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MEDICAL INFORMATION MANAGEMENT SYSTEM (MIMS): A GENERALIZED INTERACTIVE INFORMATION SYSTEM

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— GODDARD SPACE FLIGHT CENTER —
GREENBELT, MARYLAND

**MEDICAL INFORMATION MANAGEMENT
SYSTEM (MIMS): A GENERALIZED
INTERACTIVE INFORMATION SYSTEM**

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ABSTRACT

This report describes an interactive information system. It is a general purpose, free format system which can offer immediate assistance where manipulation of large data bases is required. The medical area is a prime area of application. The report is designed to serve as a manual for potential users — nontechnical personnel who will use the system. Examples of the system's operation, commentary on the examples, and a complete listing of the system program are included.

CONTENTS

| | <u>Page</u> |
|--|-------------|
| BACKGROUND AND FUNCTION OF MIMS | 1 |
| APPLICATIONS OF MIMS | 1 |
| FOR PROSPECTIVE USERS | 2 |
| PURPOSE OF THE MANUAL | 3 |
| ORGANIZATION OF MIMS | 3 |
| DEFINITIONS | 3 |
| MIMS: THE SEVEN PROGRAM UNITS | 11 |
| HEADER PROGRAM | 12 |
| If Instructions Are Needed | 12 |
| The Four ID Items | 12 |
| Repetitive Use of HEADER | 12 |
| RESTART Option in HEADER | 12 |
| COMMENTS Line in a HEADER | 12 |
| Modify a Header File | 18 |
| ACTION | 18 |
| STORE PROGRAM | 18 |
| Naming the Data File | 18 |
| Recalling the Proper Header File | 19 |
| Data Entry: Proper Format | 19 |
| Efficiency in Data Entry | 21 |
| ANOTHER ENTRY? | 21 |
| ANOTHER RECORD? | 21 |
| If No More Entries or Records | 21 |
| End of Program | 21 |
| RESTART Option in STORE | 21 |
| RETREV PROGRAM | 22 |
| ID Items | 22 |

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CONTENTS Continued)

| | <u>Page</u> |
|---|-------------|
| CONDITION Question | 22 |
| ACTION Options | 22 |
| WHAT Question | 31 |
| Format for Requesting Data | 32 |
| Data Not There | 32 |
| RESTART Option in RETREV | 32 |
| Multiple Retrieval of Data | 32 |
| UPDATE PROGRAM | 33 |
| ID Items | 33 |
| ACTION, WHAT, and TO | 33 |
| RESTART Option in UPDATE | 33 |
| Updating of Additional Data Files | 33 |
| When Finished Updating | 33 |
| SORTER PROGRAM | 36 |
| Time Needed to Sort | 36 |
| MERGE PROGRAM | 38 |
| SUPPLEMENT PROGRAM | 40 |
| GENERAL SYSTEM INSTRUCTIONS | 43 |
| Permanent Files | 43 |
| Temporary Storage | 44 |
| RANDOM ACCESS | 44 |
| USER NOTES | 45 |

TABLES

| <u>Table</u> | | <u>Page</u> |
|--------------|---------------------------------|-------------|
| 1 | To Call MIMS Programs | 5 |
| 2 | UCS System Commands | 7 |

ILLUSTRATIONS

| <u>Figure</u> | | <u>Page</u> |
|---------------|---|-------------|
| 1 | Examples of RENAME, UNSAVE, and QUE,Q | 10 |
| 2 | Creation of HEADER File GSFEXAM | 13 |
| 3 | Portion of Data in CHD File | 19 |
| 4 | Variations of the LIST Option | 23 |
| 5 | The Six Retrieval Options | 26 |
| 6 | The LIST Option Including COMMENTS Line | 29 |
| 7 | CHANGE, ADD, DELETE Options in UPDATE | 34 |
| 8 | CHD and CA Data Files Sorted | 37 |
| 9 | CHD and CA Files Merged | 39 |

MEDICAL INFORMATION MANAGEMENT SYSTEM (MIMS): A GENERALIZED INTERACTIVE INFORMATION SYSTEM

BACKGROUND AND FUNCTION OF MIMS

A computer program initially was developed at NASA/Houston to monitor the health status of astronauts and subsequently was continued by Dr. Tate Minckler at the Presbyterian Hospital in Denver. From this work a real-time information system with teletype input was developed. Its acronym is MIMS, Medical Information Management System. Its function is to handle all aspects of data related to patient care. Its prime benefits are (1) the ability to recall the record of a specific patient (or patients) in a matter of seconds, (2) the ability to search for specific types of data among patients' records, and (3) the ability to do medical research with a rich and readily available data base.

The package is a generalized information storage and retrieval system that enables the user to accomplish four basic functions:

- Definition of file structure to accommodate individual needs.
- Data entry.
- Data retrieval.
- Data revision and file maintenance.

MIMS is written in FORTRAN in a version developed by United Computing Systems, Inc. In its present form, MIMS can be run only on a CDC 6500 or 6600 computer because of the size of the internal word structure. Also, built into MIMS is a special feature of UCS' version of FORTRAN called the PFUR (Permanent File User Routine) subroutine. It causes all files to be automatically saved without the user having to issue a system SAVE command.

APPLICATIONS OF MIMS

The medical field is a fertile area for applications of MIMS. This includes hospitals, out-patient clinics, private physicians' groups, etc. The value of this system is its flexibility. The user

- decides the categories of data.
- decides on the format of the data (including alphabetic and/or numeric and the length of the data item, i.e. completely free format).
- may change any of the data entries without regard to the length of the original data field.
- can retrieve any selected item of data or all of the data.
- can generate tabular information assembled from comparison of all the records on the system — i.e. a powerful research tool.
- can generate statistical information on numeric data such as means, standard deviations and 95% confidence intervals.

NASA is currently considering the use of MIMS for its Occupational Medicine Programs at its centers throughout the country. To this end Jean Mockbee, from the Division of Occupational Medicine and Environmental Health at NASA Headquarters has generated tabular and statistical outputs as a model of the operation of MIMS in a simulated medical record-keeping application.

However, MIMS is a general-purpose information storage and retrieval system and its use is by no means restricted to medical functions. Other fruitful areas of application are for managing occupational safety data in the public and private sectors, for handling judicial information where speed and accuracy are high priorities, for serving personnel inquiry systems, for systematizing purchasing and procurement systems, and even for analyzing organizational cost structures.

Where a large data base has overwhelmed the user in his search for information, MIMS provides an efficient tool for flexible and complete data retrieval.

FOR PROSPECTIVE USERS

The MIMS program is currently supported by United Computing Systems, Inc., a time-sharing firm headquartered in Kansas City, Missouri, with local offices in major cities.

A prospective user having no computer facilities whatever need only rent a terminal(s) from USC at nominal cost to have complete use of the program. Additional billing is a function of how heavily the system is used. UCS analysts offer free technical support to their users.

A prospective user with access to a CDC 6500 or CDC 6600 need only rent a terminal. The MIMS program is available from COSMIC at nominal cost and could be mounted on the CDC machine.

PURPOSE OF THE MANUAL

This manual fully documents the user's conversational interaction and operation of the system. This guide includes examples for almost every option available in MIMS. Explanation is provided in the text material. System commands — those key words or phrases that control activities such as the activation and deactivation of the programs — are illustrated, with user responses underlined. In addition, a complete listing of the program is provided in the appendix.

