ANALYSIS OF ACCOUNT DAYFILES

TO MY WIFE

ANALYSIS OF ACCOUNT DAYFILES FOR THE CDC 6400 COMPUTER UNDER NOS

By

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Abstract

System performance evaluation is an on-going task for computer system management personnel in order to fine-tune the system operations. One of the evaluation aids that is readily available for the CDC 6400 computers is the job accounting dayfile maintained by the operating system NOS. A set of three programs in FORTRAN has been developed to analyze the dayfile with a view to evaluating the system performance. Program PHASE1 prepares the dayfile for analysis. Program PHASE2 creates a job summary file with information on system resources utilization by each job. Program PHASE3 analyzes the job summary file by evaluating various parameters characterizing the system workload and performance at regular time intervals. The results are displayed in tabular and graphical forms. Test results from the analysis of a limited number of dayfiles are discussed.

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CHAPTER I

INTRODUCTION

A. SYSTEM PERFORMANCE EVALUATION

1. Criteria

A computer system is an aggregation of hardware and software components called system resources. Inputs to the computer, such as programs, data and commands, constitute the workload. The system responds to these inputs by producing outputs with a certain level of performance. The objectives of computer system performance evaluation are to develop some meaningful and quantitative measures of how well the system completes its day's work. Thus to estimate a computer system's capability to serve its users, it is necessary to establish measurement criteria, called performance indices. Most popular performance indices fall into three categories [1]:

a. Productivity indices, which measure the volume of information processed by the system per unit time.

b. Utilization indices, which represent the ratio between the time a specified part of the system is used during a given interval of time and the duration of that interval.

c. Responsiveness indices, which measure the time between the presentation of an input to the system and the appearance of the corresponding output.

Other authors classify these criteria into effectiveness and efficiency parameters [2]. Since this type of classification suffers from confusion in terminology, it is proposed here to quantify the measurement of system performance by the following parameters:

(i) Internal Performance Parameters

It is often useful to find out how efficiently one system processes a representative workload when compared with another system. The efficiency of the system may be measured by parameters such as:

a. throughput rate, which is the amount of work completed per unit of time. For batch processing systems the throughput rate is sometimes taken as the number of jobs completed in an hour. For interactive systems, a job is usually defined as the response to a single user command. However, this kind of information is not always readily available (e.g., in job accounting files), and one may be compelled to regard all operations between log-on and log-off of a single user as a single job, as we find necessary in this work.

b. CPU productivity, which is the ratio between the time the CPU is doing useful work during a given interval of time and the duration of that interval.

(ii) External Performance Parameters

These measure the "timeliness" requirement of individual jobs or the system performance as seen by the users. The most important ones are:

a. response time, which is the elapsed time in seconds between completion of user input and appearance of the first character at the user output interface in interactive systems.

b. turnaround time, which is the elapsed time between the submission of an input to the system (time of read-in) and the appearance of the completed output (time of printout) in batch systems.

c. external delay factor, which is the ratio between job turnaround time and the job processing time. The latter is the time between the start and end of execution of the job in a multiprogramming environment. This parameter is sometimes regarded as a better measurement of the responsiveness of a batch processing system from the user's point of view as it measures to certain extent the dependence of the turnaround time on the actual time taken to process the job.

(iii) Workload Parameters

The system workload may be represented by the

type and amount of resources demanded by the users. It is characterized by a number of parameters depending on the system configuration, the selection of which varies from one evaluation project to another. Most parameters are measures of the system resource utilization, such as:

a. job CPU time, which is the total CPU time consumed by a job;
b. I/O requests, which include the number of cards read and/or number of lines printed for the job;
c. field length, which is the amount of main memory requested or used by a job, usually expressed in number of computer words or bytes;
d. secondary storage requests, which include the amount of disk space or number of magnetic tape drives required by a job;
e. job concurrency, which is the number of simultaneous users in the system (batch and time-sharing).

Sometimes a unit of work may be defined to represent a fixed amount of usage in system resources, such as the System Resource Unit (SRU) defined by the Network Operating System (NOS) of the CDC. Jobs can then be classified according to the amount of resource units requested or utilized. The instantaneous workload of a system fluctuates rapidly and therefore it

has to be characterized by some statistical average over longer periods of time, such as tens of minutes.

2. Evaluation Aids

To permit a performance evaluation, quantitative data must be collected, often at the time when events or activities took place, by some kind of evaluation aids. The commonly used evaluation aids in system performance analysis may be classified into four categories [3]:

a. Monitors, which may be hardware or software. Hardware monitors consist of separate analysis equipment connected by probes to the host computer. Data collected by this technique is generally recorded on magnetic tape to be analyzed by special programs on another mainframe at a later time. Software monitors are programs linked into the operating system software to sample and record the status of particular system components at certain times.

b. Simulators, which are software programs that model the computer system workload and capability to produce some measure of its responsiveness under some predicted load.

c. Benchmarks, which consist of one or more specific series of jobs that simulate the anticipated workload on the host computer to test system performance under these conditions.

d. System Dayfiles or Journals, which are job-logging

routines linked into the operating system to record for each job processed the events that occurred and the contents of "accumulators" that keep count of the usage of various resources. The primary purpose of such a journal is to provide information for billing users and is often called an account dayfile. Typically such data include CPU time, amount of memory allocated, I/O activity counts and resource units consumed. The starting and completion times of each job are also recorded to provide the basic data for timeliness measurements for batch jobs. It is this type of evaluation aid that has been utilized in analyzing the performance of the CDC 6400 computer at McMaster in this project.

A complete system performance evaluation often makes use of more than one of the above aids to obtain results that complement each other. For example, the output from a benchmarking test is often the monitor data tape and/or the account dayfile, which are then analyzed to determine system performance under the test load.

B. SCOPE OF WORK

The only major performance evaluation study made on the CDC 6400 computers at McMaster University was done by G. Hicks [4], who designed a real-time graphical display monitor. Other software programs written by the staff of the computer centre

tend to be designed specifically for current problem areas, and hence piecemeal in nature. Since 1978, both the System A and B CDC 6400 computers have been operated under NOS (Network Operating System), replacing SCOPE (Supervisory Control of Program Execution). Some performance evaluation on these computers under the control of the new operating system was deemed to be useful as a management tool. An account dayfile is maintained by NOS on mass storage, and is thus a readily available evaluation aid.

The objective of the current work is to develop a post-analysis program to extract and analyse the relevant information recorded on the account dayfile with a view towards evaluating the performance of the host computer. The program has been tested and sample results obtained for the account dayfiles on the System B computer, which is primarily used in the batch mode by researchers. The same program can of course be used for the System A computer which is primarily used by student users in time-sharing mode. However, no account dayfiles are being maintained for the System A computer at present.

The program developed in this work is intended to produce quantitative measurements of some selected parameters that may characterize the workload and the performance of the system. It is hoped that these results may assist management personnel in performing further statistical or paper-and-pencil analysis. The performance parameters were selected for analysis according to their representativeness and usefulness, but the set of parameters

selected is not intended to be all-encompassing. The selection is further restricted by the availability of data from the account dayfile. In the original vision of the project, an analysis of the utilization of some important subsystem softwares and programming aids was deemed worthwhile (e.g. FTN, COBOL, BASIC, MIME). That aspect has been omitted in the final product as the required information i.e., the name of the subsystem was found to be not readily available from the account dayfile.

The language chosen for implementing this analysis program is FORTRAN. The choice was made through considerations of program portability, capacity in handling numerical computations, output formatting, compatibility with some library routines (e.g., IMSL) and capability of interfacing with some utility programs (e.g., SORT/MERGE). Although the FORTRAN language is not a good candidate for structured programming, efforts were made to incorporate modern techniques of structured programming during program development. In anticipation of future development and to facilitate program maintenance, a modular program design has also been used.

As the primary purpose of the account dayfile is for billing users, it does not contain all the information that we would like to have for evaluating the system. The design of the post-analysis program naturally depends on the format in which the account dayfile is written. We shall first examine the contents of the dayfile as part of a feasibility study before proceeding to the design of its analysis programs.

