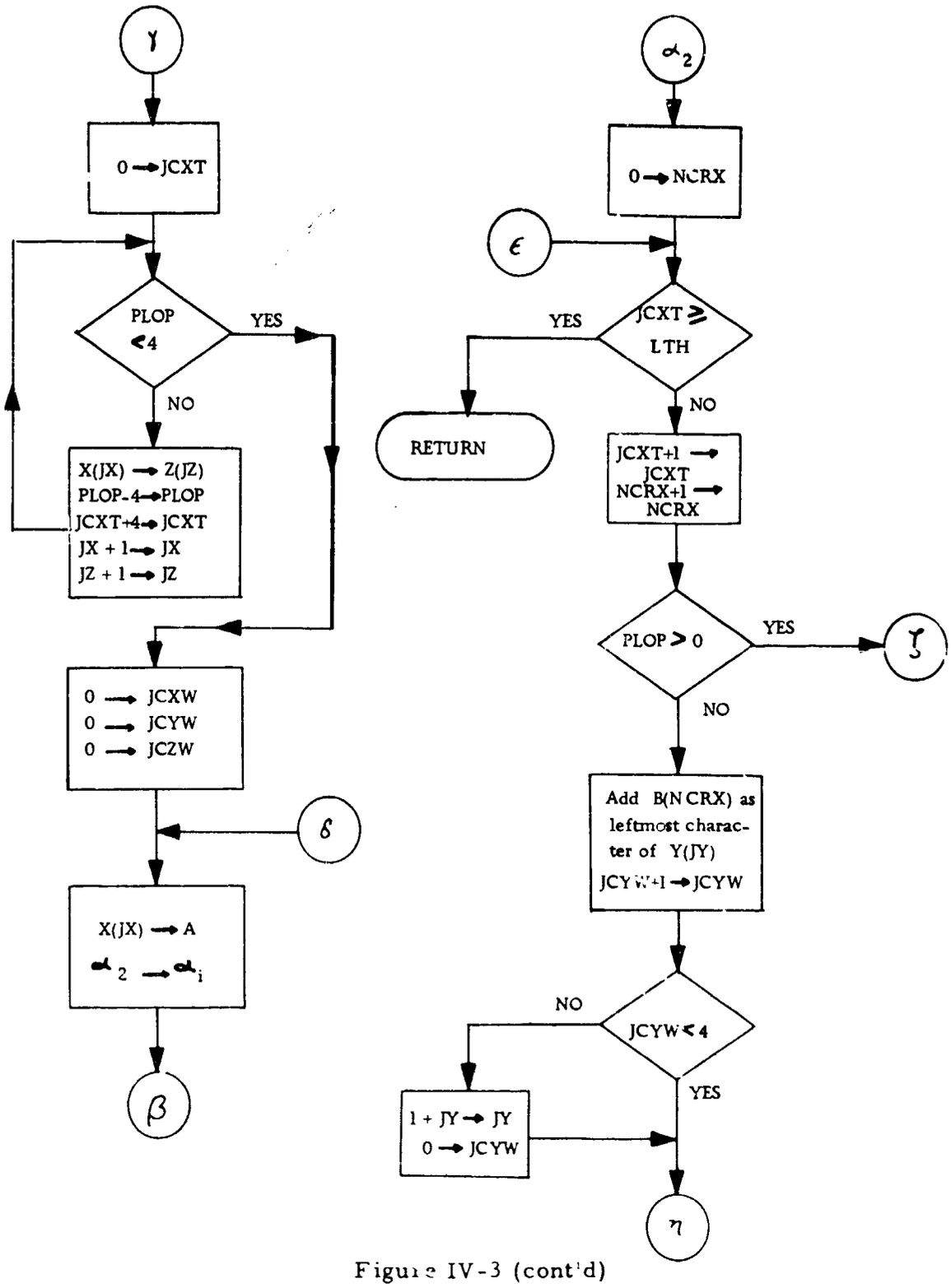


Figure IV-3 (cont'd)

Function LENGTH

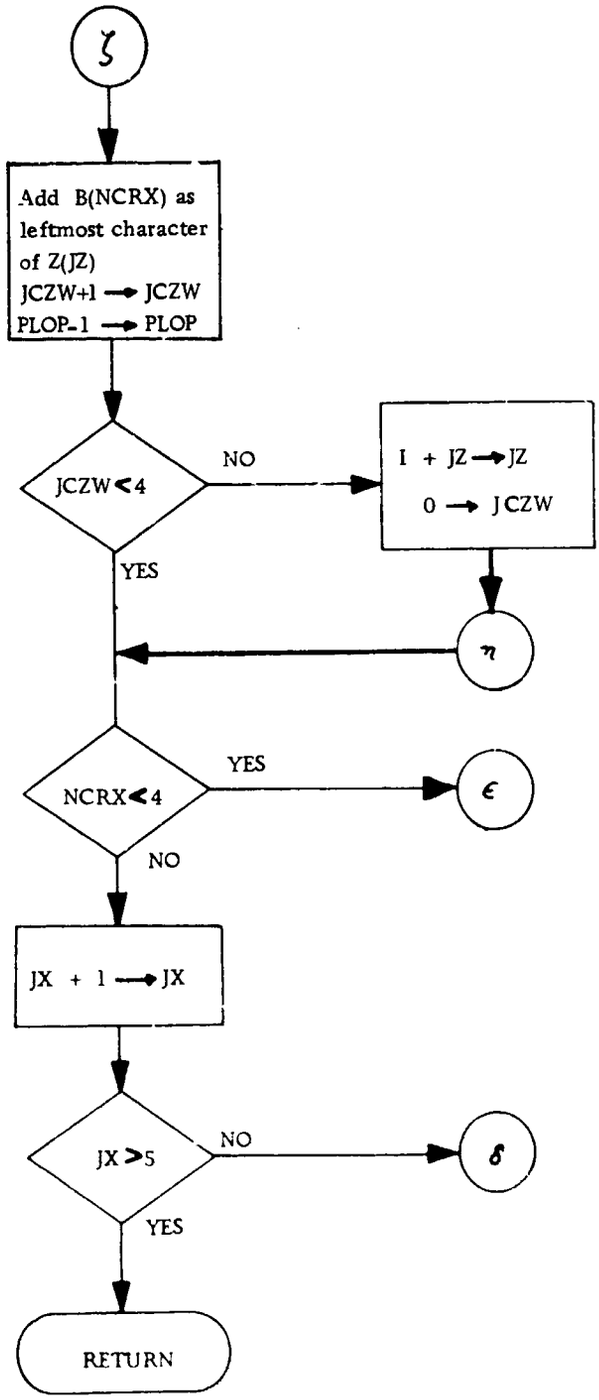


Figure IV-3 (concluded)

Function LENGTH

LENGTH takes the input string and counts the number of characters in it, up to the first blank encountered or the end of a totally filled input array. The count is returned as the value of the function; suppose this is called L. The characters may be numbered 1, 2, . . . , L, with the first character in the input being number one. Upon return, characters 1, 2, . . . , L-CUT are returned in LEFT and characters CUT, CUT+1, . . . , L are in RIGHT. If CUT is greater than or equal to L, the entire string is returned in RIGHT; if CUT=0 the entire string goes to LEFT. Negative values of CUT are not allowed. INPUT is not altered by use of the function, and a call with INPUT null (all blanks) results in a return with both LEFT and RIGHT null and the value of the function equal to zero.

IV.2.3 Method

See the flowchart of LENGTH. Note that in order to obtain efficient operation, characters are moved by the word in the formation of LEFT to as great a degree as possible.

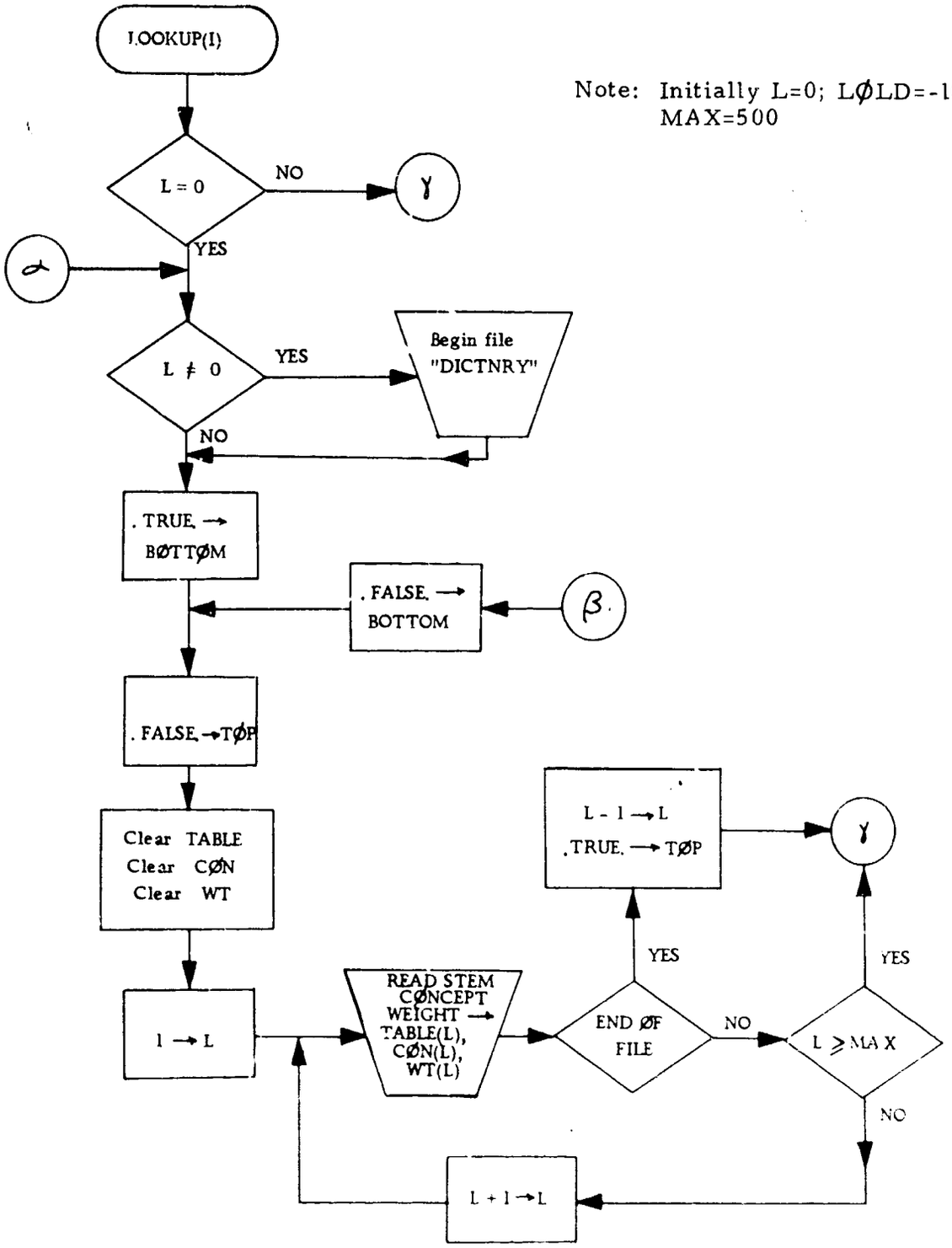
IV.3 FUNCTION LOOKUP

IV.3.1 Purpose

To search the concept dictionary file for a given stem, and to provide the concept vector for that stem if it is present in the dictionary.

IV.3.2 Action

The function LOOKUP(I) is logical in type. Its input parameters are the value of I and the stem located in the Ith position of the Present Table, PRE2(1,I), PRE2(2,I) and PRE2(3,I). The function searches the concept dictionary file DICTNRY for the stem in the specified position of the Present Table, returning a value in the function name of FALSE if the stem is not in the dictionary. If the stem is found, a value of TRUE is returned



Note: Initially L=0; LØLD=-100; MAX=500

Figure IV-4 (cont'd)

Function LOOKUP

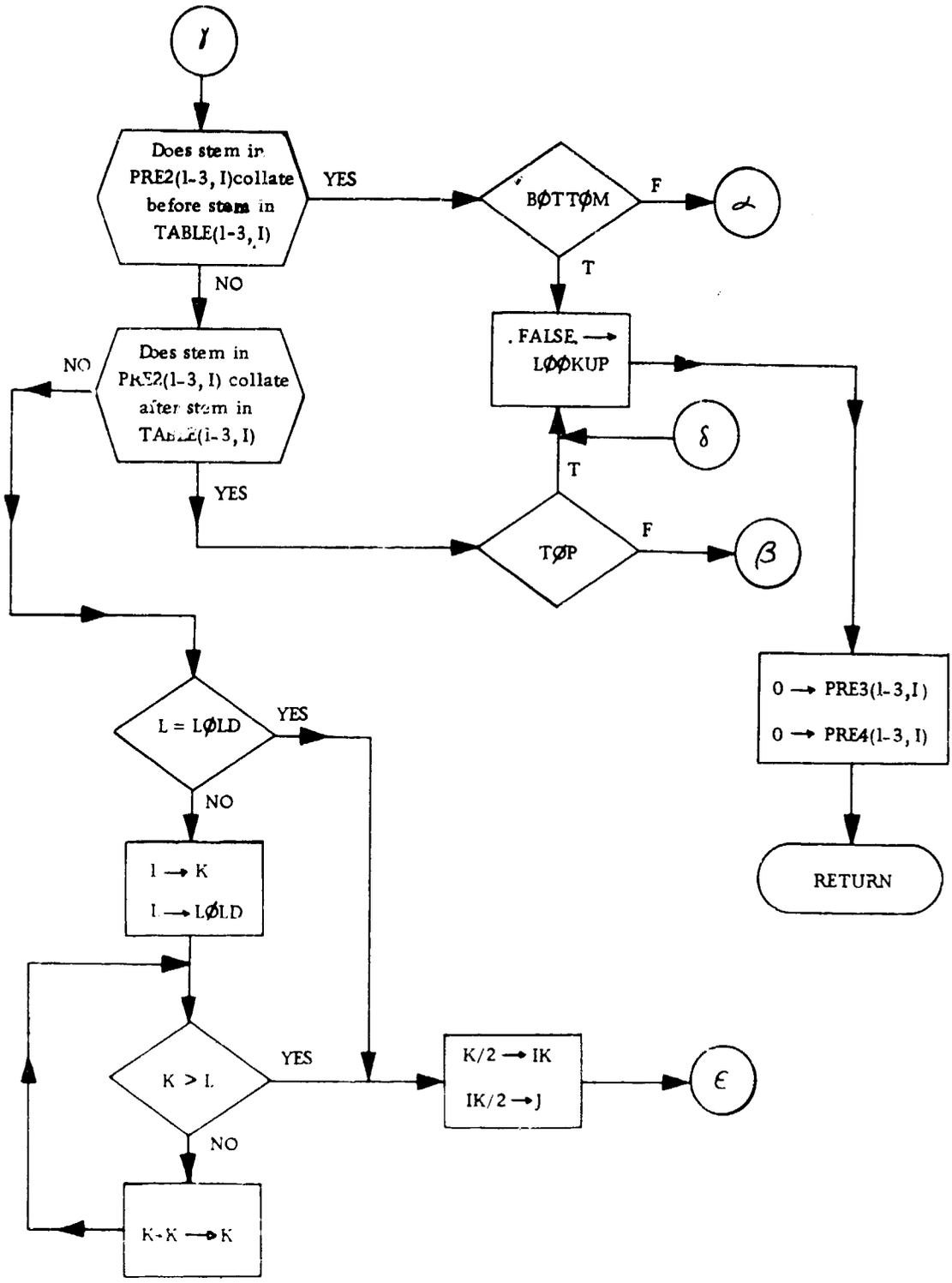


Figure IV-4 (cont'd)
Function LOOKUP

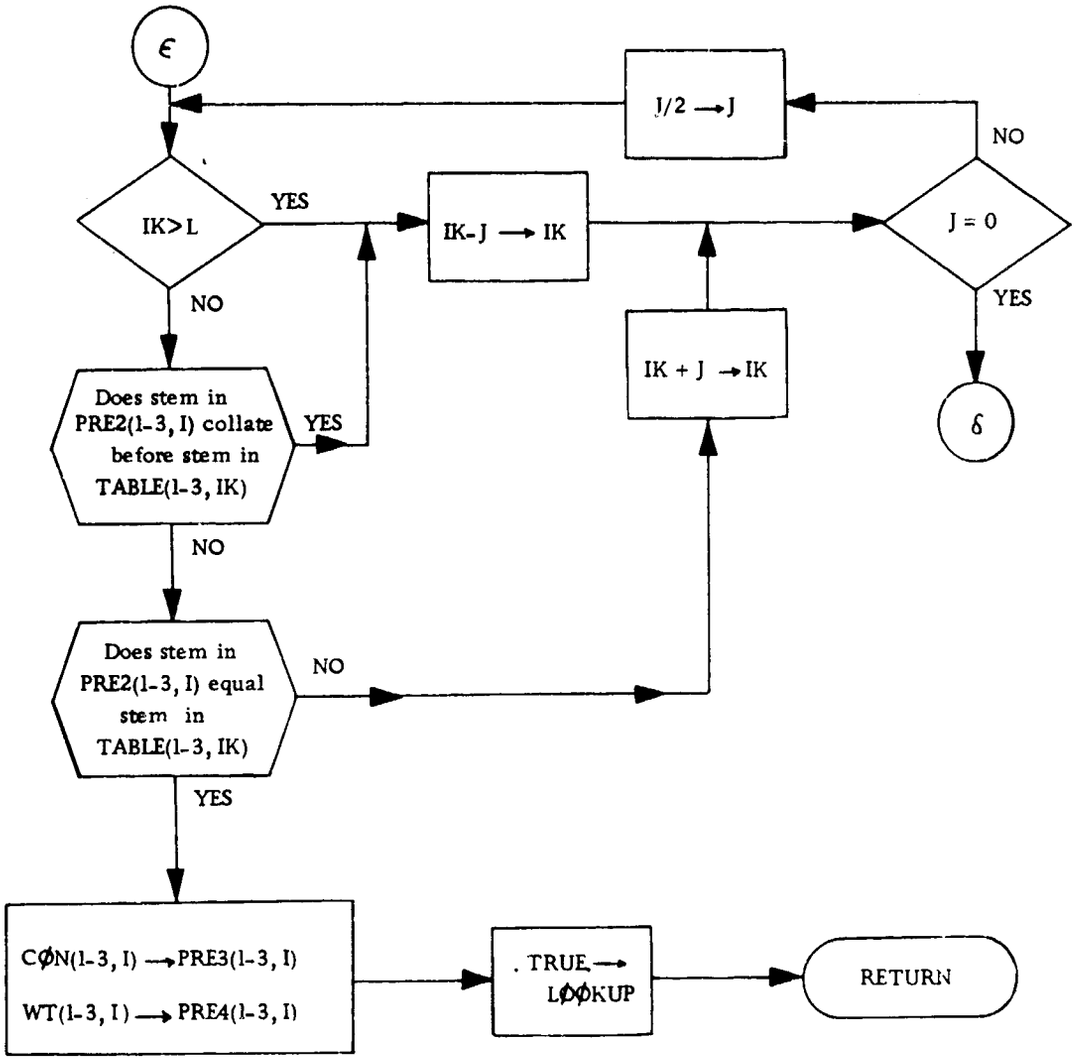


Figure IV-4 (concluded)
Function LOOKUP

in the function name and concept-weight pairs are returned in the Present Table. The concept codes are placed in PRE3(1, I) through PRE3(3, I) and the corresponding weights are placed in PRE4(1, I) through PRE4(3, I).

In the event that a stem is not found in the dictionary, values of zero are returned for both the concept codes and the concept weights in the Present Table.

IV.3.3 Method

The dictionary lookup itself is performed using a binary search, and the length of the dictionary allowable is unlimited. This is accomplished by working with segments of the dictionary. The present segment length is 500 stems with their associated concept code-weight pairs, but this can be altered as available core permits.

When the routine is first entered, the status of the present dictionary segment is checked. If no segment is in core, then the first segment is read. There are flags which are set to indicate if the present segment is the first one (read immediately following a BEGIN FILE DICTNRY or on initial entry to LOOKUP), or the last (end of DICTNRY file encountered on last reading of a DICTNRY segment).

A stem is first checked against the lowest- and highest-collating stems of the dictionary segment presently in core. If it is outside of the limits, a higher or lower segment is read into core as appropriate. An exception occurs if the stem collates above the present segment and the present segment is the highest ordered one, or if the present segment is the lowest ordered and the stem collates below it. Then, clearly, the stem is not in the dictionary and so the associated concept code and weight positions in the Present Table are set to zero and the function returns with a FALSE value.

Once the correct segment is found, it is searched using a binary technique. It is necessary to establish a search starting point, and so first the smallest power of two not less than the number of entries in the present dictionary segment is computed. This step is omitted if the previous binary search operated on a segment of length equal to the present segment length; in practice all segments but the last one are of equal length owing to the characteristics of DICGEN, the dictionary generation program.

