

ACCESS
A PROGRAM FOR THE CATALOG AND ACCESS OF INFORMATION

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1. Abstract

ACCESS is a program for the catalog and access of information. The program is primarily designed for and intended to handle a personal library, although larger applications are possible. ACCESS produces a listing of all entries by locator code (so one knows where to find the entry in his library), a listing of entry titles by user-specified category codes, and a keyword-in-context KWIC listing (each keyword specified by the user). ACCESS is presently programmed in FORTRAN and operates on any IBM System/360 under OS (it uses the IBM SORT/MERGE package). It is anticipated a machine language version (soon to be implemented) will greatly decrease the running time of the program.

2. Introduction

Numerous processes have been developed for cataloging and accessing information. The card catalog in any library is a typical example. When these become large and unwieldy, elaborate automated systems have been devised. For one's private library in his office, such automated systems are uneconomical and impractical. As a result, one is usually left to keep his own card catalog, e.g. on 3 x 5 cards in a file.

When one desires to access the information in a library (personal or public) concerning a particular subject, he has two problems:

- (1) finding all entries in the library pertaining to that subject and
- (2) actually locating the entries of interest. The latter process is the easier to solve. One simply creates a sequential ordering scheme for the file: the next entry to be inserted takes the next sequential assignment code, e.g. the set of integers or some modified code like Uxxxx, where "U" might stand for "unpublished reports" and "xxxx" for "the sequential entry in that file". The choice is arbitrary and can be varied according to the needs of the library.

The other problem -- that of locating all entries in a library pertinent to a particular subject -- quickly becomes quite complex to handle as the number of library entries increases. To create a subject-oriented index means one has to compose a "card" about the entry for each subject it is concerned with.

It becomes evident that there is a need to provide a simple, relatively economical system to provide cataloging and indexing for one's private library. The ACCESS program is an attempt to satisfy that need.

ACCESS takes almost free-form input card images and generates three kinds of reports:

1. ACCESSION LISTING: a listing of each entry in the library by locator (accession) code. This listing provides the master reference showing all input card images for each entry.
2. CATEGORY LISTING: for each category, a listing of each title card belonging to that category.

3. KEYWORD LISTING: a keyword-in-context (KWIC) listing of all keywords giving forward and backward text as additional context.

Examples of typical ACCESS output appear at the end of this report.

3. Input Specification

The ACCESS program may be run in one of two modes of operation: category mode and no-category mode. The category mode gives the full output capability of the program and requires the user to specify his categories. The no-category mode does not list title cards by categories and the codes are not input (see examples in Figures 1 and 2).

The inputs to ACCESS can be given in the following BNF-like notation:

```
*LIB <options>
*CATEGORY NAMES
    <category code> <category images>
*END CATEGORY NAMES
*ACCESSION ENTRIES
    <sets of accession entries>
*END ACCESSION ENTRIES
```

} Not input if
ACCESS run in
no-category mode.

where

<options> contains the options of the program as follows:

NOCAT	means that the run is in the no-category mode of operation and category names and codes (above) are not input
NOLIST	means the input cards will not be listed on the output stream.
(blank)	means category mode and list inputs.

<category code> is the desired category code, specified as any single character available on the 029 keypunch (one of 64 characters) punched in card column 1.

<category images> are the desired category names, up to 79 characters long and punched in card columns 2 through 80.

<sets of accession entries> are the accession entries, each one composed of a title card and one or more continuation cards as necessary; these are described in more detail below.

Keywords

All keywords are specified by the user by placing an @ (8 - 4 punch) immediately before each desired keyword. During listings, all @ are replaced by blanks so that extra blanks between words are not required by the user. Every occurrence of an @ will cause a printed line to be generated in the keyword listing.

Accession Entries

Each accession entry is a description for an actual entry in the user's library, and each entry is composed of one or more 80 character fields. An accession entry is composed of a title card and, if necessary, continuation cards. These are defined as follows:

A. Title Card (First Card of Accession Entry)

1. The Locator Code -- This is the user supplied code which serves as a locator for the entry in the library. It may be up to eight (8) non-blank characters beginning in c.c. 1 (the first blank ends the code). One usually would place a locator character here followed by a sequence number. Some examples might be

U2001	(unpublished report 2001)
L70.029	(1970 letters file, letter no. 29)
20575	(just plain sequence 20,575)
100/555	(sub-report 555 of entry 100)

The user may employ this field for any code he feels will help him locate the actual library entry.

2. The Title -- This is the title of the accession entry and may begin anywhere after the first blank following the locator code. The title may be, itself, more than one card long. If categories are included, the first keyword should be preceded by a \$ (11-3-8 punch) instead of an @ ; this causes the ACCESS program to sort the category listing title cards by \$ entries.

It is also treated as an @ and placed in the keyword listing. (This first keyword is generally the author's name or the originating agency for the report; experience has shown it is preferable to treat author's names as keywords instead of making a separate author list.)

3. The Category Code(s) -- If categories are included, then the user may specify up to three one-character categories for this entry in c.c. 78-80. These one-character codes refer to the code given in the category name cards described above. If categories are not input, then the user may extend his title into columns 78-80.

B. Continuation Cards

1. The Continuation Code -- Each continuation card of the accession entry must begin with a + (12-6-8 punch) in c.c. 1.
2. The Continuation Entry -- The description for the library entry may be continued for up to 255 cards. Card columns 2-80 may be used, and the entry is free form. All @ cause keyword entry listings. These entries should be arranged so that the multiple card images will appear in a pleasing format when printed in the accession listing.

Sample ACCESS Inputs

With the inputs defined, some examples can be given. In Figure 1 at the end of the report an example of the category mode inputs are shown. The category codes appear in the title card for each entry. Note the different methods of locator code assignment.

In Figure 2, a sample of the ACCESS inputs are given where no categories are specified. All 80 columns of the title card may be utilized and a \$

is not necessary. The ACCESS entries correspond to the first few entries of the Computer Science Department Library's unpublished report series.

Sample ACCESS Output

When the inputs to ACCESS are merged with the necessary 360 JCL (see Appendix I), the program may be executed. A sample execution is given in Figure 3 for the full capability of the program, i.e. category mode of operation. Shown in Figure 3 are the accession listing, category listing of title cards, and the keyword listing. This output was generated using the input shown in Figure 1.

A sample run of the non-category mode is given in Figure 4. Here, the category listing is eliminated while the accession and keyword listings are similar to Figure 3. The output here was generated using the input shown in Figure 2.

4. Internal Processing and Organization

In this section we define the data structures employed by the ACCESS program and outline the overall operation of the program.

A. Data Structures

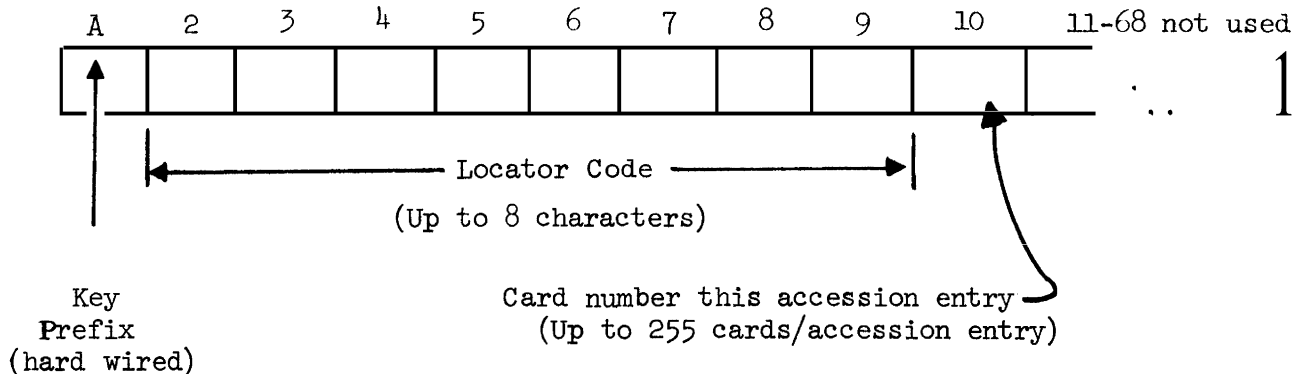
The basic idea behind processing each ACCESS entry is that all print line images for that entry are generated before the next entry is encountered. This is accomplished by the use of the following 200 character data structure, or record:



This structure employs the first 68 characters as a sort key and the remaining 132 characters as the printed line. In the following discussion, it is assumed that the full capability mode is being processed; if it is not, the program simply bypasses the category portion. Only the composition of the sort key is discussed, since the print line structure is easily seen in the output examples (Figures 3 and 4).