C. CDC 6400 ACCOUNT DAYFILE

Each record in the system dayfile written by NOS for the CDC 6400 computer is a string of alphanumeric characters with the following general format [5]:

field	format	column	description
time	bhh.mm.ss.	1-10	the time this entry is made into the dayfile in hours hh, minutes mm and seconds ss. (b denotes a blank throughout this report).
jobname	xxxxyyy	11-17	the first four characters xxxx uniquely identify the user and the next three characters yyy identify the job. This field will be described later in greater detail.
job origin	x	18	a single character describing the origin type of the job, which may be one of the following: S -- system B -- batch T -- terminal E -- remote batch
delimiter	.b	19-20	
code	geac	21-24	a unique four-character code word identifying the particular activity. The first character identifies the information group, the second identifies the event

			that caused the message to be entered into the dayfile, and the last two characters identify the activity being recorded.
delimiter	,b	25-26	
details	alphanumeric (variable length)	27-	additional information (e.g., amount of resources, file name, device number, etc.). The field ends with a period (.)

Examples of dayfile entries may be found in Figure 1, which is a listing of a section of a system dayfile. Details of the code words are described in [5]. Basically there are three groups of information:

a. Accounting Group, which provides information necessary for accounting purposes, e.g., ABCN which denotes the beginning of a job under charge number given in the details field.
b. Statistics Group, which provides information on various activities of the system, e.g., SPGT which denotes a permanent file GET operation.
c. Usage Group, which provides information on the usage of various system resources, e.g., UECP which denotes the CPU time for the job to be given in the details field.

Some code words are produced locally from modifications made by the university Computer Centre. Those that are made use of in this work are:

```
09.40.14.ARDYAGBB.  ABCN, HKJS(HKJS.
09.40.16.BKVA022T.  SPGT, COM.
09.40.16.ARDYAGBB.  SPAT, GRABOIR, PUBLIC.
09.40.17.ARDYAGBB.  SPAT, EISPACK, PUBLIC.
09.40.19.ARDYAGBB.  SPAT, PHYSLIB, HKV3.
09.40.31.AAEI005T.  SPRP, DAYDECK.
09.40.32.ARDYAGBB.  IEFL, MAX FL USED  520008 WORDS.
09.40.32.ARDYAGBB.  UEAD,       0.002KUNS.
09.40.32.ARDYAGBB.  UEPF,       0.032KUNS.
09.40.32.ARDYAGBB.  UEMS,       3.665KUNS.
09.40.32.ARDYAGBB.  UECP,       3.949SECS.
09.40.32.ARDYAGBB.  AESR,       5.639SRUS.
09.40.40.AAFI011T.  SPGT, FINDPW.
09.40.40.AAFI011T.  SPGT, FINDPW.
09.40.41.AAEIAGDB.  IBJC, 04.
09.40.43.BKSA017T.  UECO,       1.976KCHS.
09.40.43.BKSA017T.  UECI,       0.940KCHS.
09.40.43.BKSA017T.  UEAD,       0.001KUNS.
09.40.43.BKSA017T.  UEPF,       0.267KUNS.
09.40.43.BKSA017T.  UEMS,      22.591KUNS.
09.40.43.BKSA017T.  UECP,       7.838SECS.
09.40.43.BKSA017T.  AESR,      10.280SRUS.
09.40.43.AAFI011T.  SPGT, UNFILE.
09.40.43.AAEIAGDB.  ABUN, 1004995, MMU.
09.40.45.AAFI011T.  SPAT, UNFILE.
09.40.45.AAFI011T.  SPGT, UNFILE.
09.40.45.AAFI011T.  SPAT, UNFILE.
09.40.47.AAEIAGDB.  SPAT, PROFILB, SYSTEMX.
09.40.48.AAEIAGDB.  IBFL, MAX FL AVAILABLE  1140008 WORDS.
09.40.48.AAEIAGDB.  ABCN, ACS, ACS.
09.40.50.BKSA017E.  UCLP, ,       0.192KLNS.
09.40.51.AAEIAGDB.  SPGT, DAYPROC.
09.40.51.AAEIAGDB.  SPGT, FOUR.
09.40.53.BKVA022T.  UCCO,       4.096KCHS.
09.40.55.AM5Q015T.  UCCO,       4.096KCHS.
09.40.57.AAEIAGDB.  SPGT, DAYBINS.
09.40.58.AAEIAGDB.  SPGT, DAYMISC.
09.40.58.AAEIAGDB.  SPGT, IOLIST.
09.41.03.AAEIAGDB.  SPGT, USTATPL.
09.41.03.AAEI005T.  ACUN, 1002449, MMU.
09.41.10.AAEIAGDB.  SPGT, FINDNM, ACCOUNT.
09.41.10.AAEI005T.  SPAT, PROFILB, SYSTEMX.
09.41.10.AAEIAGDB.  SPGT, UIFILE, ACCOUNT.
09.41.11.AAEIAGDB.  SPAT, UIFILE, ACCOUNT.
09.41.12.AAEI005T.  IBFL, MAX FL AVAILABLE   640008 WORDS.
```

Figure 1. Examples of Account Dayfile Records

a. IBJC --

This denotes the processing of a job card. The job class as declared by the user according to the definition of the Computing Centre or as assigned by the system is given as additional information in the details field.

b. ACST --

This indicates that the job is a STALL job and hence entitled to reduced rates. These jobs may be read in at any time of the day but processing will be deferred until such time that the system load is deemed to be light enough to handle the STALL jobs in addition to the regular load without significant system performance degradation.

c. IEFL --

This denotes the maximum field length for the job, either actually used or specifically requested by the user.

A list of the code words that are recognized by this analysis program is given in Appendix A, together with their brief descriptions.

CHAPTER II

PROGRAM DESIGN AND DESCRIPTION

A. OUTLINE

In order to obtain values of parameters that characterize the workload and performance of the system, the amount of resources used by each job and the time spent by each job in the system must be known. These requirements have led to the consideration of creating from the account dayfile a Job Summary File that contains the relevant information on each job. In order to facilitate the creation of such a summary file, some preliminary processing of the account dayfile was necessary, which will be discussed in detail in the following section. The whole project of analysis then falls naturally into three distinct phases:

a. Phase One -- preprocessing of the Account Dayfile;

b. Phase Two -- creation of the Job Summary File;

c. Phase Three -- computation of parameters characterizing system workload and performance, and display of results.

Two concerns figured prominently in the design of the programs in this project. One is the allowance for future development to incorporate more information that may be useful to management personnel, and the other is the capability for allowing other system analysts to make use of the data produced during stages of this analysis. With these considerations in mind, a separate

modular program was developed for each of the three phases. The output file generated during one phase may be saved as permanent file for other application programs, but also serves as an input file to the program in the succeeding phase. The design of these programs will now be described.

B. PHASE ONE[1]

Entries in the account dayfile are strictly chronological. For the purpose of this analysis, it would be more convenient to group all the entries associated with the same job, while maintaining their chronological sequence within a particular job. This may be done conveniently by sorting the account dayfile according to some sequence. The objective of Phase One is to prepare the account dayfile for sorting. These preparations include modifications to some jobnames and the recorded times of some entries.

1. Jobname Modification

The last three characters of the seven-character jobname are assigned by the operating system in increasing order of their display code sequence, according to the time the

[1]The program for Phase One was designed jointly with W.C. Luk, who also did the coding and testing. This program will also be used in another project on response time measurements being carried out by Mr. Luk, as part of an M. Sc. project to be completed in 1979.

job enters the system. This three-character job identification is therefore unique for the job during that day and should provide a convenient key for sorting the account dayfile. However, closer examination of the dayfile showed that while this is true for jobs of batch origin, it presents a problem for jobs of terminal origin. The problem arises because the job identification in the latter cases is a three-digit number identifying the time-sharing port, and hence is not a unique identifier of the job itself. The major task in the preprocessing phase is to assign a unique job identification to every terminal job in the dayfile.