ORGANIZATION OF MIMS

The MIMS package consists of seven programs, each of which operates independently but all of which are connected by references to common file names in the system. The segments are —

- HEADER: creates categories of data.
- STORE: stores data under the categories from HEADER.
- RETRIEVE: recalls desired configurations of data.
- UPDATER: alters or deletes specific data items.
- SORTER: rearranges related (data) records.
- MERGE: combines two sets of records.
- SUPPLEM: adds new categories and data to an existing record.

The discussion of each of the seven program units and the related examples should clarify for the potential user the way in which MIMS is used as an automated hospital information system.

DEFINITIONS

Several basic terms are used throughout the discussion. For easy reference, we define them here:

- **Headings:** labels or categories of data which are created during the **HEADER** program.
- **Header file:** a group of headings corresponding to a particular data record.
- **Data field:** any group of letters, words, or numbers (or combinations of the three) that is a response to a heading.
- **Data record:** a logically related set of heading-data pairs for an arbitrary header file.
- **Data file:** a group of data records.
- **Data-file name:** the designation by which a set of data records is known; it is given during the **STORE** program.
- **ID items:** the first four data fields in a record.

Table 1
To Call MIMS Programs

| OBJECT (COMPILED) PROGRAMS | |
|-------------------------------|--|
| PURPOSE | To create headings (or categories) under which data will subsequently be stored, or modify an existing header file. |
| NAME | HEADER |
| TO RUN | —HEADER/LIB |
| TO STOP | Type an asterisk in response to the question mark after all headings have been entered. |
| TO RESTART | Type RESTART |
| PURPOSE | To enter data under a selected header file. |
| NAME | STORE |
| TO RUN | —STORE/LIB |
| TO STOP | Answer both questions "ANOTHER ENTRY" and "ANOTHER RECORD" with NO when finished entering data. To abort the program and scratch out data just entered (because of errors), type STOP. |
| TO RESTART | Typing RESTART will, like STOP, abort all data in the current file, but will reset the program to start over. |
| PURPOSE | To recall data, in its totality or selectively, stored in the system. |
| NAME | RETREV |
| TO RUN | —RETREV/LIB |
| TO STOP | END OF REQUEST or STOP will terminate execution. |
| TO RESTART | If an error has been made in requesting a search, RESTART will return the program to the first response line. |

Table 1 (continued)

| OBJECT (COMPILED) PROGRAMS | |
|-------------------------------|--|
| NEW FILE | To search a data file other than the one currently being used, type NEW FILE and give the name of the new data file when requested. |
| PURPOSE | To CHANGE, ADD to, or DELETE items in a record. |
| NAME | UPDATE |
| TO RUN | --UPDATER/LIB |
| TO STOP | If only one change is being made, the program will automatically terminate. For more than one change, type DONE* in response to the first question mark that appears after all changes have been made. Do not use STOP. This will prevent the changes from being recorded. |
| TO RESTART | Type RESTART. But realize that none of the changes just entered will be recorded. They must be reentered. |
| NEW FILE | Type NEW FILE to access a different data file for updating. |
| PURPOSE | To rearrange a data file according to any of the first four (identification) items in a record. |
| NAME | SORTER |
| TO RUN | --SORTER/LIB |
| TO STOP | Program terminates itself at completion of sort. To abort, type STOP. |
| PURPOSE | To merge two data files into a single file. The original two files are not destroyed. |
| NAME | MERGE |
| TO RUN | --MERGE/LIB |
| TO STOP | Program terminates itself at completion of merge. To abort, enter STOP. |

Table 1 (continued)

| OBJECT (COMPILED) PROGRAMS | |
|-------------------------------|--|
| PURPOSE | To add additional header to an existing data record. |
| NAME | SUPPLEMENT |
| TO RUN | --SUPPLEM/LIB |
| TO STOP | Answer NO to request for additional records. However, an abort message indicates that all input to that point has been lost. |

Table 2

UCS System Commands

| | |
|---|---|
| <p>These commands are part of the time sharing support package available to all programs under the UCS system. They are, therefore, independent of any particular program, including MIMS. This is a partial list containing the more frequently used commands. For the full set of commands available, see the UCS-VI System Guide. Either the full command word or its first three letters will serve to initiate the desired action.</p> | |
| LIST LIS | Causes the primary file (program, data file, etc.) to be listed from its beginning. The operation may be terminated by hitting an "S" (for STOP). |
| LIST, nnn | The listing will begin at line number nnn. |
| LNH | Program heading line is omitted before listing begins. |
| RUN | Causes execution of the program. |
| RHN | Same as RUN, except that date, time, and file name are not printed. |
| RUN, M = mmmmm RNH, M = mmmmm | If a program requires more than 8,192 (decimal) computer-words of memory, the parameter "M = mmmmm" may be used to allocate up to 24,576 ten character words. |

Table 2 (continued)

| | |
|--|--|
| RUN, T = tttt RNH, T = tttt | The system allows up to 64 seconds of CPU time unless the parameters "T = tttt" specifies a higher maximum in seconds. |
| RUN, M = mmmmm, T = tttt RNH, M = mmmmm, T = tttt | Both M and T may be used simultaneously in either order. |
| STOP | Will terminate/abort execution of a program when teletypewriter is NOT giving output. If entered in response to teletypewriter input, STOP will terminate program execution. |
| S | Will terminate execution only when output from the teletypewriter is being printed. |
| BYE GOODBYE GOO | These commands, all equivalent, disconnect the teletypewriter from the time-sharing system. |
| SAVE, file name SAV, file name | Copies any processing area file into permanent storage. |
| REPLACE REP | Used to replace the contents of a file called from permanent storage with an OLD command after changes have been made (i.e. line changes in the program). |
| UNSAVE, file name UNS, file name | Destroys the permanent storage copy of a file. Used to weed out data files, etc., that are no longer needed. (See Figure 1.) |
| CAT | Provides a listing of the file names saved under your user number. |
| CAT, L | Lists all of the files as well as the size of each file and the total storage occupied. |
| CAT, F | In addition to the file names, output includes creation date, last access date, and last date changed for each file in the catalog. |
| CAT, S | Gives total storage occupied by the files. |
| HOLD | Prevents an inactive terminal from automatically logging off after 10 minutes. One is charged for connect time, though. |

Table 2 (continued)

| | |
|---|---|
| <p>RENAME, file name REN, file name</p> | <p>Allows the user to give a new name (in "file name" position) to a primary file. Only the primary file remains permanent. To save the new file as a permanent file, use "SAVE, file name". This enables the user to create multiple copies of a file. (See Figure 1.)</p> |
| <p>QUERY QUE</p> | <p>Used whenever the system stops printing. System reply will be ACTIVE or IDLE.</p> |
| <p>QUERY, Q QUE, Q</p> | <p>Computer prints the CPU seconds used on the current execution. (See Figure 1.)</p> |
| <p>RESERVED WORDS</p> | |
| <p>These words are reserved for the UCS-VI System. They should not be used for file names or for the beginning characters of file names. If a reserved word is used, the program will abort at execution.</p> | |
| <p>PUNCH CATLIST COMMENT MAP SATISFY</p> | <p>INPUT PUNCHB COMMON NOGO P8</p> |
| <p>OUTPUT ACCOUNT EXECUTE NOMAP REQUEST</p> | <p>SORT LOAD EXIT RELEASE</p> |
| | <p>SCR ASSIGN MACE SCOPE</p> |

RENAME Command

SYSTEM: FOR,OLD,CVD

READY.
REN,CVD2

READY.
SAV, CVD2

Data File CVD Renamed CVD2. CVD2 Saved.
CVD Remains a Permanent File.