1. Accession Listing Sort Key

Of the 68 available characters (8-bit bytes) for the sort key, only the first 10 are utilized. The key takes the following format:



The accession listing is an output of all the ACCESS entries, sorted by locator code. The first character (key prefix) is hard-wired as an "A".

The category entry sort keys all begin with a " B ", and all keyword sort keys begin with a " C ". As a result, all accession records (key prefix equal to " A ") are sorted to the beginning, as desired.

Each accession entry is characterized by its unique locator code. Therefore, the locator code is placed in the sort key immediately after the key prefix (as shown above). Since there may be more than one card image for each entry, the eighth character in the sort key contains the binary equivalent of the card number. The remainder of the characters are not used in the accession listing sort key.

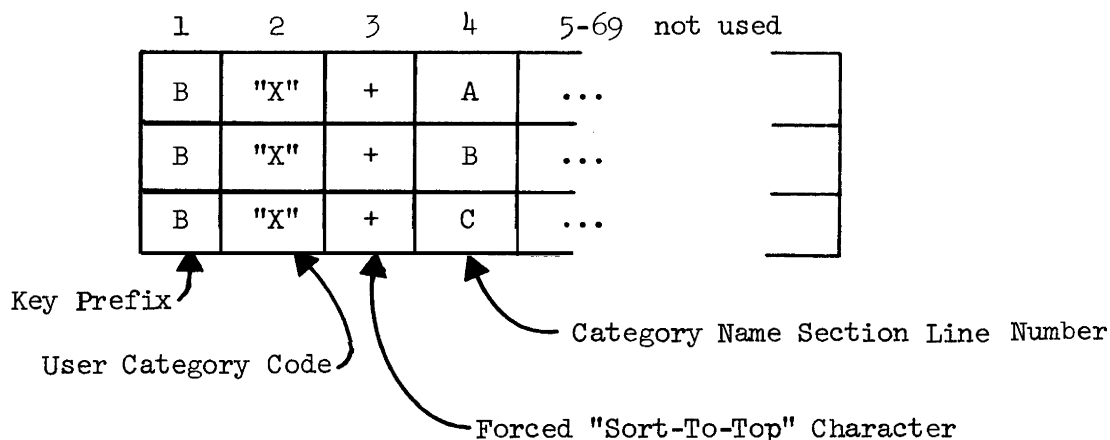
2. Category Listing Sort Key

For the category listing, there are actually two output segments for each category section: the category name segment and the ACCESS entry title card images segment. Each category name is to be set off (with blank lines) and appear at the beginning of each category section. Therefore, the sort key for the category names is different from the sort key for the title card images for that section.

The category name segment of each section is composed of three lines of the form:

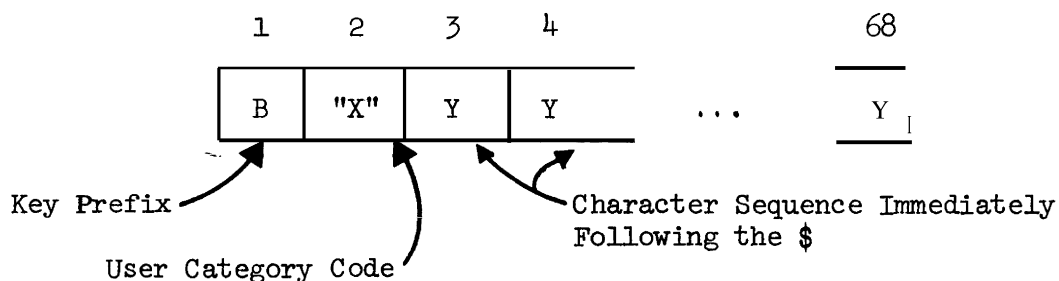
```
(blank)
*****CATEGORY -- X   YYYYYY...Y
(blank)
```

where X is the category code and YYY...Y is the category name. The sort key for these three lines are defined as follows:



Here, the key prefix is a B to indicate the category listing. The "X" is the user category code taken from c.c. 1 of the category names cards. The + (12-6-8 punch) is a character chosen to force the category name segment to the beginning of each category section. If this were not done, then it would be possible for some of the ACCESS entry title cards to sort before the category name. The A , B , C inserted in the fourth character simply serve to uniquely identify the order of the category name segment lines.

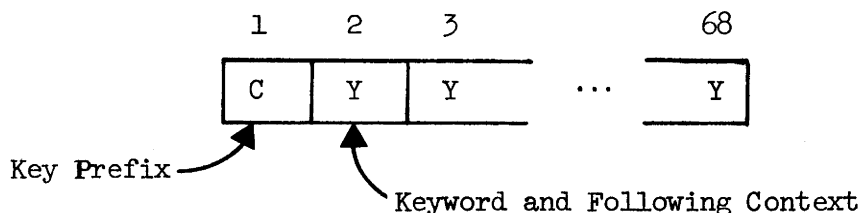
The ACCESS title card image segment contains the first card image in each ACCESS entry that has a category code in columns 78-80 of the first card. Thus, there can be up to three category title images generated for each ACCESS entry. The sort key for each category title image is defined as follows:



As above, the key prefix is a B to indicate a category listing line (or record), and the "X" is the user's category code taken from c.c. 78-80 of the title card in the ACCESS entry. The character sequence YYY...Y is taken from the title card immediately following the \$. If no \$ is present, the character sequence immediately following the locator code is used. The purpose of the YYY...Y sequence is to provide a sort sequence for the title card (usually an author's name, etc.).

3. Keyword Listing Sort Key

The sort key for the keyword listing is quite straightforward and is defined as:



The sort key prefix is a C to indicate the keyword listing. At each occurrence of an @ (a \$ is treated like an @), the character string following the @ is inserted in the sort key until either the sort key is full or the end of the ACCESS entry is reached. Thus, for each keyword (immediately preceded by an @), a keyword listing record is generated.

B. Overall Program Flow

The actual execution of the ACCESS program proceeds in three OS job steps. In the first job step, the input cards are read and a temporary file containing 200 character records (68 character sort key plus 132 character print line) is generated. The second job step (SORT/MERGE) takes the temporary file, sorts it according to the sort keys, and generates another temporary file of sorted 200 character records. The third job step lists the sorted file on the printer.

The processing flow for the first job step (the other two are rather straightforward) begins by reading in the ACCESS *LIB card. The program then decides if there are category names to be read and processed. If there are, they are read. For each category name card, three lines (200 character records) are output. Their sort keys correspond to the category name segment sort key as described above.

After this, the ACCESS entries are processed. The title card for the ACCESS is read, the locator code is stored for later use, and the output record for the accession listing is generated. Next, the category listing entry is composed (unless NOCAT was specified on the *LIB card). Finally, the title card image is placed into the first portion of a 2400 character keyword buffer. A buffer is necessary so that all keyword context may be output for a given keyword; the keyword output records are not generated until either the last card has been sensed or the keyword buffer is full (in which case all keyword records are generated and the buffer is cleared).

All continuation cards are read for the current ACCESS entry and its accession listing output record is made. The continuation card image text is appended to the current end of the keyword buffer. When a new ACCESS entry is read (card image not beginning with a +), the keyword records are composed and output, and the process begins over again.

To demonstrate this process, we can take a sample input deck and show what the keyword portion of the 200 character records look like both before and after the sort. Consider the ACCESS inputs shown in Figure 5. When these have been read in and processed by the first job step, the output records look like those shown in Figure 6. These records are then sorted, and the results are given in Figure 7. One can trace through the above described logic and defined data structures to confirm what is shown.

5. Conclusions

The ACCESS program has been described and sample input and output has been presented. The program is presently coded in FORTRAN IV for the IBM System 360/67 at Stanford. It is anticipated that another version of the program (in machine language) will be developed to decrease its running time.

The ACCESS program provides a free form input which allows one to catalog and subsequently retrieve all information in his private library.

Acknowledgment.

ACCESS is an outgrowth of a very similar, but less versatile, program which had been developed by Prof. D. E. Knuth of Stanford for his personal library.

Appendix I: Operating Instructions, Stanford IBM 360/67

In order to execute the ACCESS program on an IBM 360 under OS, necessary JCL must be specified. A procedure library entry has been made for the complete JCL. As a result, one only needs to generate the following JCL to execute the ACCESS program:

```
//jobname JOB XXXXX
//stepname EXEC ACCESS
//GO.SYSIN DD *
      (ACCESS INPUT CARDS)
/*
```

The JCL as shown above is satisfactory for runs with up to 5,000 ACCESS cards. If more than 5K input cards are anticipated, the user should change his JCL to provide more space for intermediate storage on the disc. See the consultants in the Computation Center for directions concerning how to do this.

