After a detailed study of the reserve processing activities of the Columbia University Library System, it was decided that an attempt to design a reserve system which would make the fullest use of computers would be undertaken. This would be an integrated system developed over a period of time in a series of clearly defined phases. Three different phases were distinguished which could be developed in series or simultaneously, depending on such factors as operating software and hardware availability. After three years a fully tested system, called Reserves Processing has been developed for Phase One and implemented in two working environments. The Reserves Processing system accepts input in the form of brief bibliographic citations, inventory data and course information, creates a master machine stored reserve file, produces a variety of records to assist in the processing of reserve books, and prints a variety of lists to be used for reference purposes. All of these operations, except input, are done as off-line, batch-processed operations. Only input is done in an on-line mode. This report includes a general systems description intended for the non-technical reader as well as program and hardware specifications and intended for the technical reader. (Author/JS)
A COMPUTER BASED SYSTEM FOR RESERVE ACTIVITIES IN A UNIVERSITY LIBRARY

By

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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1. INTRODUCTION AND SUMMARY

1.1. Changing Patterns of University Instruction and Their Effect on the Library.

During the past twenty years methods of instruction in colleges and universities have changed significantly. The effect on the library has, in general, been subtle but pervasive. In certain instances, though, change has caused acute problems. An example of such a problem area is that of "course reading".

The tendency in the past 10 to 20 years has been away from using a single text-book for a course and toward using selected readings from a number of sources. As a result, the academic library has had to assume an active role in the teaching process by providing special reference and reading service to students. Since students are no longer required to buy all texts that they will read in a course, the library has had to provide this support through special "reserve" collections containing multiple copies of a title.

1.2. The Concept of Reserve Collections and Procedures.

Libraries have developed the concept of "the reserve collection" together with special procedures, to handle the problem of course reading. This has solved certain problems but in turn created others. Examples of the range of problems that have arisen as a result of the reserve collection concept are the following:

1. Creation of a large but temporary collection of books
2. Movement of large quantities of books onto and off reserve status
3. Creation of special records for controlling reserve processing
4. Short term, sometimes hourly, circulation
5. Information service to students and professors
A Functional Description of the Reserve Process.

The major functions (or activities) of reserve processing are as follows:

1.3.1. Identify titles to be included. Since titles included in a reserve collection change from semester to semester, the library must communicate with professors in advance of a semester to find out what titles will be needed. Once this is known the library must establish whether the titles are owned and in what quantity they are available.

1.3.2. Assemble the reserve collection. Because of the unique reference and circulation procedures, reserve collections are usually housed in a special location. This requires that volumes be moved creating significant logistical problems, since the movement of books must usually be done in a short period of time. This is further aggravated by the fact that once a semester is finished, the reserve collection must be broken up and returned to its original location. Often times this assembling and disbursing of books occur at the same time.

1.3.3. Create records for control and reference. Various records are produced expressly for the reserve operation. Each of these records is a reformatting or rearrangement of a limited number of data elements. These include a highly abbreviated set of bibliographic data (e.g., author, simple title, and date), course information, and inventory.

1.3.4. Provide inventory control. A complete, accurate, and up-to-date record of the number of copies of a title is essential at each step in the processing cycle and for reserve reference service.

1.3.5. Provide reference service. Rapid identification and location of materials is essential for reserve reference service. Simple reference (or look-up) procedures allowing the highest degree of patron self-service, is desirable.

1.3.6. Provide circulation control. Large numbers of books are checked out for short periods of time. Circulation procedures must be simple, accurate, and up-to-date.
Reserve Collections and Procedures within the Columbia University Libraries.

In order to understand the complexities and magnitude of reserve operations, a brief description of reserve procedures at Columbia University is given in the following section. While details of operation and volume of transactions between Columbia and other academic libraries may differ, the basic functions performed are similar regardless of size or subject. This assumption is based not only on analysis of the various different reserve environments within the Columbia system but also reserve activities in other colleges and universities.

The Columbia University Library System is made up of 36 separate department libraries, each specializing in a subject area or serving a particular department. More than half of these libraries maintain specialized reserve collections and provide reserve service. In any one semester, the variation of reserve activity among these libraries is wide, ranging from several titles in Philosophy Library to 8,000 titles in the College Library. In order to understand the types of problems encountered in a typical reserve environment, a brief overview of the College Library reserve activities would be helpful.

Approximately 400 reserve lists are received from professors each semester. A list may contain anywhere from 1 to 150 titles, with an average of about 15 - 25 titles per list. Each list must be individually processed; this requires that each title be searched and verified in catalogs and printed indexes. Once identified, the physical volumes must be assembled from existing bookstocks, through inter-library loan, or specially ordered, and special records must be created to control the reserve collection.

The amount of effort expended in this one Library alone is enormous. The efficiency with which it was done and the resultant service was seriously hampered by the following factors.

1.4.1. Critical scheduling. Reserve lists from professors were expected shortly before the beginning of each semester and books were expected to be available by the time the first class met for that semester. A significant percentage of professor's lists arrived late. Processing of books onto reserve status was a major effort done under extreme pressure and with limited
staff. The difficulty was compounded by the fact that reserve books from the previous semester were deprocessed during the same period.

1.4.2. Volume of work. A typical reserve list had, on an average, 15 titles; each title required an average of 5 copies. This meant that approximately 20,000 to 30,000 physical items were involved in reserve processing each semester; this did not include books being deprocessed from reserve status from the previous semester. A complicating factor was that since there was no way of knowing when a particular title would be used, processing of books either onto or off of reserve status was done as a single, massive effort.

1.4.3. Records. Every title placed on reserve required at least three special reserve records; work records, public reference records, and circulation records. Roughly, twenty to fifty thousand records were specially typed each semester.

1.4.4. User service. Servicing of the reserve collection was entirely separate from regular reference and circulation activities. User service was severely hampered because of the following factors:

1. Lack of complete, up-to-date records

2. Significant book losses during the semester making inventory records even more inaccurate

3. Ignorance as to which titles were used and how often. (This last factor severely hampered the librarian's ability to decide how many copies of a title should be provided and to plan or schedule reserve processing efficiently.)
1.5. An Approach to the Solution of the Reserve Problem.

After detailed study of these factors it was decided that:

1. Reserve functions are fairly autonomous and have minimal contact (or interface) with other library activities. Therefore, it would be feasible to design, develop, and implement a new reserve system without disturbing or dislocating other library operations.

2. Many of the activities essential to reserve processing, such as inventory control, repetitive typing, data handling, and record creation, are ideally suited to the capabilities of computers. Therefore, the design of a new reserve system should explore the possibility of using computers wherever possible.

3. The one aspect of reserve processing which seems to vary from one system to another is the volume of work handled. All other operations performed display a high degree of similarity. If computers are used, differences in processing volume become less critical. Therefore, the desirability of designing a computer-based reserve system which is general and transferable is greatly increased.

1.6. What Was Done.

As a result of these conclusions, it was decided that an attempt to design a reserve system which would make the fullest use of computers would be undertaken.

The reserve activities of several departmental libraries within the Columbia University Library System, having varying processing volumes and serving different subject areas, were studied and specifications for a single, generalized system design were formulated to satisfy the requirement of each of the various reserve systems studied. Emphasis in this preliminary design phase focused on identifying and defining reserve functions common to all reserve environments observed. Once accomplished, these specifications were reviewed with a number of working librarians to establish whether all requirements of the reserve activity had been satisfied. In addition, reserve environments outside the Columbia Library System were studied and compared with the
preliminary reserve specifications. Very few modifications or changes to the original set of specifications were necessary.

1.7. Developing a Computer-Based System.

Translating the abstract functions identified and described in the preliminary set of specifications into a practical working system was then undertaken. Ideally, a fully on-line, real-time, interactive mode of computer operation was deemed necessary to satisfy the complete range of processing activities. But this possibility, though technically feasible with third generation computers, was not achievable on a practical level at that time (nor is it today). Therefore, the objective of designing and implementing a total reserve processing system in one step was discarded and replaced with the concept of developing an integrated system over a period of time in a series of clearly defined phases or steps.

Three different phases were distinguished and described which could be developed in series or simultaneously, depending on such factors as operating software and hardware availability. In Phase One, a master reserve file in machine readable form would be created integrating input activities, inventory control procedures, and the production of records for internal processing and reference. In a second phase, on-line circulation control and inventory monitoring procedures would be developed and integrated. In a third phase, reserve processing would be integrated with a master bibliographic system.

The time frame estimated at that time (1967) to achieve all three phases was three to five years. Time estimates of this sort tend to be optimistic. Today, after three years of work, only Phase One has been fully realized. Various aspects of Phase Two have been developed or experimented with, including a fully operational off-line circulation system. Virtually nothing of Phase Three has been accomplished excepting for preliminary specifications. Present time estimates for the development and implementation of all three phases call for an additional three to four years (roughly two years beyond our original estimate).
At present a fully tested system, called Reserves Processing, has been developed for Phase One and implemented in two working environments. The Reserves Processing system as it operates at present accepts input in the form of brief bibliographic citations, inventory data and course information, creates a master machine stored reserve file, produces a variety of records to assist in the processing of reserve books, and prints a variety of lists to be used for reference purposes. All of these operations, except input, are done as off-line, batch-processed operations. Only input is done in an on-line mode.

The remainder of this report is devoted to describing the Reserves Processing System. Part 2 of this report is a general systems description intended for the non-technical reader. Part 3 contains program and hardware specifications and is intended for the technical reader.
2. SYSTEM DESCRIPTION

2.1. Objectives.

The Reserves Processing System was designed to fulfill the following general objectives.

2.1.1. Personnel. To stabilize (or reduce) personnel requirements both professional and clerical for reserve activities. Reserve processing volume has exhibited during the past decade a geometric growth, with the number of titles processed doubling every five to six years. Assuming that this exponential growth will continue and the present manual system is maintained, personnel requirements by 1970 will have increased by 20 to 30 percent, by 1975 they will have increased by 60 to 70 percent.

2.1.2. Efficiency. To increase processing efficiency of reserve activities. Manual procedures have been expanded to what seem to be their logical limits. There is serious doubt that the simple expediency of adding more personnel will adequately solve the problem of increasing volume. In essence, it is highly likely that manual procedures will be unable to handle the reserve processing volume by 1975. Alternate methods using new technologies, especially computers, offer at present the best, possible solution.

2.1.3. Control. To achieve greater control over internal book processing and inventory control activities. With an ever increasing volume of reserve books to be handled, the ability of the librarian to control the movement and inventory of these books is seriously threatened. As this ability to control is reduced, the quality and level of service is adversely affected.

2.1.4. Core collection. To gain a more precise and quantitative understanding of the reserve collection. A seemingly significant percentage of the same titles (30 percent or more) are used from one semester to another. In addition, in any one semester a large number of courses require the same titles. This suggests that a "core collection" of reserve titles exists which are identifiable.
2.1.5. **Use Patterns.** To gain a more precise understanding of the use made by students of reserve collections. The number of titles placed on reserve by professors increases but the actual use by students of these titles is unknown and suspect. Intuitively the librarian feels that his estimate of the number copies of a title that are placed on reserve and the actual use of reserve books by students do not correlate.

2.1.6. **Cost.** To reduce the overall cost of the reserve operation. It seems that using computers will stabilize personnel costs over the next ten years. In addition, the increased control and reporting capability which computers provide may be able to stabilize, or possibly reduce, book costs through greater control of book handling procedures, better understanding of reserve use patterns, and more precise knowledge of the nature of the reserve book collection.

2.1.7. **Scheduling of Reserve Processing.** To ascertain when during a semester a title will be used. Professor's Reserve Lists are received at the beginning of a semester and, since it has been impossible to establish when a title will actually be needed (and even if it were known it would be difficult to use this information efficiently in a manual system), the librarian has processed large numbers of titles onto reserve status in the shortest period of time. This has created a situation wherein impossible and inefficient work loads occur during the first weeks of a semester. The ability of the computer to review large amounts of data rapidly offers the possibility of using computers to schedule processing activities and eliminate inefficient workloads.

2.1.8. **Accuracy.** To increase the accuracy and currency of records used for inventory control. Because of the uneven nature and the extreme pressure under which reserve processing is done, inventory and control records are often inaccurate and incomplete, seriously degrading the efficiency of other parts of the system. A simple, accurate method for creating records and storing data is necessary. The computer has the ability to store large quantities of data and to update it rapidly and accurately.
2.1.9. **Growth.** To design a system which can accommodate future growth. The computer can accept an increasing volume of data without a corresponding increase in processing time.

2.1.10 **Flexibility.** To design a system which is flexible and able to accommodate change. Reserve procedures are continually changing. The rate of change will be accelerated as better understanding of the nature of reserve activities is gained.

2.1.11 **Service.** To design and implement a system which is simple and efficient for students and professors to use. With the increased efficiency of internal procedures, more staff will be released to extend better service to users.