This can be done by replacing the two least significant digits of the port number with a two-character code in increasing order according to the time of log-on. The most significant digit, which is always 0, is retained to avoid duplication of terminal job identifications with those of batch jobs. The algorithm for this procedure is shown in flow-chart form in Figure 2. Basically an array TABLE is set up so that the current replacement jobname for terminal port N is stored in location TABLE(N). A corresponding array JFLAG, initially set to FALSE, indicates whether terminal port N is currently logged on. The port number is first obtained from a dayfile message. If that terminal is currently logged on, the replacement jobname is looked up from the table. Otherwise for a terminal port that just logged on,

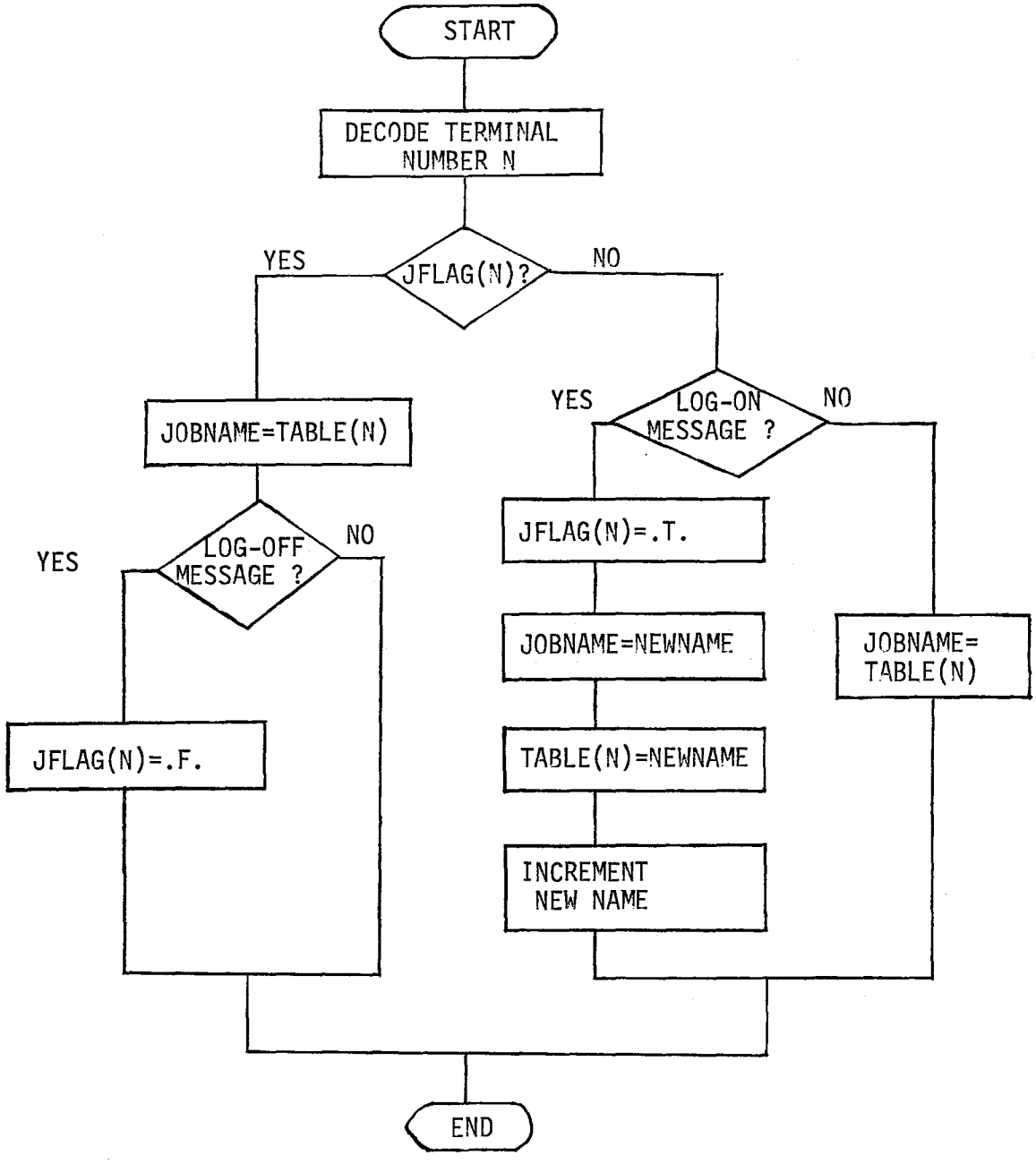


Figure 2. Flow Chart for Terminal Jobname Modification

the replacement jobname is obtained from the next new name in the sequence and assigned to that port by entering it in the appropriate location in the table.

2. Time and Date

Two other minor tasks are performed in this preprocessing phase. The first record of a dayfile normally contains the date of the file. A jobname with the lowest possible order in the collating sequence must be assigned to the first record to ensure that this record will remain the first after the file is sorted. Secondly, some entries in a dayfile are made during the small hours of the next day. Their times of entry are changed by incrementing the hour by 24 to avoid confusion.

The modified dayfile is written on a local file on mass storage to be used as the input file to the program for the next phase.

C. PHASE TWO

The objective of this phase is to create a Job Summary File from the modified account dayfile. The organization of this program is shown in Figure 3 in the form of a hierachical structure of the program modules or subroutines. It involves four distinct stages: sorting of the modified dayfile; initialization; processing of the sorted dayfile and printout of Job Summary File content and statistics.

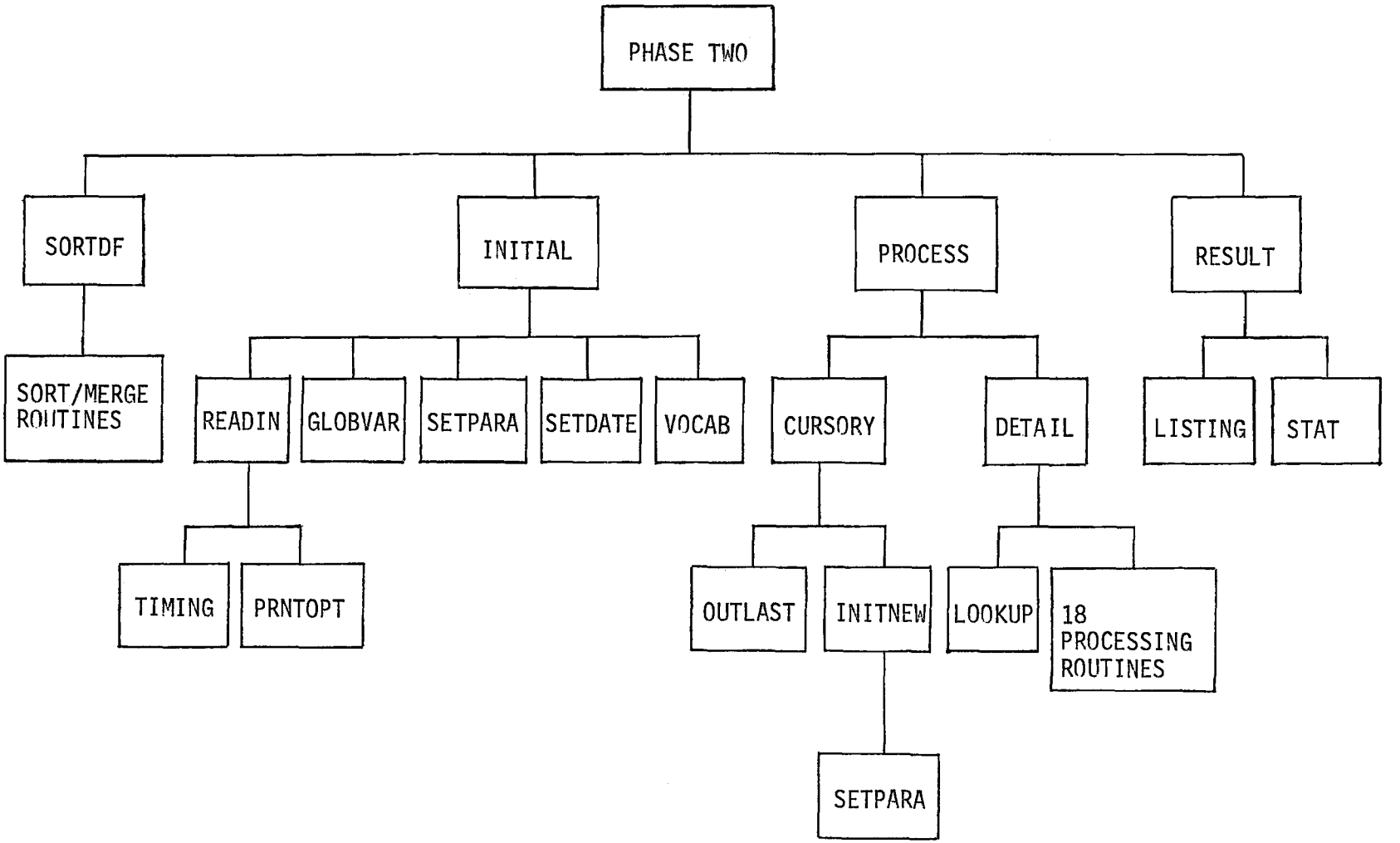


Figure 3. Organizational Chart for Program PHASE2

1. Sorting

The modified dayfile is first sorted into blocks of records in subroutine SORTDF. (The term "block" here is used in its logical sense and is not related to the physical blocking of records in storage media.) Each block contains all the records belonging to a single job. Records in each block are in chronological sequence. The sequence of blocks is in chronological order of the first record from each block. This sorting is done by using the CDC SORT/MERGE utility program.