UNSAVE Command

UNS,CHD2
READY.

Data File CHD2 is Erased.

QUE,Q Command

FOR,OLD,RETREV

READY.
RNH,M=13200

QUE,Q
JOB IN EXECUTION.
ACCUM. CPU SECONDS = 4.773

QUE,Q
JOB IN EXECUTION.
ACCUM. CPU SECONDS = 9.095

Execution is queried for CPU time during
compilation of RETREV program.

Figure 1. Examples of RENAME, UNSAVE, and QUE,Q

MIMS:

THE SEVEN PROGRAM UNITS

NOTE: For illustration purposes only, all underlined items in the figures indicate user responses. Nonunderlined items are machine generated.

HEADER PROGRAM

The HEADER program creates a file of headings (or labels) for data that will subsequently be placed under these headings by the STORE program. Headings may consist of from one to 20 alphabetic or numeric characters. For efficiency of entry and storage, short, abbreviated, but recognizable headings, are desirable. As many as 160 headings may be used for a single header file.

If Instructions Are Needed

When the first question mark appears, enter a level code (a digit from 0 to 9). This number gives the degree of indentation for each heading. When the next question mark appears, enter the heading that corresponds to the level code. For headings that will normally have data following them enter a colon after the heading. For headings used only for organization (blind headings) and not for storing data, the colon is not entered. Repeat this process until all level codes and headings have been entered. Then enter an asterisk after the next question mark to terminate the program. (See Figure 2.)

Caution:

Because of spacing considerations, the higher the level code (that is, the greater the indentation of a heading) the fewer the characters (less than 20) available for that heading name.

The Four ID Items

The first four items in a header file are given level code 0 and are used throughout the MIMS system to uniquely identify records. MIMS assumes that the fourth identifier is a date. The other three may be any name up to 30 characters long.

Repetitive Use of HEADER

Since the header file will be used for creating records for a file at any time, the user must remember what name he is calling the files.

RESTART Option in HEADER

If while entering level codes and headings the user wishes to start over, he simply types RESTART, and the program will begin again without aborting.

COMMENTS Line in a HEADER

The header file in Figure 6, contains COMMENTS as the final header. The user is free to enter up to 5,000 characters in each data field, hence the great usefulness

—HEADER/LIB

02/20/75. 11.52.40.
PROGRAM HEADER

DO YOU WANT TO CHANGE AN EXISTING HEADER FILE ? N
IF AT ANY TIME YOU WANT TO START OVER, ENTER "RESTART".
TYPE THE NAME YOU WISH TO CALL THIS HEADER FILE USING
7 OR FEWER CHARACTERS ? GSFEXAM

SUPPLY LEVEL CODES AND HEADINGS.

| | | |
|---------|---|-----------------|
| LEVEL ? | 0 | |
| HEADING | ? | <u>SS#</u> : |
| LEVEL ? | 0 | |
| HEADING | ? | <u>DEPT</u> : |
| LEVEL ? | 0 | |
| HEADING | ? | <u>RECORD</u> : |
| LEVEL ? | 0 | |
| HEADING | ? | <u>DATE</u> : |
| LEVEL ? | 1 | |
| HEADING | ? | <u>IDENT</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>DOB</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>AGE</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>SEX</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>INTORG</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>DEG</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>NCC</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>GR</u> : |
| LEVEL ? | 1 | |
| HEADING | ? | <u>EXAM</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>HT</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>WT</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>SBP</u> : |
| LEVEL ? | 2 | |
| HEADING | ? | <u>DBP</u> : |
| LEVEL ? | | |

Figure 2. Creation of HEADER File GSFEXAM

UNACCEPTABLE LEVEL CODE, TRY AGAIN

? 2
HEADING ? ? PUL:
LEVEL ? 2
HEADING ? ? HGB:
LEVEL ? 2
HEADING ? ? WBC:
LEVEL ? 2
HEADING ? ? GLU:
LEVEL ? 2
HEADING ? ? CHOL:
LEVEL ? 2
HEADING ? ? UA:
LEVEL ? 2
HEADING ? ? FEV:
LEVEL ? 2
HEADING ? ? ECG2:
LEVEL ? 2
HEADING ? ? ECG1:
LEVEL ? 2
HEADING ? ? ECG3:
LEVEL ? 2
HEADING ? ? DIAG1:
LEVEL ? 2
HEADING ? ? DIAG2:
LEVEL ? 2
HEADING ? ? DIAG3:
LEVEL ? 2
HEADING ? ? DIAG4:
LEVEL ? 2
HEADING ? ? DIAG5:
LEVEL ? 1
HEADING ? ? LIFESTYL:
LEVEL ? 2
HEADING ? ? BIRTHORD:
LEVEL ? 2
HEADING ? ? FAMSIZE:
LEVEL ? 2
HEADING ? ? HRSWK:
LEVEL ? 2
HEADING ? ? SM:
LEVEL ? 2
HEADING ? ? COF:
LEVEL ? *

"GSFEXAM" HAS BEEN SAVED AS HEADER FILE.
STOP.

0.548 /

3.287 /

12

Figure 2. Creation of Header File GSFEXAM (Continued)

-HEADER/LIB

03/11/75. 08.07.07.
PROGRAM HEADER

DO YOU WANT TO CHANGE AN EXISTING HEADER FILE ? Y

TYPE THE NAME OF THE HEADER FILE ? MAXE

DO YOU WANT INSTRUCTIONS ON HOW TO PROCEED ? N

ACTION ? CHANGE

WHAT ? DOB:

TO ? DATE BORN:

DO YOU WISH TO MAKE ANY MORE MODIFICATIONS TO THIS
FILE ? Y

ACTION ? DELETE

WHAT ? DIAG3:

DO YOU WISH TO MAKE ANY MORE MODIFICATIONS TO THIS
FILE ? Y

ACTION ? SUPPLEMENT

FROM ? EXAM:

LEVEL ? 2

HEADING ? EYES:

LEVEL ? 2

HEADING ? NOSE:

LEVEL ? *

DO YOU WISH TO MAKE ANY MORE MODIFICATIONS TO THIS
FILE ? N

YOU HAVE REPLACED HEADER FILE MAXE
STOP.