2.1.12 **Generalized (or Transferable) Systems.** To design a system which is general enough to be transferred and used in a number of reserve environments. This becomes especially desirable if a computer-based system is envisioned because of the high cost of developing and writing computer programs. (Certain of these objectives, such as core collection identification, automatic scheduling and user pattern evaluation, are only partially achieved in the Reserve Processing System as it is implemented at present. Complete realization of all of these objectives will only be attained when the integrated system has been completely developed, implemented, and run for a period of time.)

2.2. **Overview.**

All processing activities and products of the Reserve Processing System are organized around a single file, called the Master Reserve File, which is stored on randomly accessed computer disc packs. The Master Reserve File contains virtually all titles that have been used for reserve since the initiation of the system. Initially, or the first semester the system was used, this meant that considerable conversion effort was necessary to create a basic file, but with each succeeding semester, input effort has been greatly reduced. Though there probably will never be a time when new input will be entirely eliminated, the number of new titles that will have to be input at the beginning of each semester will be relatively small and stable.
New titles are entered into the Master Reserve File by encoding bibliographic, inventory, and course information. Bibliographic information is permanent and remains in the master file indefinitely. Inventory information varies reflecting the total number of copies available at any point in time. Course information is input as received (usually at the beginning of a new semester) causing the status of a title (e.g., on active reserve) to change; as course information is superseded, it is preserved temporarily in the master file and then released to a permanent historical file.

Input is done using on-line computer terminals, key-punches, or tape typewriters. File updating and processing is done in a "batch" mode and on whatever cycle is best suited to the existing need (e.g., daily during peak processing periods, on demand during slack periods).

The basic function of the main processing program is to review course requirements and compare them with the available inventory for each title being placed on active reserve. If there is a copy shortage the library is notified. If copies are available, inventory cards for each copy to be placed on reserve are produced. Various lists and products both for internal use by library staff and for public reference use are also produced. The most important lists produced are Master Worklists to assist the librarian in controlling bibliographic, course, and inventory processing; a Public Reference List used by patrons to identify books on active reserve; and Course Lists used for public reference and to notify professors of titles on reserve for the current semester.

The most important products are processing cards (called ON and OFF cards used to control the physical movement of books from storage or some other location to the reserve shelves.

A number of auxiliary programs are available to produce special lists, such as historical statistics, sequence lists, cross reference lists, and professor's lists.

The net effect of the system is tighter control over all aspects of processing by the librarian, a reduction of clerical effort, the ability of being able to spread out work over a longer period of time, and better service to students and professors. (See Figures 1–4).
2.3. Input

2.3.1. Data Collection and Verification. Four kinds of data are used in the system: bibliographic, inventory, course, and order information. Data are gathered from various sources. Bibliographic information is taken from library card catalogs; inventory information is taken from official shelf lists; course information is taken from lists supplied by professors in the form of course reading lists; and order information is taken from order files.

The collection cycle is initiated by the library sending request forms (See Figure 5), instruction sheet (See Figure 6), and a cover letter (Figure 7) to all professors scheduled to teach courses during a particular semester. The forms are sent well in advance of the beginning of the semester to allow enough time for professors to complete them and return them prior to the beginning of the semester (approximately one month before). The library begins processing of completed forms as they are returned. The processing cycle is initiated by a librarian who reviews all completed forms, checking for obvious errors, and adding copy requirements based on expected enrollment, past experience, and probable availability of multiple copies. (This last step is at present an ambiguous and intuitive process; a feature of the system which is not yet completely developed is to accumulate and record data that can be used to assist the librarian in this decision process.)

The processing cycle from this point on becomes almost entirely a clerical effort consisting of checking existing files to verify titles, ascertaining actual availability and inventory, and reporting to the machine system. The librarian is consulted only when a problem arises.

2.3.1.1. Course Information: Course information is made up of the following data elements:

a) Professor's name
b) Course number(s)
c) Number of copies required
d) Semester(s)
Figure 1
Processing Professor Reserve Request Lists
FIGURE 2
BLOCK DIAGRAM - RESERVE PROCESSING
FIGURE 3
PROCESSING BOOKS INTO RESERVE STATUS

ON CARDS → SEARCH SHELVES

IF VOLUME IS FOUND:
- KEY COPY NUMBER
- ON CARD

IF VOLUME IS NOT FOUND:
- SUB VOLUME

MAIN PROCESSING PROGRAM

UPDATED MASTER WORKLIST
UPDATED PUBLIC REFERENCE LIST

MASTERS RESERVES FILE
END OF TERM

SUBMIT
END OF TERM
PROGRAM

MASTER
RESERVE
FILE

OFF CARDS

SEARCH
RESERVE
SHELVES

IF THE BOOK
IS FOUND

SEND BOOK
TO LOCATION

OFF
CARD

COMPUTER
UPDATE

IF THE BOOK
IS NOT FOUND

MISSING
PROCEDURE

UPDATE
MASTER
FILE

SUB

UPDATED
MASTER
WORKLIST

UPDATED
MASTER
RESERVE
FILE

Figure 4
PROCESSING BOOKS OFF RESERVE STATUS
2.3.1.2. Bibliographic information. At present, minimal bibliographic data is included in the system. (In a future version of the system when a master bibliographic file is available, this part of the record may be augmented and taken automatically from the master file.) Bibliographic information consists of:

a) Author (Full Name)
b) Title (Usually Short Title Only)
c) Edition Statement
d) Date
e) Call number
f) Location (i.e., the particular collection from which copies are being taken)
g) Cross References

If a title already exists in the Master Reserve File (established by checking the Master Worklist) a message is sent to the computer and inventory processing is initiated automatically.

If a title does not appear in the Master Worklist, a search form, called a Verification Form, (Fig. 8), is filled out and checked against the main library catalog, where main entry is verified, call number added and any missing information supplied. If a title is not in the main catalog, the search form is sent to the order process.

2.3.1.3. Inventory Information: Inventory information consists of:

a) Copy numbers representing actual copies available.
b) Circulation restrictions.
c) Processing Status. (A plus (+) means that the item is being processed onto active reserve status; a minus (-) means that the item is being taken off of active reserve; no symbol indicates that the item is either on active reserve or in storage, depending upon whether there is a current course need.)
2.3.1.4. Order Information: Order information consists of the total number of copies that are on order for a given entry.

2.3.2. Data encoding: The system is designed to allow formal data encoding to occur at different points in the processing cycle, allowing the librarian to:

a. encode an entry after it is completely searched and verified

b. encode an incomplete entry and add additional data at a later time

c. revise information and/or status of an entry already resident in the file.

In each case, formal messages have been designed to facilitate this reporting function.

2.3.2.1. Encoding Entries: The system is designed to accommodate input in a variety of forms. The desired mode, that of direct on-line entry in a real time environment, was not attainable on a sustained level during development and implementation of the system. Therefore, three alternate input systems were developed. They are:

a. encoding on a 029 keypunch for batch submission and processing

b. encoding on a Dura tape typewriter for batch submission and processing.

c. Using an IBM 2741 terminal for on-line data entry and remote submission and batch processing.

There is little doubt that the most efficient and economical method of input is using an on-line terminal. Not only is there an increase in typing speed, but also a significant reduction of input typing errors. Whenever possible, input is done on the 2741 terminal; keypunch and tape-typewriter input is used primarily as a backup at present.
COLUMBIA UNIVERSITY LIBRARIES

RESERVE READING LIST FORM

Instructor: 
Campus Address: 
Telephone Extension: 
Office Hours: 
Course (Name and Number): 
Expected Enrollment: 

Return Completed List by 

To: (Department Library) 

Comments: 

For Library Use 

Call # 

Citation (Include Author, Title, Edition, Place of Publication, Publisher, and Date). Place one check (✓) next to those items which will be used during the first three weeks of the course. Place two checks next to those items which students will be expected to buy. 


FIGURE 5A

PROFESSOR RESERVE REQUEST FORM (FRONT SIDE)
<table>
<thead>
<tr>
<th>Instructor:</th>
<th>Jerome L. Sternstein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Address:</td>
<td>Dept. of History, Fayerweather Hall</td>
</tr>
<tr>
<td>Telephone Extension:</td>
<td>(?)</td>
</tr>
<tr>
<td>Office Hours:</td>
<td>(?)</td>
</tr>
<tr>
<td>Course (Name and Number):</td>
<td>Age of Industrialism, 03137</td>
</tr>
<tr>
<td>Expected Enrollment:</td>
<td>25-100 (?)</td>
</tr>
</tbody>
</table>

**For Library Use**

<table>
<thead>
<tr>
<th>Call #</th>
<th>Need</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>080108</td>
<td>✔</td>
<td>Kirkland, Dream and Thought in the Business Community, Quadrangle pb.</td>
</tr>
</tbody>
</table>

**Citation (Include Author, Title, Edition, Place of Publication, Publisher, and Date).**


**Comments:**

- Return Completed List by AUG 15 1969.
INSTRUCTION SHEET FOR COMPLETEING
THE RESERVE READING LIST FORM

PLEASE READ THE FOLLOWING INSTRUCTIONS BEFORE COMPLETEING THE
ATTACHED READING LIST FORM.

1. Please submit a separate list for each course that you will be teaching. Type one title per block. Alphabetize your lists by author. In general, titles are kept on current reserve for one semester only.

2. Provide as complete a citation as possible, following the example given. If a particular edition of a work is necessary, please specify the edition needed, otherwise the library will use the most readily available edition(s) of the work.

3. If possible, request in-print items rather than rare, expensive, or out-of-print items. The library has great difficulty in locating and acquiring out-of-print or costly materials in quantity. If the library is unable to locate any item which you have requested, you will be notified.

4. List only books which students are required to read. Do not list books which are for recommended or supplementary reading only. Please indicate those books which students are expected to buy. The Library will not place these books on reserve in quantity. If possible, indicate those items which will be used during the first three weeks of the course, so that the library can try to have the books available when they are needed.

5. The library should know the anticipated number of students enrolled in order to provide optimum service. If your estimated number should change significantly after you have submitted your list, please notify the library so that it can take proper action.

LISTS ARE PROCESSED IN THE ORDER THEY ARE RECEIVED.

PLEASE RETURN YOUR LIST PROMPTLY.

R73.1(467)2000

FIGURE 6

INSTRUCTION SHEET FOR THE RESERVE REQUEST FORM.
Since catalogs for courses to be given next fall are not available, we have examined the galley proofs for the bulletins of Columbia College, the School of General Studies, and Graduate Faculties. You are included in the list of persons who will be teaching in the fall term.

Would you please fill in the enclosed reserve reading list forms according to the attached instructions? The completed forms plus a copy of your syllabus should be returned to the College Library by August 15, 1969. The earlier the lists are returned to us for processing the more certain you can be that the required items will be on reserve for all semester. Extra forms are available upon request, x3534.

Only material which is **required** reading for all the students taking the course is placed on reserve. We do not put textbooks nor bound volumes of journals on reserve. We will xerox articles needed for the course. Reserve materials circulate for only two hours during the day and overnight from 3 p.m. until 10 a.m. the following morning.

It is important that you indicate on the forms the expected enrollment or the number of students who registered for the course last fall. Depending on the size of your class, the number of items to be read, and the type of assignment made, it may be more feasible for the books to remain on the open shelves without restrictive two-hour circulation.

Mrs. Herschman or I will be happy to answer any questions you may have about the reserve book operation. You can reach us, Monday through Friday from 8:30 until 5 at x3534, or x4338.

Yours truly,

(Mrs.) Ann M. Wilkinson
College Librarian

FIGURE 7
Figure 6a
VERIFICATION FORM (USED TO SEARCH TITLES
NEW TO THE MASTER RESERVE FILE)

Figure 6b
EXAMPLE OF A COMPLETED VERIFICATION FORM
Source documents in the form of Verification Forms, or request forms from professors, are sent to the input typist. The source documents contain all of the information gathered about an entry, together with general input processing instructions. No special pre-editing or coding is required; the typist routinely identifies the types of data and processing needed and supplies the appropriate data code and/or processing function code as part of the keying effort.

2.3.2.2. Entering a Record. (The terms "entry" and "record" are used interchangeably.) An entry as used in the system differs from the normal concept of a bibliographic entry. As the system is designed to maintain control of individual physical volumes, a record is kept of each discreet physical item. On one level, this means discreet listing of all multiple copies. On another level, this means separate entry for each volume of a multi-volume work. Thus, a two-volume work is entered into the reserve file as two entries, one for the first volume and its copies; the second for the second volume and its copies.

```
ENT
AUTH ADAMS, HENRY
TITL FORMATIVE YEARS. V1
DATE 1948
CALL G 973 A11231 V1
COPY 01 Q

ENT
AUTH ADAMS, HENRY
TITL FORMATIVE YEARS. V2
DATE 1948
CALL G 973 A11231 V2
COPY 1 Q
```

2.3.2.3. Input for File Building. "File Building" is defined as entering a new record into the Master Reserve File. This can be done by entering a name plus any other information that is available. This allows the librarian to use the system as a working area imputing as little or as much information as is available and adding to it over a period of time. The computer coordinates all of these
bits of information and processes an entry automatically when sufficient data has been accumulated or reminds the librarian when additional information is required.