CDC FORTRAN EXTENDED provides the capability of manipulating and rearranging data records under the SORT/MERGE system from within a FORTRAN program [6]. This interface is provided by a series of subroutine calls made in the FORTRAN program. The sort key in this particular case is the three-character jobname as previously discussed. The collating sequence is the 6-bit COBOL collating sequence in increasing order of the character code as these SORT/MERGE routines are provided by the COBOL Library programs. The first character of the jobname for a terminal job has been assigned the character 0 (zero) during preprocessing so that after sorting all records belonging to terminal jobs are grouped after those for batch jobs. This is designed so that subsequent analysis of the dayfile records may be made for either batch jobs only or terminal jobs only. The RETAIN option in SORT/MERGE is exercised so that all records with the same key (jobname)

retain their original chronological order. Examples of the sorted dayfile is shown in Figure 4.

2. Initialization

There are five different tasks in this stage of the analysis, to be performed by five different subroutines called by subroutine INITIAL.

(i) Subroutine READIN

This subroutine reads and interprets user's input on option selection. The user may elect to process only a portion of the dayfile by specifying the lower and upper time limits on dayfile entries, and may specify full or partial printout of the contents of the Job Summary File. These options are described in detail in the User's Guide (Appendix B).

(ii) Subroutine GLOBVAR

Global variables used in this program are declared and, if necessary, initialized in this subroutine. These variables are grouped into six labelled COMMON blocks according to their functions and the needs for communications between program units. These blocks are described below.

a. /FLAGS/

This COMMON block contains boolean variables for controlling program logic flows.

```
11.51.47.ASFIARPB. SPGT, NCTOW1.
11.51.48.ASFIARPB. SPAT, PLOT, RCIML.
11.51.49.ASFIARPB. SPAT, VPLTLIB, PUBLIC.
11.52.00.ASFIARPB. SPRP, DPLOT.
11.52.00.ASFIARPB. IEFL, MAX FL USED 114000B WORDS.
11.52.00.ASFIARPB. UEAD,       0.002KUNS.
11.52.00.ASFIARPB. UEPF,       0.034KUNS.
11.52.00.ASFIARPB. UEMS,       2.726KUNS.
11.52.00.ASFIARPB. UECP,       4.075SECS.
11.52.00.ASFIARPB. AESR,       6.617SRUS.
11.57.19.ASFIARPB. UCLP, 33,       0.404KLNS.
11.53.05.BC4YARSE. UCCR, ,       0.015KCDS.
11.53.06.BC4YARSE. IBJC, 02.
11.53.07.BC4YARSE. ABUN, 1002466, MMU.
11.53.09.BC4YARSE. SPAT, PROFILB, SYSTEMX.
11.53.11.BC4YARSE. IBFL, MAX FL AVAILABLE  114000B WORDS.
11.53.11.BC4YARSE. ABCN, ACS.
11.53.12.BC4YARSE. SPGT, MIFPLB.
11.54.24.BC4YARSE. SPAT, MMUTEXT, PUBLIC.
11.54.43.BC4YARSE. SPAT, IFTRAN, FLEMING.
11.59.08.BC4YARSE. SPSV, LGO.
11.59.50.BC4YARSE. SPSV, MIFLIBB.
11.59.54.BC4YARSE. SPPG, LGO.
11.59.55.BC4YARSE. IEFL, MAX FL USED  520000B WORDS.
11.59.55.BC4YARSE. UEAD,       0.002KUNS.
11.59.55.BC4YARSE. UEPF,       0.368KUNS.
11.59.55.BC4YARSE. UEMS,      61.816KUNS.
11.59.55.BC4YARSE. UECP,      60.000SECS.
11.59.55.BC4YARSE. AESR,      61.295SRUS.
11.53.39.ASFIARUE. IBEQ, IN.
11.53.39.ASFIARUB. IBJC, 02.
11.53.41.ASFIARUB. ABUN, 3021993, MMU.
11.53.43.ASFIARUB. SPAT, PROFILB, SYSTEMX.
11.53.44.ASFIARUB. IBFL, MAX FL AVAILABLE  114000B WORDS.
11.53.45.ASFIARUB. ABCN, RCIMK.
11.53.46.ASFIARUB. SPGT, NCTWL1.
11.53.47.ASFIARUB. SPAT, PLOT, RCIML.
11.53.48.ASFIARUB. SPAT, VPLTLIB, PUBLIC.
11.54.13.ASFIARUB. SPRP, DPLOT.
11.54.14.ASFIARUB. IEFL, MAX FL USED 114000B WORDS.
11.54.14.ASFIARUB. UEAD,       0.002KUNS.
11.54.14.ASFIARUB. UEPF,       0.034KUNS.
11.54.14.ASFIARUB. UEMS,       2.734KUNS.
11.54.14.ASFIARUB. UECP,       3.993SECS.
11.54.14.ASFIARUB. AESR,       6.546SRUS.
```

Figure 4. Examples of Sorted Account Dayfile Records

b. /CHOICE/

Variables related to option selections by the user are in this block. They are set by the subroutine READIN.

c. /STRING/

The character string that forms a record in the Dayfile is broken up into a number of fields and stored in variables belonging to this block.

d. /COUNTS/

Printouts from the program for Phase Two include a short summary of statistics, e.g., counts of jobs in various categories. These counts are maintained at various stages throughout the program execution and passed on to the Subroutine STAT for printout via variables declared in this block.

e. /LIST1/,/LIST2/

Although logically there is only one Job Summary File written by the program for Phase Two, two separate sections of this file are actually created for ease of producing printout tables and for possible use by application programs that may be developed in the future. Values of parameters that are written in the first section of the Job Summary File are stored in variables in the COMMON block /LIST1/ and those written in the second

section are in block /LIST2/.

f. /TAPEVAR/

For jobs that require magnetic tapes, the program keeps track of the tape drives used and the times of assignment and release of the drives. This is done by maintaining a table for tape usage. When a dayfile message on tape drive assignment is encountered, the device number and the time of assignment are entered into the table. When a message on tape drive release is encountered, the device number is looked up and the time of release is entered into the table. It should be noted that unless the user submitting that job specifically includes a RETURN or UNLOAD statement in the job control statements, no tape drive release message is entered into the dayfile. In such a case the table is scanned on encountering a job termination message and the release time is entered into the table if this has not been done prior to job termination. Before initializing the processing of records for a new job, the table is scanned to obtain information on tape usage by the terminating job.

(iii) Subroutine SETPARA

Before processing a block of records for a new job, the variables storing information about the job are initialized in this subroutine.

(iv) Subroutine SETDATE

The first record in an account dayfile contains the date of the file. The date is written on the header or first record of the Job Summary File. Once again care is taken to have the header record padded with a "zero" time to ensure that the header will remain the first record after the Job Summary File is sorted in Phase Three.

(v) Subroutine VOCAB

Abbreviations are used for table headings in the printout of the Job Summary File contents. For a novice user of the program, an explanation of these abbreviated names may be helpful. This "dictionary" also serves to inform the user the kind of information that is stored in the Job Summary File. Printout of this information by subroutine VOCAB is provided as a user option, which may be disabled by seasoned users of the program.

3. Processing

Subroutine PROCESS is the main module for creating the Job Summary File from the sorted account dayfile. The flow chart for this module is shown in Figure 5.