0.342 /

2.051 /

24

Figure 2. Creation of Header File GSFEXAM (Continued)

READY.
-STORE/LIB

PROGRAM: STORE DATE: 03/11/75 TIME: 10.01.29

TO START OVER, ENTER "RESTART"

ENTER NAME YOU WISH TO CALL THIS DATA FILE: ? SAM

TYPE THE NAME OF THE HEADER FILE YOU WISH TO USE ? MAXE

BEGIN DATA INPUT.

| | |
|-----------|----------------------|
| SS# | ? 987651234* |
| DEPT | ? <u>ALL</u> * |
| RECORD | ? <u>ALL</u> * |
| DATE | ? <u>09 MAR 75</u> * |
| IDENT | ? <u>*</u> |
| DATE BORN | ? <u>(1805)</u> * |
| AGE | ? <u>(52)</u> * |
| SEX | ? <u>(1)</u> * |
| INTORG | ? <u>(0)</u> * |
| DEG | ? <u>(3)</u> * |
| NCC | ? <u>(11)</u> * |
| GR | ? <u>(12)</u> * |
| EXAM | ? <u>*</u> |
| EYES | ? <u>(23)</u> * |
| NOSE | ? <u>(23)</u> * |
| HT | ? <u>(71)</u> * |
| WWT | ? <u>(176)</u> * |
| SBP | ? <u>(148)</u> * |
| DBP | ? <u>(92)</u> * |
| PUL | ? <u>(72)</u> * |
| HGB | ? <u>(168)</u> * |
| WBC | ? <u>(74)</u> * |
| GLU | ? <u>(109)</u> * |
| CHOL | ? <u>(300)</u> * |
| UA | ? <u>(056)</u> * |
| FEV | ? <u>(86)</u> * |
| ECG2 | ? <u>(4)</u> * |
| ECG1 | ? <u>*</u> |
| ECG3 | ? <u>(4)</u> * |
| DIAG1 | ? <u>(401)</u> * |
| DIAG2 | ? <u>(410)</u> * |
| DIAG4 | ? <u>*</u> |
| DIAG5 | ? <u>*</u> |

Figure 2. Creation of Header File GSFEXAM (Continued)

| | | |
|---------------------------|---------|------------------------------|
| LIFESTYL | ? | * |
| BIRTHORD | ? | (03)* |
| FAMSIZ | ? | (05)* |
| HRSWK | ? | (8)* |
| SM | ? | (8)* |
| COF | ? | (20)* |
| ANOTHER ENTRY ? <u>N</u> | | |
| ANOTHER RECORD ? <u>N</u> | | |
| "SAM | " | HAS BEEN SAVED AS DATA FILE. |
| STOP. | | |
| 0.654 / | 5.231 / | 32 |

Figure 2. Creation of Header File GSFEXAM (Continued)

being able to create a descriptive data entry. The UPDATE program can then be used to CHANGE, ADD to, or DELETE any of these COMMENTS.

Modify a Header File

This program also can be used to modify an existing header file, and asks you if you want to do so. If you answer "yes", you will then be asked the name of the header file. You may then DELETE, CHANGE, or SUPPLEMENT items to this file.

ACTION

In response to ACTION, type DELETE* or CHANGE* if you wish to DELETE or CHANGE any individual heading name. The program will then ask you What?, to which you type in the affected heading. If the ACTION was CHANGE, the program will respond TO? to which you type in the new heading name.

If the ACTION is SUPPLEMENT, the program will ask FROM?, to which you enter the heading name including colons:, , * or any other characters that appears in the original Header name, after which you want new heading names to appear. The program will then request LEVELS/HEADINGS as when originally creating the file. This instruction is terminated by an * in response to LEVEL, the same as when the original was created.

STORE PROGRAM

The STORE program enables the user to enter data under a specific header file. The program recreates the header file name from the DEPT and RECORD names supplied by the user and uses it to find the appropriate header file.

Naming the Data File

The name of a data file is a string of one to seven characters given to a specific set of data records. Data file names already in use will ordinarily not be used. In the usual case, one wishes to add new records to an existing data file. One could call the set of new records a name such as NEWDATA. He could sort NEWDATA, if necessary, using SORTER and could then call MERGE to merge NEWDATA into the appropriate existing data file having such records. This procedure could be performed regularly, perhaps daily, as a standard updating technique. The file NEWDATA could be cleared by the user at the conclusion of MERGE by typing UNSAVE, NEWDATA. Thus the name NEWDATA would be available for repeated use in this context.

Recalling the Proper Header File

User types in name of header file in response to machine's request.

Data Entry: Proper Format

Each data entry must be followed by an asterisk. For data items requiring more than one line, one hits the carriage return and waits until the end of the entire data item to affix the asterisk. Numerical data, except items like a social security number and date, must be enclosed in parentheses to accommodate the ranging function in the retrieval program. Since an asterisk represents the end of a data field, data fields such as ECG2 and ECG3 in Figure 3 are currently blank.

Another must for entering data is that the date must be in DAY MONTH YR* form where DAY and YR are two-digit numbers and MONTH is the first three letters of the month (e.g., DATE ? 08 JUL 71*). Be sure to leave one space between DAY and MONTH and one between MONTH and YR.

```
-STORE/LIB
PROGRAM: STORE    DATE: 09/06/72    TIME: 14.11.28
TO START OVER, ENTER "RESTART".
ENTER NAME YOU WISH TO CALL THIS DATA FILE:  ? CHD

TYPE THE NAME OF THE HEADER FILE YOU WISH TO USE?
GSFEXAM

BEGIN DATA INPUT.

SS#                ?  224037224*
DEPT                ?  GSFC
RECORD              ?  EXAM
DATE                ?  00 MAR 70*
  IDENT
  DOB                ?  (1805)*
  AGE                ?  (52)*
  SEX                ?  (1)*
  INTORG             ?  (28i)*
  DEG                ?  (0)*
  NCC                ?  (3)*
  GR                 ?  (1i)*
```

Figure 3. Portion of Data in CHD File

| | |
|-----------|------------------|
| EXAM | |
| HT | ? <u>(71)</u> * |
| WT | ? <u>(176)</u> * |
| SBP | ? <u>(148)</u> * |
| DBP | ? <u>(92)</u> * |
| PUL | ? <u>(72)</u> * |
| HGB | ? <u>(168)</u> * |
| WBC | ? <u>(74)</u> * |
| GLU | ? <u>(109)</u> * |
| CHOL | ? <u>(300)</u> * |
| UA | ? <u>(056)</u> * |
| FEV | ? <u>(86)</u> * |
| ECG1 | ? <u>(14)</u> * |
| ECG2 | ? * |
| ECG3 | ? * |
| DIAG1 | ? <u>(401)</u> * |
| DIAG2 | ? <u>(410)</u> * |
| DIAG3 | ? * |
| DIAG4 | ? * |
| DIAG5 | ? * |
| LIFESTYLE | |
| BIRTHORD | ? <u>(03)</u> * |
| FAMSIZE | ? <u>(05)</u> * |
| HRSSL | ? <u>(8)</u> * |
| HRSWK | ? <u>(8)</u> * |
| SM | ? <u>(20)</u> * |
| COF | ? <u>(6)</u> * |

ANOTHER ENTRY ? NO
 ANOTHER RECORD ? NO

"CHD" HAS BEEN SAVED AS DATA FILE.
 STOP.

Figure 3. Portion of Data in CHD File (Continued)

Efficiency in Data Entry

Since much of the value of the retrieval program comes from the statistics it can generate, it is advantageous to the user to convert as much of his data as possible into numeric form or codes.

For instance, the medical diagnoses used in the examples here are numerical codes from the World Health Organization's International Clarification of Diseases. In retrieval, one could access all of the codes in the range of 140-209 (the code for malignant neoplasms) instead of having to specify each cancer-related ailment by name. Recall that numeric data must be enclosed in parentheses for ranging to work in retrieval. Numbers must be positive, and contains no more than 7 digits. A decimal point may be inserted anywhere in the number.

ANOTHER ENTRY ?

To store data for another entry according to same header, reply YES (or just Y), and the program will return to the first header line in the file just used to accept more data.

ANOTHER RECORD ?

To store a new record for the same entry, the response is NO to "ANOTHER ENTRY" and is the new record name for "ANOTHER RECORD". A new header file name is constructed and called up. This new header file is then used for data entry. This allows the user to assemble records with different header files under the same data file.