One-half of the value (smallest power of two not less than the size of the present segment) is used for the starting location of the search. After an unsuccessful comparison, a distance is either added to or subtracted from the starting location, according as the search found a stem above or below the desired stem. The distance is initially one-half of the starting location, and is of course halved after its application. If the distance is reduced to zero, the stem desired is not in the dictionary and so the corresponding concept code-weight pairs are set to zero and the function returns with a value of FALSE.

IV.4 SUBROUTINE NUMBER (AND ASSOCIATED FUNCTION ZORCH)

IV.4.1 Purpose

As described in the On-Line Retrieval Interim Report (5), this routine reads document specifications from the remote terminal in a variety of forms, and returns document accession numbers and a status indicator.

IV.4.2 Action

The subroutine acts as described in the Interim Report, with three exceptions:

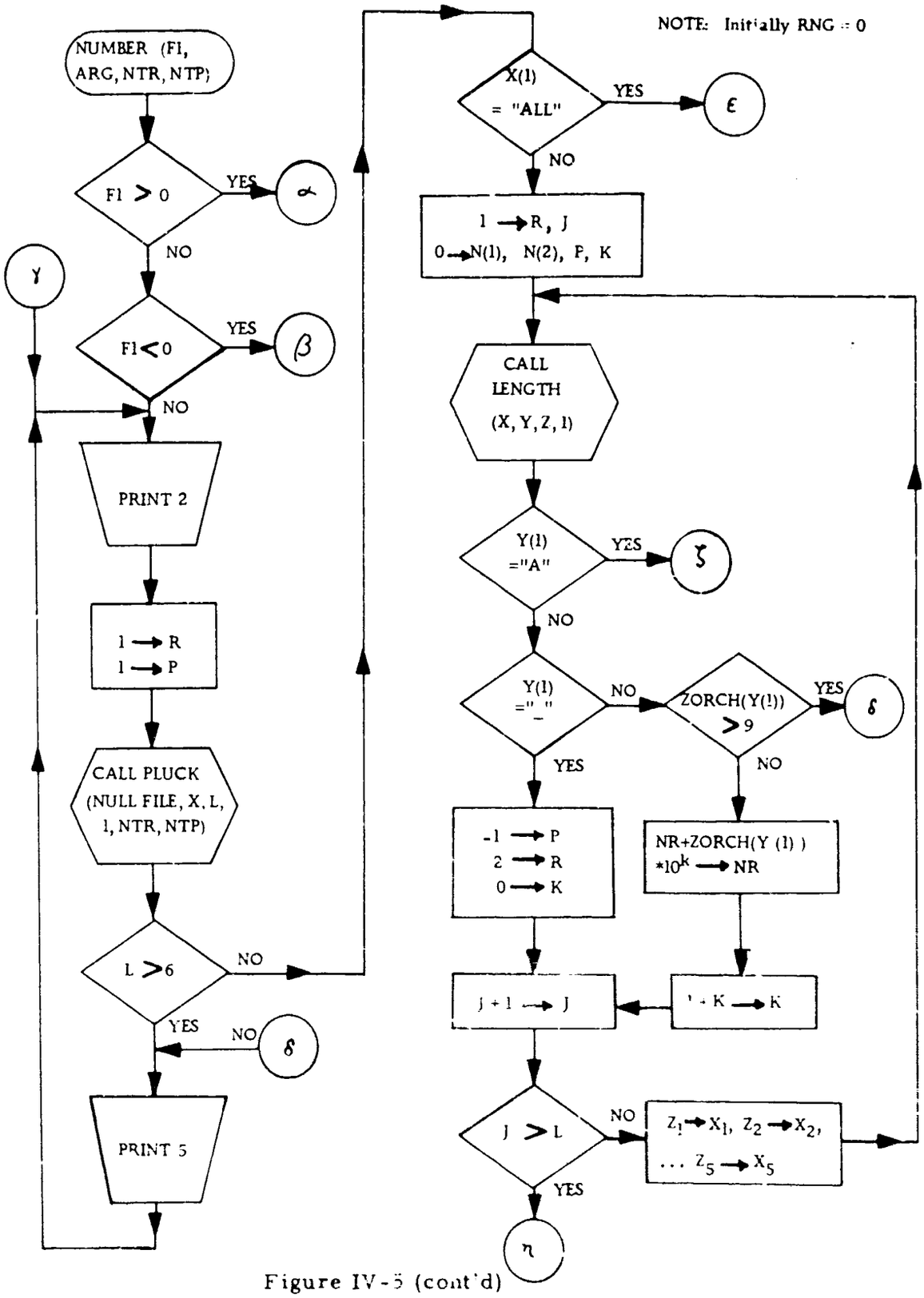


Figure IV-5 (cont'd)

Subroutine NUMBER

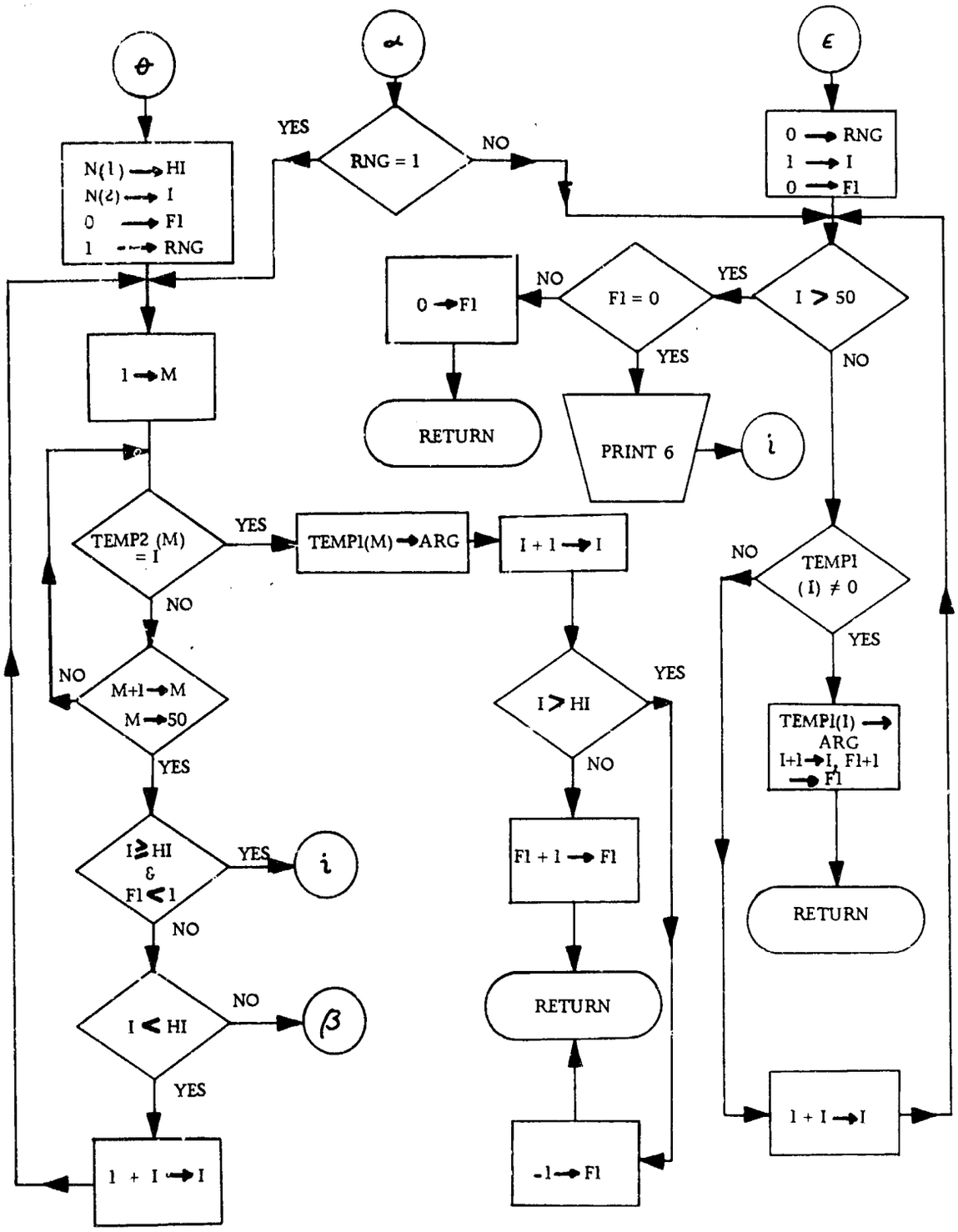


Figure IV-5 (cont'd)
Subroutine NUMBER

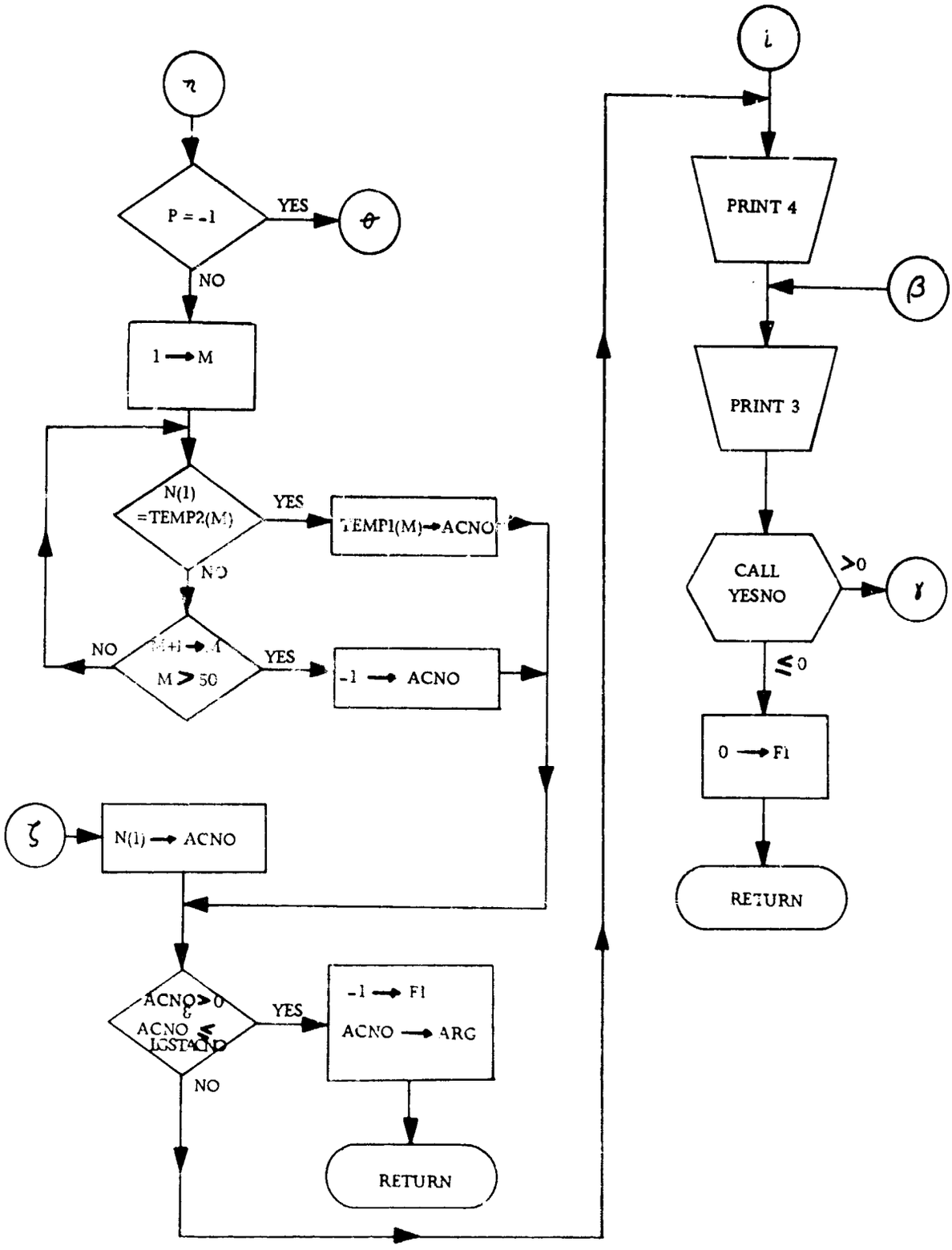


Figure IV-5 (concluded)

Subroutine NUMBER

1. The Interim Report described a version of the routine which would print an error message at the remote console and request corrected input in the event that a non-existant document is specified. In the testing of NUMBER, it became apparent that this is not desirable in the case where a range specification of temporary document identification numbers is used. For example, a specification of all documents with temporary numbers in the range between thirteen and thirty ("13-30") would be reasonable even in the event that document number twenty-five had previously been deleted from the temporary file. The user should not be forced to specify "13-24" and "26-30". The routine accepts such range specifications even though not all documents exist. However, it will not accept a specification if none of the specified documents are present in the temporary file.

2. Leading zeros do not have to be provided with accession number specifications: "A17," "A017" and "A00017" are all accepted as identifying the document whose accession number is seventeen.

3. When the user is asked if he wishes to specify additional documents, a reply of "OPTIONS" is treated the same way as a reply of "NO".

Leading and trailing blanks are allowed in the specification.

IV.4.3 Method

The subroutine uses PLUCK to read delimited strings from the remote console, as that may be treated as a file. YESNO is used when the user is asked if more documents are to be specified: all messages are printed by means of calls to OUT. LENGTH and PUT are used by PLUCK, and LENGTH is also called directly when the input specification strings are analyzed.

In order to avoid conversion problems, the transformation from ASCII to internal integer representation is programmed directly, rather than achieved by use of the ENCODE/DECODE statements. For this same reason, a small function ZORCH is used so that ASCII characters may be handled as integers. Since ZORCH is required for this reason, it is convenient to include in it a detection of non-numeric characters.

Except as noted above, the logic of NUMBER follows the description in the Interim Report.

IV.5 SUBROUTINE OUT

IV.5.1 Purpose

To print standard messages at the remote terminal.

IV.5.2 Action

A call to OUT(J) causes standard message number J to be printed at the remote terminal. Recall that some messages exist in both terse and verbose forms. A logical parameter in common, TERSE, is true if terse dialogue is desired. The verbose form of the message is printed unless both TERSE is true and message number J possesses a terse form. In the event that OUT(J) is called with a value of J corresponding to no message number, the following error message is printed and control returned to the calling program:

ERROR IN 'OUT' SUBROUTINE AT MESSAGE # nn

where "nn" is the invalid value of J used in the call.

IV.5.3 Method

For a description of the format of file MESSAGES, see section III.2.5.

IV.6 SUBROUTINE PLUCK

IV.6.1 Purpose

Subroutine PLUCK scans text files and returns character strings. Input parameters to PLUCK determine the delimiters used in string definition, the file to be searched and the starting point in that file. Output parameters are the string found, its length, and the position in the file of the start of the next scan. The position data may be saved in order to resume searching a