The program makes use of two boolean flags HALT and IGNORE to control the logic flow. The IGNORE flag is mainly set by the subroutine CURSORY which performs a preliminary examination of the current dayfile record to determine if a

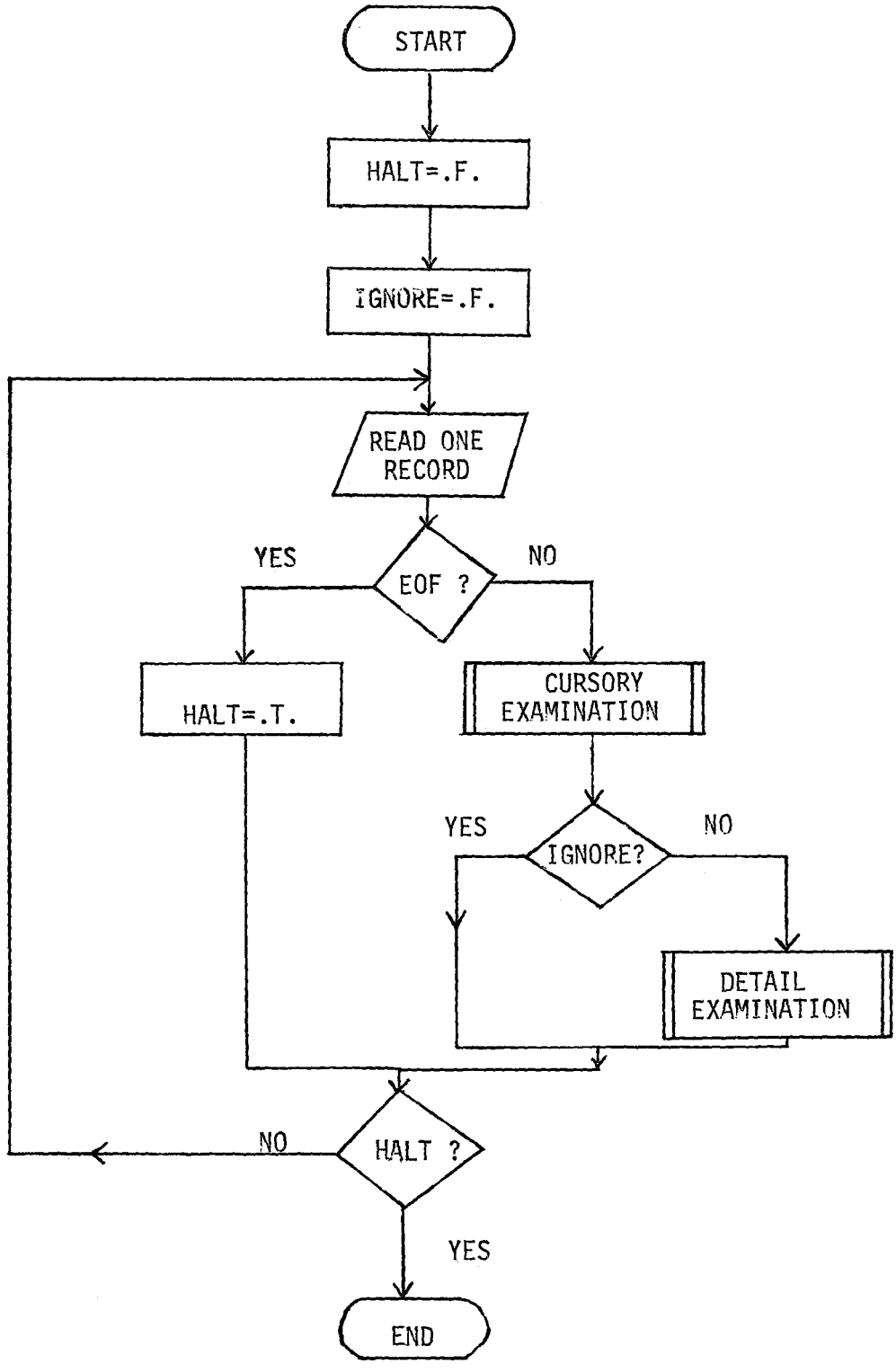


Figure 5. Flow Chart for Subroutine PROCESS

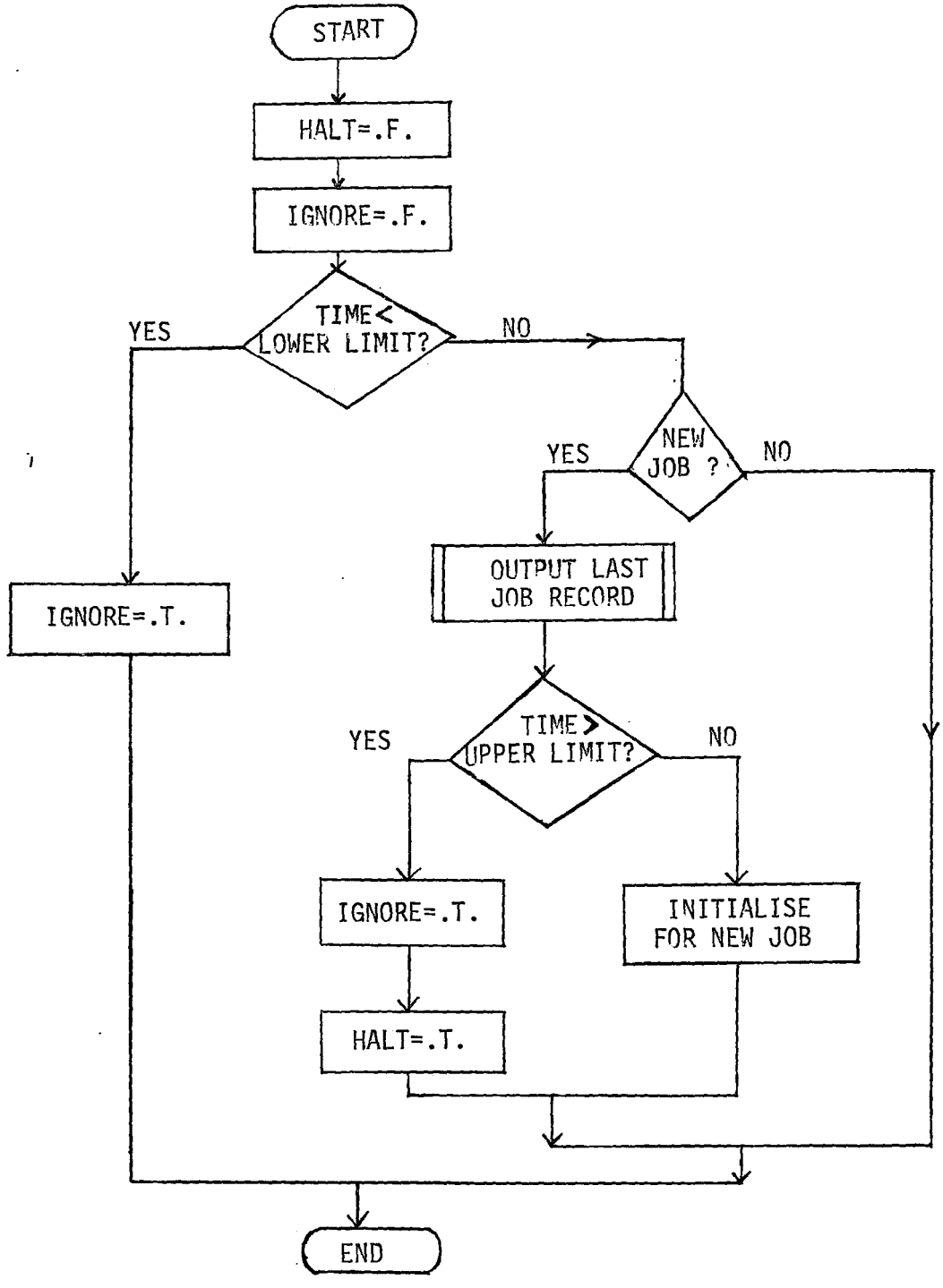


Figure 6. Flow Chart for Subroutine CURSORY

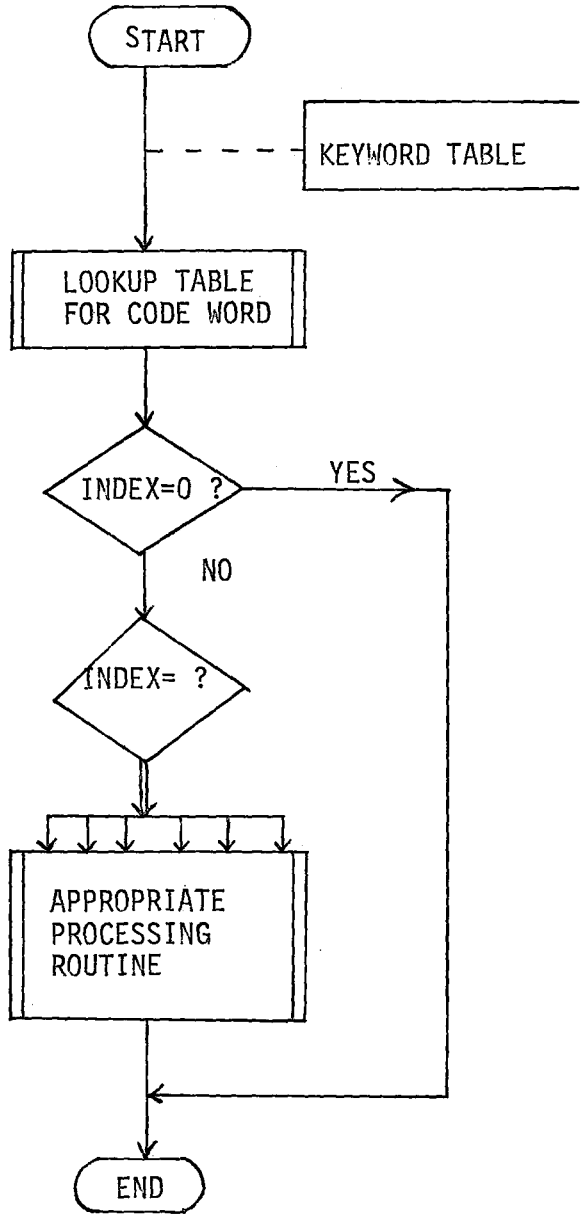


Figure 7. Flow Chart for Subroutine DETAIL

more detailed processing of the record by subroutine DETAIL is warranted. The flow charts for these two program units are shown in Figures 6 and 7.

A keyword table is maintained by the program so that each entry in that table is identified by an index associated with one of the four character codes that characterize the kind of message in the dayfile. If the current dayfile message requires detailed processing, the keyword table is looked up to find the index corresponding to the code extracted from the message. An index of 0 is returned by the subroutine LOOKUP if the code is not found in the table, indicating that the message is of no interest to this analysis. The table lookup employs a binary search algorithm. The index obtained allows the appropriate routine to be called to process the record.

After a block of records belonging to a single job is processed, the result is written on the output file by the subroutine OUTLAST. This file serves as the input file to the program in Phase Three and its contents may be printed out by the next module.

4. Printout of Results

Subroutine RESULT calls Subroutine LISTING to produce a printout of the contents of the Job Summary File in the form of two tables. The kind of information written on this file is given in Figure 8, which is simply a printout by the sub-

DICTIONARY FOR TABLE PRINTOUTS

NO. = RECORD NUMBER

JOBNAME = SYSTEM JOBNAME

TYPE = B FOR BATCH JOB
T FOR TERMINAL JOB
S FOR SYSTEM JOB
E FOR REMOTE BATCH JOB

CLASS = JOB CLASS AS DECLARED BY USER OR ASSIGNED BY SYSTEM