Concerning timing estimates, the following sample running times have been recorded on the 360/67:

<u>No. ACCESS Input Cards</u>	<u>No. of Records Generated</u>	<u>Running Time (min.)</u>
52	430	0.76
78	480	0.85
~ 2 K	9.2 K	7.64
-2.5 K	12.5 K	8.50

Appendix II: How to Obtain ACCESS

Stanford Users

For those at Stanford, the ACCESS program has been compiled and placed into a private library and the JCL has been placed in a procedure library (discussed above). The source decks may be obtained from the file &TOOO.ACCESS1 (source for the first job step) and &TOOO.ACCESS2 (source for the third job step). These reside on SYS01.

Caution: If you use the source decks, be sure to supply your private library names.

Non-Stanford Users

For those not at Stanford, the program is available for a nominal charge. Those who desire to obtain a copy of the source deck may write:

User Services
Campus Facility
Stanford Computation Center
Stanford University
Stanford, California 94305

```

1. *LIB NCIST
2. *CATEGORY NAMES
3. A A P T I F I C I A L I N T E L L I G E N C E
4. C C M P I L E R S
5. F F U C A T I O N
6. H H A R D W A R E . . . P E R I P H E R A L S
7. J J E P I G I H C . . . . . T E S T I N G
8. L C M P U T E R L A N G U A G E S
9. N N U M E R I C A L A N A L Y S I S
10. *END CATEGORY NAMES
11. *ACCESSION ENTRIES
12. M0001 $SLAGLE, J.R. AND $BORSKY, P. "EXPER. WITH A MULTI-PURPOSE A
13. + $THEOREM PROVING $HEURISTIC PROGRAM", JOUR. ACM, V O L 15, N O . 1,
14. + PAGES 65-69, 1968. DISCUSSES $MULTIPLE, A DYNAMIC $ORDERING, $BREADTH-FIRST
15. + SEARCHING ALGORITHM WHICH USES $ALPHA-BETA.
16. M0002 $WHITE, C.F., "$TIME-SHARING SERVICES", MODERN DATA, FEB. 1970,
17. + PG. 66. GIVES A TECHNOLOGY SURVEY OF T-S SERVICES.
18. M0003 $GOLDENBERGER, PROF. FRED, "$PROGRAM $TESTING, AND $VALIDATING", J
19. + DATAMATION, JULY 1968. GIVES A GOOD SURVEY OF THE GOALS OF PROGRAM TESTING.
20. M0004 $SLAGLE, J.R. AND $DIXON, J.K., "EXPERIMENTS WITH THE $M & $TREE- A
21. + $SEARCHING PROGRAM", ACM, VOL. 13, N O . 3, MARCH 1970, PG. 147-154.
22. + DISCUSSES A VARIATION $MINI-MAX METHOD WHICH AVOIDS $CONUSES F O R $MULTIPLE
23. + SUCCESSOR MAX.'S AND GIVES A PENALTY FOR MULT. SUCCESSOR MIN.'S. THUS
24. + $NETAKES THE FRANCH WITH THE MOST LIKELIHOOD OF SUCCESS IN DEEPER
25. + PENETRATIONS. THE $ALPHA-BETA PROCEDURE ALSO HAD TO BE MODIFIED.
26. W0005 $FENICHEL, R.P., $WITZENBAUM, J., AND $VOCHFLSON, J.C., "A PROGRAM FL
27. + T O $TEACH $PROGRAMMING", ACM, VOL. 13, NO. 3, MARCH 1970, PG. 141-146.
28. + GAVE A SURVEY ABOUT THE $TEACH SYSTEM, USED TO A COURSE IN PROGRAMMING.
29. + THE STUDENTS LEARNED THE $UNCL LANGUAGE.
30. M0006 $SCHWAPZ, R.M., $BURGER, J.F., AND $SIMMONS, R.F., "$ADDEDUCTIVE AI
31. + $QUESTION-ANSWERER FOR $NATURAL LANGUAGE $INFERENCE", ACM, VOL. 13, N O . 3,
32. + MARCH 1970, PG. 167-183. DISCUSSES THE $PROTOSYNTHESIS.
33. M0107 $BRYAN, GLENN L., "$STUDENT-TO-STUDENT $INTERACTION IN COMPUTER $TIME- E
34. + $SHAQFC SYSTEM", C&A, MARCH, 1970, P. 18.
35. M0008 $MORTON, KENT, "THE VALUE OF THE COMPUTER AS $PUPIL", ARTICLE E
36. + $AN $EDUCATION IN MARCH, 1970, C & A, P. 24
37. M0109 $FERGLSON, R.L., "$COMPUTER ASSISTANCE FOR INDIVIDIZED $INSTRUCTION", E
38. + ARTICLE $AN $EDUCATION IN MARCH, 1970, C&A, P. 27.
39. M0010 $SCHWETMAN, H.C., "L S E C F $REMOTE $CONSOLE SYSTEM ON $UNIVERSITY EH
40. + CAMPS", ARTICLE $AN $EDUCATION IN MARCH, 1970, C&A, P. 30.
41. R0001 $FENDRAL: $BUCHANAN, B., $SUTHERLAND, G., $FEIGENBAUM, E.A., A
42. + "$HEURISTIC $GENERAL: A PROGRAM FOR GENERATING EXPLANATORY
43. + $HYPOTHESES IN ORGANIC CHEMISTRY", MACHINE INTELLIGENCE 4,
44. + EDINBURGH UNIVERSITY PRESS, 1969.
45. R0002 $GREENBLATT, R.C., ET. AL., "THE GREENBLATT $CHESS PROGRAM", 4
46. + PROC. F J C C, 1967, PG. 801 TO 810.
47. R0003 $MICHIE, D., $FLEMING, J.G., $OLDFIELD, J.V., "A COMPARISON OF A
48. + $HEURISTICS, $INTERACTIVE, AND UNAIDED METHODS FOR SOLVING $SHORTTEST
49. + $ROUTE PROBLEM", MACHINE INTELLIGENCE 3, EDINBURGH UNIV. PRESS, 1968.
50. R0004 $NEWELL, A., "$HEURISTIC $SEARCH: ILL-STRUCTURED PROBLEMS", PROGRESS 4
51. + $IN OPERATIONS RESEARCH (VOL. 3), WILEY, 1969. DISCUSSES $HEURISTIC METHODS
52. + $IN PROBLEM SOLVING VERY NICELY - GOOD SUMMARY.
53. R0005 $NILSSON, N.J., "$SEARCHING $PROBLEM SOLVING AND $GAME P L A Y I N G $TREES A
54. + F O R $M A T H A L C O S T $SOLUTIONS", PROCEED. IFIP 68 CONGRESS, EDINBURGH, SCOTLAND,
55. + 1968. NOTE - MUCH OF THIS PAPER IS ALSO IN NILSSON'S BOOK.
56. + DISCUSSES NILSSON'S ARCH METHOD F O R $SEARCHING $AND-OR $TREES.
57. U0053 $SESAR, DENNIS, "$HARDWARE-SOFTWARE $EMULATOR FOR THE $IBM $360", H
58. + ENGR. 2250, SPRING 1968, PROF. G. $ESTRIN. USES $AN $XDS $SIGMA $7 $ASEMULATOR.
59. U0054 $KNUTH, D.E. AND $FLOYD, R.W. "NOTES ON AVOIDING $GOTO $STATEMENTS", L
60. + $STANFORD $CSD REPORT CS 144, JAN. 1970. CONSIDERS TRANSFORMING A "GOTO"
61. + TYPE PROGRAM TO A RECURSIVE PROCEDURE TYPE USING $ALGOL'S W H I L E, ETC.
62. U0055 $CATHAN, T.F. "THE THEORY AND CONSTRUCTION OF $COMPILERS", C
63. + $COMPUTER ASSOCIATES, CA-6606-0111, JUNE 2, 1966. HAS $GRAMMARS, $SYNTAX
64. + $ANALYSIS, $LEXICAL ANALYSIS, $DEFINITIONAL FACILITIES ($EXTENDABILITY) AND
65. + $OPTIMIZATION.
66. U0056 $FORSYTHE, G.F. "PITFALLS IN $COMPUTATION, OR WHY $MATH $BOOK I $N'T N
67. + $ENOUGH", $STANFORD $CSD REPORT CS 147, J A N, 1970. $NUMERICAL ANALYSIS,
68. + $ROUND OFF, $TRUNCATION.
69. U0058 $CATHAN, T.F. "THE THEORY A N D CONSTRUCTION OF $COMPILERS", 1967 C
70. + $REPORT FROM $COMPUTER ASSOCIATES ON $SYNTAX ANALYSIS. N O N O. OR INDEX.
71. *END ACCESSION ENTRIES
72.
73.
74.