If No More Entries or Records

Answer NO to "ANOTHER ENTRY" and "ANOTHER RECORD". The user is informed that his data file has been saved under the data file name given when he indicates he has no more entries and records to store. If, however, the data file name was already used, he can either supply a new name for his file or replace the other data file with his by entering an asterisk. (See Figure 3.)

End of Program

At the end of the program, a message indicating that the data file has been saved under the proper name is printed.

RESTART Option in STORE

Typing RESTART at any point during data entry commands the program to return to the beginning of the program.

RETREV PROGRAM

The ability to recall information when it is wanted is the heart of any information storage and retrieval system. The RETREV program enables the user to define a very specific or a very generalized search. To call the program, one types -RETREV/LIB.

ID Items

Retrieval is conversational, consisting of machine interrogation and user response. In all retrievals, the user answers seven questions. The more specific the responses to the ID items, the more efficient the search. For instance, a search on a specific SOC SEC # yields all records for that person and no one else. Records can be searched between a range of dates (see Figure 5).

CONDITION Question

If a search is defined by CONDITION (i.e., SBP: 150-300 OR DBP: 94 to 200, of 94-200) as in Figure 4 one might want to respond ALL* to the four ID items. Boolean connectors such as AND and OR, provide great flexibility in specifying the CONDITION of the search. Parentheses can also be used to define a logical command. Figures 4, 5 and 6 should give a feeling for the possibilities in defining a search.

ACTION Options

The response to ACTION defines the format of the data to be retrieved. The six options available are LIST, COUNT, TABULATE, TAB-SD, CROSSTAB, and COPY. (See Figure 5.)

LIST generates a copy of the data requested.

COUNT gives the number of records fitting a given description.

TABULATE generates the data asked for in WHAT according to the attributes in CONDITION. It also provides a count of all such cases.

TAB-SD is identified with TABULATE but in addition generates statistical data such as mean, standard deviation, standard error, minimum data value, and maximum data value, as well as a two standard-deviation confidence interval.

CROSSTAB generates a grid of numbers which represents the number of entries in the data field satisfying each pair of row and column conditions.

579101213
GSFC JAN69

EXAM
SBP (148)
DBP (100)

375185709
GSFC APR69

EXAM
SBP (130)
DBP (100)

232387419
GSFC MAY69

EXAM
SBP (140)
DBP (100)

216019438
GSFC JUL69

EXAM
SBP (152)
DBP (102)

232586846
GSFC SEP69

EXAM
SBP (146)
DBP (100)

COUNT IS 9

SS# ? NEW FILE
ENTER NAME OF DATA FILE: ? CA
SS# ? ALL*
DEPT ? ALL*
RECORD ? ALL*
DATE ? ALL*
CONDITIONS ? HGB:NOT 140-159*
ACTION ? LIST*
WHAT ? AGE AND HGB*

Figure 4. Variations of the LIST Option (Continued)

```

313349630
GSFC                                JAN68

IDENT
AGE                                (39)
EXAM
HGB
*****

550094455
GSFC                                AUG68

IDENT
AGE                                (52)
EXAM
HGB
*****

031051256
GSFC                                SEP68

IDENT
AGE                                (49)
EXAM
HGB
*****

234016914
GSFC                                MAY69

IDENT
AGE                                (53)
EXAM
HGB
*****

263521448
GSFC                                MAY70

IDENT
AGE                                (32)
EXAM
HGB                                (106)
*****
COUNT IS                          5
SS#                                ? ALL*
DEPT                              ? ALL*
RECORD                            ? ALL:
DATE                              ? RESTART
SS#                                ? ALL*
DEPT                              ? ALL*
RECORD

```

Figure 4. Variations of the LIST Option (Continued)


```

LIFESTYLE
BIRTHORD          (03)
FAMSIZE           (05)
HRSSL             (8)
HRSWK            (8)
SM               (20)
COF              (6)
*****
COUNT IS        1
SS#              ? 224037224*
DEPT             ? GSFC*
RECORD          ? EXAM*
DATE            ? 00 MAR 70*
CONDITIONS      ? ALL*
ACTION          ? COPY*
WHAT            ? AGE AND SBP AND DBP AND PUL*
COUNT IS        1
DID YOU COPY OR TAB ANY INFO YOU WANT TO SAVE: ? YES
WHAT NAME DO YOU WANT TO CALL IT: ? BP
BP HAS BEEN SAVED.
SS#              ? ALL*
DEPT             ? GSFC*
RECORD          ? EXAM*
DATE            ? 00 JAN 70 TO 31 DEC 70*
CONDITIONS      ? ALL*
ACTION          ? COUNT*
WHAT            ? ALL*
COUNT IS        2
SS#              ? ALL*
DEPT             ? GSFC*
RECORD          ? EXAM*
DATE            ? ALL*
CONDITIONS      ? ECG1:00 OR ECG1:10-19 OR ECG:1--1:40-49*
ACTION          ? CROSSTAB*
WHAT            ? AGE:17-29 OR AGE:30-39 OR AGE:40-49
                ? OR AGE:50-59 OR AGE:60-69*

```

| | AGE | AGE | AGE | AGE | AGE |
|-----------------|------------|------------|------------|------------|------------|
| | 17.0- 29.0 | 30.0- 39.0 | 40.0- 49.0 | 50.0- 59.0 | 60.0- 69.0 |
| ECG1 0. - 0. | 0 | 0 | 5 | 6 | 0 |
| ECG1 10.0- 19.0 | 0 | 0 | 0 | 2 | 0 |
| ECG1 40.0- 49.0 | 0 | 0 | 0 | 2 | 0 |

```

COUNT IS        15
SS#              ? ALL*
DEPT             ? GSFC*
RECORD          ? EXAM*
DATE            ? ALL*
CONDITIONS      ? ALL*
ACTION          ? TABULATE*
WHAT            ? AGE AND HT AND WT AND SBP AND DBP*

```

Figure 5. The Six Retrieval Options (Continued)

| | | AGE | HT | WT | SBP | DBP |
|----------|-------|-----|----|-----|-----|-----|
| 00000000 | NOV63 | 47 | 74 | 186 | 158 | 95 |
| 00000001 | DEC64 | 43 | 73 | 235 | 132 | 80 |
| 00000000 | MAR65 | 42 | 66 | 135 | 120 | 80 |
| 00000001 | MAY65 | 54 | 74 | 172 | 160 | 100 |
| 00000001 | OCT65 | 46 | 70 | 171 | 142 | 82 |
| 00000000 | MAY67 | 38 | 66 | 146 | 130 | 90 |
| 44114353 | NOV67 | 53 | 63 | 144 | 128 | 68 |
| 26134511 | JAN68 | 39 | 69 | 207 | 140 | 95 |
| 47303125 | AUG68 | 52 | 68 | 159 | 180 | 88 |
| 29118940 | NOV68 | 44 | 67 | 157 | 120 | 64 |
| 41412598 | JAN69 | 50 | 73 | 211 | 122 | 76 |
| 57910121 | JAN69 | 50 | 65 | 188 | 148 | 100 |
| 37518570 | APR69 | 50 | 65 | 181 | 130 | 100 |
| 06805113 | MAY69 | 58 | 66 | 178 | 140 | 90 |
| 06812041 | MAY69 | 47 | 65 | 169 | 122 | 82 |
| 23238741 | MAY69 | 39 | 67 | 162 | 140 | 100 |
| 21601943 | JUL69 | 50 | 72 | 197 | 152 | 102 |
| 23258684 | SEP69 | 57 | 64 | 121 | 146 | 100 |
| 21530480 | FEB70 | 35 | 68 | 195 | 120 | 70 |
| 22403722 | MAR70 | 52 | 71 | 176 | 148 | 92 |
| 56254341 | MAY71 | 55 | 72 | 177 | 126 | 80 |