TIME IN = TIME AT WHICH JOB WAS READ IN

TIME OUT = TIME AT WHICH PRINTOUT IS COMPLETED

EXC BEGIN = TIME AT WHICH PROCESSING OF JOB STARTS

EXC END = TIME AT WHICH JOB PROCESSING STOPS

CPU SECS = THE NUMBER OF CPU SECONDS USED BY JOB

REMARKS = ST FOR STALL JOB
AB FOR ABORTED JOB (E.G., ILLEGAL ID)

SRUS = NUMBER OF SYSTEM RESOURCE UNITS CONSUMED

MAX FL = MAXIMUM FIELD LENGTH REQUIRED OR REQUESTED IN OCTAL MEMORY WORDS

DPF ACC = NUMBER OF ACCESSES TO DIRECT ACCES PERMANENT FILES

IDPF ACC = NUMBER OF ACCESSES TO INDIRECT ACCESS PERMANENT FILES

PF UNITS = KILOUNITS OF PERMANENT FILE USAGE

MS UNITS = KILOUNITS OF MASS STORAGE USAGE

LINES PRT = NUMBER OF LINES PRINTED FOR JOB

CARDS RD = NUMBER OF CARDS READ IN FOR JOB

TP DRIVES = MAXIMUM NUMBER OF TAPE DRIVES OCCUPIED AT ANY ONE TIME DURING JOB PROCESSING

TP TIME = TOTAL TIME IN MINUTES OF TAPE DRIVE ASSIGNMENTS

Figure 8. Vocabulary for the Job Summary File

routine VOCAB. Examples of the first section of the Job Summary File are shown in Figure 9, and Figure 10 is an example of the second section.

In addition to listing the contents of the Job Summary File, the program also prints a short summary of statistics via the subroutine STAT. An example of this is shown in Figure 11.

D. PHASE THREE

The objective of this phase of the analysis is to evaluate the parameters that characterize the system workload and performance. The program organization is shown on two separate pages as Figure 12(a) (left) and Figure 12(b) (right). Not unlike the program in Phase Two, it involves four different stages in the processing:

a. sorting of the Job Summary File;
b. initialization;
c. processing the job records to characterize the system workload and performance at regular time intervals;
d. printout of results in the form of tables and line-printer plots.

1. Sorting

It was noted earlier that the sorting of the modified dayfile results in all records belonging to terminal jobs being grouped after those belonging to batch jobs. Consequently this sequence is maintained in the Job Summary File with the