```

Figure 1. Sample Category Mode ACCESS Input

```

*LIB NOCAT
*ACCESSION ENTRIES
000001 ABUSO, C.*ANALOG COMPUTATION WITH RANDOM PULSE SEQUENCES.*ILLINOIS U
+COMP.SCI.DEPT.255.*1968.
000002 AMERICAN STANDARDS ASS'N.*WORKING DOCUMENT ACOROL
+SPECIFICATIONS*AMERICAN STANDARDS ASS'N.*1965.
000003 ABRAHAM, P.*LISP-2 LANGUAGE SPECIFICATIONS.*SYSTEM OVERFL OPMENT
+COMP.*1M-3417/200/00.*1967.
000004 APELKANS, M.Y.*ON DIFFERENCE SCHEMES FOR HYPERBOLIC-EQUATIONS WITH
+DISCONTINUOUS INITIAL-VALUES.*JUPPSALA U. COMP.SCI.DEPT.*RPT.5.*1967.
000005 ANSELONE, P.M.*CORE, R.M.*AN EXTENSION OF THE NEWTON-KANTOROVICH
+METHOD FOR SOLVING NONLINEAR-EQUATIONS.*MILWAUKEE U. MATH.RES.CENTER.*MRC
+TECH. SUMMARY RPT. 520.*1965.
000006 ANDERSON, N.S.*SCENARIOS, A.S. IMENSUN, N.F.*PATTERN-RECOGNITION: I. A
+COMPUTER PROGRAM FOR GENERATING SYNTHETIC PATTERNS.*MARYLAND U. COMP.SCI.
+CENTER.*TR-64-8.*1964.
000007 APPLIED LOGIC CORP.*SEMI-ANNUAL REPORT: OT RAI DECEMBER-AUTOMATED
+MATHEMATICAL LOGIC APPLIED LOGIC CORP.*1967.
000008 ARBIB, M.A.*SOME THEORETICAL APPROACHES TO NERVOUS-SYSTEM FUNCTION.*
+7N1UFDIY BEONETICS*3ST. U.F.E.DEPT.*1967.
000009 BALZER, R.M.*STUDIES CONCERNING MINIMAL TIME SOLUTIONS TO
+TRIPPLING-SQUAD SYNCHRONIZATION PROBLEM.*CARNEGIE INST. OF TECHNOLOGY.*
+1964.
000010 BAERCKER, P.M.*PLANAR REPRESENTATIONS OF COMPLEX GRAPHS.*M.I.T.
+LINCOLN LAB.*T.N. 1967-1.*1967.
000011 ARBIB, M.A.*GIVEN, Y.*CONTRIBUTIONS TO THE THEORY OF ALGEBRAS
+CONSIDERED AS AUTOMATA.*ST. U.F.E.DEPT.*1967.
000012 BALUEV, A.N.*THREE PAPERS ON CHAPLYGIN-METHODS
+AND NONLINEAR-EQUATIONS.*MARYLAND U. COMP.SCI. CENTER.*TR-67-41.*1967.
000013 ATKINS, D.E.*THE THEORY OF IMPLEMENTATION OF SRT DIVISION.*ILLINOIS
+U. COMP.SCI. DEPT.*RPT. 230.*1967.
000014 ARNOLD, L.*ON THE ASYMPTOTIC DISTRIBUTION OF THE EIGENVALUES OF
+RANDOM MATRICES.*MILWAUKEE U. MATH.RES. CENTER.*MRC TECH. SUMMARY RPT.
+736.*1967.
000015 ARBIB, M.A.*KAHN, R.M.*A DEVELOPMENTAL MODEL
+FOR INFORMATION PROCESSING IN THE CHILD.*ST. U.F.E.DEPT.*1967.
000016 ARBIB, M.A.*KAHN, R.M.*CYBERNETIC APPROACH TO MENTAL DEVELOPMENT.*
+ST. U.F.E.DEPT.*1967.
000017 ARBIB, M.A.*NOTES ON A PARTIAL SURVEY OF CYBERNETICS IN EUROPE AND
+THE U.S.S.R.*P.F.C. RESEARCH ASSOCIATES, INC.*AFOSR-65-1412.*1965.
000018 ARBIB, M.A.*SELF-REPRODUCING AUTOMATA: SOME IMPLICATIONS FOR
+THEORETICAL BIOLOGY.*ST. U.F.E.DEPT.*1967.
000019 ARBIB, M.A.*GIVEN, Y.*ALGEBRAIC AUTOMATA II: THE CATEGORICAL
+FRAMEWORK FOR DYNAMIC ANALYSIS.*ST. U.F.E.DEPT.*1967.
000020 ABAYER, P.*ON ENDOMORPHISMS AND CONGRUENCE OF AUTOMATA.*BOEING
+SCI. RES. LABS.*MATH. NOTE 407.*1967.
000021 ABAYER, R.*THE AUTOMORPHISM GROUP OF A STRONGLY CONNECTED AUTOMATON
+ADITS QUOTIENT AUTOMATA.*ILLINOIS U. COMP.SCI. DEPT.*RPT.190.*1965.
000022 ABAYER, R.*AUTOMORPHISM GROUPS AND QUOTIENTS OF STRONGLY
+CONNECTED AUTOMATA AND MONADIC-ALGEBRAS.*ILLINOIS U. COMP.SCI. DEPT.*RPT.
+204.*1966.
+END ACCESSIONENTRIES

```

Figure 2. Sample No Category Mode ACCESS inputs

ACCESSION CODE	A C C E S S I O N E N T R Y	CATEGORY CODES
MC001	SLAGLE, J.F. AND BURSKY, P. "EXPER. WITH A MULTI-PURPOSE THEORY PROVING HEURISTIC PROGRAM", JEDP. ACM, VOL 15, NO. 1, PAGES 95-99, 1968. DISCUSSES MULTIPLE, A DYNAMIC ORDERING, BREADTH-FIRST SEARCHING ALGORITHM WHICH USES ALPHA-BETA.	A
MC002	WHITE, C.H., "THE SYAPING SERVICES", MODERN DATA, FEB. 1970, PG. 46. GIVES A TECHNOLOGY SURVEY OF T-S SERVICES.	
MC003	QUENBERGER, PROF. FRED, "PROGRAM TESTING AND VALIDATING", DATAICTION, JULY 1968. GIVES A GOOD SURVEY OF THE GOALS OF PROGRAM TESTING.	J
MC004	SLAGLE J.F. AND DIXON, J. K., "EXPERIMENTS WITH THE MENTREE-SEARCHING PROGRAM", CACM, VOL. 13, NO. 3, MARCH 1970, PG. 147-154. DISCUSSES A VARIANT MINI-MAX METHOD WHICH AWARDS BONUSES FOR MULTIPLE SUCCESSOR MAX.'S AND GIVE A PENALTY FOR MULT. SUCCESSOR MIN.'S. THUS GIVE TAKES THE BRANCH WITH THE MOST LIKELIHOOD OF SUCCESS IN DEEPER PENETRATIONS. THEIR ALPHA-BETA PROCEDURE ALSO HAD TO BE MODIFIED.	A
MC005	FENICHEL, R.R., WEITZENBAUM, J., AND DYCKELSON, J.C., "A PROGRAM TO TEACH PROGRAMMING", CACM, VOL. 13, NO. 3, MARCH 1970, PG. 141-146. GAVE A SURVEY ABOUT THE TEACH SYSTEM, USED TO A COURSE IF PROGRAMMING. THE STUDENTS LEARNED THE UNCL LANGUAGE.	E L
MC006	SCHWAPCZ, R.W., BURGER, J.F., AND "SIMMONS, R.F.", "4 DEDUCTIVE QUESTION-ANSWER FOR A NATURAL LANGUAGE INFERENCE", CACM, VOL. 13, NO. 3, MARCH 1970, PG. 167-183. DISCUSSES THEIR PROTO-SYNTHESIS II.	A L
MC007	RYAN, GLENN L., "STUDENT-TO-STUDENT INTERACTION IN COMPUTER TIME-SHARED SYSTEM", C&A, MARCH 1970, P. 18.	E
MC008	MORTON, KENT, "THE VALUE OF THE COMPUTER AS A PUPIL", ARTICLE ON EDUCATION IN MARCH, 1970, C&A, P. 24.	E
MC009	FERGUSON, P.L., "COMPUTER ASSISTANCE FOR INDIVIDIZED INSTRUCTION", ARTICLE ON EDUCATION IN MARCH, 1970, C&A, P. 27.	E
MC010	SCHWETMAN, H.D., "USE OF A REMOTE CONSOLE SYSTEM ON A UNIVERSITY CAMPUS", ARTICLE ON EDUCATION IN MARCH, 1970, C&A, P. 30.	E H
MC001	GENDRAL: RICHMAN, B., SUTHERLAND, G., FEIGENBAUM, E.A., "HEURISTIC DENDRAL: A PROGRAM FOR GENERATING EXPLANATORY HYPOTHESES IN ORGANIC CHEMISTRY", MACHINE INTELLIGENCE 4, EDINBURGH UNIVERSITY PRESS, 1969.	A
MC002	GREENBLATT, P. D., ET. AL, "THE GREENBLATT CHESS PROGRAM", PROC. FUCC, 1967, PG. 801 TO 810.	A
MC003	MICHIE, D., FLEMING, J.G., OLDFIELD, J.V., "A COMPARISON OF HEURISTICS, INTERACTIVE, AND UNAIDED METHODS FOR SOLVING A SHORTEST	A