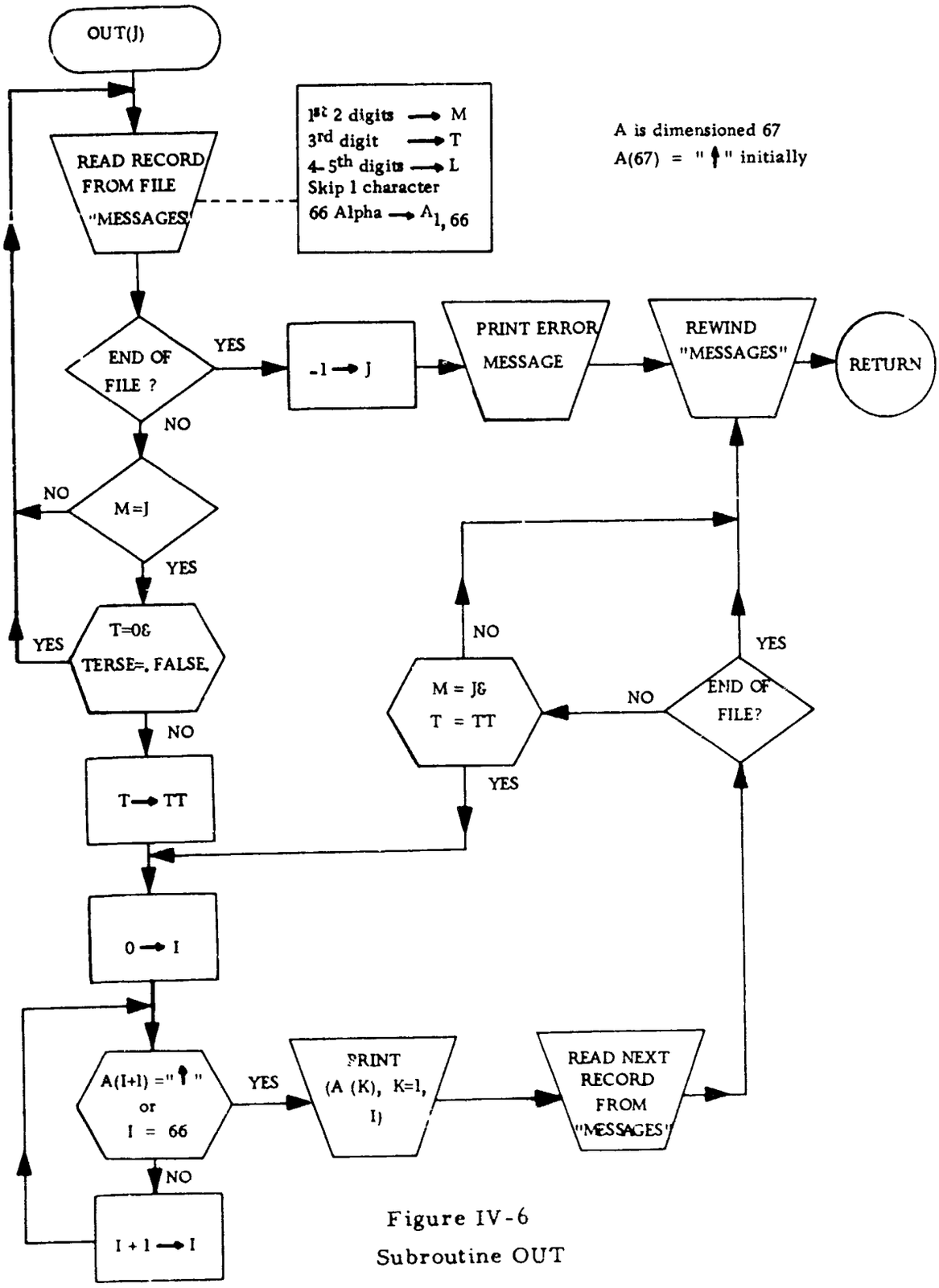


Figure IV-6
Subroutine OUT

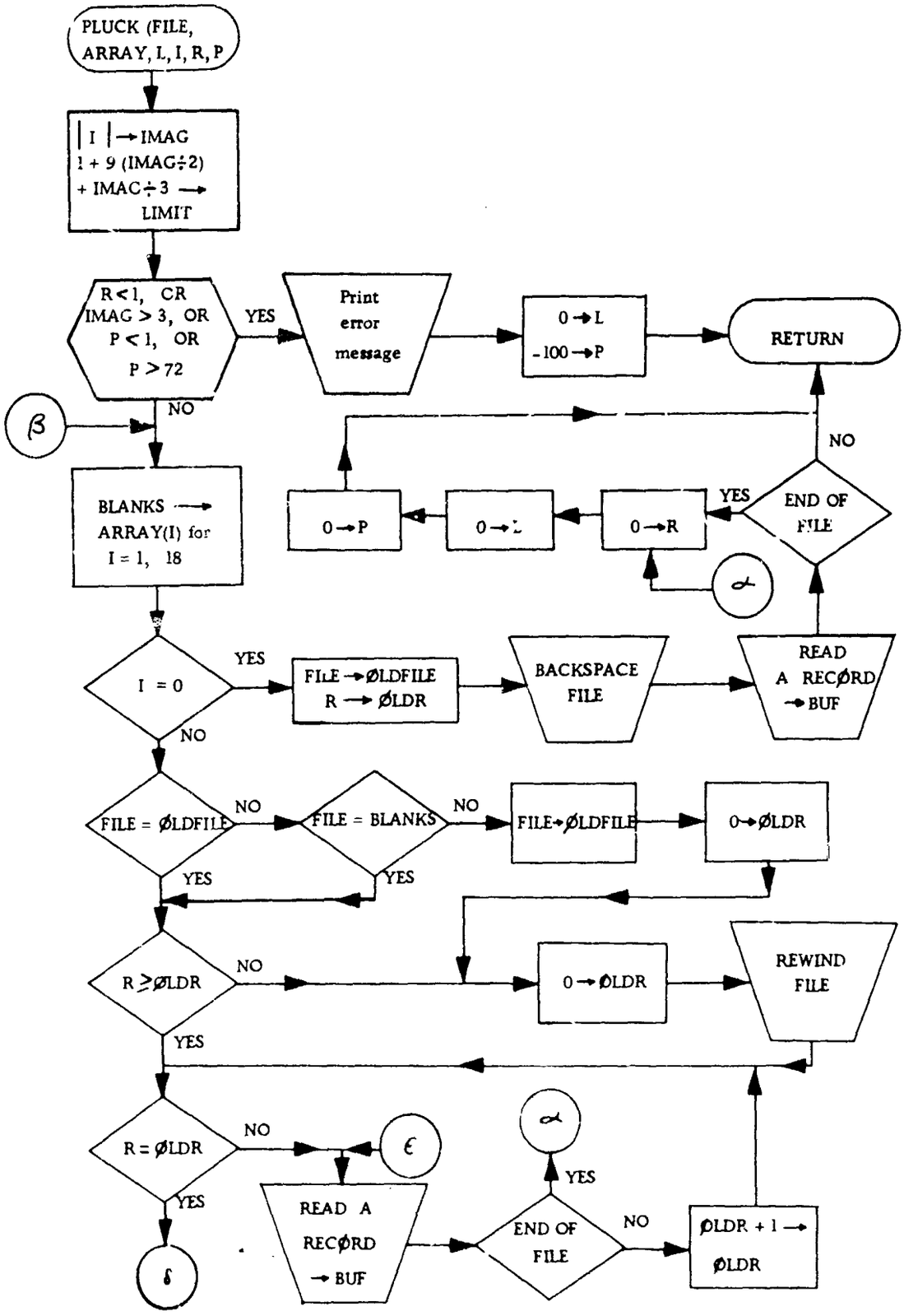


Figure IV-7 (cont'd)
Subroutine PLUCK

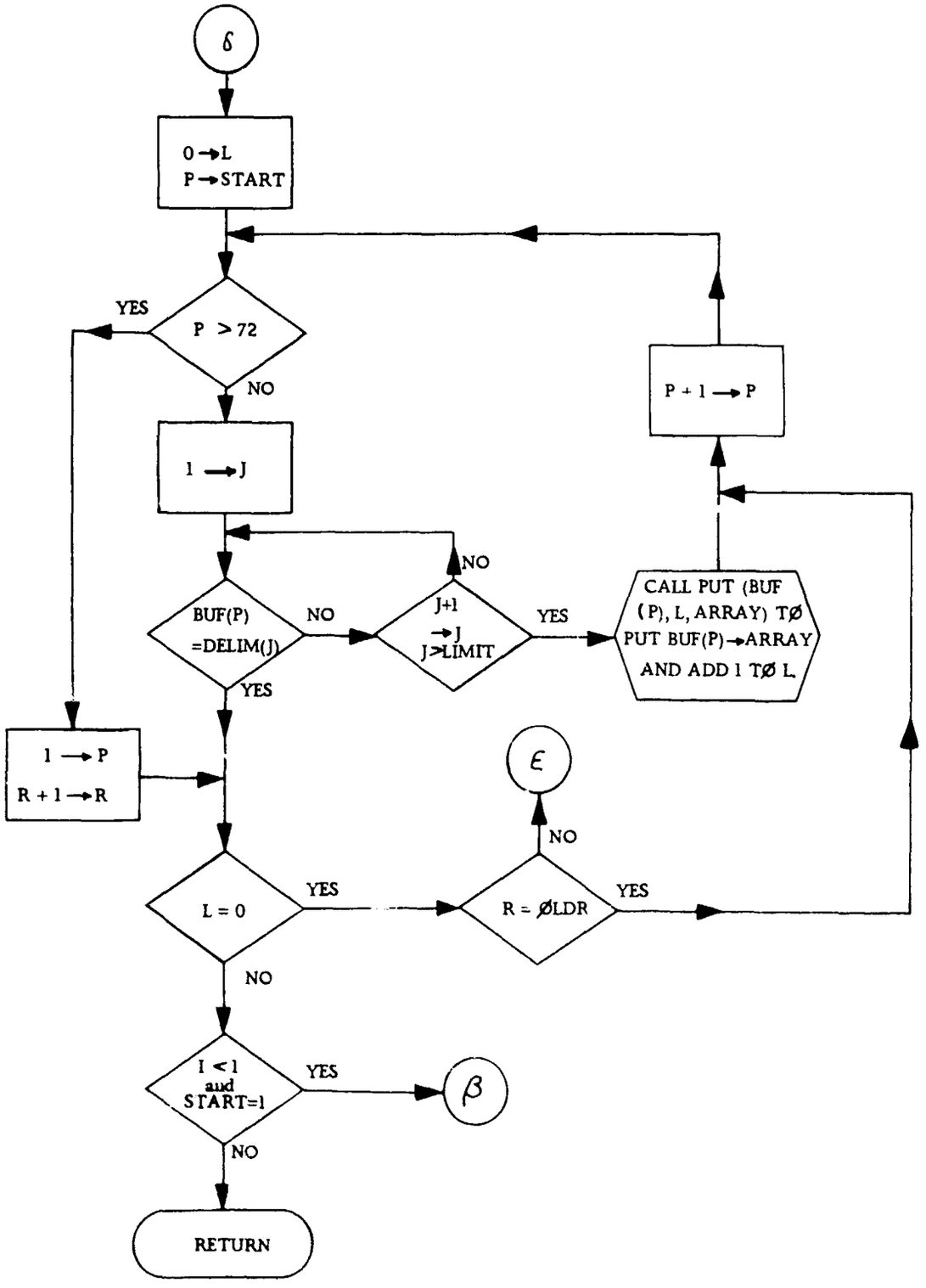


Figure IV-7 (concluded)
Subroutine PLUCK

Output from file CHICKEN

I	L	R	P	ARRAY
1	8	17	13	JØURNALS
1	3	17	17	AND
1	5	17	23	TRADE
1	9	17	33	MAGAZINES
1	4	17	38	WERE
1	10	17	49	TØP-RANKED
1	2	17	52	AS
1	4	17	57	MØST
1	10	17	68	IMPØRTANT.
1	3	18	4	211
2	8	17	13	JØURNALS
2	3	17	17	AND
2	5	17	23	TRADE
2	9	17	33	MAGAZINES
2	4	17	38	WERE
2	10	17	49	TØP-RANKED
2	2	17	52	AS
2	4	17	57	MØST
2	9	17	67	IMPØRTANT
2	3	18	4	211
3	8	17	13	JØURNALS
3	3	17	17	AND
3	5	17	23	TRADE
3	9	17	33	MAGAZINES
3	4	17	38	WERE
3	3	17	42	TØP
3	6	17	49	RANKED
3	2	17	52	AS
3	4	17	57	MØST
3	9	17	67	IMPØRTANT
-3	8	17	13	JØURNALS
-3	3	17	17	AND
-3	5	17	23	TRADE
-3	9	17	33	MAGAZINES
-3	4	17	38	WERE
-3	3	17	42	TØP
-3	6	17	49	RANKED
-3	2	17	52	AS
-3	4	17	57	MØST
-3	9	17	67	IMPØRTANT

Figure IV-8

Demonstration of PLUCK

file following a search of another file. If it is known that no intermediate activity will change the status of the first file, a special call to PLUCK can be made in order to avoid initialization after a switch from one file to another and back to the first.

In order to illustrate the workings of PLUCK, its listing here includes a test driver that reads from files CHICKEN and LENGTHFN (which contains function LENGTH). The driver contains comment lines that indicate the purpose of the calls to PLUCK, and Figure IV-8 shows the output obtained. More extensive tests were performed than those shown here.

IV.6.2 Action

In a call to PLUCK (FILE, ARRAY, L, I, R, P), the parameters have the following meaning:

FILE is a filename constant or variable, indicating the name of the file to be read. It is not required that the file be line-numbered. Unless either the last call to PLUCK obtained data from the same file or contained information on the file's status (see the case where I=0, below), the file will be rewound and repositioned upon a call.

ARRAY contains the string found, up to 72 characters left-justified in ASCII format and filled out with blanks.

L contains the number of characters in the string found. If the end of the file is reached L=0.

R is both an input and output parameter. In a call it indicates the sequential number (starting at one) of the first record to be searched. On output it indicates the number of the record containing the string found, or the next record if the string found was the last one in a record. If the end of file is reached, R=0.

P is like R, except that it indicates the next character position to be searched within the record. If the end of file is reached, P=0. If one of the calling parameters is outside the legal limits, P=-100. It is assumed that the maximum length of a record is 72 characters, but this constraint is easily changed.

I is the input parameter which controls the action of PLUCK in the selection of delimiters and the control of file initialization.

I=0. This call does not return a string. It is used when switching from the file last referenced back to a file referenced previously where the last value of R is known. It backspaces the previous file one record, and reads that record so that any following calls to that file specifying a record number R or greater do not require a complete file rewind and reread to record R.

I=1. The string starting with or following the character number P in record R is obtained. The only recognized delimiters are the space and end of record.

I=2. Like the case with I=1, except that comma, period, double quote, exclamation point, colon, semicolon, right and left parenthesis and question mark are recognized as delimiters in addition to space.

I=3. Like I=2, except that the dash is included as a delimiter.

I=-1. Like I=1, except that the first string of a record is ignored. This is for use with line-numbered files.

I=-2; I=-3. Like I=2 and I=3, respectively, except for line-numbered files.

IV.6.3 Method

Figure IV-7 shows a flowchart for subroutine PLUCK; Figure IV-8 is a listing of the program and a demonstration driver.

The use of the variables FILE 1 and FILE 2 is not obvious. Certain versions of the compiler have shown errors in the handling of IF statements dealing with filename variables, but all versions allow the

replacement statement to have filename variables on the right and ASCII variables on the left. If difficulties are encountered with the IF statement, then FILE 1 and FILE 2 may be declared ASCII rather than FILENAME. This will overcome the compiler difficulties, but it must be remembered that then only the leftmost four characters of the file names will be compared. PLUCK calls on the function PUT, described below.

IV.7 FUNCTION PUT

IV.7.1 Purpose

Function PUT is used by PLUCK to pack single characters into words. Since it provides a generally useful capability, it has been written as an integer function rather than as part of Function PLUCK.

IV.7.2 Action

Integer function PUT has three parameters: a 72 character array ARRAY, an integer L and a single character A. A call to PUT (A, L, ARRAY) puts character A into position L+1 of the 18 word array ARRAY, and returns a function value of L+1. The character in A must be left-justified and filled with blanks, and ARRAY must similarly contain blanks.

IV.8 SUBROUTINE STEM

IV.8.1 Purpose

Subroutine STEM performs stem analysis and common word detection.

The degree of suffix removal is governed by a single constant (Line 79750) of STEM. The desirable value of this constant was anticipated to lie between four and six, as stated in the Interim Report. Five has been

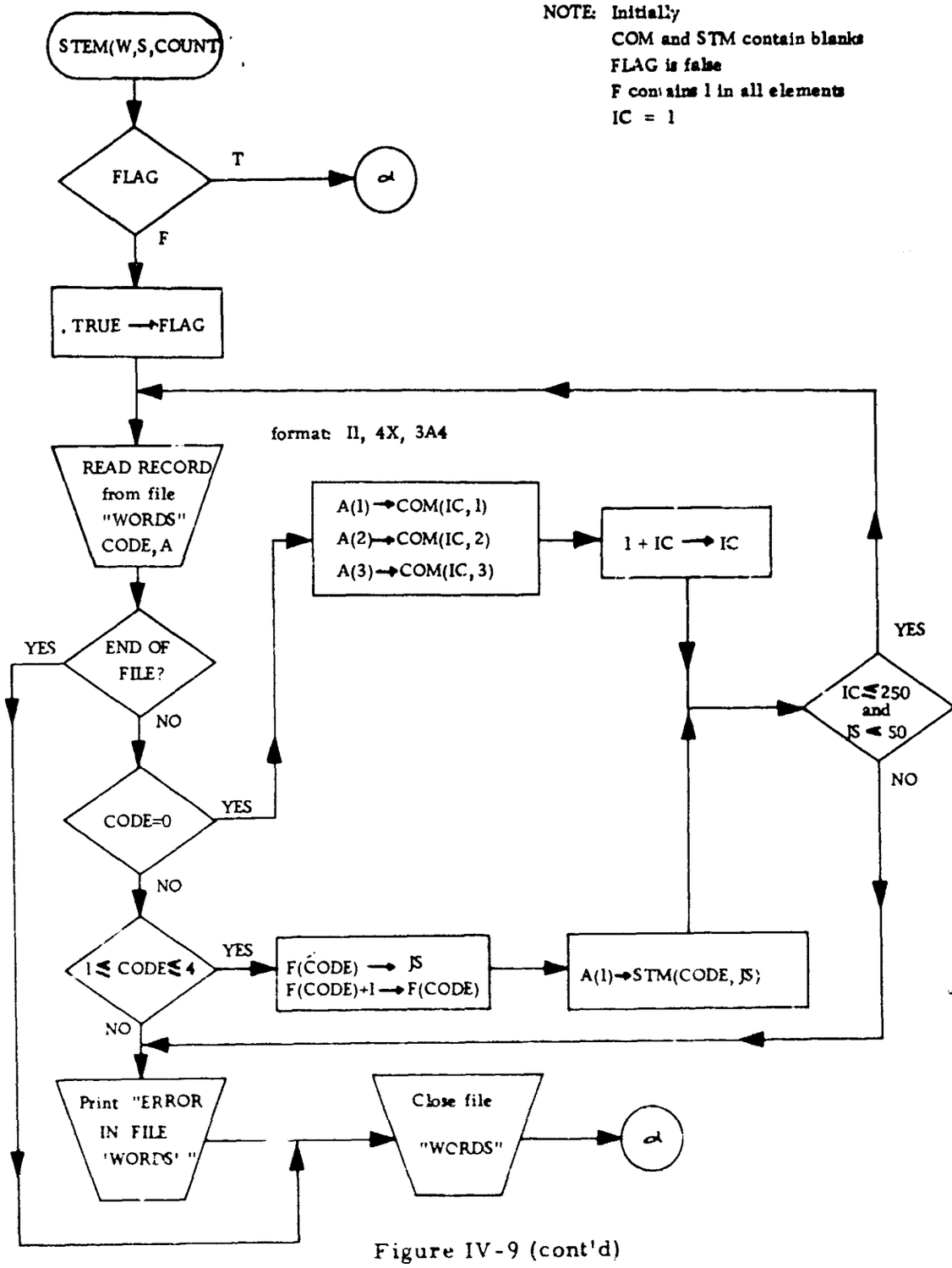


Figure IV-9 (cont'd)

Subroutine STEM

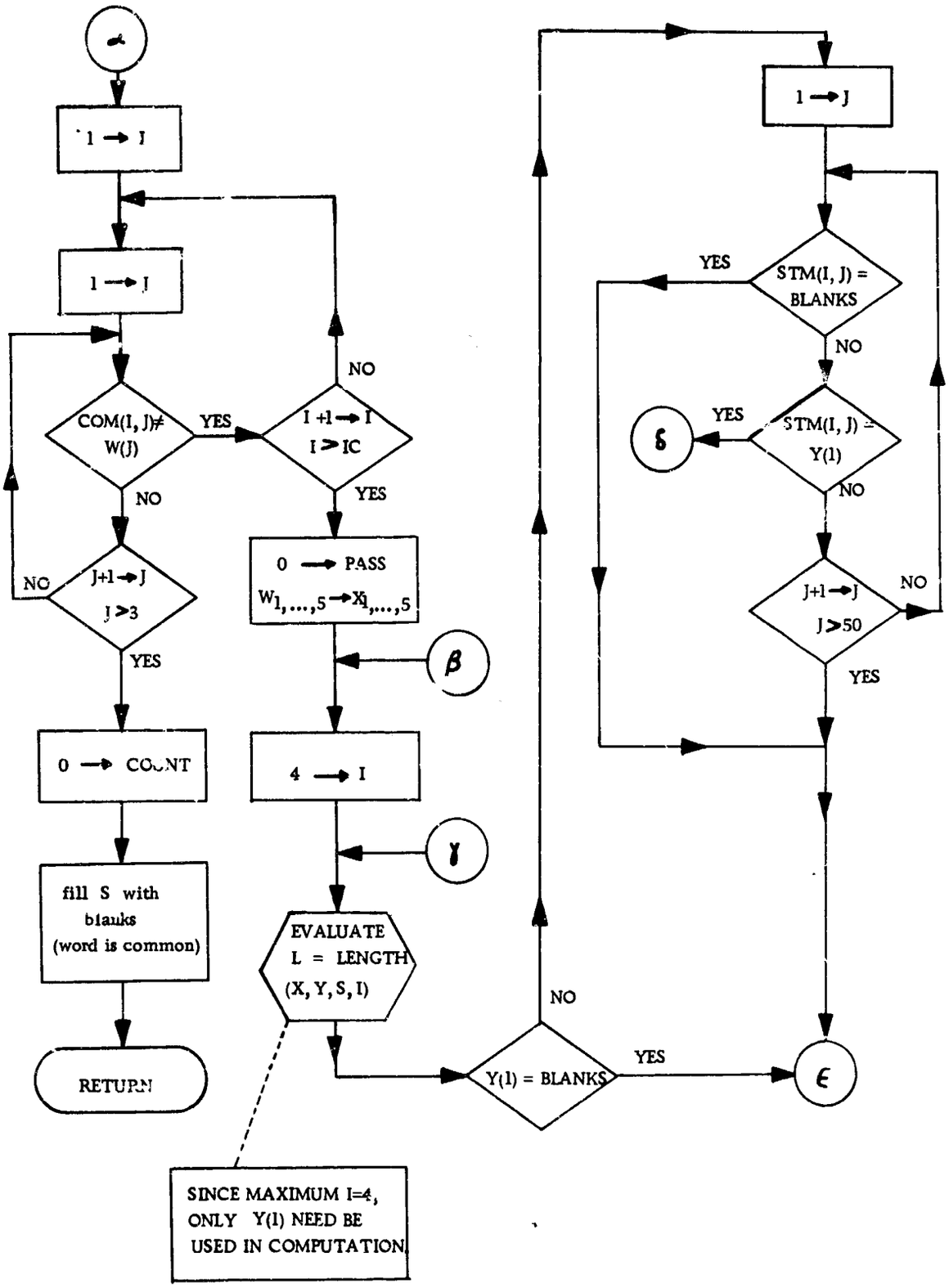


Figure IV-9 (cont'd)
Subroutine STEM

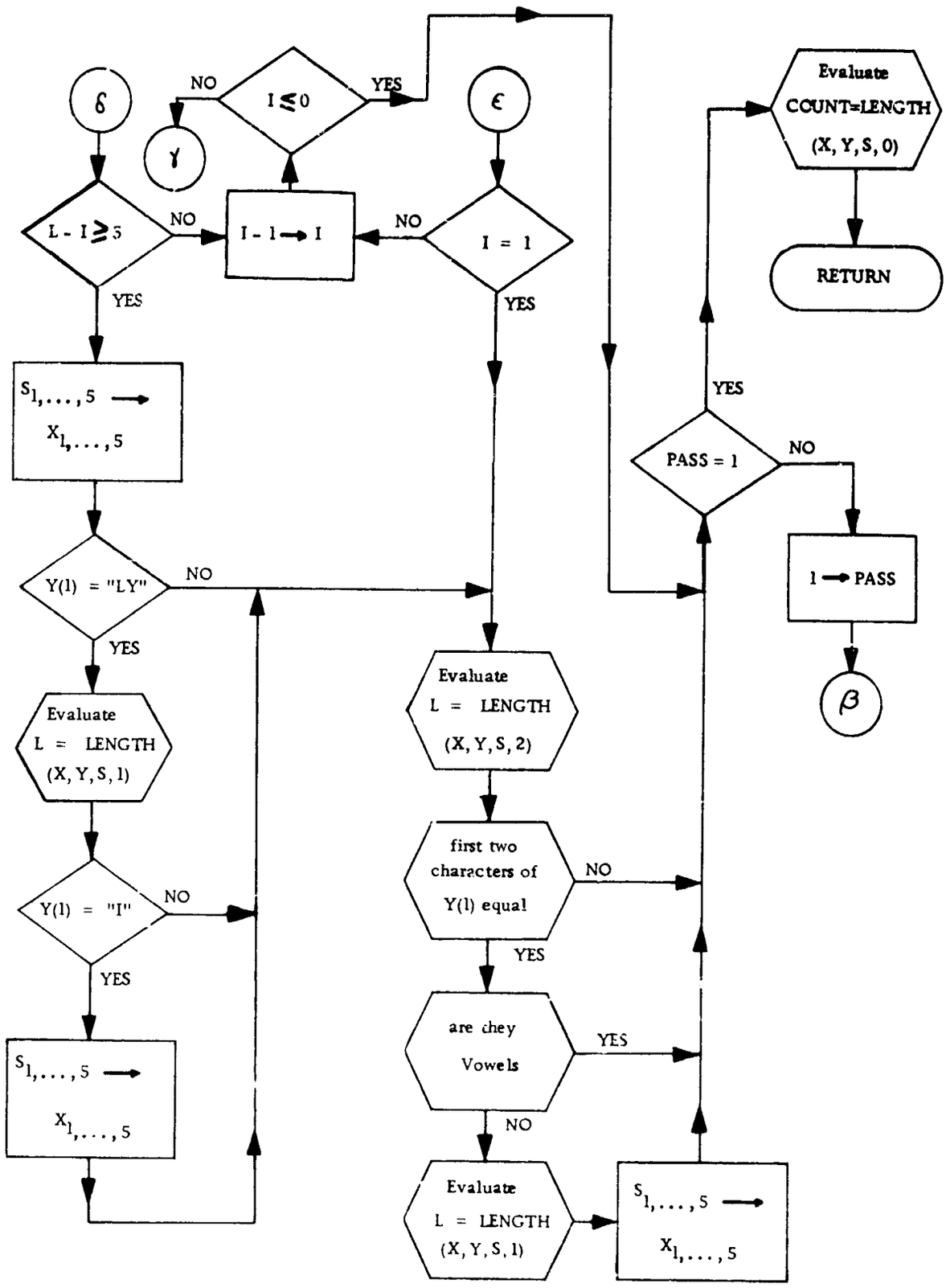


Figure IV-9 (concluded)
Subroutine STEM

selected for the present time, but of course it can be revised in accordance with future experience. Note that stems of fewer than five characters can be generated by the special cases which remove a terminal "i" after ordinary removal of "ly" and which remove the second of a double terminal consonant. For a discussion of this and other aspects of the performance of STEM, see subsection III. 2. 3 of this report.