Each bit of data is tagged with machine interpretable mnemonics at the time of input typing. A new line is typed for each data element.

EXAMPLE:

```
ENT
AUTH AARON, DANIEL
TITL AMERICA IN CRISIS
DATE 1952
CALL C 973  AA75
COPY 01 02 03 04 05 06 07 08 09 10
Q
```

In addition to typing data elements and codes, each entry must have a transaction type code, which instructs the computer to do one of several operations. Several transaction codes are identified; these include:

- **ENT** (to enter a new record)
- **ADD** (to add course, inventory and order information to a record)
- **SUB** (to delete course, inventory and order information from a record)
- **MOD** (to modify bibliographic information in a record)
- **DEL** (to delete complete record from the file)

(These transactions are discussed in detail in Section 2.3)

In typing an entry, the typist enters the transaction type code first, types the tagged data elements, and terminates the message by typing a "Q".

EXAMPLE:

```
ENT
AUTH ABIR, MORDECHAI
TITL ETIOPIA - THE AGE OF THE PRINCES
DATE 1968
```
<table>
<thead>
<tr>
<th>RESERVES WORKLIST OF 8/14/69</th>
<th>SUPPLEMENTS WORKLIST OF 8/15/69</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L26576</strong> KANT, IMMANUEL</td>
<td><strong>TERM 623</strong></td>
</tr>
<tr>
<td>PROLEGOMENA TO ANY FUTURE METAPHYSICS</td>
<td>HACKETT</td>
</tr>
<tr>
<td>C 153X</td>
<td></td>
</tr>
<tr>
<td><strong>5</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>COPIES 000 00 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>TOTAL COPIES 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>L18631</strong> KAY, F. ALLEN</td>
<td><strong>TERM 621</strong></td>
</tr>
<tr>
<td>PROSPECTS FOR SOVIET SOCIETY</td>
<td>GOVT S25310, KFISCH</td>
</tr>
<tr>
<td>1958 B NO. 4, K5 1565X</td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>COPIES 00 00 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>TOTAL COPIES 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>L06226</strong> KAY, GEORGE</td>
<td><strong>TERM 623</strong></td>
</tr>
<tr>
<td>CHIEF KALADA'S VILLAGE</td>
<td>HANCE</td>
</tr>
<tr>
<td>1965 G 332, 999 934 NO. 35</td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>COPIES 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>TOTAL COPIES 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>L11714</strong> KAY, VLADIMIR V.</td>
<td><strong>TERM 623</strong></td>
</tr>
<tr>
<td>AMERICAN STATE POLITICS</td>
<td>GOVT C3911X, GRETHEUES</td>
</tr>
<tr>
<td>1956 C 553, 9 K22</td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>COPIES 00 00 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>TOTAL COPIES 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>134</strong> KAY, VLADIMIR V.</td>
<td><strong>TERM 623</strong></td>
</tr>
<tr>
<td>POLITICS, PARTIES AND PRESSURE GROUPS</td>
<td>PIPUS</td>
</tr>
<tr>
<td>1964 C 529 KS2121</td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>COPIES 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>TOTAL COPIES 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>112</strong> KAY, VLADIMIR V.</td>
<td><strong>TERM 623</strong></td>
</tr>
<tr>
<td>PUBLIC OPINION AND AMERICAN DEMOCRACY</td>
<td>PIPUS</td>
</tr>
<tr>
<td>1964 C 539, 5 K52</td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>COPIES 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>TOTAL COPIES 00 00</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
<tr>
<td><strong>146</strong></td>
<td><strong>SHORTAGE 02 TOTAL 5</strong></td>
</tr>
</tbody>
</table>

**TOTAL COPIES 00 00**
<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC RESOURCES ON AS LE SCHOOLS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. AYAN, GEORGE I.</td>
<td>KONDOSLAV'S POETRY 1787-1814.</td>
<td>1964</td>
</tr>
<tr>
<td>BEKLOI, GEORGE I.</td>
<td>PETITIONS OF REPRESENTATIVES IN THE PARLIAMENTS OF FORMER-</td>
<td></td>
</tr>
<tr>
<td>BEKLOI, F.</td>
<td>CHRISTIANITY AND ISLAM UNDER THE SULTANS, VI</td>
<td>1928</td>
</tr>
<tr>
<td>BEKLOI, F.</td>
<td>CHRISTIANITY AND ISLAM UNDER THE SULTANS, VI</td>
<td>1928</td>
</tr>
<tr>
<td>ELLIS, E.</td>
<td>EVIDENCE AT POINT OF KULAS FOR A PREHISTORIC MIGRATION FROM R. ALZ.</td>
<td></td>
</tr>
<tr>
<td>ELLIS, E.</td>
<td>SOCIAL HISTORY OF ART, VI</td>
<td></td>
</tr>
<tr>
<td>HULMES, PHILIP E.</td>
<td>HANDBOOK FOR SOCIAL RESEARCH IN URBAN AREAS</td>
<td>1965</td>
</tr>
<tr>
<td>ELLIS, PHILIP E.</td>
<td>STUDY OF POPULATION</td>
<td>1966</td>
</tr>
<tr>
<td>HULMES, PHILIP E.</td>
<td>STUDY OF URBANIZATION</td>
<td>1966</td>
</tr>
<tr>
<td>FAYMONAS, ALFRED E.</td>
<td>PUBLICATIONS TESIS</td>
<td>1950</td>
</tr>
<tr>
<td>HULMES, ANDS</td>
<td>TWIN ECOSYSTEM</td>
<td>1966</td>
</tr>
<tr>
<td>HULMES, ANDS</td>
<td>ECOSYSTEM AND TWIN ECOSYSTEM</td>
<td>1966</td>
</tr>
<tr>
<td>HULMES, ANDS</td>
<td>GOOD CITY</td>
<td>1966</td>
</tr>
<tr>
<td>HAYDEN, HAYAS</td>
<td>IS THERE A MILITARY INDUSTRIAL COMPLEX</td>
<td>1966</td>
</tr>
<tr>
<td>HAYES, JOHN</td>
<td>THE RISE OF MATERIALISM</td>
<td>1966</td>
</tr>
<tr>
<td>HAYES, JOHN</td>
<td>THE RISE OF MATERIALISM, 7TH GENERATION OF MATERIALISM</td>
<td>1966</td>
</tr>
<tr>
<td>HAYES, JOHN</td>
<td>SOVIET OCCUPATION SYSTEM, VI</td>
<td>1966</td>
</tr>
<tr>
<td>HAYES, JOHN</td>
<td>SOVIET OCCUPATION SYSTEM, VI</td>
<td>1966</td>
</tr>
</tbody>
</table>
2.3.2.4. Update Input. Records in the file are updated in several ways, using the various processing functions. The most frequently used processing function is the ADD function code. The steps for adding information are as follows:

1. Type the function code (in this case ADD).
2. Type the entry sequence number (a unique code assigned by the computer; see section 2.3.1.2. below for a detailed description).
3. Type the data element tag immediately followed by the data to be added.
4. Type a "Q".

Several data elements can be added at one time. In the following example inventory and order information are being added to an entry. In the following example, PROFessor, COURSE, TERM, NEED, and ORDER information are being added.

```
ADD 002457
PROF LUBITZ
CRSE ECON C1501X
TERM 693
NEED 05
ORDR 05
Q
```

In a similar fashion, information can be deleted from an entry by using the SUBtract function.

```
SUB 002457
PROF LUBITZ
CRSE ECON C1501X
TERM 693
NEED 05
ORDR 05
Q
```
In the above example PROFessor, Course, TERM, NEED and ORDER information will be deleted from the entry.

Using the MODIFY function, information within an entry is changed. In this example, the author field is modified.

MOD 023285
AUTH ABERNATHY, THOMAS P.
Q

In this example both author and title are modified.

MOD 005438
AUTH ABIR, MORDECAI
TITL ETHIOPIA - THE AGE OF THE PRINCES
Q

Using the DELETE function, an entry can be completely deleted from the file. In this example, the entire entry in the Master Reserve File will be erased.

DEL 023285
Q

2.3.2.5. File contents. The main reserve file is stored on an IBM 2311 Disc Pack in sequence number order. As new entries are input, they are added to the end of the file and assigned a unique sequence number.

As outlined above, four types of information are manually input into the system: bibliographic which remains permanently resident or until deleted; inventory which remains relatively permanent but may be subtracted or added to; course information which is retained for three semesters and then fed to an historical file; and order information which remains only as long as an order is outstanding.

Additional information is added automatically by the program to a record at different times to indicate status change and certain other conditions. These include:

1. Sequence number. As each new entry is added a unique 6 digit sequence number is added to identify a record.

2. Processing status. Plus (+) and minus (-) symbols are added to indicate whether an item is being processed onto or off of reserve status. (A machine readable inventory card is produced each time a status change occurs; see 2.4.1.3. below for a description of these products.)
3. Total need. Individual course needs for a semester are added together to give the total number of copies needed for a particular semester.

4. Total inventory. The total number of copies included in the inventory field is calculated and printed as the total number of copies available.

5. Copy shortage. All course needs for a title for a particular semester are added together then subtracted from available inventory to compute Copy Shortage.

2.4. Processing Functions

The reserve computer programs are designed and written to accept data and instructions at various points in the processing cycle and automatically initiate action in the form of worklists, inventory processing cards, and public reference lists. The array of processing functions included are few in number and relatively simple to understand and use. They can be used singly or in combination providing the librarian with an extremely sophisticated combination of processing controls.

In the following section, the computer processing functions included in the system are described and examples of how they are used are given.

2.4.1. ENTER. The enter function is used to insert a new entry into the computer file. The computer will take one of several actions depending on the amount of information entered.

2.4.1.1. Establishing a record. The minimum amounts of information that may be entered to create a new record is author.

2.4.1.2. Sequence number. Every new record entered is assigned a unique, six digit sequence number by the computer. This number reflects the record's location in the computer file and is printed out in the librarian's worklist. All subsequent actions affecting a record must include this sequence number for reference purposes.

2.4.1.3. ON Inventory Cards. If course information is entered for a current semester the computer will calculate the total number of copies needed and compare this figure with the available inventory. If no inventory exists, warning messages in the form of punched cards are produced. ON cards are produced equal to the number of copies needed. A warning message is produced if the number of available copies is less than the copies listed as needed.
2.4.2. ADD. The ADD function is used to add information to a record. The ADD function can be used at any time to add information to the following data fields.

2.4.2.1. Course Data Field. Adding course information will cause the computer to increase the total number of copies needed and to produce additional ON Inventory Cards and/or warning messages.

2.4.2.2. Inventory Data Field. As new copies are added, the computer will recalculate shortages and need figures.

2.4.3. SUBtract. The SUBtract function is used to delete information from a record. The SUBtract function can be used at any time to delete information from the following data fields:

2.4.3.1. Course Data Field. Deleting a course will cause the computer to recalculate the number of copies needed, adjusting the shortage figure if necessary.

2.4.3.2. Inventory Data Field. Deleting copies from the inventory field will cause the computer to recalculate the total number of copies available and adjust the shortage figure if necessary.

2.4.4. MODIFY. The MODIFY function is used to change information in the bibliographic data field. In order to modify any part of the bibliographic data field, the entire data element is input, replacing the information already in the record.

2.4.5. DELETE. The DELETE function is used to cancel an entire record from the computer file.

2.4.6. CHK. The CHECK function is used to correct a status symbol for any copy number in the inventory data field.

2.4.7. ON. The ON function is initiated by the annotated ON inventory card. As ON inventory cards are returned to the computer, the plus (+) status code is erased from the appropriate copy number in the inventory data field.

2.4.8. OFF. The OFF function is initiated by the manually annotated OFF inventory cards. As OFF inventory cards are returned to the computer, the minus (-) status code is erased from the appropriate copy number in the inventory data field.
ON inventory cards are produced by the computer as course needs are entered into the file. This occurs at any time with processing peaks occurring immediately before or just after the beginning of a semester. OFF cards are produced as part of the Term End Program once a semester.

2.5. Output.

The computer is programmed to produce a variety of lists and machine readable records on demand. The Master Worklist, for example, can be produced on a regular schedule (e.g., daily, weekly, monthly, or whenever it is needed). During the interval between Master Worklist runs, Cumulative Supplements can be produced, again when needed. Other lists, such as course lists, are produced on-demand. Machine readable ON cards are produced automatically as semester status changes, while machine readable OFF cards are produced on-demand. This flexibility has been incorporated into the system to allow the librarian to exert as much (or as little) control over processing cycles as is necessary.