Figure 3. Sample Category Mode ACCESS Output (Sheet 1 of 5)

ACCESSION CODE	AC C E S S I O N E N T R Y	CATEGORY CODES
0004	ROUTE PROBLEM, "MACHINE INTELLIGENCE 3", EDINBURGH UNIV. PRESS, 1968. NEWELL, A. "HEURISTIC SEARCH: ILL-STRUCTURED PROBLEMS", PROGRESS IN OPERATIONS RESEARCH (VOL. 3), WILEY, 1969. DISCUSSES HEURISTIC METHODS IN PROBLEM SOLVING VERY NICELY - GOOD SUMMARY.	A
0005	NILSSON, N.-J., "SEARCHING PROBLEM SOLVING AND GAMEPLAYING TREES FOR MINIMAL COST SOLUTIONS", PROCEED. IFIP 69 CONGRESS, EDINBURGH, SCOTLAND, 1969. NOTE - MUCH OF THIS PAPER IS ALSO IN NILSSON'S BOOK. DISCUSSES NILSSON'S APPROX METHOD FOR SEARCHING AND-OF TREES.	A
0053	SESAR, DENNIS, "A HARDWARE-SOFTWARE EMULATOR FOR THE E10W360", ENG. 2258, SPRING 1969, PROF. G. ESTRIN. USES AN XOSI GHA 7 AS EMULATOR.	F
0054	KNUTH, D. E. AND FLOYD, R. W. "NOTES ON AVOIDING GO TO STATEMENTS", STANFORD CS REPORT CS149, JAN. 1970. CONSIDERS TRANSFORMING 4 "GOTO" TYPE PROGRAM TO EQUIVALENT PROCEDURE TYPE USING ALGOL'S WHILE, ETC.	L
0055	CHEATHAM, T. E. "THE THEORY AND CONSTRUCTION OF COMPILERS", COMPUTER ASSOCIATES, CC-5605-0111, JUNE 7, 1966. HAS GRAMMARS, SYNTAX ANALYSIS, LEXICAL ANALYSIS, DEFINITIONAL FACILITIES (EXTENSIBILITY) AND OPTIMIZATION.	C
0056	FORSYTHE, G. E. "PITFALLS IN COMPUTATION, OR WHY A MATH BOOK ISN'T ENOUGH", STANFORD CS REPORT CS147, JAN. 1970. NUMERICAL ANALYSIS, ROUND-OFF, TRUNCATION.	N
0058	CHEATHAM, T. E. "THE THEORY AND CONSTRUCTION OF COMPILERS", 1967 REPORT FROM COMPUTER ASSOCIATES ON SYNTAX ANALYSIS. NO INDEX.	C

Figure 3. Sample Category Mode ACCESS Output (Sheet 2 of 5)

ACCESS
CODE
C A T E G O R Y L I S T I N G

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***** CATEGORY -- 4 ...   A R T I F I C I A L   I N T E L L I G E N C E
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                                R0002
                                R0003
                                R0004
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                                R0006
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                                R0002
                                R0003
                                R0004
                                R0005
                                R0006
                                M0001
                                M0004

                                DENDRAL: BUCHANAN, R., SUTHERLAND, G., FEIGENBAUM, E. A.,
                                GREENBLATT, R. D., ET AL., "THE GREENBLATT CHESS PROGRAM",
                                WICHTIE, D., FLEMING, J. G., CLDFIELD, J. V., "A COMPARISON OF
                                NEWELL, A., "HEURISTIC SEARCH: ILL-STRUCTURED PROBLEMS", PROGRESS
                                NILSSON, N. J., "SEARCHING PROBLEMS SOLVING AND GAME PLAYING TREES
                                SCHWARCZ, R. M., RUPGER, J. F., AND SIMMONS, R. F., "A DEDUCTIVE
                                SLAGLE, J. R. AND BURSKEY, P., "EXPER. WITH A MULTI-PURPOSE
                                SLAGLE, J. R. AND DIXON, J. K., "EXPERIMENTS WITH THE MENTREE-

***** CATEGORY -- C ...   C O M P I L E R S
                                CHEATHAM, T. F., "THE THEORY AND CONSTRUCTION OF COMPILEPS",
                                CHEATHAM, T. F., "THE THEORY AND CONSTRUCTION OF COMPILEPS", 1967

***** CATEGORY -- E ...   E D U C A T I O N
                                BRYAN, GLENN L., "STUDENT-TO-STUDENT INTERACTION IN COMPUTER TIME-
                                FENICHEL, R. R., WEIZENBAUM, J., AND YOCHELSON, J. C., "A PROGRAM
                                FERGUSON, R. L., "COMPUTER ASSISTANCE FOR INDIVIDUALIZED INSTRUCTION",
                                MORTON, KENT, "THE VALUE OF THE COMPUTER AS A PUPIL", ARTICLE
                                SCHWETMAN, H. D., "USE OF A REMOTE CONSOLE SYSTEM ON A UNIVERSITY

***** CATEGORY -- H ...   H A R D W A R E . . . P E R I P H E R A L S
                                SCHWETMAN, Y. O., "USE OF A REMOTE CONSOLE SYSTEM ON A UNIVERSITY
                                SESAR, DENNIS, "A HARDWARE-SOFTWARE EMULATOR FOR THE IBM 360".

***** CATEGORY -- J ...   D E B U G G I N G . . . T E S T I N G
                                GRUENBERGER, PROF. FRED, "PROGRAM TESTING AND VALIDATING",

***** CATEGORY -- L ...   C O M P U T E R   L A N G U A G E S
                                FENICHEL, R. R., WEIZENBAUM, J., AND YOCHELSON, J. C., "A PROGRAM
                                KNUTH, D. E. AND FLOYD, R. M., "NOTES ON AVOIDING GO TO STATEMENTS",
                                SCHWARCZ, R. M., RUPGER, J. F., AND SIMMONS, R. F., "A DEDUCTIVE

***** CATEGORY -- M ...   N U M E R I C A L   A N A L Y S I S
                                FOR SYTHE, G. E., "PITFALLS IN COMPUTATION, OR WHY A MATH BOOK ISN'T

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Figure 3. Sample Category Mode ACCESS Output (Sheet 3 of 5)