IV. 8. 2 Action

STEM (WORD, STEMRD, COUNT) has a single input, an array of up to 20 characters named WORD. The subroutine returns with WORD unchanged, the stem found in STEMRD (another array of up to 20 characters) and the length of the stem in COUNT. If the input word is common, STEMRD contains blanks and COUNT=0.

STEM requires a file WORDS, in the format described above, containing up to 250 common words and up to 50 suffixes each of length one, two, three and four. If a format error is found in that file, an error message is printed. Processing continues using the part of the file read. Of course, certain invalid file data can cause a TSS system abort, over which the Dialogue Processor has no control.

IV. 8. 3 Method

The common words and stems are stored in a separate file, WORDS. This is done in order that they may be modified without altering and/or recompiling STEM. This file is read and stored by STEM upon the first call to STEM, and then the file is closed.

Stem analysis is performed as described in the Interim Report.

IV. 8. 4 Example

A short program was written to read from file CHICKEN, with contents as shown in Figure IV-10(a), using subroutine PLUCK and placing the results in an eighteen word array FEATHERS. STEM was called with FEATHERS as its argument, resulting in the output shown in Figure IV-10(b). Each asterisk indicates a rejected common word.

The control parameter of PLUCK was set to +3, and functions LENGTH and PUT were of course also loaded. It should be noted that the use of FEATHERS as output of PLUCK and input to STEM is perfectly permissible, even though the dimensioning statements within those subroutines are different.

IV. 9 SUBROUTINE WHERE

IV. 9. 1 Purpose and Action

In the degugging of a complicated program such as the Dialogue Processor, the programmer is frequently faced with the problem of determining the path of control through the program. This subroutine is designed to aid in that determination. Calls are of the form CALL WHERE (A, N), where A is an ASCII constant and N is an integer. The subroutine responds by printing the values of A and N. Successive calls produce printing of A and N on one line, until that line is filled then a new line is started. There are two exception to this:

1. As debugging progresses, the programmer may wish to turn off the action of WHERE. Therefore, when it is first called, it prints "ACTIVATE TRACE?" An answer of "NO" will suppress all printing by WHERE; when called it will immediately transfer control back to the calling program.

```
100 THE SURVEY SHØWS THAT, WHILE THE RESULTS ARE NØT INEXPLICABLY
101 CØNTRADICTØRY, DIFFERENCES IN PRINCIPLE AND METHØD MAKE IT IMPØSSIBE
102 TØ DEMØNSTRATE CERTAIN, CLØSE AGREEMENT. THE AUTHØR SUGGESTS THAT
103 FUTURE SURVEYS SHØULD BE DESIGNED TØ INCLUDE A FEW FEATURES WITH A
104 DELIBERATE RELATIØNSHIP TØ EARLIER SURVEYS SØ THAT SØME VALID
105 CØMPARISØNS CAN BE MADE.
200 IN SURVEY ØN THE USE ØF LITERATURE INVØLVING 1800 ENGINEERS,
201 300 WERE PERSØNALLY INTERVIEWED.  THE SAMPLE CØNSISTED ØF 206
202 CHEMICAL ENGINEERS AND THE BALANCE (1594) ØTHER ENGINEERS NØT
203 SPECIFIED. THE + SURVEY SHØWED THAT 85 PERCENT ØF THE CHEMICAL
204 ENGINEERS, AND 85 PERCENT ØF ØTHER ENGINEERS, USED MANUFACTURERS'
205 CATALØGUES IN THEIR WØRK. ØTHER TYPES ØF LITERATURE SURVEYED AND
206 ØTHER ENGINEERS USING THEM ARE AS FØLLØWS: REPRINTS, 73, 70;
207 PREPRINTS, 50, 37; ABSTRACTS AND INDICES, 51, 33; HANDBØØKS,
208 TRANSLATIØNS, 35, 22; TELEVISIØN IN RELATIØN TØ WØRK, 5, 6;
209 STANDARDS AND SPECIFICATIØNS, 49, 63; PATENTS, 54, 24. SIXTEEN
210 JØURNALS AND TRADE MAGAZINES WERE TØP-RANKED AS MØST IMPØRTANT.
211 MANUFACTURERS CATALØGUES, ABSTRACTS AND INDEXES, AND PATENTS
212 WERE ALSØ CATEGØRIZED BY PERCENT ØF USE BY FUNCTIØN GRØUPS ØF
213 ENGINEERS (CHEMICAL, CØNSULTING, DESIGN AND DEVELØPMENT, FACILITIES
214 PLANNING, AND INFØRMATIØN RETRIEVAL).
```

Figure IV-10(a)
File CHICKEN

```
10 * SURVE SHØWS * * * RESULT * * INEXPLICAB
101 CØNTRADICTØ DIFFER * PRINCIPL * METHØD MAKE *
IMPØSSIBL 102 * DEMØNSTR CERTAIN CLØSE AGREE * AUTHØR SUGGEST *
103 FUTUR SURVE * * DESIGN * INCLUD * * FEATUR * *
104 DELIB RELAT * EARLI SURVE * * * VALID
105 CØMPARIS * * MADE
20 * SURVE * * USE * LITERAT INVØLV 180 ENGINE
201 30 * PERSØN INTERVIEW * SAMPL CØNSIST * 206
202 CHEMIC ENGINE * * BALANC 1594 * ENGINE *
203 SPECIF * + SURVE SHØWED * 85 PERCENT * * CHEMIC
204 ENGINE * 85 PERCENT * * ENGINE USED MANUFACTUR
205 CATALØGU * * WØRK * TYPES * LITERAT SURVE *
206 * ENGINE USING * * * FØLLØW REPRINT 73 70
207 PREPRINT 50 37 ABSTRACT * INDIC 51 3 HANDBØØK
208 TRANSLA 35 2 TELEVI * RELAT * WØRK 5 6
209 STANDARD * SPECIFICA 49 63 PATENT 54 24 SIXTE
210 JØURN * TRADE MAGAZIN * TØP RANKED * * IMPØRT
21 MANUFACTUR CATALØGU ABSTRACT * INDEX * PATENT
212 * * CATEGØRIZ * PERCENT * USE * FUNCT GRØUP *
213 ENGINE CHEMIC CØLSULT DESIGN * DEVELØP FACILIT
214 PLAN * INFØRMA RETRIEV
```

Figure IV-10(b)

Results of STEM

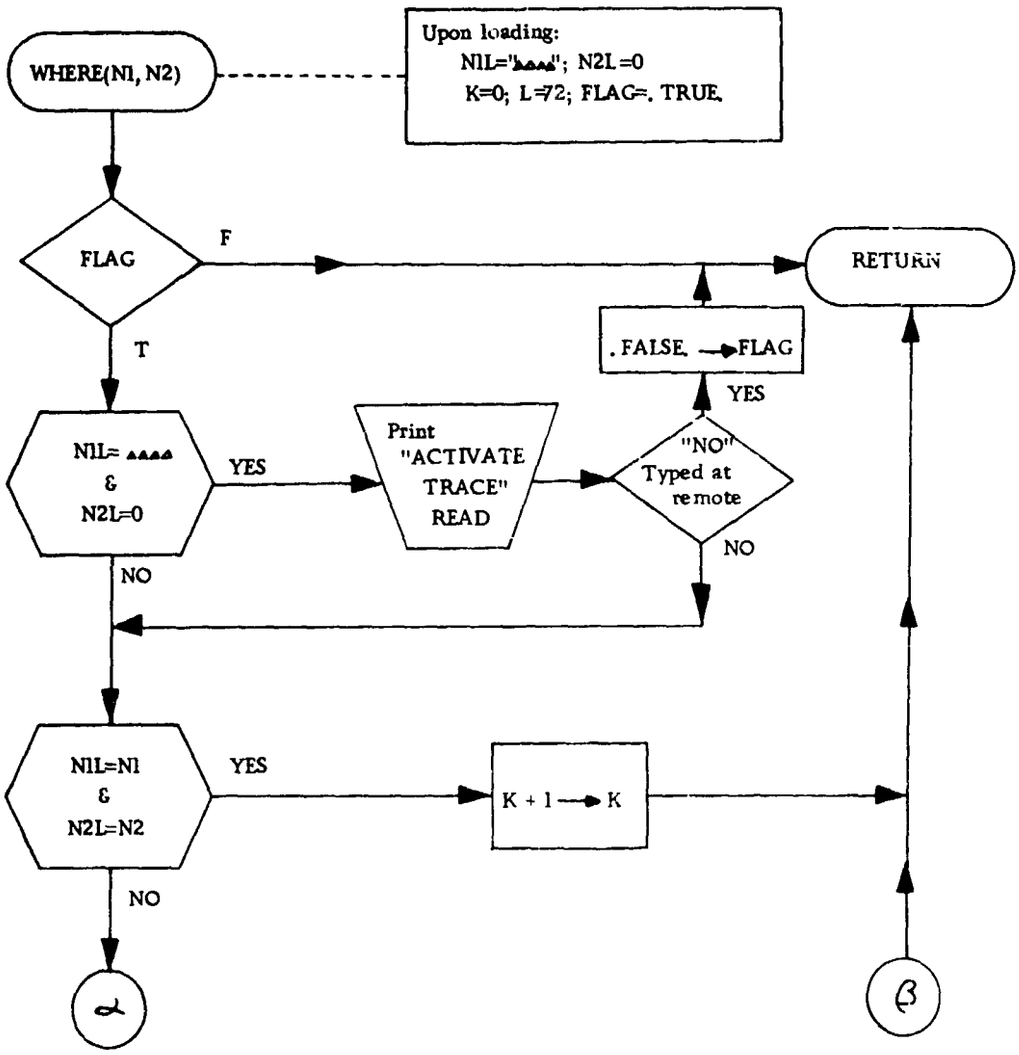


Figure IV-11 (cont'd)
WHERE

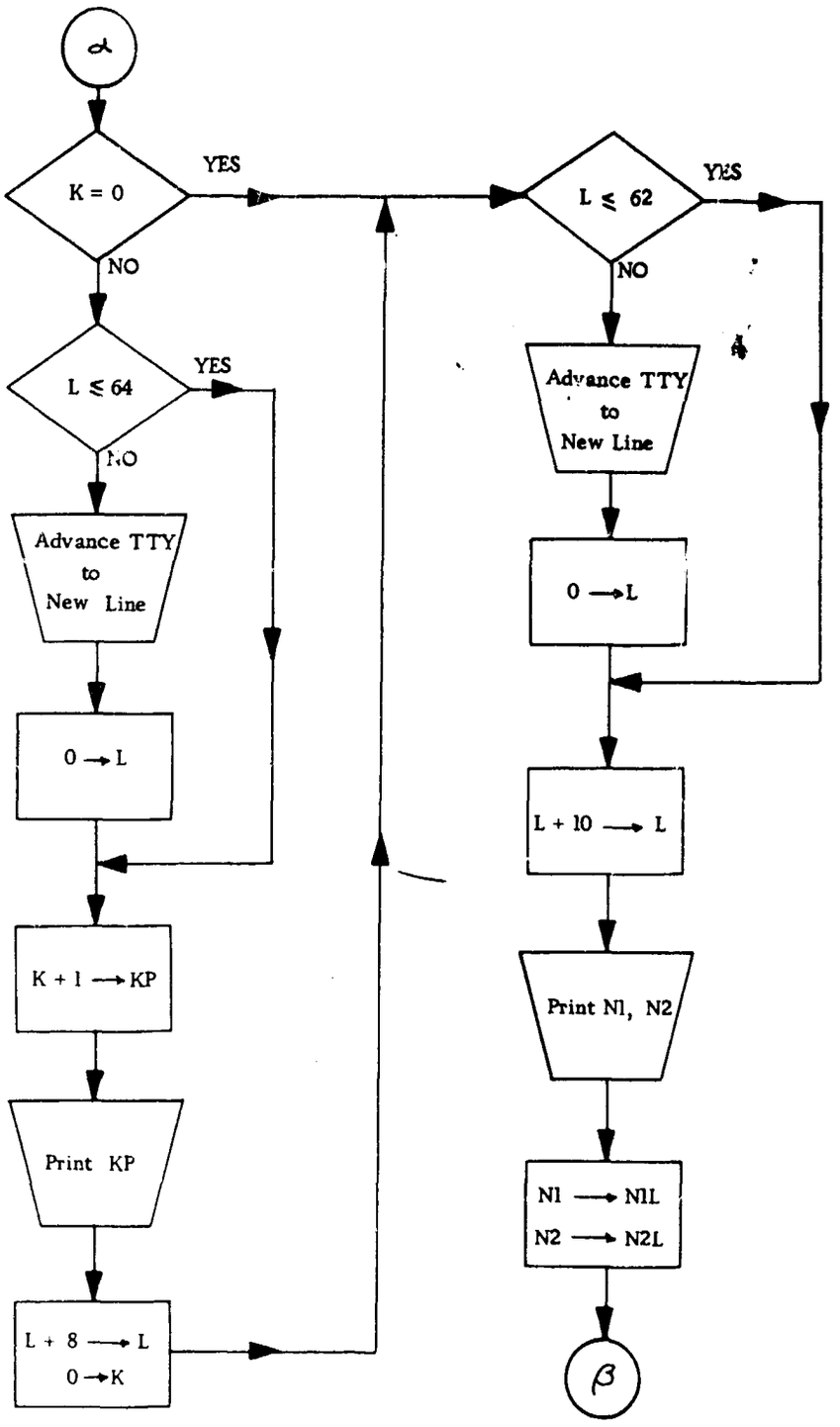


Figure IV-11 (concluded)

WHERE

2. In a loop resulting in repeated calls to WHERE with unchanging arguments, repeated printing of the arguments would be unnecessary, wasteful and annoying. Therefore the arguments are printed once upon entry to the loop, and upon exit those arguments are followed by: "*kk/", where kk is the number of times the loop was executed.

IV.9.2 Method

The flowchart (Figure IV-11) and listing (Figure VI-9) explain this straightforward subroutine.

IV.9.3 Deactivation

In the code delivered to RADC, the subroutine has been altered so that the query "Activate Trace?" is not printed and no trace is supplied. This is done by adding two lines to WHERE:

```
99035        FLAG=.FALSE.; PRINT 500
99036  500   FORMAT (2H & Ⓑ)
```

IV.10 FUNCTION YESNO(I)

Many system-generated queries must be answered either "yes" or "no". This subroutine reads a string from the remote terminal and sets its arguments to one if "yes" was read or zero if "no" was read. The sophisticated user is allowed the word "options", which sets the argument to minus one; any other response causes the system to ask the user to 'ANSWER "YES" OR "NO".', and repeats the query.

In many applications it is useful to call such a routine as an arithmetic function, so that the statement

```
IF (YESNO(I) ) 1, 2, 3
```

branches to 1 for "options", to 2 for "no" and to 3 for "yes".

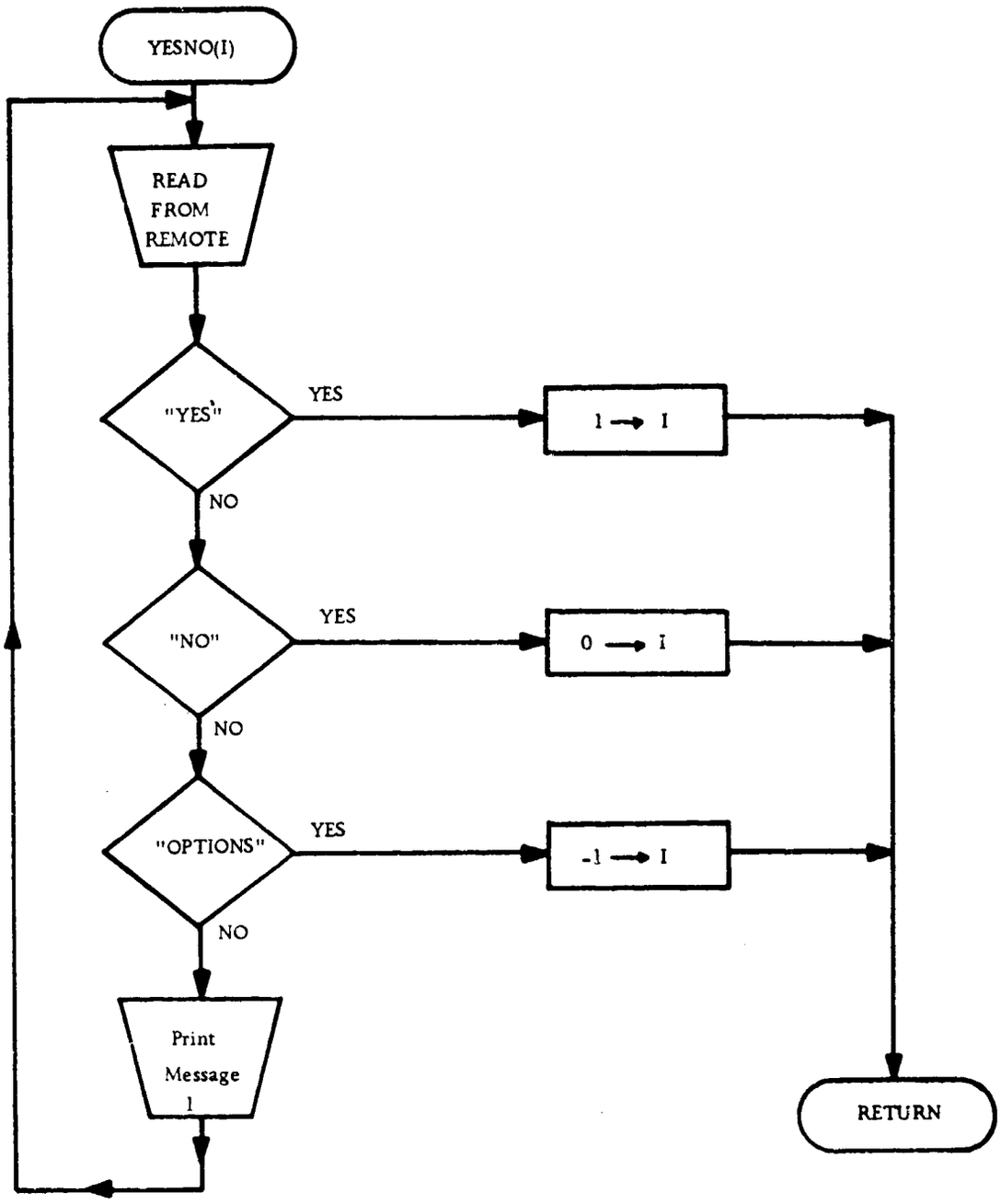


Figure IV-12
YESNO

SECTION V

FURTHER WORK

The work performed on this project has resulted in the design and partial implementation of an on-line system that promises to add new important capabilities to on-line information retrieval systems. For this promise to be fulfilled, the investigation and implementation effort should be continued.

Of first importance is the implementation of the complete On-Line System itself. Once the System is implemented, it will provide the best possible tool for experimentation with the techniques of automatic indexing within an on-line environment. Estimates can be made of such factors as expected response time, precision, and relevance, and valuable experimentation can be conducted using batch programs. However, the combined impact upon the user of all these factors can be determined only by constructing the entire System. And it is this total impact on the user that determines the utility of these techniques.