2.5.1. Master Worklist. The Master Worklist is a complete listing of all entries in the master reserves file, and may be produced in its entirety or as a cumulative supplement each time the master file is updated. Figure 9 is a sample page of this list and should be consulted when reading the following discussion of these elements. Figure 10 represents a typical page from a Master Worklist. The Master Worklist is the master guide to the reserve collection, and is referred to for many reasons. Its primary use is for staff reference and in processing new reserve requests from professors.

Bibliographic and inventory information appear on the left side of the page, with author and sequence number offset in a hanging indention to facilitate scanning of entries. Course information appears on the right side of the page. All data elements are included in full.

2.5.1.1. Bibliographic Information. Sequence number and author appear on the first line of the entry; title is printed on the second line; and edition, date of publication, and call number appear on the third.

2.5.1.2. Inventory and Order Information. Individual copy numbers appear immediately below bibliographic information. The maximum number of copies allowable is 99.
Status symbols, or processing flags, appear immediately below the copy numbers to which they apply. (If there are no flags for a line, the output is condensed and no blank line is left below a copy number line.)

The total number of copies in inventory and the number of copies on order is printed on the last line of the inventory field.

2.5.1.3. Course Information. Course information for the current and two future semesters can be included for any one entry. Semesters are identified as three digit numbers, the first two digits representing year and the third representing semester within that year (i.e., 1 = Spring, 2 = Summer session, and 3 = Fall). A total of eight (8) different courses are allowed among these three semesters. Each course is printed on one line under the appropriate semester and includes course number, professor name, and number of copies needed. On a separate line for each semester, the total need and copy shortage is printed. The computer generates these summary figures each time the course field is updated. If there is no course listed for a semester, all data for that term are suppressed.

2.5.2. Supplementary Worklist. As mentioned above, the Worklist can be produced in two forms, either as a Master List or as a Supplement. Which of the two lists is produced is decided before a computer run is submitted. The Supplementary List is cumulative, containing entries that have been entered or referenced since the last Master Worklist run. At any one time, no more than two lists need be consulted to ascertain the status of an entry in the file. All entries in the Supplementary List are incorporated in the Master Worklist each time a Master run is done.

During peak processing periods, Master Worklist runs can be submitted as often as needed. Experience has indicated that weekly runs with Supplementary runs on each of the intervening weekdays is adequate. During slack periods Master and Supplementary runs may be varied as wanted. Experience has indicated that monthly master runs with weekly Supplementary runs is adequate.

2.5.3. Public Reference List. (Figure 11). The Public Reference List is produced by the main processing program on the same
schedule as a Master or Supplement Work List. The Public Reference List is an extract of the Worklist and contains a three-line entry (author, title, edition and date) for those entries on active reserve. No other entries in the reserve file appear in the Public List Reference.

The Public Reference List is alphabetically arranged by author, and subarranged by title. It can be printed in the form of a Master and Cumulative Supplement on the same basis as the Worklist. The Public List is produced in multiple copies and is used for circulation and reference purposes.

2.5.4. Error List (Figure 12). An error list is produced for both Master and Supplementary runs. The Error list includes input typing errors (i.e., format errors, tagging errors), sequence number errors (the automatically generated sequence number contains a check digit), and inventory card matching errors (i.e., an ON card is submitted for a non-existent copy number). In addition, warning messages are included.

Processing statistics for a complete run are printed at the end of the error list. These include the number of records referenced, the number of ON cards produced, the number of Warning cards produced, and the number of transactions for each of the different processing functions submitted.

2.5.5 Sequence List and Supplement (Figure 13). A master Sequence List in numerical order is produced once or twice a year, and contains, for each entry in the master reserve file, the sequence number, a portion of the author field (32 characters), a portion of the title (5 characters). The list serves as a numerical index to the Master File and is used for error correction.

A Sequence List supplement, in the same basic format as the Master Sequence List, is produced with each processing run and contains all new entries entered into the file. Supplements are bound with the Master Sequence List.

2.5.6. Professor List. (Figure 14). The Professor List is produced on demand by a special program several times a semester and consists of a series of separate lists by professor's name and course number listing all titles placed
on reserve for the current semester. Each entry contains all bibliographic data included in the Master File (except location). Entries in each list are divided into two categories, those which are actually on active reserve and those which are "in process".

Copies of the Professor List are put out for reference and are used by library staff and public to identify titles on reserve for a particular course. In addition, individual course lists are sent to the respective professors.

2.5.7. Inventory Check List. During the same run which produces the Professor List, an Inventory Check List is produced. It is arranged alphabetically and contains complete bibliographic information for entries which have an active course need (that is, titles which have been requested by a professor for reserve for the current semester) but for which no copies are on active reserve or on order. The list is used as a reminder to the librarian of entries that may need follow-up action.

2.5.8. "ON" Processing Cards (Figure 15). "ON" processing cards in the form of machine readable punched cards are produced by the main processing program during both master and supplementary runs whenever a new course need is ENTERed or ADDED for an entry. As ON processing cards are produced a plus (+) status symbol is added to each copy number of the entry in the Reserve File. Data on these cards include sequence number, partial author and call number (or title, if the call number is not used). Space is provided for manually keying a two-digit copy number. ON cards are produced for as many copies as the need indicates, up to the total number of copies in the inventory for that entry.

ON cards are used to collect physical volumes from various locations and as a unit searching record for copies that cannot be located. When a copy is found, the copy number is written on the face of the card, and returned to the input staff where copy number is keypunched into the card. The ON card is then returned to the computer, causing the ON processing flag to be deleted from that copy number in the file, thus indicating that that copy is now on active reserve.

2.5.9. Warning Message Cards (See Figure 16). Certain warning messages relating to the processing of copies onto reserve are produced as punched cards instead of being printed on the error list. These messages are produced when a possible
copy shortage may exist, when there are outstanding OFF cards for an entry which has an additional need, or when the same course is ADDed twice. These cards are used for manual processing only and are not resubmitted to the computer.

2.5.10. "OFF" Processing Cards (Figure 17). OFF cards, produced by a special "End of Term Program", are produced once a semester. The OFF card has the same general format as the ON inventory card described above differing only in that the message reads OFF instead of ON and the inclusion of an actual copy number. As OFF cards are produced a minus (-) status symbol is added to the respective copy number in the file.

OFF cards are used to deprocess volumes from the reserve shelves, and as searching records for copies that cannot be located. Once a copy is deprocessed (i.e., taken from the reserve shelf and returned to its original location), its OFF card is returned to the computer, and the minus sign (-) is deleted from the appropriate copy number.

OFF cards are only produced for entries which have no current or future course NEED. For example, if three copies of a title are on active reserve for the Spring semester, and there is no NEED for that entry for the succeeding two semesters, an OFF card is produced. If a NEED does exist for either of the two succeeding semesters no OFF cards would be produced.

2.5.11. Cross-Reference List (Figure 18). Cross references are ENTERed into the file as separate entries and appear in the Public Reference list and Master Worklist. A separate listing of all cross reference in the Master Reserve File is produced by a special program once a semester. The list is arranged alphabetically by author, and contains only that information needed for identification and verification of cross references (i.e., author, title, sequence number, and the body of the cross reference entry and its sequence number).

The list is referred to by the input typist when it is necessary to activate cross references. For example, when adding a course NEED to an entry which has the notation "X-REF" in the LOCation field, the typist looks up the entry in the Cross Reference list to find the sequence numbers of the cross references themselves. Once known, a dummy course NEED is prepared and submitted to the computer.
2.5.12. Historical Summaries. Various historical summaries are included in the reserve system design, and programs for these are being developed. The objective of these summaries is to supply the library with statistics:

1. relating to frequency and volume of reserve requests for specific titles and for broad classes of material.

2. pinpointing reserve book needs (or excesses) of individual departments and professors.
3. PROGRAM DESCRIPTION

The Reserves System consists of a Master Processing Program and a number of auxiliary programs. The main computer program processes bibliographic, inventory and course data and produces worklists and public lists; auxiliary programs provide additional facilities and maintenance functions. (See descriptions of the individual programs below.) All programs are written in OS/360 COBOL F. The Columbia implementation includes LASP/MVT, but this is not necessary. With minor changes in the JCL (Job Control Language), programs will operate in a conventional OS/360 environment.

3.1. The Main Program.

3.1.1. Purpose - The objectives of the reserve program are:

3.1.1.1. Inventory control. To continually maintain an inventory record of the number of copies of a particular title in stock, and to balance this inventory against anticipated course requirements for the current and coming academic terms.

To preserve historical records of previous terms' requirements, in order to help the librarian properly anticipate needs.

3.1.1.2. Processing and deprocessing. To aid in the manual task of processing volumes onto the active reserve shelf at the beginning of a term (assembling the reserve collection) and of deprocessing volumes off the active reserve shelf at the end of the semester (disbursing the reserve collection).

3.1.1.3. List production. To produce worklists for the librarian which give complete information about each title in the file.

To produce lists for public use, in both author and course (or professor) sequence which give only essential bibliographic information. (Public lists are made available as a book form catalog, and may be widely distributed.)

3.1.2. Input commands - Following is a listing and identification of computer processing functions:

3.1.2.1. FMT (enter). Used to establish initially a record on the file for a particular title. Once a record is established it remains on the file permanently, unless it is specifically deleted with the DEL (see below) command. Any and all data fields may be entered into the newly established record by means of this command. The computer assigns a new
sequence number to the record, placing it at the end of the file. The sequence number assigned implies the record's relative track location within the file, and includes a machine-generated check digit. Thus, records may be retrieved randomly using this number as key. All user commands refer to the record in this way.

3.1.2.2. **DEL (delete)**. Used to delete a title from the file. No further reference to the title record will be allowed nor will it appear in any list. The actual space on the disc is not relinquished for a new title; this is done by using an auxiliary command, SAVE.

3.1.2.3. **MOD (modify)**. Used to alter the contents of the bibliographic data field in an already existing record on the file. Any bibliographic data field not specified when the record was originally established by an ENT is considered to contain blanks, and so may be modified in the same way as a bibliographic data field with informative contents.

3.1.2.4. **ADD**. Used to alter the contents of the copy inventory, course requirement, and/or on order data fields on an existing record by adding additional data to existing data elements and to enter additional course requirements to the course field.

3.1.2.5. **SUB (subtract)**. The corollary of the ADD command above.

3.1.2.6. **ON**. A one-card command produced by the computer. When course information is first entered, the computer flags all copy numbers associated with that record with a "+" sign. The computer then issues an ON card for each copy which must be processed onto reserve (determined by the contents of the incoming NEED field). Each ON card contains the command code "ON", the sequence number of the record, and selected bibliographic information. Actual copy numbers are not punched by the computer. As the librarian locates copies and places them on active reserve, the number of each copy is punched into an ON card for that title; the card is then returned to the computer, causing the "+" sign to be deleted from the specified copy number.

Adding additional courses or increasing the NEED of existing courses will cause additional ON cards to be issued but will not affect the copy number flags. The number of ON cards issued will not exceed the number of "+" flags remaining. If the value of the incoming NEED field exceeds the number of remaining "+" flags (hence the number of available copies) a warning message is issued which accompanies the ON cards.
When copies are added to a title record which includes course information, the new copy numbers will appear in the list with "+" signs.

Reducing either the NEED or the number of copies causes no automatic action by the computer.

3.1.2.7. OFF. A one-card command produced by the end-of-term program, and similar in function to the ON card (see above).

The end-of-term program flags each copy number which is to be processed off reserve (as determined by the program). An OFF card is produced for each copy and contains the command code "OFF", the sequence number of the title, selected bibliographic information, and a single copy number. These cards inform the librarian that specific copies are to be processed OFF reserve. As the copies are processed, OFF cards are returned to the computer causing the "-" sign to be deleted from the specified copy number.

3.1.2.8. CHK (check). Used to remove + and/or - flags from copy numbers. This is normally done by the ON and OFF functions (see above); the CHK function is only used to correct error conditions arising from incorrect input information. Up to 25 copy numbers may be referenced by a single CHK function.

3.1.2.9. SAVE. An auxiliary command issued by the computer on a punched card. When the entire file is periodically dumped for backup safety, the computer looks for records flagged as having been deleted by the DELETE command, and generates a SAVE punched card for the space on the disk occupied by each deleted record. The SAVE card, containing the old record's sequence number which refers to the space on the disk, is then substituted for an EDIT command card by the librarian, and the new record is established on the space formerly occupied by the deleted record, instead of being added to the end of the file.

The librarian need not wait for the computer to issue the punched card, but may key the SAVE command together with all the data fields appropriate to the EDIT command.
3.1.3. **Process control.** The RUN card (see section 3.4.1.1.) specifies whether the run is to produce a Master List or Supplements to the previous Master List. A Master List contains all titles in the file; a Supplement List contains only those titles which have been ENTERed or addressed by user commands since the last Master List was printed. Supplements are, therefore, cumulative.