U0054 "GOTO" TYPE PROGRAM TO A RECURSIVE PROCEDURE TYPE USING ALGOL'S WHILE, ETC. U0054
 U0054 STYLING OF SUCCESSIVE PENETRATIONS. THEIR ALPHA-BETA PROCEDURE ALSO FACT CSE MODIFIED. U0054
 U0054 ORDERING, BREADTH-FIRST SEARCHING ALGORITHM WHICH USES ALPHA-BETA. U0054
 U0054 BOOK DISCUSSES NILSSON'S SEARCH METHOD FOR SEARCHING ANG-OR TREES. U0054
 U0054 PS 85-39, 1948. DISCUSSES MULTIPLE, A DYNAMIC ORDERING, BREADTH-FIRST SEARCHING ALGORITHM WHICH USES ALPHA-BETA. U0054
 U0054 BRYAN, GLEN L. "STUDENT-TO-STUDENT INTERACTION IN COORDINATE GEOMETRY". U0054
 U0054 BUCHANAN, R., SUTHERLAND, G., FEIGENBAUM, E.A., "HEURISTIC SEARCHING, J.F. AND SIMMONS, R.F., "A DEDUCTIVE QUESTIONS". U0054
 U0054 BURSKEY, P. "EXPER. WITH A MULTI-PURPOSE THEOREM PROVER". U0054
 U0054 CHEATHAM, T.E. "THE THEORY AND CONSTRUCTION OF COMPILE". U0054
 U0054 CHEATHAM, T.E. "THE THEORY AND CONSTRUCTION OF COMPILE". U0054
 U0054 CHES PROGRAM", PROC. FJCC, 1967, PG. 801 TO 810. U0054
 U0054 COMPILERS", COMPUTER ASSOCIATES, CA-6606-0111, JUNE 2, 1967. U0054
 U0054 COMPILERS", 1967. REPORT FROM COMPTON ASSOCIATES ON S. U0054
 U0054 COMPUTATION, OR WHY A MATH BOOK ISN'T ENOUGH", STANFORD U0054
 U0054 CONSOLE SYSTEM ON A UNIVERSITY CAMPUS", ART. 10. U0054
 U0054 DEDUCTIVE QUESTION-ANSWER FOR NATURAL LANGUAGE INFERENCE. U0054
 U0054 DEFINITIONAL FACILITIES (EXTENDABILITY) AND OPTIMIZATION. U0054
 U0054 DENPALL: BUCHANAN, R., SUTHERLAND, G., FEIGENBAUM, E.A., U0054
 U0054 DIXON, J.K. "EXPERIMENTS WITH THE M & N TREE". SEACQ. U0054
 U0054 EDUCATION IN MARCH, 1973. CEA, P. 24. U0054
 U0054 EDUCATION IN MARCH, 1970, CEA, P. 30. U0054
 U0054 EMULATOR FOR THE IBM 360", ENGR. 2258, SPRING 1968, P. U0054
 U0054 ESTIN. USES AN XDS SIGMA 7 AS EMULATOR. U0054
 U0054 EXTENDABILITY) AND OPTIMIZATION. U0054
 U0054 FEIGENBAUM, E.A., "HEURISTIC GENERAL: A PROGRAM FOR U0054
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 U0054 FORSYTH, G.E. "PITFALLS IN COMPUTATION, OR WHY A MATH U0054
 U0054 GAME PLAYING TREES FOR MINI HAL GOST SOLUTIONS". PROCE. U0054
 U0054 GO TO STATEMENTS", STANFORD CSO REPORT CS 148, JAN. 1, U0054
 U0054 GRAMMARS, SYNTAX ANALYSIS, LEXICAL ANALYSIS, DEF. INITI. U0054
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 U0054 INSTRUCTION", ARTICLE ON EDUCATION IN MARCH, 1970. CEA. U0054
 U0054 INTERACTIVE, AND UNIFIED METHODS FOR SOLVING A SHORTES U0054
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 U0054 ESTIN. USES AN XDS SIGMA 7 AS EMULATOR. U0054
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 U0054 GAME PLAYING TREES FOR MINI HAL GOST SOLUTIONS". PROCE. U0054
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 U0054 INTERACTIVE, AND UNIFIED METHODS FOR SOLVING A SHORTES U0054
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 U0054 KNUTH, D.E. AND FLOYD, R.W. "NOTES ON AVOIDING GO TO S U0054
 U0054 LEXICAL ANALYSIS, DEFINITIONAL FACILITIES (EXTENDABIL U0054
 U0054 M & N TREE- SEARCHING PROGRAM". CACM, VOL. 13, NO. 3 U0054
 U0054 MATH BOOK ISN'T ENOUGH", STANFORD CSO REPORT CS 147. U0054

Figure 3. Sample Category Mode ACCESS Output (Sheet 4 of 5)

KEYWORD LISTING

00003 m 0
 00004 1970, 3, "ARCHITECTURE, J.G., OLDFIELD, J.V., "A COMPARIS
 00005 MINI-MAX METHOD WHICH AWARD BENEFITS FOR MULTIPLE USE
 00006 MORTON, KENT, "THE VALUE OF THE COMPUTER AS A PUPIL",
 00007 MULTIPLE, A DYNAMIC ORDERING, BREACTI-FIRST SEARCHING, M0001
 00008 JOU, R.A.C.M., VOL 15, NO. 1, PAGES 85-89, 1968. DISCUSSES
 00009 AND SIMPSON, P.F., "4 DEDUCTIVE QUESTION-ANSWERER FOR
 00010 NATURAL LANGUAGE INFERENCE", CACM, VOL. 13, NO. 3, MAR
 00011 NEWELL, A., "HEURISTIC SEARCH: ILL-STRUCTURED PROBLEMS
 00012 NILSSON, N.J., "SEARCHING PROBLEM SOLVING AND GAME PL
 00013 NUMERICA ANALYSIS, ROUND OFF, TRUNCATION, U0056
 00014 OPTIMIZATION, U0055
 00015 ORDERING, REEADY-FIRST SEARCHING ALGORITHM WHICH USE
 00016 PROBLEMS SOLVING AND GAME PLAYING TREES FOR M IN MALCO
 00017 PROGRAMMING, CACM, VOL. 13, NO. 3, MARCH 1970, P. 14
 00018 PUPIL", ARTICLE ON EDUCATION IN MARCH, 1970, C&A, P. 2
 00019 QUESTION-ANSWERER FOR NATURAL LANGUAGE INFERENCE, CAC
 00020 REMOTE CONSOLE SYSTEM ON A UNIVERSITY CAMPUS, ARTICL
 00021 ROUND OFF, TRUNCATION, U0056
 00022 SCHWARTZ, R.M., BURGER, J.F., AND SIMMONS, R.F., "A DE
 00023 SCHWIFTAN, H.D., "USE OF A REMOTE CONSOLE SYSTEM ON A
 00024 SEARCH: ILL-STRUCTURED PROBLEMS", PROGRESS IN OPERATI
 00025 SEARCHING PROGRAM", CACM, VOL. 13, NO. 3, MARCH 1970,
 00026 SEARCHING PROBLEM SOLVING AND GAME PLAYING TREES FOR
 00027 SESAR, DENNIS, "A HARDWARE-SOFTWARE EMULATOR FOR THE I
 00028 SHORTEST ROUTE PROBLEM", MACHINE INTELLIGENCE 3, EDI N
 00029 SIGMA 7 AS EMULATOR, U0053
 00030 SIMMONS, R.F., "A DEDUCTIVE QUESTION-ANSWERER FOR NA
 00031 SLAGLE, J.R. AND BURSLEY, P., "EXPER. WITH A MULTI-PURP
 00032 SLAGLE, J.R. AND DIXON, J.K., "EXPERIMENTS WITH THE M
 00033 SUTHERLAND, G., FEIGENBAUM, E.A., "F-EURISTIC DENDRAL
 00034 SYNTAX ANALYSIS, NO NC. OR INDEX, U0055
 00035 TEACH SYSTEM, USED TO A COURSE IN PROGRAMMING, THE ST
 00036 TESTING AND VALIDATING, DATAHAT ION, JULY 1968, GIVE
 00037 THEOREM PROVING HEURISTIC PROGRAM, JOUR. ACM, VOL 15,
 00038 TIME-SHARED SYSTEM", C&A, MARCH, 1970, P. 18,
 00039 TIME-SHARING SERVICES", MODERN DATA, FEB. 1970, PG. 66
 00040 TREE-SEARCHING PROGRAM", CACM, VOL. 13, NO. 3, MARC
 00041 TREES FOR MINIMAL COST SOLUTIONS, PROCED. IFIP 68 C O
 00042 TRUNCATION, U0056
 00043 UNCL LANGUAGE, U0055
 00044 UNIVERSITY CAMPUS, ARTICLE ON EDUCATION IN MARCH 19
 00045 VALIDATING, DATAHAT ION, JULY 1968, GIVES A GOOD SUR
 00046 WEIZENBAUM, J., AND YOCHELSON, J.C., "A PROGRAM TO TE
 00047 WHITE, C.H., "TIME-SHARING SERVICES", MODERN DATA, FE
 00048 XDS SIGMA 7 AS EMULATOR, U0053
 00049 YOCHELSON, J.C., "A PROGRAM TO TEACH PROGRAMMING", CA
 00050 ZEN, DENNIS, "A HARDWARE-SOFTWARE EMULATOR FOR THE I84
 00051 225B, SPRING 1968, PROF. G. ESTRIN, U0053
 00052 225B, SPRING 1968, PROF. G. ESTRIN, U0053
 00053 225B, SPRING 1968, PROF. G. ESTRIN, U0053

Figure 3. Sample Category Mode ACCESS Output (Sheet 5 of 5)