Simultaneously with the implementation, experiments should be performed to determine optimum settings for the various features of the indexing programs that can be varied parametrically. The value of such experimentation is vividly illustrated by the discussion of the dictionary of 900 stems (Figure III-4) in subsection III. 2. 3. By studying the effect of variation of these various factors upon the results obtained, the System can be "tuned" to maximize its performance.

SECTION VI

LISTINGS

This Section contains listings of all programs and subprograms that comprise the dialogue processor and its associated supporting software. The Directory of Programs and Subprograms in Figure IV-1 serves to index this Section.

```
70000C      DØCK 11/10/69
70010C     FUNCTIØN DØCK GETS TITLES, AUTHØRS ØR ABSTRACTS ØNE LINE AT
70020C     A TIME,-RETURNING FALSE WHEN ALL LINES RETURNED.
70030      FUNCTIØN DØCK(CØDE,I,ARRAY,CØUNT)
70040      LØGICAL DØCK
70040      CØMMØN TERSE, NØNØ(100), TEMP1(50), TEMP2(50), TEMP3(50),
70060&     TEMP4(50), TEMP5(50), TEMP6(50), QUERY1(50), QUERY2(50)
70070&     , PRE1(5,25), PRE2(3,25), PRE3(3,25), PRE4(3,25)
70080&     , LGSTACNØ
70090      INTEGER TEMP1, TEMP2, TEMP4, QUERY1, PRE3
70100     ASCII PRE1,PRE2
70110      LØGICAL TERSE, TEMP5, TEMP6
70120      ASCII ARRAY(18),TEMPØ(18)
70130      LØGICAL FLAG
70140      INTEGER CØDE,CØUNT
70150      DATA FLAG/.FALSE./
70160 100  IF(LGSTACNØ.GE.I .AND. CØDE.GE.1 .AND. CØDE.LE.3) GØ TØ 400
70170 200  PRINT 201, CØDE, I
70180 201  FØRMAT("-ERRØR IN DØCK AT CØDE, I:", 2I20)
70190 300  DØCK=.FALSE.; FLAG=.FALSE.; CØUNT=0; RETURN
70200C     TEST IF ØN ØLD SEQUENCE--FIND DESIRED DØCUMENT IF NØT.
70210 400  IF(FLAG) GØ TØ 700
70215      READ("DATA1",501) ARRAY
70220      BEGIN FILE "DATA1"
70230      J=0
70240 500  READ("DATA1",501,END=200) (ARRAY(K),K=1,18)
70250 501  FØRMAT(18A4)
70260      IF(ARRAY(1).NE."**TI") GØ TØ 500
70270      J=J+1
70280      IF(J.NE.I) GØ TØ 500
70290C     CØRRECT DØCUMENT LØCATED. FIND DESIRED INFØRMATIØN. CØDE=1,2
70300C     3 AS TITLE, AUTHØR ØR ABSTRACT.
70310 600  READ("DATA1",501,END=200) (ARRAY(K),K=1,18)
70320      IF(CØDE.EQ.1) GØ TØ 800
```

Figure VI-1 Function DOCK (cont'd)

```
70330      IF(.NØT.((CØDE.EQ.2 .AND. ARRAY(1).EQ."**AU") .ØR.
70340&     (CØDE.EQ.3 .AND. ARRAY(1).EQ."**AB"))) GØ TØ 600
70350      READ("DATA1",501,END=200) (ARRAY(K),K=1,18)
70360      GØ TØ 800
70370 700  DØ 701 K=1,18
70380 701  ARRAY(K)=TEMPØ(K)
70390 800  READ("DATA1",501,END=200) (TEMPØ(K), K=1,18)
70400      IF(TEMPØ(1).GE."**AA".AND.TEMPØ(1).LE."**ZZ") GØ TØ 900
70410      DØCK=.TRUE.; FLAG=.TRUE.; GØ TØ 950
70420 900  DØCK=.FALSE.; FLAG=.FALSE.
70430 950  DØ 960 J=1,18
70440 960  IF(ARRAY(J).NE."    ") CØUNT=J
70450      RETURN; END
```

Figure VI-1 Function DOCK (concluded)

```
82000C     FUNCTIØN 'LENGTH' FØR STEM ANALYSIS RØUTINE.
82010      FUNCTIØN LENGTH(X,Y,Z,I)
82020      INTEGER A,B(4),X(5),Y(5),Z(5),PLØP
82030      DATA L,L2/0000040040040,0040040040040/
82040      DATA L3/0040000000000/
82050 1    DØ 2 J=1,5
82060      Z(J)=L2
82070 2    Y(J)=L2
82080      J=5
82090 3    IF(X(J).NE.L2) GØ TØ 4
82100      J=J-1
82110C     TEST TØ SEE IF INPUT STRING NULL (BLANKS).
82120      IF (J.GT.0) GØ TØ 3
82130      LENGTH=0
82140      RETURN
82150C     HERE WHEN J=NØ. ØF WØRDS CØNTAINING AT LEAST ØNE CHARACTER.
82160C     ALSØ IS INDEX ØF LAST SUCH WØRD.
82170 4    LTH=4*(J-1)
82180      A=X(J)
82190      ASSIGN 7 TØ IB
82200 5    K=134217728
82220      M=0
82230 6    IF(A.LT.K) N=0
82235      IF(A.GE.K) N=A/K
82240      A=A-N*K
82242      M=M+1
82244      B(M)=N*134217728+L
82246      K=K/512
82248      IF(M.LT.4) GØ TØ 6
82250C     B HAS ØNE CHARACTER PER ELEMENT
82260      GØ TØ IB, (7,13)
82270 7    DØ 8 M=1,4
82280      IF(B(M).EQ.L2) GØ TØ 9
```

Figure VI-2 Function LENGTH (cont'd)

```
82290 8    LTH=LTH+1
82300 9    LENGTH=LTH
82310C     STRING LENGTH CØMPUTED. NØW SPLIT UP.
82320      PLØP=LTH-I
82330C     IF I>STRING LENGTH, PLØP<0 PUTS STRING IN Y.
82340      JX=1; JY=1; JZ=1; JCXT=0
82350 10   IF(PLØP.LT.4) GØ TØ 11
82360      Z(JZ)=X(JX)
82370      PLØP=PLØP-4
82380      JCXT=JCXT+4
82390      JX=JX+1; JZ=JZ+1; GØ TØ 10
82400 11   JCXW=0; JCYW=0; JCZW=0
82410 12   ASSIGN 13 TØ IB; A=X(MINO(JX,5)); GØ TØ 5
82420 13   NRCX=0
82430 14   IF(JCXT.GE.LTH) RETURN
82440      JCXT=JCXT+1; NRCX=NRCX+1
82450      IF(PLØP.GT.0) GØ TØ 15
82460      K=1
82461      IKYPØØ=JCYW
82462 998  IF(IKYPØØ.EQ.0) GØ TØ 999
82463      K=K*512; IKYPØØ=IKYPØØ-1; GØ TØ 998
82464 999  CØNTINUE
82470      Y(JY)=(Y(JY)-L3/K)+(B(NRCX)-L)/K
82480      JCYW=JCYW+1
82490      IF(JCYW.LT.4) GØ TØ 16
82500      JY=JY+1
82510      JCYW=0
82520      GØ TØ 16
82530C     BLØCK STARTING WITH 10 MØVES GRØUPS ØF 4 CHARACTERS INTØ Z.
82540C     PART ABØVE MØVES CHAR. TØ Y. BELØW CHAR. TØ Z UNBLØCKED.
82550 15   K=1
82551      IKYPØØ=JCZW
82552 887  IF(IKYPØØ.EQ.0) GØ TØ 888
```

Figure VI-2 Function LENGTH (cont'd)

```
82553      K=K*512; IKYP00=IKYP00-1; GO TO 887
82554 888  CONTINUE
82560      Z(JZ)=(Z(JZ)-L3/K)+(B(NRCX)-L)/K
82570      JCZW=JCZW+1; PLOP=PLOP-1
82580      IF(JCZW.LT.4) GO TO 16
82590      JZ=JZ+1
82600      JCZW=0
82610 16   IF(NRCX.LT.4) GO TO 14
82620      JX=JX+1
82630      IF(JX.GT.5) RETURN
82640      GO TO 12
82650      END
```

Figure VI-2 Function LENGTH (concluded)

```
75010C     FUNCTIØN TAKES STEM IN PRE2 AND PLACES CØN. VECT. IN PRE.
75015C     VALUE TRUE IF STEM IN FILE 'DICTNRY'.
75020      FUNCTIØN LØØKUP(I)
75030      CØMMØN TERSE, NØNØ(100), TEMP1(50), TEMP2(50), TEMP3(50),
75040&     TEMP4(50), TEMP5(50), TEMP6(50), QUERY1(50), QUERY2(50)
75050&     , PRE1(5,25), PRE2(3,25), PRE3(3,25), PRE4(3,25)
75060&     , LGSTACNØ
75070      INTEGER TEMP1, TEMP2, TEMP4, QUERY1, PRE3
75080     ASCII PRE1,PRE2
75090      LØGICAL TERSE, TEMP5, TEMP6
75100C     DICTIØNARY LØØKUP FUNCTIØN PUTS CØNCEPT VECTØR IN PRE-
75110C     TABLE CØRRESPØNDING TØ STEM IN I-TH LØCATIØN ØF TABLE.
75120C     RETURNS WITH FALSE VALUE IF STEM NØT IN DICTIØNARY.
75130      LØGICAL TØP, BØTTØM, LØØKUP
75140      DIMENSIØN WT(3,500)
75150      ASCII TABLE(3,500)
75160      INTEGER CØN(3,500)
75170      DATA L,LØLD,MAX/0,-100,500/
75180C     SEE IF STEMS ARE IN CØRE.  LØAD IF NØT.
75190 100 IF( L.NE.0) GØ TØ 300
75200 200 IF(L.NE.0) BEGIN FILE "DICTNRY"
75210      BØTTØM=.TRUE.; GØ TØ 220
75220C     IF MØRE STEMS NEEDED, ØVERLAY THEM.
75230 210 BØTTØM=.FALSE.
75240 220 TØP=.FALSE.
75250C     CLEAR CØRE DICTIØNARY & VECTØRS BEFØRE LØADING.
75260      DØ 221 N1=1,MAX
75270      DØ 221 N2=1,3
75280      TABLE(N2,N1)="    "
75290      CØN(N2,N1)=0
75300 221 WT(N2,N1)=0.0
75310C     READ UNTIL TABLES FULL ØR FILE EXHAUSTED.
75320      L=1
75330 230 READ("DICTNRY", 231, END=240) (TABLE(J,L),J=1,3), (CØN(J,L),
75340&     WT(J,L), J=1,3)
```

Figure VI-3 Function LOOKUP (cont'd)

```
75350 231 FØRMAT(3A4, 1X, 3(I4,F9.5))
75360     IF(L.GE.MAX) GØ TØ 300
75370     L=L+1; GØ TØ 230
75380C    ALL FILE READ.
75390 240 L=L-1; TØP=.TRUE.; GØ TØ 300
75400C    DØES QUERY STEM CØLLATE BEFØRE DICTIØNARY SEGMENT IN CØRE?
75410 300 IF (PRE2(1,I) .LT. TABLE(1,1) ) GØ TØ 305
75420     IF (PRE2(1,I) .GT. TABLE(1,1) ) GØ TØ 320
75430     IF (PRE2(2,I) .LT. TABLE(2,1) ) GØ TØ 305
75440     IF (PRE2(2,I) .GT. TABLE(2,1) ) GØ TØ 320
75450     IF (PRE2(3,I) .GE. TABLE(3,1) ) GØ TØ 320
75460C    STEM CØMES BEFØRE PART ØF DICTIØNARY IN CØRE. IF THE FIRST
75470C    PART IS IN CØRE, THEN STEM NØT IN DICTIØNARY.
75480 305 IF(.NØT.BØTTØM) GØ TØ 200
75490C    HERE ØN ALL UNSUCCESSFUL LØØKUPS.
75500 310 LØØKUP=.FALSE.
75510     DØ 311 N1=1,3
75520     PRE3(N1,I)=0
75530 311 PRE4(N1,I)=0.0
75540     RETURN
75550C    PERFØRM SIMILIAR FUNCTIØN TØ SEE IF STEM FØLLØWS HIGHEST
75560C    DICTIØNARY SEGMENT IN CØRE & IF THAT IS LAST SEGMENT.
75570 320 IF (PRE2(1,I) .GT. TABLE(1,L) ) GØ TØ 325
75580     IF (PRE2(1,I) .LT. TABLE(1,L) ) GØ TØ 400
75590     IF (PRE2(2,I) .GT. TABLE(2,L) ) GØ TØ 325
75600     IF (PRE2(2,I) .LT. TABLE(2,L) ) GØ TØ 400
75610     IF (PRE2(3,I) .LE. TABLE(3,L) ) GØ TØ 400
75620 325 IF(TØP) GØ TØ 310
75630     GØ TØ 210
75640C    K IS THE SMALLEST PØWER ØF 2 THAT IS > CURRENT IN-CØRE
75650C    SEGMENT LENGTH.  CØMPUTE ØNLY IF IT HAS CHANGED.
75660 400 IF(L.EQ.LØLD) GØ TØ 430
75670 410 K=1; LØLD=L
75680 420 IF(K.GT.L) GØ TØ 430
```

Figure VI-3 Function LOOKUP (cont'd)

```
75690      K=K+K; GØ TØ 420
75700C     NØW START BINARY SEARCH. IK IS INDEX AND J IS DELTA.
75710 430  IK=K/2
75720 440  J=IK/2
75730 445  IF(IK.GT.L) GØ TØ 490
75740C     ARE WE LØØKING TØØ HIGH IN THE TABLE?
75750      IF(PRE2(1,I).LT.TABLE(1,IK)) GØ TØ 490
75760      IF(PRE2(1,I).EQ.TABLE(1,IK).AND.PRE2(2,I).LT.TABLE(2,IK))
75765&     GØ TØ 490
75770      IF((PRE2(1,I).EQ.TABLE(1,IK).AND.PRE2(2,I).EQ.TABLE(2,IK))
75775&     .AND.PRE2(3,I).LT.TABLE(3,IK)) GØ TØ 490
75780C     EITHER A MATCH IS FØUND ØR WE'RE LØØKING TØØ LØW.
75790 460  DØ 461 N1=1,3
75800      IF (PRE2(N1,I) .NE. TABLE(N1,IK) ) GØ TØ 480
75810 461  CØNTINUE
75820C     HERE IF SUCCESSFUL. PUT CØNCEPT VECTØR IN PRE & RETURN.
75830 470  DØ 471 N1=1,3
75840      PRE3(N1,I)=CØN(N1,IK)
75850 471  PRE4(N1,I)=WT(N1,IK)
75860      LØØKUP=.TRUE.; RETURN
75870 480  IK=IK+J; GØ TØ 500
75880 490  IK=IK-J
75890 500  IF(J .EQ. 0) GØ TØ 310
75900      J=J/2; GØ TØ 445; END
```

Figure VI-3 Function LOOKUP (concluded)

```
78000C      SUBRØUTINE 'NUMBER' IDENTIFIES DØCUMENTS, REQUIRES CØMMØN
78010C     MESSAGE FILE PLUS YESNØ, ØUT, PLUCK, PUT, LENGTH
78020C     AND ZØRCH.
78030      SUBRØUTINE NUMBER(F1,ARG,NR,NP)
78040C     SHARED CØMMØN STØRAGE FØR THE DIALGØUE PRØCESSØR.
78050      CØMMØN TERSE, NØNØ(100), TEMP1(50), TEMP2(50), TEMP3(50),
78060&      TEMP4(50),TEMP5(50),TEMP6(50),QUERY1(50),QUERY2(50),
78070&     PRE1(5,25), PRE2(3,25), PRE3(3,25), PRE4(3,25)
78080&      ,   LGSTACNØ
78090      INTEGER TEMP1, TEMP2, TEMP4, QUERY1, PRE3
78100      ASCII PRE1, PRE2
78110      LØGICAL TERSE, TEMP5, TEMP6
78120      INTEGER F1,ARG,RNG,R,P,ACNØ,ZØRCH,YESNØ,HI,N(2)
78130      ASCII X(18), Y(5), Z(5)
78140      DATA RNG/0/
78150      IF(F1.GT.0) GØ TØ 130
78160      IF(F1.LT.0) GØ TØ 90
78170C     ENTRY IS NØT ØNE ØF A SEQUENCE.
78180 10   CALL ØUT(2)
78190 20   CALL PLUCK("          ",X,L,1,NR,NP)
78200C     READ TTY INPUT.
78210      IF(L.GT.6) GØ TØ 50
78220C     L>6 IMPLYS ERRØR.
78230      IF(X(1).EQ."ALL") GØ TØ 180
78240      P=0;R=1;N(1)=0;N(2)=0;J=1;K=0
78250C     SCAN INPUT FRØM RIGHT.
78260 21   ND=LENGTH(X,Y,Z,1)
78270      IF(Y(1).EQ."A") GØ TØ 59
78280C     INPUT IS RANGE, SMALLER IN N(1).
78290      IF(Y(1).NE."-") GØ TØ 22
78300      P=-1;R=2;K=0; GØ TØ 23
78310 22   IF(ZØRCH(Y(1)).GT.9) GØ TØ 50
78320      N(R)=N(R)+(MAXO(1,10**K))*(ZØRCH(Y(1)))
78330      K=K+1
78340 23   J=J+1
```

Figure VI-4 Subroutine NUMBER
Function ZORCH (cont'd)

```
78350       IF(J.GT.L) GØ TØ 30
78360       DØ 24 M=1,5
78370 24    X(M)=Z(M)
78380C      RETURN FØR NEXT CHARACTER.
78390       GØ TØ 21
78400 30    IF(P.LT.0) GØ TØ 120
78410C      TØ 120 IF RANGE. SEARCH FØR SINGLE TEMP. ID. IF NØT.
78420       DØ 31 M=1,50
78430       IF(TEMP2(M).EQ.N(1)) GØ TØ 40
78440 31    CØNTINUE
78450       ACNØ=-1; GØ TØ 60
78460 40    ACNØ=TEMP1(M); GØ TØ 60
78470 50    CALL ØUT(5); GØ TØ 10
78480 59    ACNØ=N(1)
78490 60    IF( ACNØ.GT.0 .AND. ACNØ.LE.LGSTACNØ ) GØ TØ 80
78500 70    CALL ØUT(4); GØ TØ 90
78510 80    F1=-1; ARG=ACNØ; RETURN
78520 90    CALL ØUT(3)
78530       IF(YESNØ(P).GT.0) GØ TØ 10
78540C      NØ MØRE WANTED
78550 100   F1=0
78560 110   RETURN
78570 120   I=N(2); HI=N(1); F1=0; RNG=1; GØ TØ 140
78580C      RANGE ØF TEMP. NØS. ØR "ALL".
78590 130   IF(RNG.NE.1) GØ TØ 190
78600 140   DØ 141 M=1,50
78610       IF(TEMP2(M).EQ.I) GØ TØ 150
78620 141   CØNTINUE
78630       IF(I.GE.HI .AND. F1.EQ.0) GØ TØ 70
78640       IF(I.LT.HI) GØ TØ 142
78650       F1=-1; GØ TØ 90
78660 142   I=I+1 ; GØ TØ 140
78670 150   ARG=TEMP1(M); I=I+1
78680       IF(I.GT.HI) GØ TØ 160
78690       F1=F1+1; GØ TØ 110
```

Figure VI-4 Subroutine NUMBER
Function ZORCH (cont'd)

```
78700 160 F1=-1; GØ TØ 110
78710 180 RNG=0; I=1; F1=0
78720C     ALL TEMP FILE WANTED.
78730 190 IF (I.GT.50) GØ TØ 220
78740     IF(TEMP1(I).NE.0) GØ TØ 210
78750     I=I+1; GØ TØ 190
78760 210 ARG=TEMP1(I); I=I+1; F1=F1+1; GØ TØ 110
78770 220 IF(F1.NE.0) GØ TØ 230
78780C     F1=0 & I>50 IMPLYS TEMP FILE EMPTY.
78790     CALL ØUT(6); GØ TØ 70
78800 230 F1=0; GØ TØ 110
78810     END
78820C
78830C
78840C     FUNCTIØN 'ZØRCH' IS USED BECAUSE ØF RESTRICTIØNS IN SØME
78850C     VERSIØNS ØF THE LANGUAGE--IT AVOIDS MIXING MØDES.
78860     FUNCTIØN ZØRCH(K)
78870     INTEGER ZØRCH
78880     DATA LEFT,LEFTL/006004004004Ø,007104004004Ø/
78890     IF(K.LT.LEFT  .ØR.  K.GT.LEFTL) GØ TØ 1
78900     ZØRCH=(K-LEFT)/134217728; RETURN
78910 1   ZØRCH=100; RETURN; END
```