The RUN card also specifies whether a Public List is to be produced. The Public List contains only bibliographic information for titles in the Worklist which are on current and active reserve. (i.e., those titles which have both at least one course and at least one copy number without a plus or minus symbol.)

3.1.4. **Inventory balancing and control.** The program stores up to 99 two-digit copy numbers for each entry. These are entered either by the ENTER or ADD command, and may be deleted by the SUBTRACT command.

Each title record can also contain information for up to eight courses. This information includes the number of copies required for each course, and is entered either by the ENTER or ADD command. The number of copies required (NEED) may be modified by the ADD or SUBTRACT command. Courses may be deleted by the SUBTRACT command.

The program groups courses for each title by term (up to three terms) and adds the NEED data fields for all courses in each term, printing a total need for each term. The number of copies listed as inventory is totaled and printed as the total number of copies on hand. The total NEED and the total inventory on hand are compared and any difference is printed as the SHORTAGE for that term.

Additional inventory control is provided both by the main program and by the end-of-term program in the form of ON and OFF cards. (See sections 3.1.2.6. and 3.1.2.7.)
3.1.5. Hardware and software environment. The Main Reserves Program requires the following devices in its present implementation at Columbia:

- A random access device for main file residence;
- A card reader/punch for input and punched card output;
- A printer for the various lists.

In addition, sequential file space is needed for the four alphabetical indices. (In the Columbia implementation, this is on the same direct access device as the main file (two 2311 disk drives) but could as well be four tape drives or any other sequential devices).

Printed and punched output is spooled onto direct access by OS/MHP/LASP and printed or punched under system control after the run is complete. This could also be done using tapes or a minimum of three online printers and a punch.

The main program requires at present approximately 170K bytes of main storage, which allows a maximum of 2000 transactions in a single run. (Each transaction causes an index record to be generated and saved in an array in main storage). By reducing the number of transactions permitted in a single run, the storage requirement could be reduced by as much as 80K bytes.

Running time is primarily dependent on how many titles are printed in the Worklist. Typical running time for a file of 12,000 titles is 6 minutes. This includes only CPU cycles utilized plus a 28 millisecond penalty for each I/O instruction which induces a WAIT state.

3.2. Auxiliary Programs

3.2.1. Professor/Course List program. Bibliographic and course information is extracted from the file, sorted, and edited to produce a series of alphabetical lists, each containing the titles on reserve for a single Professor/Course combination in the current term. These lists appear alphabetically by Professor and Course, and each begins a new page, allowing them to be separated and sent to respective professors notifying them of titles placed on reserve for their course. A title which has more than one current course field in the Master File will appear in more than one such list.
Within each list, there are two alphabetical subsections. The first includes all titles which have in fact been processed onto active reserve (as indicated by the presence in the Master File of at least one copy number having no plus flag). The second includes those titles which have no such unflagged copy numbers, indicating that they are being processed for reserve. Any items in this second section which have no copy numbers (indicating no inventory) and, in addition, have a zero value in the Order field, are also printed in a separate Inventory Check list as a reminder to the librarian that copies must be ordered.

The program requires a direct access device for main file residence, an on- or offline printer in addition to the system logical output device, and sorting capability. The amount of main storage required is approximately 10K bytes plus space for a sort program.

3.2.2. End of term program. The three terms which the main program can accommodate are moved forward by one term. If this causes the total NEED to drop to zero, deprocessing OFF cards will be issued for all unflagged copy numbers. Courses being deleted from the file are written on an historical file for later reference and statistical summary. Each tape record of this file contains one course field and the sequence number of the title with which it was associated.

The program requires a direct access device for main file residence, and system logical input and output, including punch. Since the number of OFF cards may be large, it might be preferable for the punch to be off line, but this is not necessary. Main storage requirement is approximately 10K bytes.

3.2.3. Cross reference list program. An alphabetical list of all entries which are cross-referenced in the Master File is produced by this program. Following each entry is a list of all references to it.

Cross-references are distinguished in the Master File by the keyword SEE in the Title field, which contains both author and title of the referenced main entry.
The program requires a direct-access device for main file residence, an output printer in addition to system logical output, and sorting capability.

Main storage requirement is approximately 5K bytes plus space for the sort program.

3.2.4. Historical summary program. [being developed]
RESERVES PROGRAM
FLOW DIAGRAM

START

1 READ CONTROL RECORD OF OLD MASTER FILE

2 READ RUN CARD

3 RUN NUMBER CORRECT?
   NO
   YES

4 OPEN APPROPRIATE INDICES, INITIALIZE RUN TYPE

5 PRODUCE PUBLIC LIST?
   NO
   YES

6 INITIALIZE PUBLIC LIST

7 LOG MESSAGES RUN NUMBER, TYPE, ETC.

8 REWRITE CONTROL RECORD (CURRENT)

ERROR MESSAGE

STOP
READ AND CHECK ONE TRANSACTION

10 IS THIS AN ENTER?

NO

READ SPECIFIED MASTER RECORD

GENERATE NEW SEQUENCE NO., INITIALIZE MASTER RECORD PROCESS AREA

PROCESS TRANSACTION FIELDS

GENERATE INDEX RECORD AND PLACE IN STORAGE ARRAY

IS THIS AN ENTER?

NO

REWRITE UPDATED MASTER RECORD

YES

WRITE NEW MASTER RECORD

NO

WAS THE TRANSACTION THE LAST?
19. SELECT LOWEST KEY FROM ARRAY, OLD INDICES
20. SET KEY, READ MASTER RECORDS
21. WRITE NEW INDEX RECORD
22. FORMAT AND PRINT WORKLIST ENTRY
23. WAS PUBLIC LIST REQUESTED?
24. SHOULD ITEM APPEAR IN PUBLIC LIST?
25. FORMAT AND PRINT PUBLIC LIST ENTRY
26. END OF OLD INDEX AND OF ARRAY

EOJ
1. The control record contains the following information about the last (previous) run:
   - Serial number and date.
   - Whether MASTER or SUPPL. worklist was produced.
   - Highest sequence number assigned.
   - Index configuration.
   - The date of the most recent MASTER run. (If the last run was a MASTER, this date will be the date of that run.)

2. The RUN card supplies the following information:
   - Serial number of the current run.
   - Whether MASTER or SUPPL. worklist is desired.
   - Whether Public List is desired.

3. Check of RUN number prevents accidental re-run of data.

4. Four indices are maintained by the program, two for MASTER lists and two for SUPPL. lists. The correct configuration is automatically selected by the program. Flags are set indicating which lists are to be produced.

5. Determined from RUN card.

6. Appropriate headings are generated and the output file for the Public list is opened.

7. The updated control record reflecting information for the current run is printed, along with the previous control record, the RUN card, and a message indicating whether the Public list has been initiated.

8. The current control record is held in storage throughout the run, and is also written into the master file at this time to assure the correct RUN number being saved in case of subsequent system failure or abnormal termination.

9. As each transaction is read, the header is first checked for validity. Subsequent fields must then conform to the format for that type of transaction. Any error will cause the transaction to be rejected and error messages to be printed. The input cards will be printed following the message; this continues until a valid header card is read.

10. Determined from the transaction header card.
11. The access key is the sequence number punched on the transaction header card.

12. The sequence number stored in the control record is incremented by one and a check digit computed. The record processing area is initialized with all alphanumeric fields blank and all numeric fields set to zero.

13. Further error checking takes place here. Certain errors will cause warning messages only to be printed; others will cause the erroneous field(s) to be discarded and error messages to be printed. In any case where fields are discarded, the error message includes a complete listing of the transaction cards as submitted. In transactions which permit multiple operations, only the affected operation is discarded. For example, if an ENTER transaction includes a Course whose TERM is unacceptable to the program, only the course information will be rejected. The bibliographic information, and inventory information, if any, will be processed normally. The error messages are specific.

14. The index record contains portions of the AUTHOR and TITLE fields of the master record, and its sequence number. All index records generated during the process phase are held in storage in an array, and then merged alphabetically with the old index file during the output or printing phase. These indices provide for selection of master records in alphabetical order for printing in the Worklist and Public list.

15. As determined from the transaction header card.

16. The updated master record is rewritten in place in the master file, replacing the old record.

17. A new master record is written, using as key the new sequence number generated by the program.

18. Processing of transactions continues until all input has been exhausted.

19. The lowest (i.e. earliest in alphabetical order) index record is selected from the storage array (see Box 14) and compared to the incoming old index record. The lowest of these is placed in an intermediate area. If the record is taken from the storage array, its position is set to blanks. If the incoming index record is chosen, another record is read from the appropriate index. Duplicate index records are deleted.
20. The record key is found in the index record. The master record is compared with the alphabetic portion of the index record. Failure to match indicates that the AUTHOR and/or TITLE fields of the master record have been changed by the MODIFY function, and therefore the current index record no longer represents the correct position in the alphabetical lists. Since the MODIFY function generates a new index record, the outdated index record is deleted.

21. If correct, the current index record is written into the new index.

22. The fields of the master record are properly formatted and printed in the Worklist.

23. As determined by the RUN card.

24. Two criteria determine an entry's appearance in the public list; the presence of at least one course field and presence of at least one copy number without flags.

25. The fields of the master record are properly formatted and printed in the Public list.

26. Processing continues until both the old index files and the storage array of new index records are exhausted.
APPENDIX B:

INPUT CARD FORMATS
Input card format:

1. RUN card.

Columns  Contents
1 - 4     RUN=  
5 - 8     Serial number of the current run, with leading zeros.  
9         blank  
10-15     MASTER if a Master Worklist is desired,  
          SUPPL. if a Supplementary Worklist is desired.  
16        blank  
17-19     PUB if a Public List is desired; otherwise blank.  
20-80     Unused (may contain comments)

2. ON and OFF cards.

Columns  Contents
1 - 4     ON or OFF  
5 -10     Sequence number of record to be referenced.  
11        unused  
12-45     Author of referenced title (optional, does not affect processing)  
46        unused  
47-76     Call number of referenced title (optional, does not affect processing)  
77-78     unused  
79-80     Copy number to be tested, with leading zero if any.

3. Transaction Header cards.

Columns  Contents
1 - 4     Transaction code (ENT, ADD, SUB, MOD, CHK, SAVE)  
5 -10     Sequence number of the record to be referenced.  
11-80     unused

4. Data field cards.

Each data field is identified by its name in columns 1 - 4. Data begins in column 5 for all fields, but formats differ and are shown below. Unused areas of the card should be left blank.

In the table below, an X opposite a field name indicates that the field is optional in the transaction(s) at the top of the column in which the X appears.
Symbols used in the table: $ = blank  
  d = decimal digit  
  x = alphanumeric

<table>
<thead>
<tr>
<th>Field name</th>
<th>Transaction codes</th>
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1. AUTH field is required in ENT and SAVE transactions.
2. CRSE, PROF, TERM and NEED fields must appear in combination.
3. Need field may be omitted when Course information is included in a SUB transaction, in which case it will be considered to be equal to the existing NEED.

The DEL transaction does not include any data fields, but must be followed by a trailer ("Q") card. (See below)
5. **Transaction Trailer cards.**

The field cards for a single transaction must be followed by a trailer card having a "Q" in column 1, and the remainder of the card blank.
Error Messages and Action Taken.

Errors arising from the RUN card.

RUN CARD MISSING OR INVALID.
   a) The RUN card was not the first data card.
   b) It was not properly identified by the characters RU:= in columns 1-4.
   c) The run specification (MASTER or SUPPL,) was not recognizable.
   Action: The program terminates immediately.

RUN NUMBER INCORRECT. MUST BE nnnn
   The run number specified on the RUN card is not the number of the current run as determined by the computer. nnnn specifies the correct number.
   Action: The program terminates immediately.

Transaction headers and data formats.

NOT A VALID HEADER: xxx...
   The first card following the RUN card or a previous transaction does not have one of the transaction codes in columns 1-4. The card-image is included in the message.
   Action: The card is discarded and the next card read. This may be repeated until a valid transaction code is read.

THE FOLLOWING IS NOT A VALID FORMAT, AND HAS BEEN REJECTED.
   a) A complete transaction has been read, but the fields included are not a permissible combination for that transaction.
   Action: The transaction is discarded and the cards listed following the message.
   b) While reading a transaction, a duplicate or unrecognizable field identifier has been encountered.
   Action: The transaction is discarded and the cards listed following the message. Cards will continue to be discarded and listed until a transaction trailer card ('Q') is encountered.

INVALID SEQUENCE NUMBER:
   In any transaction except ON, OFF, or SAVE, (see below) the sequence number field is incorrectly punched, or no record exists for that number.
   Action: The transaction is discarded and the cards listed following the message.

INVALID SEQUENCE NUMBER: xxx...
   SUBSTITUTION: "ENT"
   In a SAVE transaction, the sequence number field is incorrectly punched, or does not represent an available record area. The text of the SAVE header is shown.
   Action: The transaction is changed by the program to an ENT transaction, and a new sequence number is generated.
INVALID SEQUENCE NUMBER: xxx...
The sequence number field on an ON or OFF card is incorrectly punched or no record exists for that number. The card-image is shown.
Action: The card is discarded.