NO.	JOBNAME	TYPE	CLASS	TIME IN	TIME OUT	EXC BEGIN	EXC END	CPU SECS	REMARKS
606	APVICMR	B	4	22.43.12	22.47.03	22.43.14	22.43.37	4.511	
607	APVICMT	E	1	-	-	22.43.37	23.08.56	.291	
608	AASYCNC	B	2	22.51.18	22.59.41	22.51.20	22.55.08	45.436	
609	AASYCND	B	4	22.51.26	23.01.00	22.51.30	22.57.20	73.151	
610	AASYCNE	B	4	22.51.30	23.00.34	22.51.33	22.57.43	82.406	
611	ASDYCNP	B	2	23.01.10	23.04.00	23.01.13	23.01.55	12.407	
612	ASDYCNR	B	2	23.01.34	23.01.51	23.01.39	23.01.44	0.000	AB
613	ASDYCNU	B	2	23.03.36	23.03.54	23.03.39	23.03.43	0.000	AB
614	ANMICOC	B	4	23.10.56	23.44.17	23.35.28	23.40.26	105.552	ST
615	BKZACOF	B	0	23.12.56	23.14.30	23.13.01	23.13.27	6.730	
616	BKZACOT	B	0	23.24.02	23.25.34	23.24.07	23.24.35	6.716	
617	ASDYCOY	B	2	23.28.14	23.28.33	23.28.19	23.28.24	0.000	AB
618	APVICPM	B	6	23.37.06	25.08.52	24.08.40	25.08.12	1767.791	ST
619	ASDYCPO	B	2	23.38.03	23.41.30	23.38.06	23.39.04	15.209	
620	ASDYCQS	B	2	24.04.21	24.10.49	24.04.25	24.06.03	52.025	
621	APVICQT	B	4	24.04.43	24.13.36	24.04.45	24.05.18	8.829	
622	APVICQV	B	4	24.05.24	24.15.22	24.05.26	24.05.59	8.935	
623	APVICQW	E	1	-	-	24.05.19	24.11.22	.375	
624	ASDYCQX	B	2	24.06.03	24.11.51	24.06.06	24.07.11	45.005	
625	APVICQZ	E	1	-	-	24.11.22	24.23.20	.360	
626	A3AICRY	B	5	-	25.23.26	24.27.41	25.13.30	36.050	ST
627	APVICSI	B	4	24.36.23	25.01.34	24.36.26	24.57.37	398.498	
628	00150AC	T	-	-	-	08.25.15	08.29.41	2.165	
629	00160AD	T	-	-	-	03.54.58	09.07.01	.421	
630	00150AE	T	-	-	-	08.36.28	13.12.48	316.326	
631	00170AF	T	-	-	09.13.00	08.36.18	10.45.59	1.054	
632	00140AH	T	-	-	-	08.43.22	09.00.01	.028	
633	00200AI	T	-	-	09.11.30	08.57.17	09.14.18	2.274	
634	00060AJ	T	-	-	-	09.00.03	09.01.37	1.427	
635	00210AK	T	-	-	-	09.02.10	09.03.41	.045	
636	00220AL	T	-	-	-	09.03.02	09.12.13	2.496	
637	00660AM	T	-	-	-	09.03.14	09.10.18	1.347	
638	00210AN	T	-	-	-	09.05.50	09.08.27	.052	
639	00160AO	T	-	-	-	09.08.52	09.34.48	1.770	
640	00220AR	T	-	-	-	09.12.45	09.14.10	.964	
641	00220AS	T	-	-	-	09.14.33	09.27.36	4.187	
642	00200AT	T	-	-	-	09.28.04	11.14.27	3.734	
643	00210AU	T	-	-	10.29.30	09.28.29	10.31.06	10.741	
644	00220AV	T	-	-	09.41.34	09.30.00	10.33.34	23.891	
645	00230AW	T	-	-	-	09.35.40	09.40.53	.182	
646	00230AX	T	-	-	-	09.41.18	09.41.36	.001	
647	00230AY	T	-	-	-	11.10.41	11.19.14	.044	
648	00060AZ	T	-	-	-	09.54.06	10.00.06	.275	
649	00110BA	T	-	-	-	09.54.22	10.12.09	.472	
650	00140BB	T	-	-	-	09.56.40	10.17.12	1.986	
651	00050BC	T	-	-	-	10.12.58	10.17.38	6.256	
652	00070BD	T	-	-	-	10.20.25	10.26.02	.076	
653	00060BE	T	-	-	-	10.31.10	10.33.39	.071	
654	00210BF	T	-	-	10.42.42	10.33.20	10.45.51	.715	
655	00210BH	T	-	-	-	10.46.38	11.00.10	.058	
656	00050BI	T	-	-	-	10.46.49	10.54.57	1.037	
657	00220BJ	T	-	-	-	10.49.12	11.57.28	5.233	
658	00140BK	T	-	-	-	10.54.16	10.55.11	.024	
659	00060BL	T	-	-	10.59.27	10.58.17	10.59.07	.184	
660	00210BM	T	-	-	-	11.01.55	11.04.21	.015	

Figure 9. Contents of First Section of the Job Summary File

NO.	SRUS	MAX FL	DPF ACC	IDPF ACC	PF UNITS	MS UNITS	LINES PRT	CARDS RD	TP DRIVES	TP TIME
606	6.196	60000	3	0	.032	3.828	832	176	-	-
607	5.696	13000	11	1	.062	2.938	0	0	1	8.833
608	48.011	1023000	2	5	.174	18.788	576	34	-	-
609	72.469	1023000	2	5	.174	19.627	829	28	-	-
610	80.676	1023000	2	5	.174	19.974	832	28	-	-
611	17.295	712000	0	0	.010	14.417	2560	951	-	-
612	2.013	25000	0	2	.016	.443	128	307	-	-
613	2.013	25000	0	2	.016	.443	64	307	-	-
614	97.373	10000000	0	3	.108	17.014	2528	112	-	-
615	7.689	450000	0	0	.005	3.958	1088	343	-	-
616	7.681	450000	0	0	.005	3.971	1088	343	-	-
617	2.006	25000	0	0	.010	.387	64	952	-	-
618	1448.390	11000000	2	2	.042	23.652	958	1108	-	-
619	20.246	712000	0	0	.034	16.356	2495	951	-	-
620	38.695	640000	0	2	.044	6.019	1024	310	-	-
621	9.528	600000	3	0	.032	5.325	1659	356	-	-
622	9.594	600000	3	0	.032	5.208	1659	356	-	-
623	6.329	130000	8	1	.050	3.615	0	0	1	.833
624	34.064	640000	0	2	.044	6.014	1024	310	-	-
625	6.324	130000	7	1	.046	3.614	0	0	1	9.200
626	136.567	700000	10	1	.110	10.380	13247	0	1	12.950
627	328.030	10000000	2	2	.031	22.504	3730	108	-	-
628	3.331	540000	3	7	.070	3.744	0	0	-	-
629	1.960	540000	6	14	.606	3.420	0	0	-	-
630	1.322	540000	11	36	4.977	153.980	0	0	-	-
631	1.997	540000	17	44	3.109	11.308	256	0	-	-
632	1.079	540000	3	5	.071	.501	0	0	-	-
633	3.044	540000	4	7	.089	2.849	192	0	-	-
634	2.808	540000	2	6	.075	3.717	0	0	-	-
635	1.084	540000	3	6	.060	.534	0	0	-	-
636	1.011	540000	7	11	.151	8.142	0	0	-	-
637	2.799	540000	4	4	.079	6.610	0	0	-	-
638	1.188	540000	4	5	.110	1.182	0	0	-	-
639	3.137	540000	4	13	.152	4.695	0	0	-	-
640	2.270	540000	0	1	.011	2.642	0	0	-	-
641	3.079	540000	3	10	.117	12.442	0	0	-	-
642	6.972	540000	5	11	1.201	15.381	0	0	-	-
643	12.266	540000	3	7	.070	16.802	576	0	-	-
644	17.033	540000	6	14	.186	8.965	512	0	-	-
645	2.292	540000	5	5	.074	1.292	0	0	-	-
646	1.002	540000	0	0	.005	.400	0	0	-	-
647	1.572	540000	11	23	.073	4.528	0	0	-	-
648	1.366	540000	3	5	.068	1.379	0	0	-	-
649	1.085	540000	20	15	.683	9.082	0	0	-	-
650	4.582	540000	3	5	.124	15.471	0	0	-	-
651	6.033	540000	3	9	.101	2.230	0	0	-	-
652	1.159	540000	3	8	.070	.893	0	0	-	-
653	1.129	540000	2	4	.044	.941	0	0	-	-
654	1.935	540000	3	4	.065	2.257	84	0	-	-
655	1.306	540000	3	5	.075	1.564	0	0	-	-
656	2.680	540000	3	10	.110	4.538	0	0	-	-
657	9.788	540000	20	5	.220	21.690	0	0	-	-
658	1.082	540000	4	4	.064	.484	0	0	-	-
659	1.398	540000	3	3	.047	1.753	320	0	-	-
660	1.047	540000	3	6	.070	.613	0	0	-	-

Figure 10. Contents of Second Section of the Job Summary File

STATISTICS FOR DAYFILE 79/08/10

TOTAL NUMBER OF RECORDS READ FROM SORTED DAYFILE	= 26082
NUMBER OF RECORDS USED IN THIS ANALYSIS	= 12125
NUMBER OF RECORDS NOT USED IN THIS ANALYSIS	= 13957
TOTAL NUMBER OF JOB RECORDS WRITTEN ON JOB-SUMMARY FILE	= 785
NUMBER OF TIME-SHARING JOBS	= 158
NUMBER OF SYSTEM JOBS	= 5
NUMBER OF REMOTE BATCH JOBS	= 190
NUMBER OF BATCH JOBS	= 432
OF WHICH THE NUMBER OF STALL JOBS	= 38
TOTAL NUMBER OF JOBS FOR WHICH RECORDS ARE INCOMPLETE	= 31
NUMBER OF TIME-SHARING JOBS ALREADY IN SYSTEM AT START	= 0
NUMBER OF NON TS JOBS ALREADY IN SYSTEM AT START	= 0
DURING PERIOD OF ANALYSIS NUMBER OF JOBS ENTERING SYSTEM	= 793
TIME-SHARING JOBS	= 159
SYSTEM JOBS	= 7
BATCH JOBS INCLUDING REMOTE BATCH	= 627