COUNT IS 21

DID YOU COPY OR TAB ANY INFO YOU WANT TO SAVE: ? NO
SS#

? ALL*
DEPT ? GSFC*
RECORD ? EXAM*
DATE ? 00 JAN 69 TO 31 DEC 69*
CONDITIONS ? ALL*
ACTION ? TAB-SD*
WHAT ? WT AND DBP AND GLU AND CHOL*

| | | WT | DBP | GLU | CHOL |
|----------|-------|-----|-----|-----|------|
| 41412598 | JAN69 | 211 | 76 | 100 | 235 |
| 57910121 | JAN69 | 188 | 100 | 300 | 250 |
| 37518570 | APR69 | 181 | 100 | 340 | 350 |
| 06805113 | MAY69 | 178 | 90 | | |
| 06812041 | MAY69 | 169 | 82 | 74 | 290 |
| 23238741 | MAY69 | 162 | 100 | | |
| 21601943 | JUL69 | 197 | 102 | 86 | 270 |
| 23258684 | SEP69 | 121 | 100 | 95 | 135 |

| | | | | |
|------------|-----|-----|-----|-----|
| NO | 8 | 8 | 6 | 6 |
| MEAN | 175 | 93 | 165 | 255 |
| SD | 25 | 9 | 109 | 64 |
| SE | 8 | 3 | 44 | 26 |
| MAX | 211 | 102 | 340 | 350 |
| MIN | 121 | 76 | 74 | 135 |
| MEAN + 2SD | 226 | 112 | 385 | 384 |
| MEAN - 2SD | 125 | 75 | 54 | 125 |

DID YOU COPY OR TAB ANY INFO YOU WANT TO SAVE: ? NO
SS# ? NEW FILE
ENTER NAME OF DATA FILE: ? CA

Figure 5. The Six Retrieval Options (Continued)

SYSTEM: -RETREV/LIB

PROGRAM: RETRIEVE

DATE: 09/08/72

TIME: 08.51.01

ENTER NAME OF DATA FILE: ? EXAMPLE

SS# ? 375185709*
DEPT ? ALL*
RECORD ? ALL*
DATE ? 00 APR 69*
CONDITIONS ? ALL*
ACTION ? LIST*
WHAT ? ALL*

375185709

GSFC

APR69

IDENT
DOB (1908)
AGE (50)
SEX (1)
INTORG (800)
DEG (1)
NCC (7)
GR (00)

Figure 6. The LIST Option Including COMMENTS Line

| | |
|-----------|--|
| EXAM | |
| HT | (65) |
| WT | (181) |
| SBP | (130) |
| DBP | (100) |
| PUL | (80) |
| HGB | (158) |
| WBC | |
| GLU | (340) |
| CHOL | (350) |
| UA | (065) |
| FEV | |
| ECG1 | (42) |
| ECG2 | |
| ECG3 | |
| DIAG1 | (250) |
| DIAG2 | (277) |
| DIAG3 | (401) |
| DIAG4 | |
| DIAG5 | |
| LIFESTYLE | |
| BIRTHORD | (01) |
| FAMSIZE | (01) |
| HRSSL | |
| HRSWK | |
| SM | (0) |
| COF | |
| COMMENTS | DIAGNOSES OF DIABETES MELLITUS, OBESITY, HYPERTENSION, FREQUENT PVCs ON ECG, RECENT EPISODE OF MILD VISUAL BLURRING, 06-69 DECEASED, PULMONARY EMBOLISM |
| ***** | |
| COUNT IS | 1 |

Figure 6. The LIST Option Including COMMENTS Line (Continued)

The COPY, TABULATE, TAB-SD, and CROSSTAB options enable the user to specify information he wants to file under a new data file name. Ordinarily after information is retrieved and displayed for the user, it is not saved; it must be retrieved again if needed at a later date. (See Figure 5, second retrieval.)

COPY is commonly used to transfer a copy of a patient's record to another file. For example, suppose there is a file called ACTIVE for current patients and one called INACTIV (just seven letters allowed) for past patients. One wants to transfer the records of a newly released patient from ACTIVE to INACTIV. He calls RETREV and specifies the COPY option under ACTION for the patient(s) involved. He attaches a name such as TRANSFER to this group of records and merges TRANSFER into the INACTIV file. TRANSFER could then be erased after the merge by typing UNSAVE, TRANSFER. For research purposes, it is often desirable to be able to work with duplicated data records. In fact, the entire set of records in the system could be duplicated in this manner. [One could also use the system command RENAME (see Table 2) to accomplish the same result.] When using the COPY OPTION which follows TABULATE, TAB-SD, or CROSSTAB, the created file is in the exact format printed and cannot be read by any "MIMS" Program, but is available for user created programs.

There are limitations on the size of the tables generated in the CROSSTAB, TABULATE, and TAB-SD options. In CROSSTAB, one may have a maximum of 10 rows and columns in the aggregate. In addition, the number of columns is limited to 5. Thus, possible arrays are (rows \times columns) 5×5 , 2×8 , 2×2 , 4×3 , etc. In Figure 5, the table is 3×5 . It is not shown in the examples, but the row and column headings need not be homogeneous, i.e. one could have five different categories across the top and not just one (AGE) as shown. Entries to the tables generated by TABULATE and TAB-SD are the actual data items in the file. (See Figure 5, 5th and 6th retrievals.) However, the table allows room for only 8 characters per entry, so one must be careful not to use a category in the table whose data violates this conditions. Again there is a maximum of 5 columns, but there is no limit to the number of rows, since these are machine generated and correspond to all the entries (patients, personnel, etc.) satisfying the CONDITIONS of the search.

WHAT Question

The seventh question, WHAT, can be used to specify what to LIST (e.g., ALL* or AGE AND HT*), or it can be used to specify the horizontal axis under TABULATE, CROSSTAB, and TAB-SD.

Format for Requesting Data

An asterisk must follow the response to each of the seven questions. Since spacing is important, one must use the identical spacing in RETREV that was used in STORE while entering data.

Data Not There

If a search is specified by CONDITION and no existing data matches this specification, the program will respond NONE OF THE SPECIFIED RECORDS THE INFO. If a search is conducted on a non-existent SOC SEC #, DEPT, RECORD, or DATE, the program response is SPECIFIED RECORD IS NOT IN FILE. Thus, the system does provide a definite response when no data is found to match a request.

RESTART Option in RETREV

If for any reason the user wishes to restart a search, he simply types RESTART. (See Figure 4.)

Multiple Retrieval of Data

Once the user has supplied the name of the data file he wishes to search, he may conduct as many searches as he wishes. The command ENDOFREQUEST or STOP signals that he is finished. However, the user may wish to search a data file different from the original one. To do this, he simply types NEW FILE; the program will request the name of the other file, and additional searches can be performed. (See Figures 4, 5.)

UPDATE PROGRAM

The UPDATE program alters data files by (1) changing an entry in a data record, (2) adding to a data record, and/or (3) deleting a heading and its corresponding data (or deleting an entire record or records). To call UPDATE, one types —UPDATER/LIB.