SEQUENCE NUMBER IN USE: xxx...
SUBSTITUTION "ENT"
A SAVE transaction specifies a sequence number which represents a record in the file which has not been deleted.
Action: The SAVE transaction is changed by the program to an ENT transaction, for which a new sequence number is generated.

DELETING RECORD nnnnn xxx...
The sequence number shown was specified on a DEL transaction.
The contents of the Author field of the record are also shown.
Action: The record is deleted from the file. This message is provided for verification purposes.

ON and OFF cards.
Each message includes the text of the card which caused the error.
Action: In each case, the error card is ignored.

COPY NUMBER INCORRECTLY PUNCHED: xxx...
The contents of the copy number field are non-numeric.

ZERO COPY ILLEGAL: xxx...
The copy-number field contains zeros, not valid as a copy number.

CANNOT LOCATE COPY: xxx...
The specified copy number is not represented in the record.

NOT FLAGGED PLUS: xxx... (ON card)
NOT FLAGGED MINUS: xxx... (OFF card)
The specified copy number is not flagged as assumed by the ON or OFF card.

Bibliographic data fields. (Identifiers AUTH, TITL, EDTN, DATE, CALL, LOCN)
nn BIB FIELD(S) TRUNCATED. aaaa nnnnnn AUTH=xxx...
In an ENT or MOD transaction, the indicated number of bibliographic data fields were longer than the permissible length and were truncated. The transaction code and sequence number, and the contents of the Author field (after processing) are shown.
Action: Processing continues.
Knowledge of certain aspects of transaction processing is helpful in interpreting the following messages. Briefly, these are the important points:

a) ENT, ADD and SUB transactions may each include any combination of inventory and course information.

b) When both inventory and course information are included, the inventory information is processed first. Error in inventory processing will not prevent processing of course information, but may affect the result.

c) Course information in the file consists of the input fields CRSE, PROF, TERM and NEED. The first three identify the course field and must always appear in combination.

d) To avoid confusion when multiple error and warning messages are produced the card input is listed only once on the error list. Thus all messages for a single transaction appear together, followed by the text of the input cards. The contents of the Author field are added to the text of the transaction header card.

The COPY field.

COPY xnn NOT FOUND.
A copy number specified in a SUB or CHK transaction is already in the specified record.
Action: The copy number is not processed. The error count for the COPY field is incremented. (see below)

ADDED DUPLICATE COPY xnn, WARNING ONLY.
A copy number specified in an ADD or ENT transaction is already in the specified record.
Action: The Last Copy indicator will reflect the current input. The error count for the COPY field is incremented. (see below)

nn ERRORS IN COPY FIELD. CHECK RESULT.
Indicates the total number of errors encountered in processing the COPY field, including unrecognizable information and incorrectly positioned numbers. The librarian should check the final result in the Worklist, and make necessary corrections.

The ORDR field.

ORDR FIELD IS INCORRECTLY PUNCHED OR VALUE IS UNACCEPTABLE.

a) In an ENT, ADD or SUB transaction, the contents of the ORDR field are invalid.

b) In an ADD transaction, the ORDR field contains a value which if added to the current On Order field will exceed the maximum permissible value (99).

c) In a SUB transaction, the ORDR field contains a value greater than the current On Order.
Action: The ORDR field is not processed.
Course information fields.

CRSE FIELD TRUNCATED. (and/or) PROF FIELD TRUNCATED.
The contents of the specified field(s) exceed the maximum permissible length.
Action: The field is truncated before processing.

ADDED SAME COURSE, CHECK NEW NEED.
In an ADD transaction, the course identification fields match an existing course in the specified record.
Action: The specified NEED is added to the existing Need for that course.

DELETING COURSE.
In a SUB transaction, the NEED field has been omitted, or contains a value equal to the current Need for the specified course.
Action: The course field is deleted from the file.

COURSE INFORMATION NOT PROCESSED.
This message will always be preceded by one of the five messages shown below.
Action: The course information fields have not been processed for the reason given.

TERM NOT ACCEPTABLE, OR INCORRECTLY PUNCHED:
The contents of the TERM field do not match any of the three terms recognized by the program.
Action: The course information cannot be processed. See above.

NEED FIELD IS INCORRECTLY PUNCHED:
The contents of the NEED field are invalid.
Action: The course information cannot be processed. See above.

NEED IS TOO LARGE:
 a) In an ADD transaction, specify an existing course, the NEED field contains a value which if added to the existing Need for that course would exceed the maximum permissible value.
 b) In an ADD transaction, the NEED field contains a value which if added to the Total Need for the specified term will exceed the maximum permissible value.
 c) In a SUB transaction, the NEED field contains a value larger than the existing Need for the course specified.
Action: The course information cannot be processed. See above.

CANNOT LOCATE COURSE:
In a SUB transaction, the CRSE, PROF and TERM fields do not match an existing course field in the specified record.
Action: The course information cannot be processed. See above.
CANNOT ADD ANOTHER COURSE:
An ADD transaction specifies course information for a record which already contains the maximum number of courses, and the specified fields do not match one of the existing courses.
Action: The course information cannot be processed. See above.

Output phase.

MOD AUTH/TITL nnnnnn WAS: xxx... NOW: xxx...
The current index record has selected a master file record whose Author and/or Title fields have been MODified in such a way that the position of the record in the alphabetical lists has changed. The sequence number is shown along with the alphanumeric portion of the current index record (WAS: xxx...) and a construct of the same portion of the index record generated at the time the MOD transaction was processed (NOW: xxx...).
Action: The current index record is deleted.

Errors arising internally.
These messages are generated by routines which are included in the program for logical consistency, but will normally be executed only in cases of undetected machine error or program error.

OPEN ROUTINE FAILED.
In the initialization phase, the program has failed to select the correct indices for the current run. All relevant program flags and assignment indicators are listed following the message.
Action: The program terminates immediately.

FILE SELECT #nn FAILED.
In the output phase, the program has failed to select the proper index in a read or write operation. nn specifies the point in the program at which the error was detected. All relevant program flags and assignment indicators are listed following the message.
Action: The program closes all active files and terminates.
APPENDIX D

PROGRAM LISTINGS

1. The Main Program (COLLRESV)
2. The End-of-Term Program (COLLTERM)
3. The Professors' Lists Program (RESVPROF)
4. The Cross Reference Program (XREFRESV)
<table>
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<td>008700 SELECT &quot;MASTER-FILE ASSIGN 'COLRESV'&quot; DIRECT-ACCESS.</td>
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<td>00285</td>
<td>C28000 10 PLOT PICTURE X(75).</td>
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<td>C28000 10 FILLER PICTURE X(45).</td>
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**COLLRESV 13**
04454  643370 DISPLAY 'ADDED DUPLICATE COPY'; IFIC '*, WARNING ONLY.'
04450  643370 AND 1 TO FS GO TO NEXTICP.
04450  643450 NEWICP, AND 1 TO NCP. IF INK NOT = SPACE MOVE B TO CPF (1) 4 SUBTRACT 2 FROM CPF (1) GO TO SAMECP.
04450  644170 ELSE MOVE 'A' TO CPF (1) = 2 SUBTRACT 2 FROM CPF (1) GO TO NEXTICP.
04450  644290 SAMECF, IF CPF (1) > 2 SUBTRACT 2 FROM CPF (1) GO TO SAMECP.
04450  646110 GO TO NEXTICP.
04450  644450 IF CPF (1) = 3 OR 4 SUBTRACT 2 FROM CPF (1).
04450  646750 ELSE IF CPF (1) = 2 DISPLAY 'NOT FLAGGED PLUS:' SVCPN.
04450  646900 ELSE IF CPF (1) = 3 OR 4 DISPLAY 'FLAGGED PLUS.' SVCPN.
04450  646900 ELSE IF CPF (1) = 2 DISPLAY 'ILLEGAL.' SVCPN.
04450  646900 ELSE IF CPF (1) = 3 OR 4 DISPLAY 'Cannot Locate Copy.' SVCPN.
04450  646900 ELSE IF CPF (1) = 2 DISPLAY 'illegal.' SVCPN.
04450  646900 ELSE IF CPF (1) = 3 OR 4 DISPLAY 'Cannot Locate Copy.' SVCPN.
04450  646900 ELSE IF CPF (1) = 2 DISPLAY 'illegal.' SVCPN.
04450  646900 ELSE IF CPF (1) = 3 OR 4 DISPLAY 'Cannot Locate Copy.' SVCPN.
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04450  646900 ELSE IF CPF (1) = 2 DISPLAY 'illegal.' SVCPN.
04450  646900 ELSE IF CPF (1) = 3 OR 4 DISPLAY 'Cannot Locate Copy.' SVCPN.
OCD AUTO/TITL / SEON / WAS / ORIG / NOW / XDORIA

GO TO PRINTEXIT.

MOVE PR TO Orig. IF DAILY GO TO PRINT.

IF PP = 2 PERFORM 'COPYOUT VARYING P FROM 1 TO 6 UNTIL P = 200'.

MOVE 1 TO PR. IF PP = 1 MOVE 3 TO PR. IF PP = 3 AND HARSE

= 1 MOVE 4 TO PR.

NOTE IF PP IS CHANGED TO 4 SHOULD GO TO PRINTIT.

GO TO ADOPT4.

WRITE TECI FROM OUTREC, GO TO ADOPT.

WRITE TEC2 FROM OUTREC, GO TO ADOPT.

WRITE TEC3 FROM OUTREC, GO TO ADOPT.

WRITE TEC4 FROM OUTREC.

PRINTIT.
CO3931  C65700  ELSE MOVE SPACE TO PCRSF (W) SUBRACT 1 FROM K.  COLRESV
CO3932  C65700  "AND J TO O IF G < 1 < Go TO PCG.  COLRESV
CO3939  C63600  IF X < M AND 1 TO X MOVE SPACE TO PCRSF (M) GOTO TO BLKPC. COLRESV
CO3934  C63600  "MOVE 1 TO Y AND 1 TO X IF X NOT < (X + X) PERFORM HEAD. COLRESV
CO3946  C65700  "IF X > 1000 PRINT & WRITE PRINT FROM PRINT FILE (K)." COLRESV
CO3962  C65700  "ADD 1 TO Y AND 1 TO X GO TO PRINTEN. COLRESV
CO3965  C65700  "IF Y < 1000 PRINT & WRITE FILE -" "AND CPG = XY  ""MOVING -" "XY. COLRESV
CO3969  C65700  "NEXT SENTENCE FLG GO TO PRINTEN.  COLRESV
CO3990  C65700  "MOVE " "INPUT" "TO " "PRINT" "FILE " "TITLE ""TO PUTITL ""MOVE ""FROM """"TO ""COLRESV
CO3997  C65700  "PRINTEN", IF X NOT = N REWRITE MASTER-RECORD INVALID DISPLAY COLRESV
CO3997  C65700  "PRINTEN", GO TO SCAN WPLD OPENING S.  COLRESV
CO4007  C65700  "PRINTEN", AND 1 TO X " "MOVE " "TO " "PAGN " "MOVE " "TO " "WRITE " "PRINT " "FROM " "COLRESV
CO4009  C65700  "PAGN", MOVE X TO GCH (X).  COLRESV
CO4011  C67700  "ENDPUT", (E-""GCH") = 2 " "GO " "TO " "OPRC.  COLRESV
CO4011  C67700  "ENDPUT", SCAN, EXIT.  COLRESV
CO4012  C67700  "CSP", IF EX AT (0) > " "HOLDN, GO TO CSPXIT. COLRESV
CO4013  C67700  "CSP", IF EX AT (0) < " "HOLDN, MOVE CASE (0) TO HOLDN. COLRESV
CO4014  C67700  "MOVE", TO " "CSTG, GO TO CSPXIT. COLRESV
CO4015  C67700  "HOLDN, IF CASE = (0) GO TO CASE. COLRESV
CO4016  C67700  "SUBTRACT 1 FROM GX GO TO CSP. COLRESV
CO4017  C67700  "CSPXIT, EXIT. COLRESV
CO4018  C67700  "CSPXIT, IF EX AT (0) " "END., DISPLAY " "END. MASTER-FILE. COLRESV
CO4019  C67700  "PERS, IF EX AT (0)" " "WRITE " "FILE " "TO " "PERS " "FILE " "" " "TO " "PERS. COLRESV
CO4020  C67700  "PERS", IF PERS AT (0)" " "MOVE " "TO " "PERS " "FILE " "TO " "PERS. COLRESV
CO4021  C67700  "ALLOW, DISPLAY " "END. OF OUTPUT PHASE. COLRESV
CO4022  C67700  "IF X > 10 DISPLAY " "a " "READ " "FAILURES ON MASTER-FILE. COLRESV
CO4023  C67700  "CLOSE. COLRESV
CO4024  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4025  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4026  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4027  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4028  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4029  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4030  C67700  "IF TEL = " "TO " "CLOSE " "TAPERT. COLRESV
CO4031  C67700  "CLOSE PRINT-FIILE. COLRESV
CO4032  C67700  "END OF WORKLIST, TO PRTLNM WRITE PRTLNM COLRESV
CO4033  C67700  "END OF PUBLIC LIST, TO PRTLNM WRITE PRTLNM COLRESV
CO4034  C67700  "DISPLAY " "PUBLIC LIST, PRODUCED. COLRESV
CO4035  C67700  "DISPLAY " "FILES CLOSED, END OF JOB, STOP RUN. COLRESV