Figure VI-4 Subroutine NUMBER
Function ZORCH (concluded)

```
80000C      ØUT 11/10/69
80010C      SUBRØUTINE ØUT PRINTS FRØM FILE 'MESSAGES'. TERSE FØRMS FIRST.
80020       SUBRØUTINE ØUT(J)
80030       CØMMØN TERSE, NØNØ(100), TEMP1(50), TEMP2(50), TEMP3(50),
80040&       TEMP4(50), TEMP5(50), TEMP6(50), QUERY1(50), QUERY2(50)
80050&      , PRE1(5,25), PRE2(3,25), PRE3(3,25), PRE4(3,25)
80060&      , LGSTACNØ
80070       INTEGER TEMP1, TEMP2, TEMP4, QUERY1, PRE3
80080      ASCII PRE1,PRE2
80090       LØGICAL TERSE, TEMP5, TEMP6
80100       INTEGER T,TT
80110       ASCII A(67)
80120       DATA A(67)/"↑"/
80130 1     READ("MESSAGES",2,END=100) M,T,L,(A(K),K=1,66)
80140 2     FØRMAT(I2,I1,I2,1X,66A1)
80150       IF(M.NE.J) GØ TØ 1
80160       IF((T.EQ.0) .AND. (.NØT. TERSE)) GØ TØ 1
80170       TT=T
80180 3     I=0
80190 4     IF(A(I+1).EQ."↑".ØR.I.GE.66) GØ TØ 5
80200       I=I+1; GØ TØ 4
80210 5     PRINT 6,(A(K),K=1,I)
80220 6     FØRMAT(1H ,66A1)
80230       READ("MESSAGES",2,END=200)M,T,L,(A(K),K=1,66)
80240       IF(M.EQ.J.AND.T.EQ.TT) GØ TØ 3
80250 200   BEGIN FILE "MESSAGES"; RETURN
80260 100   PRINT 300,J; J=-1; GØ TØ 200
80270 300   FØRMAT("-ERRØR IN 'ØUT' SUBRØUTINE AT MESSAGE ↓", I4)
80280       END
```

Figure VI-5 Subroutine OUT

```
83000C      SUBRØUTINE 'PLUCK' GETS STRINGS FRØM FILES. IT REQUIRES FUNCT-
83010C      TIØN 'PUT', WHICH PACKS APLHA INFØRMATIØN.
83020       SUBRØUTINE PLUCK(FILE,ARRAY,L,I,R,P)
83030       INTEGER R,ØLDR,P,PUT,START
83040       FILENAME FILE
83045       FILENAME ØLDFILE
83047       ASCII FILE1,FILE2
83048C      BECAUSE CURRENT RADC VERSIØN HAS NØT BEEN CHANGED TØ ALLØW
83049C       FILENAME CØMPARISØNS, ØNLY FIRST 4 CHARACTERS USED.
83050       ASCII ARRAY(18),  DELIM(11), BLANKS, BUF(72)
83060       DATA BLANKS/"    "/
83070       DATA ØLDFILE/""/
83080       DATA DELIM/004004004004,005404004004,005604004004,
83090&      004204004004,004104004004,007304004004,007204004004,
83100&      005004004004,005104004004,007704004004,005504004004/
83110C      LIMIT=1,10 ØR 11: CØNTRØLS SELECTIØN ØF DELIMIT CHARACTERS.
83120       IMAG=IABS(I)
83130       LIMIT=1+9*(IMAG/2)+IMAG/3
83140C      CHECK FØR ILLEGAL PARAMETERS
83150       IF(.NØT.(R.LT.1.ØR.IMAG.GT.3.ØR.P.LT.1.ØR.P.GT.72)) GØ TØ 10
83160       PRINT 1,R,P,I
83170 1     FØRMAT("-PAR. ERRØR IN 'PLUCK': R,P,I", 3I12)
83180       L=0;P=-100;RETURN
83190C      INITIALIZE, THEN SET UP FØR CØNTINUATIØN ØN FILE SWITCH IF I=0
83200 10    DØ 11 J=1,18
83210 11    ARRAY(J)=BLANKS
83220       IF(I.NE.0) GØ TØ 20
83230       ØLDFILE=FILE
83240       ØLDR=R
83250       BACKSPACE FILE
83260       READ(FILE,12,END=60) BUF
83270 12    FØRMAT(72A1)
83280       RETURN
83290C      RESET IF NEW FILE NØT PRECEEDED BY I=0, THEN GET RECØRD.
83300 20    FILE1=FILE; FILE2=ØLDFILE
```

Figure VI-6 Subroutine PLUCK (cont'd)

```
83305      IF(FILE1.EQ.FILE2) GØ TØ 30
83310      ØLDFILE=FILE
83320      GØ TØ 31
83330 30   IF(R.EQ.ØLDR) GØ TØ 70
83340 31   IF(FILE1.EQ.BLANKS) GØ TØ 40
83341      READ(FILE,12,END=60) BUF
83342      BEGIN FILE FILE
83350      ØLDR=0
83360 40   IF(R.EQ.ØLDR) GØ TØ 70
83370 50   READ(FILE,12,END=60) BUF
83380      ØLDR=ØLDR+1; GØ TØ 40
83390C     RETURN WITH L=R=P=0 IF END REACHED.
83400 60   L=0;R=0;P=0;RETURN
83410C     NØW STEP THRØUGH BUFFER TØ FIND NEXT DELIMITED STRING.
83420 70   L=0;START=P
83430 80   IF(P.GT.72) GØ TØ 100
83440      DØ 81 J=1,LIMIT
83450      IF(BUF(P).EQ.DELIM(J)) GØ TØ 110
83460 81   CØNTINUE
83470C     HERE IF NØN-DELIM FØUND
83480      L=PUT(BUF(P),L,ARRAY)
83490 90   P=P+1; GØ TØ 80
83500C     HERE IF END ØF RECØRD; AT 110 IF ØTHER DELIM FØUND.
83510 100  P=1
83520      R=R+1
83530 110  IF(L.NE.0) GØ TØ 120
83540      IF(R.EQ.ØLDR) GØ TØ 90
83550      GØ TØ 50
83560C     GØØD STRING FØUND. IGNØRE IF I<0 & FIRST STRING ØF RECØRD.
83570 120  IF(I.LT.0.AND.START.EQ.1) GØ TØ 10
83580      RETURN;END
```

Figure VI-6 Subroutine PLUCK (concluded)

```
83800C     FUNCTIØN 'PUT' PUTS CHARACTER A INTØ L+1 CHAR. PØSITIØN
83810C     ØF ARRAY. ARRAY MUST BE INITIALLY CLEARED TØ BLANKS. VALUE
83820C     RETURNED IS L+1; L AND A ARE UNCHANGED.
83830      FUNCTIØN PUT(A,L,ARRAY)
83840      INTEGER PUT
83850      INTEGER A,ARRAY(13),B1,B2,PUT
83860      DATA B1,B2/0000040040040,0040000000000/
83870      N=L+1
83880      PUT=N
83890      JC=MØD(L,4)
83900      JW=L/4+1
83910      K=1
83911 998  IF(JC.EQ.0) GØ TØ 999
83912      K=K*512; JC=JC-1; GØ TØ 998
83913 999  IF(B2.GE.K) ARRAY(JW)=ARRAY(JW)-B2/K
83914      IF((A-B1).GE.K) ARRAY(JW)=ARRAY(JW)+(A-B1)/K
83920      RETURN; END
```

Figure VI-7 Function PUT

```
79000C      SUBRØUTINE 'STEM' FØR STEM ANALYSIS. W IS WØRD INPUT, S IS STE
79010C      ØUTPUT, CØUNT IS LENGTH ØF STEM ØR ZERØ IF FUNCTIØN WØRD.
79020       SUBRØUTINE STEM(W,S,CØUNT)
79030       ASCII A(3), S(5), W(5), X(5), Y(5), V(5), CØM(250,3),
79031&      STM(4,50), BLANKS
79040       LØGICAL FLAG
79050       INTEGER CØUNT,CØDE,PASS,F(5)
79060       DATA F,IC/6*1/
79070       DATA CØM,STM,BLANKS,V,FLAG/951*"    ",
79080&      "AA","II","EE","ØØ","UU",.FALSE./
79090C      CHECK IF CØMMØN WØRDS AND STEMS LØADED--LØAD THEM IF NØT.
79100 1     IF(FLAG) GØ TØ 10
79110       FLAG=.TRUE.
79120 2     READ("WØRDS",3,END=9) CØDE,A
79130 3     FØRMAT(I1,4X,3A4)
79140       IF(CØDE.NE.0) GØ TØ 5
79150       DØ 4 J=1,3
79160 4     CØM(IC,J)=A(J)
79170       IC=IC+1; GØ TØ 6
79180 5     IF(CØDE.LT.1.ØR.CØDE.GT.4) GØ TØ 7
79190       JS=F(CØDE); F(CØDE)=F(CØDE)+1
79200       STM(CØDE,JS)=A(1)
79210 6     IF(IC.LE.250.AND.JS.LT.50) GØ TØ 2
79220 7     PRINT 8
79230 8     FØRMAT("-ERRØR IN FILE 'WØRDS'")
79240 9     CLØSE FILE "WØRDS"
79250C      MAKE IC THE NUMBER ØF CØMMØN WØRDS STØRED
79260       IC=IC-1
79270C      NØW CHECK TØ SEE IF INPUT IS CØMMØN WØRD (UP TØ 12 CHARACTERS)
79280 10    DØ 12 I=1,IC
79290       DØ 11 J=1,3
79300       IF(W(J).NE.CØM(I,J)) GØ TØ 12
79310 11    CØNTINUE
79320       GØ TØ 13
79330 12    CØNTINUE
```

Figure VI-8 Subroutine STEM (cont'd)

```
79340       GØ TØ 15
79350C      HERE IF INPUT IS CØMMØN WØRD.
79360 13    CØUNT=0
79370       DØ 14 J=1,5
79380 14    S(J)=BLANKS
79390       RETURN
79400C      NØW DØ STEM ANALYSIS.  FIRST INITIALIZE--X IS STRING PRØC.
79410 15    PASS=0
79420       DØ 16 J=1,5
79430 16    X(J)=W(J)
79440C      START ØF FULL PASS
79450 17    I=4
79460C      CHECK FØR SUFFIX ØF LENGTH I.
79470 18    L=LENGTH(X,Y,S,I)
79480       IF(Y(1).EQ.BLANKS) GØ TØ 20
79490       DØ 19 J=1,50
79500       IF(STM(I,J).EQ.BLANKS) GØ TØ 20
79510       IF(STM(I,J).EQ.Y(1)) GØ TØ 22
79520 19    CØNTINUE
79530 20    IF(I.EQ.1) GØ TØ 25
79540 21    I=I-1; IF(I.LE.0) GØ TØ 28
79550       GØ TØ 18
79560C      HERE IF STEM FØUND.  REMØVE IT UNLESS WØRD TØØ SHØRT.
79570 22    IF(L-I.LT.5) GØ TØ 21
79580       DØ 23 J=1,5
79590 23    X(J)=S(J)
79600C      IF WØRD ENDED IN 'LY' CHECK FØR 'I'.
79610       IF(Y(1).NE."LY") GØ TØ 25
79620       L=LENGTH(X,Y,S,1)
79630       IF(Y(1).NE."I") GØ TØ 25
79640       DØ 24 J=1,5
79650 24    X(J)=S(J)
79660C      CHECK FØR DØUBLE CØNSØNANT.
79670 25    L=LENGTH(X,F,S,2)
```

Figure VI-8 Subroutine STEM (cont'd)

```
79680      IF(F(1)/262144.NE.(F(1)/134217728)*513) GØ TØ 28
79690      L=LENGTH(X,Y,S,2)
79700C     V CØNTAINS 'AA' ... 'UU'.
79710      DØ 26 J=1,5
79720      IF(Y(1).EQ.V(J)) GØ TØ 28
79730 26   CØNTINUE
79740      L=LENGTH(X,Y,S,1)
79750      DØ 27 J=1,5
79760 27   X(J)=S(J)
79770C     A PASS HAS BEEN MADE--TWØ ALLØWED. USE 'LENGTH' TØ PUT STEM
79780C     IN S AND CØUNT ITS LENGTH IF TWØ PASSES MADE.
79790 28   IF(PASS.NE.1) GØ TØ 29
79800      CØUNT=LENGTH(X,Y,S,0)
79810      RETURN
79820 29   PASS=1; GØ TØ 17
79830      END
```

Figure VI-8 Subroutine STEM (concluded)

```
99000C      WHERE 11/10/69
99010       SUBRØUTINE WHERE(N1,N2)
99020       LØGICAL FLAG; ASCII N1, N1L, A
99030       DATA N1L,N2L,K,L,FLAG/"    ",0,0,72,.TRUE./
99040       IF (FLAG) GØ TØ 2
99050 1     RETURN
99060 2     IF(N1L.NE."    ".ØR.N2L.NE.0) GØ TØ 4
99070       PRINT 3
99080 3     FØRMAT(" ACTIVATE TRACE?")
99090       READ:A
99100       IF (A.NE."NØ") GØ TØ 4
99110       FLAG=.FALSE.;GØ TØ 1
99120 4     IF(N1.EQ.N1L.AND.N2.EQ.N2L) GØ TØ 11
99125       IF(K.EQ.0) GØ TØ 8
99130       IF(L.LE.64)GØ TØ 6
99140       PRINT 5
99150 5     FØRMAT(1H )
99160       L=0
99170 6     PRINT 7,K
99180 7     FØRMAT(2H&*,I6,1H/)
99190       L=L+8
99200       K=0
99210 8     IF(L.LE.62) GØ TØ 9
99220       PRINT 5
99230       L=0
99240 9     L=L+10
99250       PRINT 10,N1,N2
99260 10    FØRMAT(3H&  ,A4,I4)
99270       N1L=N1
99280       N2L=N2
99285       GØ TØ 1
99287 11    K=K+1
99290       GØ TØ 1; END
```

Figure VI-9 Subroutine WHERE

```
81000C      FUNCTIØN YESNØ(I) RETURNS VALUE IN NAME AND ARGUMENT.
81010       FUNCTIØN YESNØ(I)
81020       INTEGER YESNØ
81030       ASCII A
81040 1     READ("          ",2)A
81050 2     FØRMAT(A4)
81060       IF (A.EQ."YES") GØ TØ 3
81070       IF(A.EQ."NØ") GØ TØ 4
81080       IF(A.EQ."ØPTI") GØ TØ 5
81090       CALL ØUT(1)
81100       GØ TØ 1
81110 3     I=1;GØ TØ 6
81120 4     I=0;GØ TØ 6
81130 5     I=-1
81140 6     YESNØ=I;RETURN;END
```

Figure VI-10 Function YESNO

```
999C **** ØN-LINE DIALØGUE PRØCESSØR 1/15/70
1000C     DIALØGUE PRØCESSØR--MAIN PRØGRAM
1010      CØMMØN TERSE, NØNØ(100), TEMP1(50), TEMP2(50), TEMP3(50),
1020&     TEMP4(50), TEMP5(50), TEMP6(50), QUERY1(50), QUERY2(50),
1030&     PRE1(5,25), PRE2(3,25), PRE3(3,25), PRE4(3,25), LGSTACNØ
1040      LØGICAL TERSE, TEMP5, TEMP6, WFLG, SEEFLG,NEWQ, RFLG, DEFLG,
1050&     WRDFLG, DØCDØC, SKIP1, PRINTQ, PRINTR, ØPTIØN, FLAG, RAG,
1060&     BAG, PS, LØØKUP, DØCK, FIRST
1070      INTEGER YESNØ, F1, ARG, PUT, TEMP1, TEMP2, TEMP4, QUERY1, PRE3
1080      ASCII PRE1, PRE2, ØPTIØNS(13), VALUES(6), S(5), W(5),
1090&     ARRAY(18)
1100      FILENAME TELETYPE
1110      DIMENSIØN WT(5), ICØN(5)
1120      DATA ØPTIØNS/ "CHG", "CLR", "CØN", "DDC", "DEL", "END", "DØC",
1130&     "MØD", "ØFF", "RET", "SEE", "WGT", "WRD"/
1140      DATA VALUES/ "1", "2", "3", "4", "5", "END"/-
                                                        1150      DATA T
1160C     SINCE INITIAL ENTRY ØCCURS ØNLY ØNCE DURING USE, DATA STATE-
1170C     MENTS INITIALIZE AND #100 CØMES BELØW, WHERE CØMMØN INVØLVED.
1180      DATA JX,IX,NTR,NTP/0,3*1/
1190      DATA NEWQ,RFLG,DEFLG,WFLG,SEEFLG,WRDFLG,DØCDØC/7*.FALSE./
1200      DATA SKIP1,PRINTQ,PRINTR,ØPTIØN/4*.FALSE./
1202      CALL ØUT(74)
1210C     INITIALIZE CØMMØN STØRAGE
1220C     ********** HIGHEST ACCESSIØN NUMBER SET HERE**********
1230 100  LGSTACNØ=50; CALL WHERE("INIT",100)
1240      TERSE=.FALSE.
1250      DØ 101 I=1,50
1260      NØNØ(I)=0; NØNØ(I+50)=0; TEMP3(I)=0.0
1270      TEMP1(I)=0; TEMP2(I)=0; TEMP4(I)=0; QUERY1(I)=0
1290      TEMP5(I)=.FALSE.; TEMP6(I)=.FALSE.; QUERY2(I)=0.0
1300 101  CØNTINUE
1310      DØ 110 I=1,25
1320      DØ 105 J=1,5
1330 105  PRE1(J,I)="    "
```

Figure VI-11 Program DIALOGUE (cont'd)

```
1340        DO 110 K=1,3
1350        PRE2(K,I)="    "; PRE3(K,I)=0
1360 110    PRE4(K,I)=0.0
1370C       BEGIN DIALOGUE WITH OPERATOR.
1380        CALL OUT(7)
1390        IF(YESNO(I)) 500,220,120
1400 120    CALL WHERE("3-1",120); IF(.NOT.SKIP1) GO TO 130
1410        CALL OUT(8)
1420        IF(YESNO(I)) 500,130,500
1430 130    CALL OUT(9)
1440 200    CALL WHERE("2-2",200); NR=1; NP=1; I=1;FLAG=.TRUE.;RAG=.FALSE.
1450 201    CALL PLUCK(TELETYPE,ARRAY,L,2,NTR,NTP)
1460        IF(ARRAY(1).EQ."END") GO TO 205
1470        DO 202 J=1,5
1480 202    W(J)=ARRAY(J)
1490        CALL STEM(W,S,L)
1500        IF(L.EQ.0) GO TO 201
1510 203    IF (PRE1(1,I).EQ."    ") GO TO 9203
1520        IF (I.GE.25) GO TO 205
1530        I=I+1; GO TO 203
1540 9203   DO 204 J=1,5
1545        IF (J.LE.3) PRE2(J,I)=S(J)
1550 204    PRE1(J,I)=W(J)
1560        BAG=LOOKUP(I)
1570        FLAG=FLAG.AND.BAG
1580        RAG=RAG.OR.BAG
1590        GO TO 201
1600 205    IF (FLAG) GO TO 300
1610        CALL OUT(10)
1620C       GO TO 300 IF ALL STEMS IN DICTIONARY. PRINT EXCEPTIONS IF NOT.
1630        DO 207 I=1,25
1640        IF(PRE3(1,I).NE.0) GO TO 207
1650        IF(PRE1(1,I).NE."    ") WRITE(TELETYPE,9900) (PRE1
1655&       (K,I), K=1,5)
1660        DO 206 J=1,5
```

Figure VI-11 Program DIALOGUE (cont'd)

```
1670        IF(J.LE.3) PRE2(J,I)="    "
1680 206    PRE1(J,I)="    "
1690 207    CONTINUE
1700C       GO TO 300 UNLESS TABLE TOTALLY EMPTY
1710        IF (RAG) GO TO 300
1720        CALL OUT(11)
1730 210    CALL WHERE("5-2",210); CALL OUT(12)
1740C       CHANGE MODE?
1750        IF (YESNO(I)) 500,211,120
1760 211    CALL OUT(13)
1770C       DOES USER WANT TO QUIT?
1780        IF(YESNO(I)) 500,220,230
1790 220    CALL WHERE("1-2",220); NEWQ=.TRUE.; GO TO 1310
1800 230    CALL OUT(26); STOP
1810 240    CALL WHERE("6-2",240); IF(RFLG) GO TO 500
1820        GO TO 210
1830C       QUERY IN-- FORM QUERY VECTOR--FIFTY LARGEST COMPONENTS
1840 300    CALL WHERE("4-3",300); L=1
1850        DO 309 I=1,25
1860        DO 309 J=1,3
1870        IF(PRE3(J,I).EQ.0) GO TO 309
1880        DO 301 K=1,50
1890        IF(PRE3(J,I).NE.QUERY1(K)) GO TO 301
1900        QUERY2(K)=QUERY2(K)+PRE4(J,I); GO TO 309
1910 301    CONTINUE
1920        IF (L.GT.50) GO TO 303
1930        QUERY1(L)=PRE3(J,I); QUERY2(L)=PRE4(J,I); L=L+1; GO TO 309
1940 303    SMALL=1E6
1950        DO 304 K=1,50
1960        IF (QUERY2(K).GE.SMALL) GO TO 304
1970        SMALL=QUERY2(K); LS=K
1980C
1990 304    CONTINUE
2000        IF(PRE4(J,I).LE.SMALL)  GO TO 309
2010        QUERY1(LS)=PRE3(J,I); QUERY2(LS)=PRE4( J,I)
```