ID Items

As in RETREV, the user specifies what he wishes to update by responding to seven questions. The ID responses should be obvious, depending on need. The user may answer with ALL* or with specifics.

ACTION, WHAT, and TO

ACTION may be CHANGE*, ADD*, or DELETE* (see Figure 7). In the first case, WHAT and TO are asked in that order. If ADD* is used, TO and WHAT are asked in that order. For DELETE*, only WHAT is asked. If ACTION is CHANGE*, WHAT must be answered by a specific heading followed by an asterisk. The response to TO is simply the new data entry. For ADD, the user follows the same procedure. But be sure to leave a space before filling in the WHAT line. It was not done in Figure 6 because the original data field was blank.

RESTART Option in UPDATE

To begin again, type RESTART. Be warned, though, that all "updates" to this point will be lost. Often it is preferable to complete the responses in such a way that no match (update) will be found and to redo the intended correction.

Updating of Additional Data Files

To update additional data files, the user enters NEW FILE, and the system will request the name of the file. The user continues by updating records in the new file.

When Finished Updating

When the updating is completed, the user enters DONE* to end the program. All changes will have been recorded on the permanent records. If only one update is being made, respond NO to the first question asked by the program, and the change will be recorded automatically followed by program termination.

-UPDATER/LIB

PROGRAM: UPDATE DATE: 09/07/72 TIME: 12.08.01

DO YOU WANT TO MAKE MORE THAN ONE CHANGE ? NO
ENTER THE NAME OF THE FILE TO BE UPDATED ? CHD

| | |
|-------------------------|---------------------|
| SS# | ? <u>224037224*</u> |
| DEPT | ? <u>GSFC*</u> |
| RECORD | ? <u>EXAM*</u> |
| DATE | ? <u>00 MAR 70*</u> |
| ACTION | ? <u>CHANGE*</u> |
| WHAT | ? <u>WT:(176)*</u> |
| TO | ? <u>(186)*</u> |
| MATCH ON 224037224 GSFC | EXAM |
| STOP. | |

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48.773 /

880

Figure 7. CHANGE, ADD, DELETE Options in UPDATE

SORTER PROGRAM

The SORTER program arranges records according to priorities given to the four ID items by the user. These priorities are indicated by typing 1, 2, 3, or 4 after each question mark. One also specifies if the records are to be sorted into ascending (A) or descending (D) order according to these priorities. While 4 entries are required, the same number may be repeated 4 times. All 4 entries may be made on the same line by separating the numbers by commas or spaces.

This segment is used to sort two data files prior to their merger and to enable the user to list data in a given order, i. e., by SOC SEC #, by alphabetical order of DEPT or RECORD, or by DATE.

The user types SORTER/LIB to call the program, and responds with RNH after the teletype communicates READY (Figure 8).

Time Needed to Sort

The system automatically grants 64 seconds of CPU time for each program execution. It may occur that some sorts will require additional time to obtain more, see the RNH, T=ttt system command in Table 2.

-SORTER/LIB

PROGRAM: SORTER DATE: 09/07/72 TIME: 11.56.47

ENTER NAME OF THE DATA FILE TO BE SORTED ? CHD

WILL THE DATA FILE BE SORTED INTO ASCENDING (A) OR
DESCENDING (D) SEQUENCE ? A

ENTER SORTING SEQUENCE HERE

? 4, 1, 1, 1

SORT COMPLETED.
YOU HAVE SORTED 21 DATA RECORDS.
STOP.

4.206 / 33.647 / 552

RNH

PROGRAM: SORTER DATE: 09/07/72 TIME: 12.00.04

ENTER NAME OF THE DATA FILE TO BE SORTED ? CA

WILL THE DATA FILE BE SORTED INTO ASCENDING (A) OR
DESCENDING (D) SEQUENCE ? A

ENTER SORTING SEQUENCE HERE

? 4, 1, 1, 1

SORT COMPLETED.
YOU HAVE SORTED 8 DATA RECORDS.
STOP.

1.553 / 12.423 / 216

Figure 8. CHD and CA Data Files Sorted

MERGE PROGRAM

The MERGE program merges two sorted data files (see the STORE program section, which discusses merging two data files). New records cannot be placed into an existing permanent data file directly. They must first be placed into a new data file which is then merged with (i. e., into) the related permanent file. The user can either save or erase this new data file.

In Figure 9, the data files CHD and CA are being merged. Prior to this, they have been sorted into ascending (A) order. (In fact, a "merger" of two data files will occur even though the files have not been sorted. The resulting order will not be as predictable, though). In this example the resulting file is called CHDCA. It could have been called either CHD or CA, in which case the original of these would have been erased. Any file no longer needed after a merger can be erased with the UNSAVE system command.

The merge keys should be in the same sequence as the sort keys that were previously used on the files. Similarly to SORT, the 4 numbers may be repeated and can be entered on 1 line if desired.

At the end of the merge, the program will ask for the name of the new merged file. If you enter a name already in use, the program will give you the option of entering a new name, or if you wish to replace that file with the new merged file, type an *.

The program will then ask if you wish to delete (UNSAVE) any files. If you answer "yes", the program requests the name of the file to be deleted. This process is repeated until you type "no" to the delete query. This routine will normally be used when you have created a file which has no further utility since it has been merged into a master file.

-MERGE/LIB

PROGRAM: MERGE DATE: 09/07/72 TIME: 12.02.25

ENTER NAME OF THE FIRST FILE TO BE MERGED: ? CHD

ENTER NAME OF THE SECOND FILE TO BE MERGED: ? CA

ARE THESE FILES IN ASCENDING(A) OR DESCENDING(D) SEQUENCE ? A
WHAT IS THE ORDER OF THE MERGE KEYS. ANSWER THE FOUR
QUESTION MARKS WITH A 1,2,3, OR 4.

? 4, 1, 1, 1

29 DATA RECORDS HAVE BEEN MERGED.
UNDER WHAT NAME SHOULD ALL OF THE MERGED RECORDS NOW BE
FOUND ? CHDCA

CHDCA HAS BEEN SAVED AS MERGED FILE.
STOP.

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Figure 9. CHD and CA Files Merged

SUPPLEMENT PROGRAM

The SUPPLEMENT program adds new categories and data to an existing file. The new categories are created and stored by program HEADER, but this file must not contain any 0 levels, that is the four ID items must not be included in a supplemental header file. The program is initiated by typing -SUPPLEM/LIB.

The program asks if you wish to SUPPLEMENT more than 1 record in this file. If you answer "no", the program will automatically end after supplementing 1 record. If you answer "yes", you must terminate the program by typing "done*" in response to any ID request.

The program will then request the names of the data and supplemental header files. This will be followed by the 4 ID requests. If you have indicated that you wish to supplement more than 1 record, you may answer "all*" to any of the ID requests, and all records in the file that match the ID conditions will be supplemented.

The program will then request CONDITIONS. The response should be the header name after which you want your new headings and data to appear.

Whenever the program matches your ID and heading fields, it prints out the 1st ID characters from each of the 1st 2 ID items of that record.