COLRESV 28
LEVEL IJAN67

1

00001. 00G100 IDENTIFICATION DIVISION.
00002. 00G200 PROGRAM-ID. 'COLTERM'.
00003. 00G300 AUTHOR. J.J. HETLAND.
00004. 00G400 ENVIRONMENT DIVISION.
00005. 00G500 INPUT-OUTPUT SECTION.
00006. 00G600 FILE-CONTROL.
00007. 00G700 SELECT MASTER ASSIGN 'MASTER' DIRECT-ACCESS.
00008. 00G800 ORGANIZATION DIRECT ACCESS RANDOM.
00009. 00G900 SYMBOLOIC. SEG. ACTUAL T lettuce.
00010. 00G100 SELECT HYSTERICAL ASSIGN HYSTERIC' UTILITY.
00011. 00G110 SELECT MINUSFILE ASSIGN DEFCARDS UTILITY.
00012. 00U1200 1-O-CONTROL.
00013. 00U1300 APPLY RESTRICTED SEARCH 1-CN_MASTER.
00014. 00U1400 DATA DIVISION.
00015. 00U1500 FILE SECTION.
00016. 00G1600 FD MASTER.
00017. 00G1700 RECORDING F_LABEL.RECORD STANDARD DATA RECORD MASTREC.
00018. 00G1800 01 MASTREC.
00019. 00G1900 02_PR. PICTURE 9 COMPUTATIONAL-3.
00020. 00G2000 02_FILLER.
00021. 00G2100 03_AUTH. PICTURE X(7).
00022. 00G2200 03_TITL. PICTURE X(7).
00023. 00G2300 03_EDTN. PICTURE X(10).
00024. 00G2400 03_DATN. PICTURE X(10).
00025. 00G2500 03_CALN. PICTURE X(30).
00026. 00G2600 03_LOCN. PICTURE X(10).
00027. 00G2700 02_INVN.
00028. 00G2800 03_OKDR. PICTURE 99.
00029. 00G2900 03_NCP. PICTURE 99.
00030. 00G3000 02_CPF.
00031. 00G3100 03_CPF. PICTURE 9 COMPUTATIONAL-3 OCCURS 99.
00032. 00G3200 02_CSF.
00033. 00G3300 03_NCRSE. PICTURE 99 COMPUTATIONAL-3.
00034. 00G3400 03_TNEED. PICTURE 99 OCCURS 3.
00035. 00G3500 03_SHOE. PICTURE 99 OCCURS 3.
00036. 00G3600 03_CSF. OCCURS 8.
00037. 00G3700 04_NEED. PICTURE 99.
00038. 00G3800 04_CIO.
00039. 00G3900 05_TERM.
00040. 00G4000 06_FILLER. PICTURE 99.
00041. 00G4100 06_TERM. PICTURE 99.
00042. 00G4200 06_CIO.
00043. 00G4300 06_CASE. PICTURE X(15).
00044. 00G4400 06_PROP. PICTURE X(15).

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<tr>
<td>00074</td>
<td>C07400 01 CHKDATA.</td>
</tr>
<tr>
<td>00075</td>
<td>C07500 02 FILLER PICTURE XXX VALUE 'OFF'.</td>
</tr>
<tr>
<td>00076</td>
<td>C07600 02 CHASEON PICTURE X(6).</td>
</tr>
<tr>
<td>00077</td>
<td>C07700 02 FILLER PICTURE X VALUE SPACE.</td>
</tr>
<tr>
<td>00078</td>
<td>C07800 02 CHAUTH PICTURE X(34).</td>
</tr>
<tr>
<td>00079</td>
<td>C07900 02 FILLER PICTURE X VALUE SPACE.</td>
</tr>
<tr>
<td>00080</td>
<td>C08000 02 CHCALN PICTURE X(30).</td>
</tr>
<tr>
<td>00081</td>
<td>C08100 02 FILLER PICTURE XX VALUE SPACE.</td>
</tr>
<tr>
<td>00082</td>
<td>C08200 02 CHCKPY PICTURE 99.</td>
</tr>
<tr>
<td>00083</td>
<td>C08300 01 RDATA.</td>
</tr>
<tr>
<td>00084</td>
<td>C08400 02 RUNSER PICTURE 9999.</td>
</tr>
<tr>
<td>00085</td>
<td>C08500 02 FILLER PICTURE X.</td>
</tr>
<tr>
<td>00086</td>
<td>C08600 02 DATE PICTURE X(8).</td>
</tr>
<tr>
<td>00087</td>
<td>C08700 02 FILLER PICTURE X.</td>
</tr>
<tr>
<td>00088</td>
<td>C08800 02 TERM PICTURE 999.</td>
</tr>
<tr>
<td>00089</td>
<td>C08900 02 FILLER PICTURE X.</td>
</tr>
<tr>
<td>00090</td>
<td>C09000 02 LTP PICTURE X(17).</td>
</tr>
<tr>
<td>00091</td>
<td>C09100 02 FILLER PICTURE X.</td>
</tr>
</tbody>
</table>

**COLTERM 2**
00092  009200  02  FILLER  PICTURE X(5).
00093  005300  02  MGIN_ PICTURE S.
00094  009400  02  FILLER  PICTURE X(5).
00095  005500  02  MOUT_ PICTURE S.
00096  009500  02  FILLER  PICTURE X(5).
00097  005600  02  MGIN_ PICTURE S.
00098  009600  02  FILLER  PICTURE X(5).
00099  009700  02  FILLER  PICTURE X(5).
00100  010000  02  FILLER  PICTURE X(5).
00101  010100  02  FILLER  PICTURE X(5).
00102  010200  02  FILLER  PICTURE X(5).
00103  010300  02  FILLER  PICTURE X(5).
00104  010400  02  FILLER  PICTURE X(5).
00105  010500  01  _SEQ_
00106  010600  02  _FSEQ_  PICTURE X(5).
00107  010700  02  FILLER  REDEFINES FSEQ.
00108  010800  03  01  PICTURE S.
00109  010900  03  02  PICTURE S.
00110  011000  03  03  PICTURE S.
00111  011100  03  04  PICTURE S.
00112  011200  03  05  PICTURE S.
00113  011300  02  09  PICTURE S.
00114  011400  01  FILLER.
00115  011500  02  01  PICTURE S9 COMPUTATIONAL.
00116  011600  02  02  PICTURE S9 COMPUTATIONAL.
00117  011700  02  03  PICTURE S9 COMPUTATIONAL.
00118  011800  02  04  PICTURE S9 COMPUTATIONAL.
00119  011900  02  05  PICTURE S9 COMPUTATIONAL.
00120  012000  01  FILLER.
00121  012100  02  _NEWNEED_ PICTURE.S99 COMPUTATIONAL OCCUPUS 3.
00122  012200  PROCEDURE DIVISION.
00123  012300  ACCEPT NEWTERM. EXHIBIT NAMED NEWTERM.
00124  012400  IF NEWTERM NOT NUMERIC DISPLAY
00125  012500  _NEWTERM INCORRECTLY PUNCHED_ THEN GO TO ABORT2.
00126  012600  MOVE ZERO TO SEON, TRKEY.
00127  012700  READ MASTER INC ROTA
00128  012800  INVALID EXHIBIT.NAMED. ROTA READ FAILED.* TRKEY SEEN.
00129  012900  THEN GO TO ABORT1.
00130  013000  IF NEWTERM NOT > TERM A....
00131  013100  DISPLAY _CURRENT TERM IS _ TERM A.
00132  013200  _NEW TERM MUST BE GREATER_.
00133  013300  *.
00134  013400  OPEN DLPTL HYSTERICAL. MINUSFILE.
00135  013500  DISPLAY _PRESENT FILE STATUS: _ ROTA.
00136  013600  OPEN DLPTL HYSTERICAL. MINUSFILE.
00137  013700  MOVE FSEQ TO MAXSEQ.
00138  013800  MOVE ZERO TO GSEQ.
00139 CL1600 LP1.
11 IF..GENSEON<..MAXSEON..ADD..1..TO..GENSEON
00140 CL1400 ELSE GO TO ENDED.
00143 CL1430 MOVE D3 TO B3 MOVE D4 TO B4 MOVE D5 TO B5.
00144 CL1440 COMPUTE..TKEY = GENSEON / 5.
00145 CL1450 READ..MASTER..INVALID..EXHIBIT..NAMED....
00146 CL1460 "READ..FAILURE" TKEY SEON THEN GO TO LP1.
00147 CL1470 IF PR = 0 GO TO LP1.
00148 CL1480 MOV..DLEN..TO..NEWNEED..(1).
00149 CL1490 MOV..DLEN..TO..DELH.
00150 CL1500 MOV..TC..A..TO..NEWNEED..(2).
00151 CL1510 IF C = 0 GO TO LP1..NOTE..NO..PROCESS..IF..NO..COURSES.
00152 CL1520 IF A > C OR B GO TO P2.
00153 CL1530 IF..TERM..(A).ACT<..NEWTERM.
00154 CL1540 CL1540 ADD 1 TO A.
00155 CL1550 CL1550 MOVE..CRSF..(A) TO..CRSF..(B).
00156 CL1560 CL1560 IF..TERM..(B) TC D ADD..NEED..(B) TO..NEWNEED..(D).
00157 CL1570 CL1570 ELSE...
00158 CL1580 CL1580 MOVE..CRSF..(A) TC..HCRSF.
00159 CL1590 CL1590 ADD 1 TO..DELCNT.
00160 CL1600 CL1600 THEN IF HCRID NOT = SPACE
00161 CL1610 CL1610 MOVE..SEQN..TO..HSEQN..WRITE..HYSTREC.
00162 CL1620 CL1620 ADD 1 TO..A GO TO LP2.
00163 CL1630 CL1630 MOVE..B..TO..NCRSE..MOVE..NEWNEED..(1) TO..TNEED..(1).
00164 CL1640 CL1640 IF..TERM..(1) TC D ADD..NEED..(2) TO..NEWNEED..(D).
00166 CL1660 CL1660 ELSE...IF..DELCNT..>..DELH..ADD 1 TO..TID..DELCNT..
00167 CL1670 CL1670 ELSE..GO..TO..LP1..NCTE..NC..DELETIONS..HENCE..NO..DEPROCESS.
00168 CL1680 CL1680 IF..C =..SHORT..(D).
00169 CL1690 CL1690 ADD 1 TO..C.
00170 CL1700 CL1700 COMPUTE..C =..NEWNEED..(D) -..A.
00171 CL1710 CL1710 IF C > 0 MOVE..C..TO..SHORT..(D).
00172 CL1720 CL1720 ELSE..MOVE..C..TO..SHORT..(D).
00173 CL1730 CL1730 ADD 1 TO D GO TO LP3.
00174 CL1740 CL1740 IF..B..>..0 GO TO P4.
00175 CL1750 CL1750 MOVE..SEQN..TO..CHKSEQN
00176 CL1760 CL1760 MOVE..SEQN..TO..CHKCALN
00177 CL1770 CL1770 MOVE..AUTH..TO..CHKAUTH
00179 CL1790 CL1790 IF..C < B AND..A < 99 ADD 1 TO A
00180 CL1800 CL1800 IF..D =..0 GO..TO..LP4.
00181 CL1810 CL1810 MOVE..SEQN..TO..CHKSEQN
00183 CL1830 CL1830 MOVE.. CPF..(A) TC..D.
00184 CL1840 CL1840 IF..D =..0 GO..TO..LP4.
00185 CL1850 CL1850 ADD 1 TO..C.