Figure VI-11 Program DIALOGUE (cont'd)

```
2020 309   CONTINUE
2040 314   CALL WHERE("5-3",314); IF(.NOT.PRINTQ) GO TO 330
2050C      IF PRINTQ SET, USER CAN PRINT PRE & QUERY
2060       CALL OUT(15)
2070       IF(YESNO(I)) 500,330,315
2080 315   CALL OUT(16)
-2085       NFULL=0
2090       DO 319 I=1,25
2100       IF(PRE3(1,I).GT.0) WRITE(TELETYPE,9901) (PRE1(J,I),J=1,5),(
2110&      PRE2(K,I),K=1,3), (PRE3(L,I),PRE4(L,I),L=1,3)
2115       NFULL=NFULL+PRE3(1,I)
2120 319   CONTINUE
2125       IF(NFULL.EQ.0) CALL OUT(75)
2130       WRITE(TELETYPE, 9902)
2140       CALL OUT(17)
2150       IF(YESNO(I)) 500,330,320
2160 320   CALL OUT(18)
2161       DO 323 K=1,46,5
2162       I=K+4
2163       DO 321 J=K,I
2164       IF(QUERY1(J).NE.0) GO TO 322
2165 321   CONTINUE
2166       GO TO 323
2167 322   WRITE(TELETYPE,9903) (QUERY1(II), QUERY2(II), II=K,I)
2170 323   CONTINUE
2175       WRITE(TELETYPE,9902)
2180C      NOW CORRELATE. FIRST CLEAR RETRIEVED LAST FLAG, FORM TERM
2190 330   NJX=0; SIGQ=0.0; FLAG=.FALSE.
2200       DO 331 I=1,50
2210       IF (QUERY2(I).LE.0) GO TO 331
2220       SIGQ=SIGQ+(QUERY2(I))**2
2230 331   TEMP6(I)=.FALSE.
2240C      NOW CORRELATE QUERY AGAINST DOCUMENTS.
2250       COR=0; SIGD=0; IOLD=1
2260 332   READ("CONCEPTS",9904,END=342)  I, (ICON(K), WT(K), K=1,5)
```

Figure VI-11 Program DIALOGUE (cont'd)

```
2270C       CHECK IF DØCUMENT EXCLUDED.
2280        DØ 333 K=1,100
2290        IF (I.EQ.NØNG(K)) GØ TØ 332
2300 333    CØNTINUE
2310 334    IF (IØLD.NE.I) GØ TØ 336
2320        DØ 335 J=1,5
2330        IF(WT(J).GT.0) SIGD=SIGD+WT(J)**2
2340        DØ 335 K=1,50
2350        IF (QUERY1(K).NE.ICØN(J)) GØ TØ 335
2360        CØR=CØR+QUERY2(K)*WT(J)
2370 335    CØNTINUE
2380        GØ TØ 332
2390 336    IF((SIGQ*SIGD).LE [illegible] GØ TØ 341
2395        CØR=CØR/SQRT(SIGD*SIGQ)
2400C       CØRRELATIØN NØW FØUND. IF ZERØ SKIP. IF NØT, CHECK IF ALREADY
2410C       IN TABLE. IF SØ, MAKE SIGN ØF ACCESSIØN NEGATIVE AS A 'RETR-
2420C       IEVED TWICE' FLAG AND MØDIFY TABLE ENTRY. IF NØT, ENTER IF
2430C       RØØM EXISTS ØR IF CØRRELATES HIGHER THAN ANØTHER NEW HIT.
2440        IF(CØR.LE.0) [illegible] TØ 341
2450        DØ 337 J=1,50
2460        IF(TEMP1(J).EQ.IØLD) GØ TØ 338
2470 337    CØNTINUE
2480        GØ TØ 339
2490 338    TEMP1(J)=-TEMP1(J); TEMP3(J)=CØR; TEMP6(J)=.TRUE.; GØ TØ 341
2500 339    SMALL=1E6; L1=0; L2=0
2510        DØ 340 J=1, 50
2520        IF(TEMP1(J).EQ.0) L1=J
2530        IF(TEMP1(J).LT.0 .ØR. (.NØT.TEMP6(J)) .ØR.
2540&       TEMP3(J).GE.SMALL) GØ TØ 340
2550        SMALL=TEMP3(J); L2=J
2560 340    CØNTINUE
2570C       HAVE FØUND A PLACE IN TEMP TABLES ØR L1=L2=0
2580        IF(L1.EQ.0 .AND. CØR.GT.SMALL) L1=L2
2590        IF(L1.EQ.0) GØ TØ 341
2600        TEMP1(L1)=IØLD
```

Figure VI-11 Program DIALOGUE (cont'd)

```
2610        TEMP2(L1)=IX; IX=IX+1; JX=JX+1; NJX=NJX+1
2620        TEMP3(L1)=CØR
2630        TEMP5(L1)=.FALSE.
2640        TEMP6(L1)=.TRUE.
2650 341    CØR=0; SIGD=0; IØLD=I; GØ TØ 334
2660C       NØW PERFØRM RANKING ØN NEW HITS AND REVERSE ANY ACC. NØ. <0.
2670 342    DØ 343 J=1,50
2680        IF(TEMP1(J).LT.0) TEMP1(J)=-TEMP1(J)
2690 343    IF(TEMP6(J))  TEMP4(J)=0
2700        DØ 345 J=1,50
2710        BIG=0.0; L=0
2720        DØ 344 K=1,50
2730        IF(TEMP4(K).NE.0 .ØR. (.NØT.TEMP6(K)) .ØR.
2740&       TEMP3(K).LT.BIG )  GØ TØ 344
2750        BIG=TEMP3(K); L=K
2760 344    CØNTINUE
2770        IF(L.NE.0)  TEMP4(L)=J
2780 345    CØNTINUE
2785        BEGIN FILE "CØNCEPTS"
2790C       TEMP  FILE NØW BUILT. TELL USER HØW MANY HITS FØR LAST QUERY.
2800        IF (NJX.LT.50) GØ TØ 346
2810        CALL ØUT(19); GØ TØ 350
2820 346    CALL ØUT(20); WRITE(TELETYPE,9905) NJX
2830 350    IF(NJX.EQ.0) GØ TØ 240
2840C       RETRIEVAL HAS BEEN PERFØRMED.  IF USER HAS SELECTED MØDE #4
2850C       HE MAY NØW PRINT TEMPØRARY FILE.
2860 400    CALL WHERE("8-4",400); IF(.NØT.PRINTR) GØ TØ 440
2870 420    CALL WHERE("9-4",420); CALL ØUT(21)
2880        IF(YESMØ(I)) 500,440,430
2890 430    CALL ØUT(22)
2900        DØ 435 I=1,50
2910        IF(TEMP1(I).EQ.0) GØ TØ 435
2920        WRITE(TELETYPE,9906) TEMP1(I), TEMP2(I), TEMP3(I), TEMP4(I),
2930&       TEMP5(I), TEMP6(I)
2940 435    CØNTINUE
```

Figure VI-11 Program DIALOGUE (cont'd)

```
2945        WRITE(TELETYPE,9902)
2950 440    CALL ØUT(23)
2960        IF (YESNØ(I)) 500,500,445
2970C       PRINT BIBLIØGRAPHIC DATA, IF NØT PRINTED BEFØRE.
2980C
2990 445    J=1
3000 450    K=1
3010 455    IF(TEMP1(J).EQ.0) GØ TØ 475
3015        K=K+1
3020        WRITE(TELETYPE,9907) TEMP1(J), TEMP2(J)
3030        IF(TEMP5(J)) GØ TØ 460
3040 456    FLAG=DØCK(1,TEMP1(J), ARRAY, L)
3050        WRITE(TELETYPE,9913) (ARRAY(N),N=1,L)
3060        IF(FLAG) GØ TØ 456
3070 457    FLAG=DØCK(2,TEMP1(J), ARRAY, L)
3080        WRITE(TELETYPE,9913) (ARRAY(N),N=1,L)
3090        IF(FLAG) GØ TØ 457
3100        GØ TØ 470
3110 460    CALL ØUT(24)
3120 470    TEMP5(J)=.TRUE.
3130 475    J=J+1
3140        IF(J.GT.50) GØ TØ 490
3160 480    IF(K.LE.5) GØ TØ 455
3170C       MØRE DESIRED?
3175        WRITE(TELETYPE,9902)
3180        CALL ØUT(3)
3190        IF(YESNØ(I)) 500,500,450
3200 490    WRITE(TELETYPE,9902); CALL ØUT(25)
3210C       THIS IS THE ØPTIØNS SECTIØN.
3220 500    CALL WHERE("ØPT",500); CALL ØUT(27)
3230        NR=1; NP=1
3240        CALL PLUCK(TELETYPE,ARRAY,L,3,NTR,NTP)
3250        IF(ARRAY(1).EQ."HELP") GØ TØ 520
3260        DØ 501 J=1,13
3270        IF (ARRAY(1).EQ.ØPTIØNS(J)) GØ TØ 580
```

Figure VI-11 Program DIALOGUE (cont'd)

```
3280 501   CØNTINUE
3290 510   CALL ØUT(31); GØ TØ 500
3300 520   CALL ØUT(28)
3310       IF (ØPTIØN) GØ TØ 540
3320 530   CALL ØUT(30); IF(YESNØ(I)) 500,500,540
3330 540   CALL ØUT(29); GØ TØ 500
3340 580   DEFLG=.FALSE.; RFLG=.TRUE.
3350 590   CALL WHERE("INDX",J); GØ TØ (1300,760,1400,600,1100,1130,
3360&      1200,600,1330,1000,740,930,730), J
3370C      QUERY MØDIFICATIØN--FIRST CHECK TØ SEE IF DØING DØC.-DØC.
3380 600   CALL WHERE("MØD",600); WFLG=.FALSE.
3390       IF (DØCDØC)  GØ TØ 605
3400       CALL ØUT(51);  GØ TØ 610
3410 605   CALL ØUT(69)
3420 610   IF (YESNØ(I)) 500,700,620
3430C      ENTRY PØINT FØR DØCUMENT-DØCUMENT CØRRELATIØN.
3440 620   CALL WHERE("DDC",620)
3450       DØ 622 I=1,25
3460       DØ 621 J=1,3
3470       PRE2(J,I)="    "
3480       PRE3(J,I)=0
3490 621   PRE4(J,I)=0.0
3500       DØ 622 J=1,5
3510 622   PRE1(J,I)="    "
3520       IF(.NØT.DØCDØC) GØ TØ 640
3530 630   CALL ØUT(59)
3540       IF(YESNØ(I)) 500,640,650
3550 640   DØ 641 I=1,50
3560       QUERY1(I)=0
3570 641   QUERY2(I)=0.0
3580 650   CALL ØUT(52)
3590       F1=0; DØCDØC=.TRUE.
3600 660 CALL NUMBER(F1,ARG,NTR,NTP)
3610       IF(F1.EQ.0) GØ TØ 900
3620C      NØW DEEP INTØ DØCUMENT-DØCUMENT CØRRELATIØN.
```

Figure VI-11 Program DIALOGUE (cont'd)

```
3630 661   READ("CØNCEPTS",9904,END=664) I, (ICØN(K), WT(K), K=1,5)
3640       IF(I.LT.ARG) GØ TØ 661
3650       IF(I.GT.ARG) GØ TØ 664
3660       DØ 663 K=1,5
3670       L=0
3680       DØ 662 J=1,50
3690       IF (QUERY1(J).EQ.0) L=J
3700       IF (ICØN(K).EQ.0) GØ TØ 664
3710       IF (QUERY1(J).NE.ICØN(K)) GØ TØ 662
3720       QUERY2(J)=QUERY2(J)+WT(K)
3730       GØ TØ 663
3740 662   CØNTINUE
3750       IF (L.EQ.0) GØ TØ 663
3760       QUERY1(L)=ICØN(K); QUERY2(L)=WT(K)
3770 663   CØNTINUE
3775       GØ TØ 661
3780 664   BEGIN FILE "CØNCEPTS"; GØ TØ 660
3790C      ASK IF PRESENT QUERY TØ BE CLEARED.
3800 700   CALL WHERE("10-7",700); CALL ØUT(70)
3810       IF(YESNØ(I)) 500,710,800
3820 710   CALL ØUT(53)
3830       IF(YESNØ(I)) 500,720,750
3840 720   IF(.NØT.WFLG) GØ TØ 900
3855       DØ 9721 J=1,50
3856       QUERY1(J)=0
3857 9721  QUERY2(J)=0.0
3858       DØ 729 I=1,25
3860       IF (PRE2(1,I).EQ."    ") GØ TØ 729
3870       IF (.NØT.LØØKUP(I)) GØ TØ 729
3880       DØ 729  J=1,3
3890       L=0
3900       IF(PRE3(J,I).EQ.0) GØ TØ 729
3910       DØ  721 K=1,50
3920       IF(QUERY1(K).EQ.0) L=K
3930       IF(QUERY1(K).NE.PRE3(J,I)) GØ TØ 721
```

Figure VI-11 Program DIALOGUE (cont'd)

```
3940        QUERY2(K)=QUERY2(K)+PRE4(J,I); GØ TØ 729
3950 721    CØNTINUE
3960        IF(L.EQ.0) GØ TØ 729
3970        QUERY1(L)=PRE3(J,I); QUERY2(L)=PRE4(J,I)
3980 729    CØNTINUE
3990C
4000        GØ TØ 900
4010C       HERE IF PRESENT QUERY TØ BE PRINTED.
4020 730    CALL WHERE("WRD",730); WRDFLG=.TRUE.; GØ TØ 750
4030 740    CALL WHERE("SEE",740); SEEFLG=.TRUE.
4040 750    CALL ØUT(54); L=0
4050        DØ 751 I=1,25
4060        IF(PRE1(1,I).NE."    ") WRITE(TELETYPE,9900) (PRE1(J,I),J=1,3)
4070 751    CØNTINUE
4080        IF (SEEFLG) GØ TØ 930
4090        GØ TØ  840
4100C       HERE TØ CLEAR EVERYTHING EXCEPT FILE ØF RETRIEVED DØCUMENTS.
4110 760    CALL WHERE("CLR",760); CALL ØUT(72)
4120        DØ 761 I=1,50
4130        QUERY1(I)=0
4140 761    QUERY2(I)=0.0
4150        DØ 763 I=1,25
4160        DØ 762 J=1,5
4170 762    PRE1(J,I)="    "
4180        DØ 763 K=1,3
4190        PRE3(K,I)=0; PRE4(K,I)=0.0
4200 763    PRE2(K,I)="    "
4210        DØCDØC=.FALSE.; GØ TØ 500
4220C       NØW REPLACE ØLD QUERY. FIRST CLEAR PRESNT.
4230 800    CALL WHERE("12-8",800)
4240        DØ 802 I=1,25
4250        DØ 801 J=1,5
4260 801    PRE1(J,I)="    "
4270        DØ 802 K=1,3
4280        PRE2(K,I)="    "; PRE3(K,I)=0
```

Figure VI-11 Program DIALOGUE (cont'd)

```
4290 802   PRE4(K,I)=0
4300 810   DECDOC=.FALSE.; WFLG=.TRUE.
4310       CALL OUT(56); I=1
4320 815   NR=1; NP=1
4330 816   CALL PLUCK(TELETYPE,ARRAY,L,2,NTR,NTP)
4340       IF(L.EQ.0  .OR. ARRAY(1).EQ."END") GO TO 830
4350       DO 817 J=1,5
4360 817   W(J)=ARRAY(J)
4370       CALL STEM(W,S,L)
4380       IF (L.EQ.0) GO TO 816
4390       I=1
4400 818   IF(PRE1(1,I).EQ."    ") GO TO 819
4410       I=I+1; IF(I.GT.25) GO TO 830
4420       GO TO 818
4430 819   DO 820 J=1,5
4440 820   PRE1(J,I)=W(J)
4450       DO 821 J=1,3
4460 821   PRE2(J,I)=S(J)
4470       GO TO 816
4480C      NOW ALL NEW,NON-COMMON QUERY WORDS AND THEIR STEMS ARE IN PRE.
4490 830   FLAG=.TRUE.
4500       DO 832 I=1,25
4505       IF(PRE1(1,I).EQ."    ") GO TO 832
4510       IF(LOOKUP(I)) GO TO 832
4520       IF(FLAG) CALL OUT(10)
4530       FLAG=.FALSE.; WRITE(TELETYPE,9900) (PRE1(K,I),K=1,5)
4540       DO 831 K=1,5
4550       IF(K.LE.3) PRE2(K,I)="    "
4560 831   PRE1(K,I)="    "
4570 832   CONTINUE
4600       GO TO 850
4610C      ASK IF ANY WORDS TO BE ADDED.
4620 840   CALL WHERE("13-8",840); CALL OUT(55)
4630       IF(YESNO(I)) 500,850,810
4640C      ASK IF ANY WORDS TO BE DELETED
```

Figure VI-11 Program DIALOGUE (cont'd)

```
4650 850  CALL ØUT(57)
4660      IF(YESNØ(I)) 500,700,860
4670 860  DØCDØC=.FALSE.;WFLG=.TRUE.;NR=1;NP=1;FLAG=.TRUE.
4675      CALL ØUT(56)
4680 861  CALL PLUCK(TELETYPE,ARRAY,L,2,NTR,NTP)
4685      IF (L.GT.0) M=L/4 + MINO(1, (L-4*(L/4)))
4690      IF(L.EQ.0 .ØR. ARRAY(1).EQ."END") GØ TØ 870
4700      DØ 865 I=1,25
4710      DØ 862 J=1,5
4720      IF(ARRAY(J).NE.PRE1(J,I)) GØ TØ 865
4730 862  CØNTINUE
4740      DØ 863 K=1,5
4750 863  PRE1(K,I)="    "
4760      DØ 864 L=1,3
4770      PRE2(L,I)="    "
4780      PRE3(L,I)=0
4790 864  PRE4(L,I)=0.0
4800      GØ TØ 861
4810 865  CØNTINUE
4820      IF (FLAG)  CALL ØUT(58)
4830      WRITE(TELETYPE,9900) (ARRAY(K),K=1,M)
4840      FLAG=.FALSE.; GØ TØ 861
4850 870  IF(.NØT.FLAG) GØ TØ 850
4860      IF(.NØT.WRDFLG) GØ TØ 700
4870      WRDFLG=.FALSE.; GØ TØ 500
4880C     HERE WHEN QUERY VECTØR TØ BE INSPECTED/MØDIFIED--PERHAPS.
4890 900  CALL WHERE("11-9",900); CALL ØUT(60)
4900      IF(YESNØ(I)) 500,910,935
4910 910  CALL WHERE("14-9",910); CALL ØUT(65)
4920      IF(YESNØ(I)) 500,600,920
4930 920  DØ 921 I=1,50
4940      IF(QUERY1(I).NE.0) GØ TØ 1000
4950 921  CØNTINUE
4960      CALL ØUT(66)
4970C     QUERY VECTØR IS NULL!
```

Figure VI-11 Program DIALOGUE (cont'd)

```
4980        IF (YESNØ(I)) 500,500,1130
4990C       HERE QUERY VECTØR TØ BE INSPECTED/MØDIFIED--FØR SURE
5000 930    CALL WHERE("WGT",930); CALL ØUT(71)
5010C
5020 935    CALL ØUT(18)
5030        DØ  938 I=1,46,5
5040        L=I+4
5050        DØ 936 K=I,L
5060        IF(QUERY1(K).NE.0) GØ TØ 937
5070 936    CØNTINUE
5080        GØ TØ 938
5090 937    WRITE(TELETYPE,9903) (QUERY1(J),QUERY2(J),J=I,L)
5100 938    CØNTINUE
5105        WRITE(TELETYPE,9902)
5110        IF(.NØT.SEEFLG) GØ TØ 940
5120        SEEFLG=.FALSE.; GØ TØ 500
5130C       VECTØR HAS BEEN PRINTED--IS IT TØ BE MØDIFIED.
5140 940    CALL ØUT(61)
5150        IF (YESNØ(I)) 500,910,945
5160 945    CALL ØUT(62)
5170 950    READ: I,WX
5180        IF(I.GE.1 .AND. I.LE.1500) GØ TØ 960
5190        CALL ØUT(64); GØ TØ 970
5200 960    L=0
5210        DØ 961 J=1,50
5220        IF(QUERY1(J).EQ.0) L=J
5230        IF(QUERY1(J).NE.I) GØ TØ 961
5240        QUERY2(J)=QUERY2(J)+WX; GØ TØ 970
5250 961    CØNTINUE
5260        IF(L.EQ.0) GØ TØ 970
5270        QUERY1(L)=I; QUERY2(L)=WX
5280C       CHECK IF ANY MØRE WANTED
5290 970    CALL ØUT(3)
5300        IF(YESNØ(I)) 500,910,980
5310 980    CALL ØUT(63); GØ TØ  950
```