ACCESSION CODE	A C C E S S I O N E N T R Y	C A T E G O R Y C O D E S
CC0001	DEUSO, C.*ANALOG COMPUTATION WITH RANDOM PULSE SEQUENCES.* ILLINOIS U. COMP.SCI,DEPT,APT. 255,*1963.	
CC0002	AMERICAN STANDARDS ASS'N.*WORKING DOCUMENT COBOL SPECIFICATIONS.* AMERICAN STANDARDS ASS'N.* 1965.	
CC0003	ABRAMAMS, P.* LISP-2 LANGUAGE SPECIFICATIONS.* SYSTEM DEVELOPMENT CORP.*TM-3217/200/00.*1967.	
CC0004	APPELKRAS, M.V.*ON DIFFERENCE SCHEMES FOR HYPERBOLIC-EQUATIONS WITH CONTINUOUS INITIAL-VALUES.* UPSALA U. COMP.SCI,DEPT.*RPT.5.*1967.	
CC0005	AMSELME, P.W. MOORE, R.H.*AN EXTENSION OF THE NEWTON-KANTOROVICH METHOD FOR SOLVING NONLINEAR-EQUATIONS.* WISCONSIN U. MATH.RES. CENTER.*MRC TECH. SUMMAR V 4PT. 520.*1965.	
CC0006	ANDERSON, N.S. ROSENFELD, J. SIMENSON, N.F.*PATTERN-RECOGNITION:1. A COMPUTER PROGRAM FOR GENERATING SYNTHETIC-PATTERNS.* MARYLAND U. COMP.SCI. CENTER # TP-64-9.*1964.	A
CC0007	APPLIED LOGIC CORP.*SEMI-ANNUAL REPORT: CTR-AIDED SEMI-AUTOMATED MATHEMATICS.* SAC001.* APPLIED LOGIC CORP.* 1967.	
CC0008	APPLE, M.A.*SOME THEORETICAL APPROACHES TO NERVOUS-SYSTEM FUNCTION.* NEUROCYBERNETICS* CO. U. E.E.DEPT.* 1967.	
CC0009	BALZER, R.M.*STUDIES CONCERNING MINIMAL TIME SOLUTIONS IN THE FIRING-SQUAD SYNCHRONIZATION PROBLEM.* CARNEGIE INST. OF TECHNOLOGY.* 1966.	
CC0010	PARKER, R.M.*PLANAR-REPRESENTATIONS OF COMPLEX GRAPHS.* M.I.T. LINCOLN LAB.*TM. 1947-1.*1967.	
CC0011	APR 19, M.A. GIVFON, V.*CONTRIBUTIONS TO THE THEORY OF ALGEBRAS CONSIDERED AS AUTOMATA.* ST. U. E.E.DEPT.* 1967.	
CC0012	BALCEV, A.A.*THREE PAPERS ON CHAPLYGIN-METHODS AND NONLINEAR-EQUATIONS. * MARYLAND U. COMP.SCI. CENTER.*TP-67-41.*1967.	
CC0013	ATKINS, D.E.*THE THEORY OF IMPLEMENTATION OF SRT DIVISION.* ILLINOIS U. COMP.SCI,DEPT,APT. 230.*1967.	
CC0014	ASHTON, L.*ON THE ASYMPTOTIC DISTRIBUTION OF THE EIGENVALUES OF RANDOM MATRICES.* WISCONSIN U. MATH.RES. CENTER.*MRC TECH. SUMMARY RPT. 734.*1967.	
CC0015	AKHIE, V.A. KAHN, P.W.*A DEVELOPMENTAL MODEL OF INFORMATION-PROCESSING IN THE CHILD.* ST. U. E.E.DEPT.* 1967.	
CC0016	AKHIE, V.A. KAHN, P.W.*A CYBERNETIC APPROACH TO MENTAL DEVELOPMENT.*	

Figure 4. Sample No Category Mode ACCESS Output (Sheet 1 of 4)

ACCESSION CODE	ACCESSION ENTRY	CATEGORY CODES
000017	ST. U. E.E. DEPT.* 1967. ARRIF, M.A. NOTES ON A PARTIAL SURVEY OF CYBERNETICS IN EUROPE AND THE U.S.S.R.* P.E.C. RESEARCH ASSOCIATES, INC.* AFOSM-65-1412.* 1965.	
000018	ARRIF, M.A. * SELF-REPRODUCING-AUTOMATA; SOME IMPLICATIONS FOR THEORETICAL LOGIC.* ST. U. E.E. DEPT.* 1967.	
000019	ARRIF, M.A. GIVISON, Y. * ALGEBRA AUTOMATA II: THE CATEGORICAL FRAMEWORK FOR DYNAMIC ANALYSIS.* ST. U. E.E. DEPT.* 1967.	
000020	BAYER, P. * ON HOMOMORPHISMS AND CONGRUENCES OF AUTOMATA.* BOEING SCI. RES. LABS.* MATH. NOTE 497.* 1967.	
000021	BAYER, P. * THE AUTOMORPHISM GROUP OF A STRONGLY CONNECTED AUTOMATON AND ITS QUOTIENT AUTOMATA.* ILLINOIS U. COMP. SCI. DEPT.* RPT. 199.* 1966.	
000022	BAYER, P. * AUTOMORPHISM GROUPS AND QUOTIENTS OF STRONGLY CONNECTED AUTOMATA AND MODULAR ALGEBRAS.* ILLINOIS U. COMP. SCI. DEPT.* RPT. 204.* 1966.	

Figure 4. Sample No Category Mode ACCESS Output (Sheet 2 of 4)

KEYWORD LISTING

000001 APPAHAMS, P. *LISP-2 LANGUAGE SPECIFICATIONS.*SYSTEM 000003
000002 AFUSG, C.*PARALOG COMPUTATION WITH RANDOM PULSE SEQUENC 000001
000003 ALGERAS, M.A.*GIVE*ON, Y.*CONTRIBUTIONS TO THE THEORY OF 000019
000004 ALGERAS CONSIDERED AS AUTOMATA.*ST.U.E.E.DEPT.* 000011
000005 STANDARD'S ASSN.*WORKING DOCUMENT COROL SPEC~0 00002
000006 AMERICAN STANDARDS ASSN.*WORKING DOCUMENT COROL SPEC~0 00002
000007 ANDERSON, N.S. ROSENFELD, A. STIMENSON, N.F.*PATTERN-R 000006
000008 ANSE TONE, P.M. MOORE, R.H.*AN EXTENSION OF THE NEWTON- 000005
000009 APELKANS, M.Y.*ON DIFFERENCE SCHEMES FOR HYPERPOLIC-E 000004
000010 APPLIED LOGIC CORP.*1967. 000007
000011 APPLIED LOGIC CORP.*SEMI-ANNUAL REPORT: CTR-AIDED SEMI-000007
000012 ARBIR, M.A.*SELF-REPRODUCING-AUTOMATA: SOME IMPLICATI 000017
000013 ARBIR, M.A.*NOTES ON A PARTIAL SURVEY OF CYBERNETICS 1~000017
000014 ARBIR, M.A.*SOME THEORETICAL APPROACHES TO FRYOUS-SYS 000008
000015 ARBIR, M.A.*GIVE*ON, Y.*ALGEBRA AUTOMATA II: THE CAT-000019
000016 ARBIR, M.A. KAHN, R.M.*A DEVELOPMENTAL MODEL OF INFOR 000015
000017 ARBIR, M.A. KAHN, R.M.*A CYBERNETIC APPROACH TO MENTAL 000016
000018 ARNOLD, L.*ON THE ASYMPTOTIC DISTRIBUTION OF THE EIGEN 000014
000019 ATKINS, D.E.*THE THEORY OF IMPLEMENTATION OF FRT DIVIS 000013
000020 AUTOMATA AND MONADIC-ALGEBRAS.*ILLINOIS U. COMP.SCI. 000022
000021 AUTOMATA II: THE CATEGORICAL FRAMEWORK FOR DYNAMIC A 000019
000022 AUTOMATA.*BRIEFING SC L.PES.LARS.*MATH. NOTE 497.*1967. 000020
000023 AUTOMATON AND ITS QUOTIENT AUTOMATA.*ILLINOIS U. COMP. 000011
000024 BAECCKER, R.M.*PLANAR REPRESENTATIONS OF COMPLEX GRAP 000021
000025 BALUEV, A.N.*THREE PAPERS ON CHAPLYGIN-METHODS AND NO 000012
000026 BALZER, R.M.*STUDIES CONCERNING MINIMAL TIME SOLUTIONS 000009
000027 BAYER, Q.*AUTOMORPHISM GROUPS AND QUOTIENTS OF STRONGL 000022
000028 BAYER, R.*ENDOMORPHISMS AND CONGRUENCES OF AUTOMATA 000020
000029 BAYER, R.*THE AUTOMORPHISM GROUP OF A STRONGLY CONNECT 000021
000030 BOEING SC L.RES.LABS.*MATH. NOTE 457.*1967. 000020
000031 CARNegie INST. OF TECHNOLOGY.*1966. 000009
000032 CHAPLYGIN-METHODS AND NONLINEAR-EQUATIONS. *YARYLAN 000012
000033 CHILD, S.T. U. E.E.DEPT.*1967. 000015
000034 COROL SPECIFICATIONS* AMERICAN STANDARDS ASSN.*196 000002
000035 CYBERNETIC APPROACH TO MENTAL DEVELOPMENT. ST. U. E.E. 000016
000036 CYBERNETICS IN EUROPE AND THE U.S.S.R.*P.E.C. RESEAR 000017
000037 DIVISION.*ILLINOIS U. COMP.SCI.DEPT.*RPT. 230.*1967. 000013
000038 EIGENVALUES OF RANDOM MATRICES: WISCONSIN U. MATH.RE 000014
000039 FIRING-SQUAD SYNCHRONIZATION PROBLEM+ CARNegie INST. 000009
000040 GIVE*ON, Y.*ALGEBRA AUTOMATA II: THE CATEGORICAL FR 000019
000041 GIVE*ON, Y.*CONTRIBUTIONS TO THE THEORY OF ALGEBRAS C 000011
000042 GRAPHS.*M.I.T. LINGCOLN LAB.*T.N.1967-1967. 000010
000043 HYPERPOLIC-EQUATIONS WITH DISCONTINUOUS INITIAL-VALUES. 000004
000044 ILLINOIS U. COMP.SCI.DEPT.*RPT. 204.*1966. 000022
000045 ILLINOIS U. COMP.SCI.DEPT.*RPT.199.*1966. 000021
000046 ILLINOIS U. COMP.SCI.DEPT.*RPT. 255.*1968. 000013
000047 ILLINOIS U. COMP.SCI.DEPT.*RPT. 230.*1967. 000013
000048 INFORMATION-PROCESSING IN THE CHILD.*ST. U. E.E.DEPT.* 000015