COLLTERM 4
00186  C18400  IF D < 3 ADD 4 TO D
00187  C18500  MOVE A TO CHKCPY.,WHITE,CHKCD,CHKM,CHKDA.
00188  018600  ADD 1 TO MINUSCNT
00189  C18700  ELSE IF D < 5 SUBTRACT 2 FROM D.
00190  C18800  MOVE D TO CPF (A) GC TO LP4.
00191  C18900  ELSE REWRITE MASTREC.
00192  C19000  INVALID DISPLAY 'REWRITE FAILED' TRKEY SEON.
00193  C19100  GO TO LP1.
00194  C19200  ABAND. CLOSE MASTER.
00195  C19300  ABORTZ. DISPLAY KUN CANCELED STOP RUN.
00196  C19400  ENDED. CLOSE MINUSFILE HYSTERICAL.
00197  C19500  MOVE ZERO TO TRKEY SEON.
00198  C19600  READ MASTER INVALID EXHIBIT NAMED
00199  C19700  'ROTA READ FAILED' TRKEY SEON GO TO BLECH.
00200  C19800  MOVE NUTERM TO TERM.
00201  C19900  MOVE 0 TO KUNSER.
00202  C20000  REWRITE MASTREC FROM ROTA INVALID EXHIBIT NAMED
00203  C20100  'ROTA REWRITE FAILED' TRKEY SEON GO TO BLECH.
00204  C20200  CLOSE MASTER.
00205  C20300  DISPLAY *TERM END PROCESS COMPLETE*.
00206  C20400  DISPLAY *NUMBER OF TITLES HAVING COURSES DELETED * "TDELCNT"
00207  C20500  DISPLAY *TOTAL NUMBER OF COURSES DELETED * "DELCNT"
00208  C20600  DISPLAY *TOTAL NUMBER OF CCS PRODUCED "MINUSCNT*
00209  C20700  DISPLAY *UPDATED FILE STATUS: "RTDA*.
00210  C20800  DISPLAY *NEXT REGULAR RUN MUST BE RUN=0001*.
00211  C20900  STOP RUN.
00212  C21000  BLECH DISPLAY *PROCESS COMPLETE BUT CANNOT UPDATE FILE STATUS*.
00213  C21100  DISPLAY *FILE STATUS REMAINS AS SHOWN ABOVE*.
00214  C21200  CLOSE MASTER STOP RUN.
IDENTIFICATION DIVISION.

PROGRAM-ID. 'RESVPROF'.

AUTHOR. H.J. HETLAND.

ENVIRONMENT DIVISION.

INPUT-OUTPUT SECTION.

FILE-CONTROL.

ORGANIZATION DIRECT ACCESS RANDOM.

SYMBOLIC SEGNFF ACTUAL TAKEY.

SELECT PROFLIST ASSIGN 'PROFLIST' UTILITY RESERVE 5.

I-D-CONTROL.

APPLY RESTRICTED SEARCH 1 CN 'MASTER-FILE'.

DATA DIVISION.

FILE SECTION.

FD 'MASTER-FILE' RECORDING F LABEL RECORD STANDARD DATA RECORD 'MASTER-RECORD'.

02 PR PIC 9 COMPUTATIONAL-9.

02 BIG.

03 AUTH PIC X(76).

03 TITL PIC X(76).

03 EDTN PIC X(10).

03 DATN PIC X(10).

03 CALN PIC X(30).

03 LCCN PIC X(10).

02 INVENT.

03 ORDR PIC 9.

03 NCP PIC 99.

02 CPPF.

03 CPF PIC 9 COMPUTATIONAL-3 OCCURS 99.

03 CASES.

03 NCASE PIC 99 COMPUTATIONAL-3.

03 TNEED PIC 99 OCCURS 3.

03 SHORT PIC 999 OCCURS 3.

03 CRSF OCCURS 8.

04 NEED PIC 99.

04 CID.

05 TERM PIC 999.

06 CASE PIC X(15).

06 PROF PIC X(15).

FD 'PROFLIST RECORDING F LABEL RECORD OMITTED BLOCK 5 RECORDS'.

DATA RECORD PREC.
RESVPROF 2
PROCEDURE DIVISION.

MAIN-STUFF SECTION.

OPEN I-O MASTER-FILE MOVE C TO TKEY, SEQN.
READ MASTER-FILE INTO RTDA INVALID DISPLAY 'LABELBOMB' GO TO BOMB.

MOVE TRM (1) TRM (2) TRM (3) GO TO T123 T231 T312.

T123. MOVE 2 TO TRB (2) MOVE 3 TO TRB (3) GO TO TEX.
T231. MOVE 1 TO TRB (2) MOVE 1 TO TRB (3) ADD 1 TO TRA (3') GO TO T312.
TEX.

MOVE 1 TO TRB (2) MOVE 2 TO TRB (3) ADD 1 TO TRA (2') ADD 1 TO TRA (3').

MOVE ASEQNE. COMPUTE TRKEY = ASEQNE/5.
READ MASTER-FILE INVALID DISPLAY 'READ FAILURE', SEQN' SEQNS

READ STUFF INPUT PROCEDURE OUTPUT-PROCEDURE.
IF TALLY NOT = C DISPLAY 'SORT FAILED.' STOP RUN.

RESVPROF 4
GO186  MOVE PROF (A) TO SPROF MOVE CASE (A) TO SARE MOVE B18 TO
GO187  SB18 MOVE ORF TO SORF RELEASE SREC. ADD 1 TO A GO TO TST1.
        00018500
GO188  ENDIN. DISPLAY "END OF INPUT PHASE" "CLOSE MASTER-FILE."
        000187CC
GO189  COMPUTE CT4 = CT2 + CT3. COMPUTE CT5 ROUNDED = CT3 / CT6.
        000188CC
GO191  "DISPLAY 'MASTER TITLE' 'CT1
GO192  "COURSES/TITLE 'CT5
GO193  "INVENTORY CHECKS 'CT2
GO194  "TOTAL SORTIN. 'CT4
GO195  "TOTAL SORTIN. 'CT4
GO196  "OUTPUT-STUFF SECTION.
        00019000
GO197  "OPEN OUTPUT PROFLIST. "MOVE-SPACE TO HCRID.
        00019600
GO198  "MOVE CT1, CT3.
        00019800
GO199  "IF SCRID = HCRID GO TO SAMECRID. MOVE SCRID TO HCRID.
        00019900
GO200  "IF SORE = 'Y' MOVE SPROF TO ORF GO TO ENDPREF.
        00020000
GO201  "NEWCRID. MOVE SPROF TO ORF MOV SCRSOV6-16-T0' 004,1850G
        00020100
GO202  "ADD 1 TO PGCTNT MOVE PGCTNT TO PGNO. MOVE SPACE TO ORF.
        03320200
GO203  "WRITE PREC FROM H1 AFTER 0 WRITE PREC FROM H2 AFTER 2.
        03320300
GO204  "ADD 1 TO 'CT1.
        03320400
GO205  "BSKIP. MOVE SPACE TO PREC WRITE PREC AFTER 2. MOVE 0 TO CRSCNT.
        00020500
GO206  "SAMECRID. IF SORF > ORF GC TO ORORD.
        00020600
GO207  "IF CSRCNT > CRSPG GO TO OVERFLOW.
        00020700
GO208  "PRTCRS. MOVE SAINT TO PAINT WRITE PREC FROM PLIN AFTER 1.
        00020800
GO209  "MOVE SPACE TO TBLNK. MOVE STTIL TO PTITL WRITE PREC FROM
        00020900
GO210  "PLIN AFTER 1. MOVE SPACE TO PTITL.
        00020A00
GO211  "MOVE SDNT TO PEDNT MOVE SDATN TO PDATN MOVE SCATN TO PCATN.
        00021100
GO212  "WRITE PREC FROM PLIN AFTER 1. ADD 1 TO CRSCNT ADD 1 TO CT3.
        00021200
GO213  "PRTEX. GO TO NOW. NOTE ALTER TC NOW2.
        00021300
GO214  "OVERFLOW. ADD 1 TO PGCTNT MOVE PGCTNT TO PGNO.
        00021400
GO215  "WRITE PREC FROM H2 AFTER 0. MOVE 0 TO PGN2.
        00021500
GO216  "WRITE PREC FROM PLIN AFTER 2.
        00021600
GO217  "ADD 1 TO CRSCNT GO TO SAMECRID.
        00021700
GO218  "IF ORF NOT = 'Y' GO TO BSKIP. MOVE 0 TO CRSCNT.
        00021800
GO219  "ORDRO. MOVE SORF TO ORF. IF CRSCNT NOT < CRSPG GO TO OVERFLOW.
        00021900
GO220  "MOVE "THE FOLLOWING TITLES ARE BEING OBTAINED FOR RESERVATIONS"
        00021A00
GO221  "OF PROFESSORS LISTS...' TO PAUIT.
        00021B00
GO222  "WRITE PREC FROM PLIN AFTER 3.
        00021C00
GO223  "ADD 1 TO CRSCNT GO TO SAMECRID.
        00021D00
GO224  "ENDPROF. MOVE "END OF PROFESSORS LISTS.' TO PAUIT
        00022200
GO225  "WRITE PREC FROM PLIN AFTER C.
        00022300
GO226  "ADD 1 TO PGCTNT MOVE PGCTNT TO PGNO.
        00022400
GO227  "ALTER PRTEX TO PROCEED TO NOW2.
        00022500
GO228  "MOVE 0 TO PGCTNT MOVE PAGE ' TO PAG.
        00022600
GO229  "INVENTORY CHECKS TO HDTXT. GO TO ICOVFL.
        00022700
GO230  "NOW2. RETURN SFILE END GO TO ENCPROF.
        00022800
GO231  "IF CRSCNT NOT > CRSPG GO TO PRTCRS.
        00022900
GO232  "ICOVFL. MOVE 0 TO CRSCNT. ADD 1 TO PGCTNT. MOVE PGCTNT TO PGNO.
        00023100

RESVPROF 5
03233 WRITE PREC FROM HI AFTER 0.
03234 MOVE SPACE TO PREC WRITE PREC AFTER 3, GO TO PRTCRS.
03235 ENDC. MOVE 'END OF INVENTORY CHECK' TO PAUTL
03236 WRITE PREC FROM PLIN AFTER 2.
03237 ENDC. DISPLAY 'TOTAL COURSES' 'CTI' 'TITLES/COURSE' 'CTS.'
03238 CLOSE PROFLIST.

RESVPROF 6
IDENTIFICATION DIVISION.

PROGRAM-ID. XREFRESV.

AUTHOR. H. J. HETLAND.

ENVIRONMENT DIVISION.

INPUT-OUTPUT SECTION.

FILE-CONTROL.

SELECT MASTER ASSIGN 'MASTER' UTILITY.

SELECT CROSSREF ASSIGN 'CROSSREF' UTILITY.

DATA DIVISION.

FILE SECTION.

FD MASTER.

RECORDING F BLOCK 5 RECORDS.

LABEL RECORD STANDARD DATA RECORD MASREC.

01 MASREC.

02 BIB.

AUTH PICTURE X(76).

03 TITL.

PICTURE X(76).

04 XMAIN PICTURE X(72).

05 EDTN PICTURE X(10).

06 CATN PICTURE X(10).

07 CALN PICTURE X(10).

08 LUCN PICTURE X(10).

09 INVENT.

CRU PICTURE 99.

ACP PICTURE 99.

CPF PICTURE 9 COMPUTATIONAL-3 OCCURS 99.

CASES.

CPSE PICTURE 99 COMPUTATIONAL-3.

INeed PICTURE 99 OCCURS 3.

SHORT PICTURE 99 OCCURS 3.

CRSF OCCURS 8.

NEED PICTURE 99.

CID.

TERM PICTURE 999.

GRID.

CASE PICTURE X(15).

PROP PICTURE X(15).

SEQN PICTURE 9(16).

CROSSREF.

RECORDING F BLOCK 5 RECORDS.

LABEL RECORD OMITTED DATA RECORD PREC.
XREFRESV 2
PROCEDURE DIVISION.

SORT, SFILE ASCENDING SPEC.

INPUT PROCEDURE IN-PROC.

OUTPUT PROCEDURE OUT-PROC.

IF TALLY = 0 DISPLAY 'CROSSREF COMPLETE.'

ELSE DISPLAY 'SORT FAILED.'

STOP RUN.

IN-PROC SECTION.

READ MASTER INTO RDTA END DISPLAY 'NO MASTER FILE.' STOP RUN.

DISPLAY 'LIST OF retrieving SFILE AS OF RDTA.

READ MASTER END GO TO ENDD.

IF PR = PG LC TO LP1.

IF TITLE NOT = 'NEW' GO TO LP1.

MOVE XMAIN TO SMAIN. MOVE AUTH TO SXREF. MOVE SEQN TO SXSEQ.

RELEASE SPEC GO TO LP1.

ENDIN. CLOSE MASTER.

DISPLAY 'END OF INPUT.' XCTR CROSS REFERENCES FOUND.'

OUT-PROC SECTION.

OPEN OUTPUT CROSSREF.

MOVE DATE TO HDATE.

COMPUTE LNCT = IN + 1.

LP2. RETURN SFILE END GO TO ENDP.

IF SMAIN = PMAIN GO TO SAFER.

IF LNCT > LN OVER 0 TO LNCT

ADD 1 TO LNCT GO TO LP2.

ENDOUT. MOVE 'END OF CROSS REFERENCE LIST.' TO PMAIN.

WRITE REC FROM MLIN AFTER 2.

CLOSE CROSSREF.