Figure VI-11 Program DIALOGUE (cont'd)

```
5320C      ENTER HERE BEFØRE ACTUAL RETRIEVAL.
5330 1000 CALL WHERE("RET",1000); IF(JX.EQ.0) CALL ØUT(41)
5340       CALL ØUT(43)
5350       IF(YESNØ(I)) 500,1020,1010
5360 1010 L=100
5370       DØ  1012 J=1,50
5380       DØ  1011 I=1,100
5390       IF(NØNØ(101-I).EQ.0) L=101-I
5400       IF(TEMP1(J).EQ.0 .ØR. TEMP1(J).EQ. NØNØ(I)) GØ TØ 1012
5410 1011 CØNTINUE
5420       NØNØ(L)=TEMP1(J)
5430 1012 CØNTINUE
5440       GØ TØ 1030
5450 1020 DØ 1021 I=1,100
5460 1021 NØNØ(I)=0
5470 1030 CALL ØUT(44)
5480C      CHECK IF PRINT SUPPRESS TØ BE  REMØVED.
5490       IF(YESNØ(I)) 500,1040,1050
5500 1040 DØ 1041 I=1,50
5510 1041 TEMP5(I)=.FALSE.
5520C      DELETE ANY FRØM TEMP FILE?
5530 1050 CALL WHERE("1510",1050); DEFLG=.FALSE.
5540       IF(JX.EQ.50) GØ TØ 1070
5550       IF(JX.EQ. 0) GØ TØ 1090
5560       WRITE(TELETYPE,9915) 50-JX
5570       CALL ØUT(45)
5580       IF (YESNØ(I)) 500,1090,1080
5590 1070 CALL ØUT(46)
5600 1080 DEFLG=.TRUE.; GØ TØ 1100
5610 1090 CALL ØUT(42)
5620       LMAX=50
5630       WRITE(TELETYPE,9908) IX
5640       GØ TØ 314
5650C      NØW DELETE DØCUMENTS FRØM TEMP FILE.
5660 1100 CALL WHERE("DEL",1100); CALL ØUT(36)
```

Figure VI-11 Program DIALOGUE (cont'd)

```
5670        IF(DEFLG) CALL OUT(37)
5680        CALL OUT(38); F1=0
5690 1101   CALL NUMBER(F1,ARG,NTR,NTP)
5700        IF (F1.EQ.0)  GO TO 1120
5710        DO 1102 J=1,50
5720        IF(ARG.NE.TEMP1(J)) GO TO 1102
5730        TEMP1(J)=0;TEMP2(J)=0;TEMP3(J)=0.0;TEMP4(J)=0
5740        TEMP5(J)=.FALSE.; TEMP6(J)=.FALSE.
5750        JX=JX-1
5760 1102   CONTINUE
5770        GO TO 1101
5780 1120   IF (DEFLG) GO TO 1050
5790        GO TO 500
5800C       END OF QUERY SEQUENCE
5810 1130   CALL WHERE("END",1130)
5820        DO 1131 J=1,50
5830        TEMP1(J)=0;TEMP2(J)=0;TEMP3(J)=0.0
5840        TEMP4(J)=0;TEMP5(J)=.FALSE.;TEMP6(J)=.FALSE.
5850        QUERY1(J)=0;QUERY2(J)=0.0; NONO(J)=0
5860 1131   NONO(J+50)=0
5870        DO 1133 I=1,25
5880        DO 1132 J=1,5
5890 1132   PRE1(J,I)="    "
5900        DO 1133 J=1,3
5910        PRE2(J,I)="    "; PRE3(J,I)=0
5920 1133   PRE4(J,I)=0.0
5930        IX=1;JX=0
5940        NEWQ=.FALSE.;DEFLG=.FALSE.;DOCDOC=.FALSE.;TERSE=.FALSE.
5950        SKIP1=.FALSE.;PRINTQ=.FALSE.;PRINTR=.FALSE.;OPTION=.FALSE.
5960        RFLG=.FALSE.; CALL OUT(32); GO TO 210
5970C       HERE TO PRINT DOCUMENT DATA.
5980 1200   CALL WHERE("DOC",1200); IF(JX.EQ.0) GO TO 1205
5990        CALL OUT(47)
6000        IF(YESNO(I)) 500,1205,430
6010 1205   F1=0; CALL OUT(68)
```

Figure VI-11 Program DIALOGUE (cont'd)

```
6020 1210 CALL NUMBER(F1,ARG,NTR,NTP); IF(F1.EQ.0) GO TO 500
6030C
6040      WRITE(TELETYPE,9909) ARG
6050      DO 1211 J=1,50
6060      IF(TEMP1(J).EQ.ARG) GO TO 1212
6070 1211 CONTINUE
6080      GO TO 1220
6090 1212 WRITE(TELETYPE,9910) TEMP2(J),TEMP3(J),TEMP4(J)
6100      IF(.NOT.TEMP6(J)) WRITE(TELETYPE,9911)
6110      WRITE (TELETYPE,9912)
6120      IF(.NOT.TEMP5(J)) GO TO 1220
6130      PS=.TRUE.; GO TO 1225
6140 1220 PS=.FALSE.
6150 1225 DO 1226 I=1,100
6160      IF(NONO(I).NE.ARG) GO TO 1226
6170      CALL OUT(48); GO TO 1230
6180 1226 CONTINUE
6190 1230 IF (PS) GO TO 1235
6200 1231 FLAG=DOCK(1,ARG,ARRAY,L)
6210      WRITE(TELETYPE,9913) (ARRAY(K), K=1,L)
6220      IF (FLAG) GO TO 1231
6230 1232 FLAG=DOCK(2,ARG,ARRAY,L)
6240      WRITE (TELETYPE,9913) (ARRAY(K),K=1,L)
6250      IF (FLAG) GO TO 1232
6260      GO TO 1240
6270 1235 CALL OUT(49)
6280      IF(YESNO(K)) 500,1240,1231
6290 1240 CALL OUT(50)
6300 1245 IF(YESNO(K)).500,1270,1260
6310 1260 FLAG=DOCK(3,ARG,ARRAY,L)
6320      WRITE(TELETYPE,9913) (ARRAY(K),K=1,L)
6330      IF (FLAG) GO TO 1260
6340      IF (F1 .EQ. (-1)) GO TO 1210
6350      F1=4; GO TO 1280
6360 1270 IF (MOD(F1,5).NE.0) GO TO 1210
```

Figure VI-11 Program DIALOGUE (cont'd)

```
6370 1280 WRITE (TELETYPE,9902); CALL ØUT(33)
6380      IF (YESNØ(K)) 500,1290,1210
6390 1290 F1=-1; GØ TØ 1210
6400C     THIS SECTIØN ALLØWS USER TØ CHANGE MØDES ØF ØPERATIØN.
6410 1300 CALL WHERE("CHG",1300); NEWQ=.FALSE.
6420 1310 CALL WHERE("7-13",1310);TERSE=.FALSE.;SKIP1=.FALSE.;PRINTQ=
6430&     .FALSE.;PRINTR=.FALSE.;ØPTIØN=.FALSE.
6440      CALL ØUT(34)
6450      IF(YESNØ(I)) 500,1316,1314
6460 1314 CALL ØUT(35)
6470 1316 CALL ØUT(14)
6480      NR=1; NP=1
6490 1317 CALL PLUCK(TELETYPE,ARRAY,L,3,NTR,NTP)
6500      DØ 1318 I=1,6
6510      IF (ARRAY(I) .EQ. VALUES(I)) GØ TØ 1319
6520 1318 CØNTINUE
6530      CALL ØUT(73); GØ TØ 1300
6540C     BRANCH ØN ØPTIØN SELECTED
6550 1319 GØ TØ (1320,1321,1322,1323,1324,1325), I
6560 1320 TERSE=.TRUE.; GØ TØ 1317
6570 1321 SKIP1=.TRUE.; GØ TØ 1317
6580 1322 PRINTQ=.TRUE.; GØ TØ 1317
6590 1323 PRINTR=.TRUE.; GØ TØ 1317
6600 1324 ØPTIØN=.TRUE.; GØ TØ 1317
6610C     NEW ØPTIØNS SELECTED
6620 1325 IF(NEWQ) GØ TØ 120
6630      GØ TØ 500
6640C     THIS PART CALLED TØ BUILD A FILE FØR ØFFLINE LISTING.
6650 1330 CALL WHERE("ØFF",1330); F1=0
6660      CALL ØUT(67)
6670 1340 CALL NUMBER(F1,ARG,NTR,NTP)
6680      IF (F1.EQ.0) GØ TØ 500
6690      WRITE("ØFFLINE",9909, ARG
6700      DØ 1350 J=1,3
6710 1341 FLAG=DØCK(J,ARG,ARRAY,L)
```

Figure VI-11 Program DIALOGUE (cont'd)

```
6720        WRITE("0FFLINE",9913) (ARRAY(K),K=1,L)
6730        IF(FLAG) G0 T0 1341
6740 1350   C0NTINUE
6750        CALL 0UT(40)
6760        G0 T0 1340
6770C       THIS PART PRINTS D0CUMENTS' C0NCEPT-WEIGHT DATA.
6780 1400   CALL WHERE("C0N",1400); F1=0
6800 1410   CALL NUMBER(F1,ARG,NTR,NTP)
6810        IF (F1.EQ.0) G0 T0 500
6820        CALL 0UT(39)
6830        WRITE(TELETYPE,9914) ARG; CALL 0UT(18)
6840 1420   READ("C0NCEPTS",9904,END=1440)  I, (IC0N(K), WT(K), K=1,5)
6850        IF (I.GT.ARG) G0 T0  1440
6860        IF (I.LT.ARG) G0 T0  1420
6870        WRITE(TELETYPE,9903) (IC0N(K),WT(K), K=1,5)
6880        G0 T0 1420
6890 1440   BEGIN FILE "C0NCEPTS"
6895        WRITE(TELETYPE,9902)
6900        IF(MOD(F1,5).NE.0) G0 T0 1410
6910        CALL 0UT(33)
6920        IF ('ESN0(I)) 500,500,1410
6930 9900   F0RMAT(1X,5A4)
6940 9901   F0RMAT(1X,5A4,1X,3A4,1X,3(I5,F9.5))
6950 9902   F0RMAT(2X)
6960 9903   F0RMAT(5(I4,F9.5))
6970 9904   F0RMAT(I6,5(I4,F9.5))
6980 9905   F0RMAT(2H& ,I4,1H.)
6990 9906   F0RMAT(I6,I13,E18.4,I9,L11,"/",L1)
7000 9907   F0RMAT(// " ACC. N0.",I6,"."/" TEMP. ID.",I7,".")
7010 9908   F0RMAT(1H&,I3,1H.)
7020 9909   F0RMAT(/" ACC. N0.",I6,1H.)
7030 9910   F0RMAT("&  ID.",I3,". C0RR.",F6.3,". RANK",I3,".")
7040 9911   F0RMAT("&N0T ")
7050C
```

Figure VI-11 Program DIALOGUE (cont'd)

```
7060 9912 FØRMAT("&RETRIEVED BY LAST QUERY")
7070 9913 FØRMAT(1X,18A4)
7080 9914 FØRMAT("&", I6, ".")
7085 9915 FØRMAT(" THERE ARE",I3," SPACES IN THE TEMPØRARY FILE ")
7090      END
```

Figure VI-11 Program DIALOGUE (concluded)

```
1000C       CØNGRA 12/30/69
1010        ASCII D(900,3), X(18), W(5), S(5), FLAG
1020        INTEGER CØND(900),CØN(50)
1030        DIMENSIØN WTD(900),WT(50)
1040        DATA ID,NR,NP/3*1/
1050        DØ 100 I=1,900
1060    100 READ ("DICTNRY",101) (D(I,L),L=1,3), CØND(I)
1070    101 FØRMAT (3A4,1X,I4)
1080    105 DØ 110 K=1,900
1090    110 WTD(K)=0.0
1100        DØ 115 K=1,50
1110        CØN(K)=0
1120    115 WT(K)=0
1130        WTMAX=0.0
1140        PRINT:"PRØCESS NØ. ", ID
1150        READ: FLAG
1160        IF (FLAG.NE."NØ") GØ TØ 120
1170        END FILE "CØNCEPTS"
1180        STØP
1190    120 CALL PLUCK("DATA1",X,L,2,NR,NP)
2000        IF (X(1).EQ."**EN") GØ TØ 200
2010        DØ 121 K=1,5
2020    121 W(K)=X(K)
2030        CALL STEM(W,S,L)
2040        IF (L.EQ.0) GØ TØ 120
2050        DØ 130 K=1,900
2060        DØ 125 L=1,3
2070        IF (S(L).NE.D(K,L))GØ TØ 130
2080    125 CØNTINUE
2090        GØ TØ 140
2100    130 CØNTINUE
2110        GØ TØ 120
2120    140 WTD(K)=WTD(K)+1.0
2130        WTMAX=AMAX1(WTMAX,WTD(K))
2140        GØ TØ 120
```

Figure VI-12 Program CONGRA (cont'd)

```
2150  200 LIMIT=1
2160      DØ 210 K=1,900
2170      IF (WTD(K).EQ.0) GØ  TØ 210
2180      CØN(LIMIT)=CØND(K)
2190      WT(LIMIT)=WTD(K)/WTMAX
2200      LIMIT=LIMIT+1
2210      IF(LIMIT.GT.50) GØ TØ 220
2220  210 CØNTINUE
2230  220 LIMIT=LIMIT-1
2240      PRINT: LIMIT, "CØNCEPTS AT LINE NØ.", NR, "."
2250      K=1
2260  225 L=K+4
2270      WRITE("CØNCEPTS",226) ID, (CØN(J),WT(J), J=K,L)
2280  226 FØRMAT (I6, 5(I4,F9.5))
2290      IF (L.GE.LIMIT) GØ TØ 230
2300      K=L+1
2310      GØ TØ 225
2320  230 ID=ID+1
2330      GØ TØ 105
2340      END
```

Figure VI-12 Program CONGRA (concluded)

```
100C     PRØGRAM TØ GENERATE TEST DICTIØNARY.
110     ASCII X(18), DICT(5000,3), S(5)
120     LØGICAL FLAG
130      DATA NR,NP,DICT/2*1,15000*"     "/
140      PRINT: "MAXIMUM NUMBER ØF ENTRIES"
145      IKYPØØ=0
150      READ: IMAX
160 1    I=0
170 2    CALL PLUCK("DATA1", X, L, 2, NR, NP)
180      IF(NR.EQ.0) GØ TØ 15
190      IF(X(1).NE."**AB") GØ TØ 3
191      IKYPØØ=IKYPØØ+1
192      PRINT: IKYPØØ, I, "  MØRE?"
193      READ:  S(1)
194      IF(S(1).EQ."NØ") GØ TØ 15
200      FLAG=.TRUE.; GØ TØ 2
210 3   IF(X(1).NE."**AU" .AND. X(1).NE."**TI" .AND. X(1).NE."**EN"
2204      .AND. X(1).NE."**CØ") GØ TØ 31
230      FLAG=.FALSE.; GØ TØ 2
240 31   IF (FLAG) GØ TØ 4
250      NR=NR+1; NP=1; GØ TØ 2
260 4    IF(X(1).LT."A   " .ØR. X(1).GT."ZZZZ") GØ TØ 2
270      CALL STEM(X,S,L)
280      IF(L.EQ.0) GØ TØ 2
290 5    J=1
300      IF(I.EQ.0) GØ TØ 13
310 6    IF(S(1).LT.DICT(J,1)) GØ TØ 10
320     IF(S(1).GT.DICT(J,1)) GØ TØ 9
330     IF(S(2).LT.DICT(J,2)) GØ TØ 10
340     IF(S(2).GT.DICT(J,2)) GØ TØ 9
350     IF(S(3).LT.DICT(J,3)) GØ TØ 10
360     IF(S(3).GT.DICT(J,3)) GØ TØ 9
365      GØ TØ 2
370 9    J=J+1
```

Figure VI-13 Program DICGEN (cont'd)

```
380        IF(J.GT.1) GØ TØ 13
390        GØ TØ 6
400 10     K=I
410 11     KK=K+1
420        DØ 99 KKK=1,3
430 99     DICT(KK,KKK)=DICT(K,KKK)
440        IF(K.EQ.J) GØ TØ 13
450 12     K=K-1; GØ TØ 11
460 13     DØ 97 KKK=1,3
470 97     DICT(J,KKK)=S(KKK)
475 PRINT 69
476 69 FØRMAT(2H&)
480        IF(I.GE.IMAX) GØ TØ 15
490 14     I=I+1; GØ TØ 2
500 15     PRINT 16, I
510 16     FØRMAT("-THERE ARE", I5, " STEMS." ////)
520        DØ 89 J=1,I
530 89     WRITE("DICTNRY",17) (DICT(J,K),K=1,3),J,1.0,0,0.0,0,0.0
535 17     FØRMAT(3A4,1X,3(I4,F9.5))
537        END FILE "DICTNRY"
540        STØP; END
```

Figure VI-13 Program DICGEN (concluded)

SECTION VII

REFERENCES

1. Baker, A. W., Hoffmann, J. P. and Smith, J. L. Colex User's Manual. System Development Corporation, Technical Memorandum TM-DA-(L)-15/001/00, undated.

2. Bleier, Robert E., Treating hierarchical data structures in the SDC time-shared data management system (TDMS), Proceedings of 22nd National Conference, Association for Computing Machinery. Thompson Book Company, Washington, 1967, p. 41.

3. Giering, R. H., Information Processing and the Data Spectrum. Data Corporation publication, October 1967.

4. Giering, R. H., Analysis of Existing and Proposed Data Handling Systems. Data Corporation Technical Note DTN-69-9, October 1967.

5. Lowe, T. C. and Roberts, D. C., On-Line Retrieval Interim Report. Informatics Inc., Bethesda, Md.. Report No. TR-69-1090-1A. August 1969, RADC Report No. RADC-TR-69-304.

6. Lowe, Thomas C., Design Principles for an On-Line Information Retrieval System. Ph.D. Dissertation, U. of Pennsylvania, Philadelphia, 1966.

7. Nance, J. W. and Lathrop, J. W., System Design Specification eneral Purpose Orbit. SDC Technical Memorandum TM-DA-20/ 000/00, 1968.

8. Stevens, Mary Elizabeth, Automatic Indexing: A State of the Art Report. National Bureau of Standards Monograph 91, 1965.

9. Welch, Noreen O., A Survey of Five On-Line Retrieval Systems. Mitre Corporation Report MTP-322, August 1968, (in support of COSATI Panel 2).

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13. ABSTRACT

This report is concerned with the implementation of an on-line information storage and retrieval system for the Rome Air Development Center. This system is to incorporate techniques of automatic document classification for a large document collection in an interactive environment. Following a review of the system design, the implementation of the system executive is described in detail. Because this executive program also governs communications between the user and the system, it must be a communications package, a training aid, a file building program, and an executive program all in one.

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ERRATA

The reader of this report should be aware of the contributions made by Dr. Gerard Salton of the Dept. of Computer Sciences at Cornell University through his research in information storage and retrieval, particularly the SMART document retrieval system. Many of the notions and methodologies concerned with document retrieval described in this report are attributable to him. For example, the concept vector technique as used in this system, and fundamental to it, should be credited to Dr. Salton as well as the techniques used for document-document and query-document correlation. Publications authored by Dr. Salton and his students (1A, 2A, 3A, 4A, 5A) were consulted and significantly influenced the overall system design. The reader is encouraged to refer to these documents as well as to RADC-TR-69-304 (6A) for further details.

REFERENCES

1A Salton, G. and Lesk, M.E., The SMART Automatic Document Retrieval System - an illustration. C. ACM 8, 6(June 1965), pp. 391-398.

2A. Salton, Gerard, The Evaluation of Automatic Retrieval Procedures selected test results using the SMART System. American Documentation 16, 3(July 1965) pp. 209-222.

3A. Salton, G., et.al., The SMART System - Retrieval Results and Future Plans, in Rep No. ISR-11 to the National Science Foundation, Dept of Computer Science, Cornell University, Ithaca, NY, June 1966, I-4.

4A. Salton, G. and Lesk, M.E., Computer Evaluation of Indexing and Text Processing. J. ACM 15, 1(Jan 1967) 8-36.

5A. Salton, G., Automatic Information Organization and Retrieval. McGraw-Hill, New York, 1968.

6A. Lowe, T.C. and Roberts, D.C., On-Line Retrieval, Informatics Inc., Bethesda, MD. Report No. TR-69-1090-1A, August 1969, RADC Report No. RADC-TR-69-304.