03/04/75. 13.25.52
PROGRAM HEADER

DO YOU WANT TO CHANGE AN EXISTING HEADER FILE ? N
IF AT ANY TIME YOU WANT TO START OVER, ENTER "RESTART".
TYPE THE NAME YOU WISH TO CALL THIS HEADER FILE USING
7 OR FEWER CHARACTERS ? EXAM

SUPPLY LEVEL CODES AND HEADINGS.

| | | |
|---------|----------|--------------------------------|
| LEVEL ? | <u>1</u> | |
| HEADING | | ? <u>SKIN</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>PRURITUS:</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>RASH:</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>OTHER:</u> |
| LEVEL ? | <u>1</u> | |
| HEADING | | ? <u>RESPIRATORY</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>SOR THROAT:</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>HORSNESS:</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>COUGH:</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>SPUTUM:</u> |
| LEVEL ? | <u>2</u> | |
| HEADING | | ? <u>DYSPNEA:</u> |
| LEVEL ? | <u>*</u> | |
| "EXAM | <u>"</u> | HAS BEEN SAVED AS HEADER FILE. |
| STOP. | | |

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RUN COMPLETE.

-SUPPLEM/LIB
START UNICMD

READY - EXE!

03/11/75. 08.56.47.
PROGRAM SUPPLE1

DO YOU WISH TO SUPPLEMENT MORE THAN 1 RECORD ? N
ENTER NAME OF DATA FILE ? SAM
ENTER NAME OF SUPPLEMENTAL HEADER FILE ? EXAM
TO END THIS PROGRAM TYPE DONE IN RESPONSE TO ANY ID
REQUEST

| | |
|------------------------|----------------------|
| SS# | ? 987651234* |
| DEPT | ? <u>ALL</u> * |
| RECORD | ? <u>ALL</u> * |
| DATE | ? <u>09 MAR 74</u> * |
| CONDITIONS | ? <u>GLU</u> * |
| MATCH ON 987651234 ALL | ALL |
| SKIN | |
| PRURITUS: | ? <u>(23)</u> * |
| RASH: | ? <u>(71)</u> * |
| OTHER: | ? <u>(146)</u> * |
| RESPIRATORY | |
| SOR THROAT: | ? <u>(36)</u> * |
| HORSNESS: | ? <u>(29)</u> * |
| COUGH: | ? <u>(72)</u> * |
| SPUTUM: | ? <u>(42)</u> * |
| DYSYPNEA: | ? <u>(69)</u> * |
| PROGRAM COMPLETE | |
| STOP. | |

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END UNICMD

GENERAL SYSTEM INSTRUCTIONS

Permanent Files

Permanent storage area is set aside for the individual user number catalogs (files). This storage area is accessible from all modes of interaction with the VCS System. Maintenance is provided by system file commands. MIMS programs transfer a copy of a permanent file to temporary storage, and use this copy during execution.

Temporary Storage

Temporary storage is set aside for program access while programs are running. Changes made to temporary storage have no affect on permanent storage until the "REPLACE" command is issued. At that time the old permanent file is replaced by the changed temporary file.

The following MIMS programs automatically replace permanent files upon completion of a normal execution — SORTER, UPDATER, SUPPLEM. In addition, MERGE, STORE, HEADER, and RETREV will replace a permanent file if that file name is given in response to the request for 'new file name'. In this latter case, the programs will ask for verification of the request by reminding the user that that file name is presently permanent. These file characteristics demand that the user observe the following conventions.

Any number of terminals may make use of program RETREV simultaneously.

Any number of terminals may use Header and STORE simultaneously provided that each uses a unique permanent file name for the file he is creating.

MERGE, SORTER, UPDATER, and SUPPLEM should never be used on a file if it is being currently accessed by any other user. In a multi-terminal environment, one terminal should be designated to run these programs during those times when no one else is using those files.

In order to minimize computer costs, maximum use should be made of the COPY option of RETREV. In this procedure records which are of interest to the user can be isolated into a smaller file than the original. Thus all subsequent manipulations — SORTER, UPDATER, SUPPLEM, and other options of RETREV will run in the minimum time. Also, since the copied file would have its own unique name, all programs in the system could be used on this file without disturbing original permanent files that others would be using. In a clinical setting the copied file might consist of only one patient's records which could

then be modified by a physician. In this latter instance, the records would be merged back into the master file with program MERGE, using the replacement option. The merge would be directed by a single terminal during a specific time period when all individual records would be merged back into the master file, one at a time. At the end of each merge, the copied file should be deleted, unless further use will be made of it.

The SORT program's speed is dependent on the size of the file to be sorted. Therefore, wherever possible records should be isolated from large master files by the COPY option of RETREV before they are sorted.

Large files which are used infrequently or with predictable periodicity should be stored on magnetic tape to minimize costs. These files can be copied to disk a few hours prior to their use, and copied back to tape afterwards if they have been changed. If they were not changed but merely analyzed, they should be deleted from disk storage after use.

RANDOM ACCESS

A series of programs have been added to MIMS to allow a user to more quickly search a file. The programs index the four items and place this index in permanent storage. Therefore, this file organization is only useful when the response to all four ID requests is going to be other than 'ALL'.

There are three programs in this series. They are:

1. -SEQ2RAN/LIB This program will convert an sequential MIMS data file to the indexed format. The user responds to the program queries with the names of the sequential file, and the name that the indexed file will be called. This latter name must be 6 or fewer characters. The data file will be stored under that name, and the index will be stored under that same name prefixed by the letter 'I'. Replacement of random files is handled the same as in all other MIMS programs. However, an index file can only be replaced if its data file is replaced also. Thus particular care must be exercised in selecting names for random data files so that the addition of the letter 'I' as a prefix to the index file name does not duplicate another user file name which is not on index file. Conversion begins after the file names have been accepted, and the total count of the number of records converted is printed.
2. -RAN2SEQ/LIB This program reversus the process described above, and converts a MIMS indexed file to a MIMS sequential file. The user types in response to the program, the names of the indexed data file and the sequential file to be created. The program prints out the number of records that have been converted.

3. **-RETRAN/LIB** This program functions identically to **-RETREV/LIB** which has already been described in a previous section. The only difference is the **-RETRAN** accepts only indexed files, and **-RETREV** only sequential files. **-RETRAN** should not be used if the response to all four ID requests is 'ALL', as it takes longer to read an individual record using this access method as opposed to sequential access. The principal savings comes from the fact that any record in the data file can be read directly, without having to read the records which immediately preceded it.

USER NOTES

The indexed file organization used here exacts a premium in increased permanent file space. This premium may be as high as 50%, depending on the length of the header names. The longer the names, the less extra storage will be required.

After a file has been converted to the indexed organization, the user should either delete or store on tape the sequential file for which an indexed copy has been made. This step will hold down the user's storage costs.

After an indexed file has been converted to sequential organization, the indexed data file, and its index file, should be either deleted or stored on tape. Remember that the index file has the same name as the data file, prefixed with the letter 'I'. Thus if the data file is called 'RANDOM', its index file would be called 'IRANDOM'.

Since **-RETRAN** is the only MIMS program that can make use of indexed files, the following procedures must be followed if you wish to modify an indexed record.

1. Keep a sequential master copy of the indexed file. This copy should be on tape to reduce storage costs.
2. Using the copy option of **-RETRAN**, copy all records that are to be modified into separate files.
3. Modify these small files using **-UPDATER** or **-SUPPLEM**.
4. Merge these small files into one file.
5. Merge the combined change file into the sequential master file using the replacement option.

6. Convert the master sequential file to indexed, replacing the old indexed file (-SEQ2RAN).

7. Replace the master sequential file on tape.