Figure 4. Sample Ito Category Node ACCESS Output (Sheet 3 of 4)

KEYWORD LISTING

000004 REFERENCE SCHEMES FOR HYPERBOLIC-EQUATIONS WITH DISCONTINUOUS INITIAL-VALUES.* UPPSALA U. COMP.SCI.DEPT.*RPT.5.*1967. 000004
000015 KAHN, R.M.*A DEVELOPMENTAL MODEL OF INFORMATION-PROCESS 000015
000016 KAHN, R.M.*CYBERNETIC APPROACH TO MENTAL DEVELOPMENT 000016
000017 LISP-2 LANGUAGE SPECIFICATIONS.* SYSTEM DEVELOPMENT CO 3 0 0 0 3
000018 M.I.T. LINCOLN LAB.*N. 1967-1*1967. 000018
000019 MARYLAND U. COMP.SCI. CENTER.* TR-64-R.*1964. 000019
000020 MARYLAND U. COMP.SCI. CENTER.*TR-67-41.*1967. 000020
000021 MATRICES.* WISCONSIN U. MATH.RES. CENTER.*MRC TECH. SU 000021
000022 MONASTIC-ALGEBRAS.* ILLINOIS U. COMP.SCI.DEPT.*RPT.2 0 000022
000023 MOORE, F.H.*AN EXTENSION OF THE NEWTON-KANTOROVICH ME 000023
000024 NEUROCYBERNETICS.* ST. U. E.E.DEPT.* 1967. 000024
000025 NEWTON-KANTOROVICH METHOD FOR SOLVING NONLINEAR-EQUAT 000025
000026 NONLINEAR-EQUATIONS.* MARYLAND U. COMP.SCI. CENTER.* 000026
000027 P.E.C. RESEARCH ASSOCIATES, INC.*AFOSR-65-1412.*1965. 000027
000028 PATTERN-RECOGNITION: I-COMPUTER PROGRAM FOR GENERATING 000028
000029 PULSE SEQUENCES.* ILLINOIS COMP.SCI.DEPT.*RPT.255.*196 000029
000030 ROSENFELD, A. SIMENSON, N.F.* PATTERN-RECOGNITION: I. CO 000030
000031 SELF-REPRODUCING-AUTOMATA: SOME IMPLICATIONS FOR THEOR 000031
000032 SIMENSON, N.F.* PATTERN-RECOGNITION: I. COMPUTER PROG 000032
000033 SNODGRASS APPLIED LOGIC CORP.* 1967. B - W 000033
000034 ST. U. E.E.DEPT.* 1967. 000034
000035 ST. U. E.E.DEPT.* 1967. 000035
000036 ST. U. E.E.DEPT.* 1967. 000036
000037 ST. U. E.E.DEPT.* 1967. 000037
000038 SYNTHETIC-PATTERNS.* MARYLAND U. COMP.SCI. CENTER.* 000038
000039 SYSTEM DEVELOPMENT CORP.*TR-3417/200/00.*1967. 000039
000040 UPPSALA U. COMP.SCI.DEPT.*RPT.5.*1967. 000040
000041 WISCONSIN U. MATH.RES. CENTER.*MRC TECH. SUMMARY PP 000041
000042 WISCONSIN U. MATH.RES. CENTER.*MRC TECH. SUMMARY PP. 000042

Figure 4. Sample NoCategory Mode ACCESS Output (Sheet 4 of 4)

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*LIE
 *CATEGORY NAMES
 C C C M P I L E S
 D C A T A S T R U C T U R E S
 *END CATEGORY NAMES
 *ACCESSION ENTRIES
 R0162 ... SWISTH, A. AND H. JEWBER, "EULER: A GENERALIZATION OF RALGOL AND ITS CD
 + FORMAL DEFINITION," GADM, JAN. 1966, PG. 13. PRECEDENCE, PARSING
 *END ACCESSION ENTRIES

Figure 5. Sample ACCESS Input To Show Sort Keys

S C R I P T	KEY	P R I N T	L I N E
BC+A	... (NOT USED)	...	***** CATEGORY -- C ... C L M P I L E Q S
BC+R	... (NOT USED)	...	
BC+C	... (NOT USED)	...	
BD+A	... (NOT USED)	...	***** CATEGORY -- D ... D A T A S T R U C T U R E S
BD+E	... (NOT USED)	...	
BD+C	...	...	(ACCESS TITLE)
ARC182 1	...	...	(1ST CATEGORY)
BCW1R1P, A. AND H. JEWBER	...	...	(2ND CATEGORY)
BCW1R1P, A. AND H. JEWBER	...	...	(CONTINUATION IMAGE FOR ACCESSION LISTING)
ARC182 2	...	...	(1ST KEYWORD IN ACCESSION ENTRY)
BCW1R1P, A. AND H. JEWBER	...	...	(2ND KEYWORD IN ACCESSION ENTRY)
CAREER, "EULER: A GENF ...	...	...	(3RD KEYWORD I N ACCESSION ENTRY)
CALCCLAND I T S FORMAL D	...	...	(4TH KEYWORD I N ACCESSION ENTRY)
CPRECEDENCE, PARSING	...	...	(5TH KEYWORD I N ACCESSION ENTRY)
CPARSING	...	...	

Figure 5. Sort Keys Before Sort

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SORT KEY	PRINT LINE
ARC182 1	... (ACCESS TITLE)
ARC1922	... (CONTINUATION IMAGE FOR ACCESSION LISTING)
BC+A ... (NOT USED)	... ***** CATEGORY -- (1ST CATEGORY)
BC+E ... (NOT USED)	... ***** CATEGORY -- (2ND CATEGORY)
BC+C ... (NOT USED)	... ***** CATEGORY -- (3RD CATEGORY)
BC+IRTH, N. AND FARMER	... ***** CATEGORY -- (4TH CATEGORY)
BC+A ... (NOT USED)	... ***** CATEGORY -- (5TH CATEGORY)
BC+B ... (NOT USED)	... ***** CATEGORY -- (6TH CATEGORY)
BC+C	... ***** CATEGORY -- (7TH CATEGORY)
BC+IRTH, N. AND FARMER	... ***** CATEGORY -- (8TH CATEGORY)
CALCUL AND ITS FORMAL	... ***** CATEGORY -- (9TH CATEGORY)
CAPASING	... ***** CATEGORY -- (10TH CATEGORY)
CPRECEDENCE, FARSING	... ***** CATEGORY -- (11TH CATEGORY)
CWEBER, MULLER: A GENE	... ***** CATEGORY -- (12TH CATEGORY)
CWIRTH, N. AND FARMER	... ***** CATEGORY -- (13TH CATEGORY)

Figure 7. Sort Keys After Sort