Figure 11. Printout of Statistics for Account Dayfile

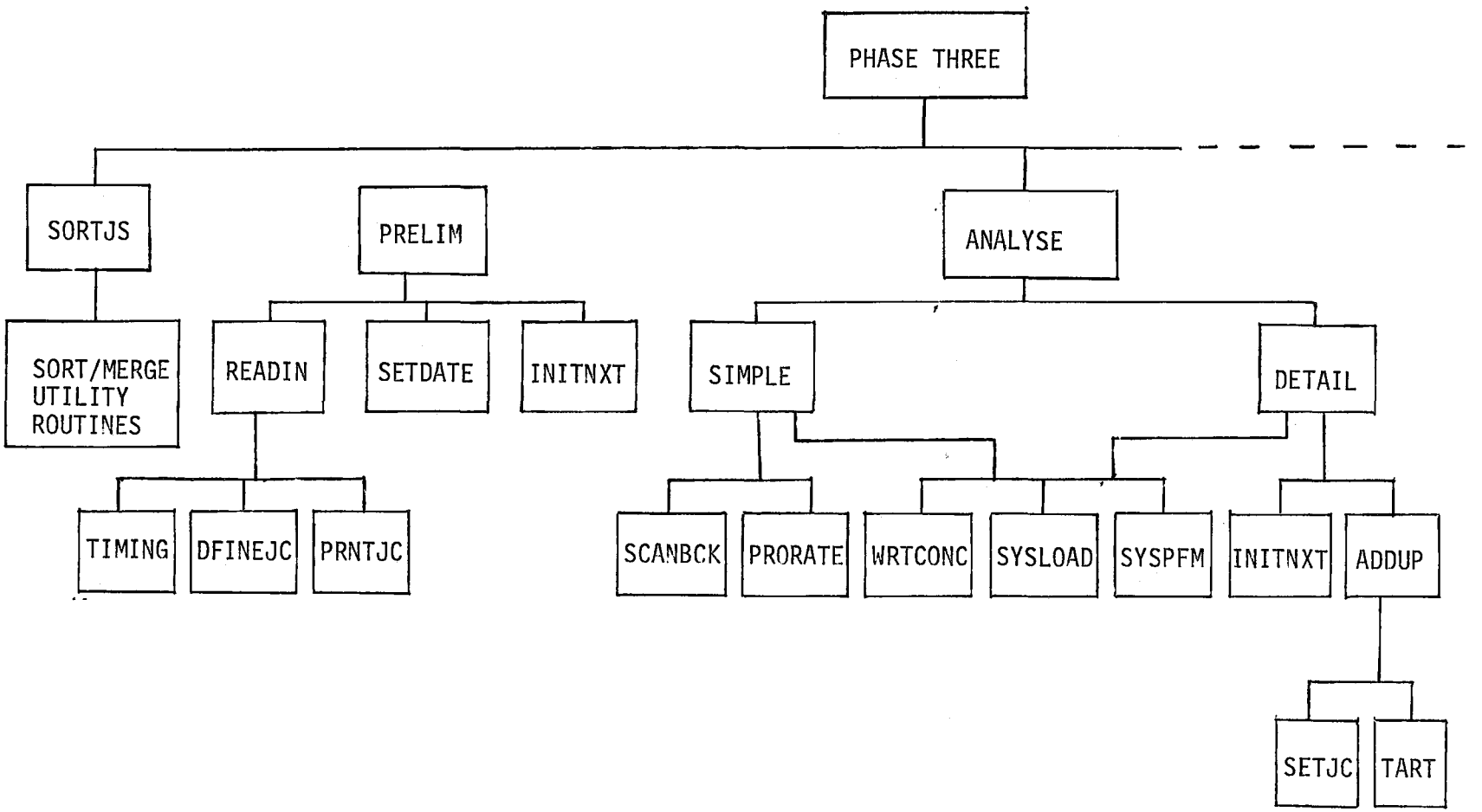


Figure 12(a) Organizational Chart for Program PHASE3 (left)

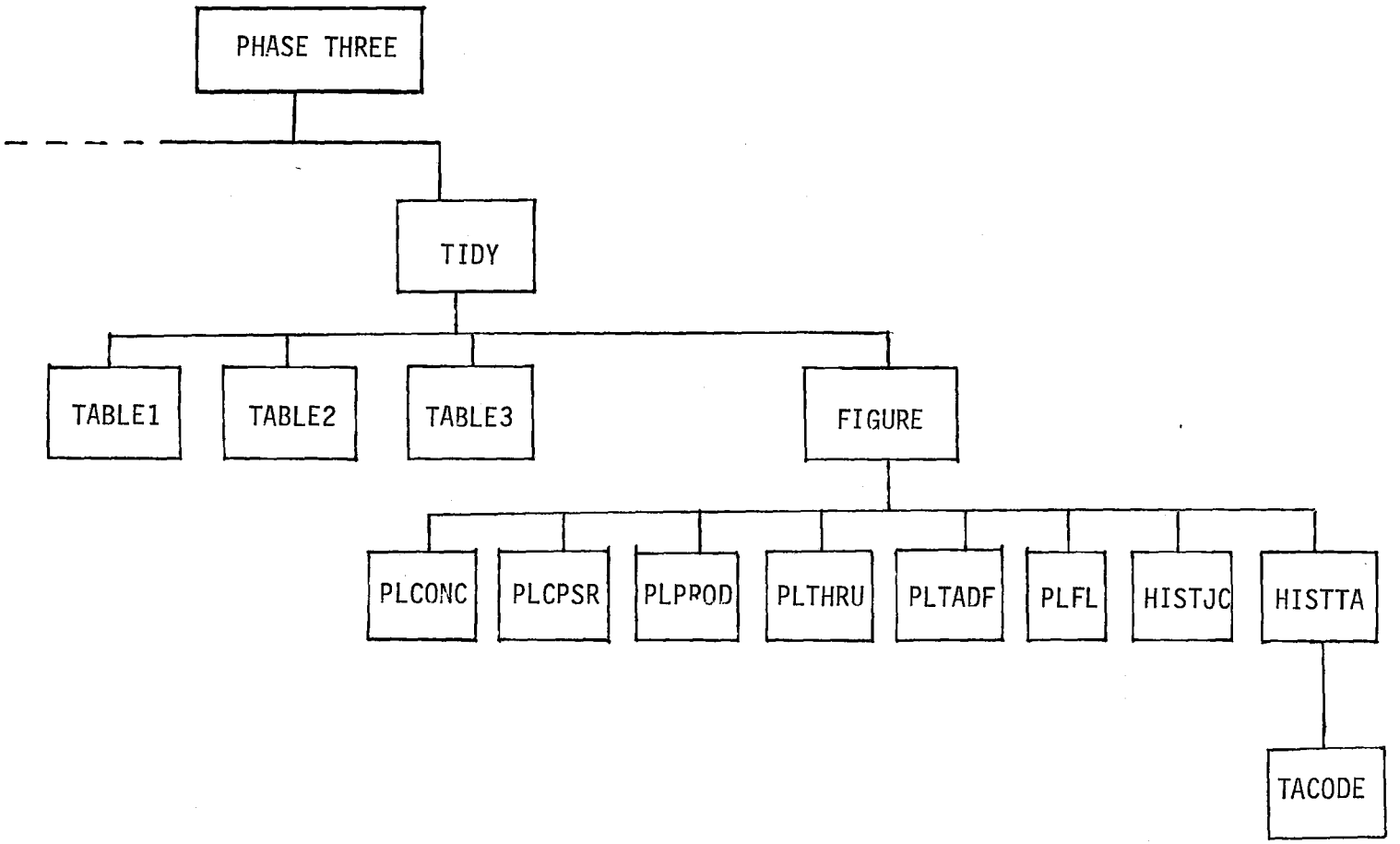


Figure 12(b) Organizational Chart for Program PHASE3 (right)

batch job records preceding the terminal job records. They may have to be merged together so that they are ordered according to the time at which job execution starts. Once again this is accomplished in the subroutine SORTJS by the FORTRAN Extended interface with the SORT/MERGE utility program in the form of subroutine calls. The sort key in this case is the field in the Job Summary File record that records the time at which that particular job began its execution in the system. This is the field labelled TEXBGN. Since the time recorded is in the original account dayfile format, i.e., alphanumeric, the same COBOL-6 character set collating sequence can be used.

2. Initialization

Some of the functions performed in this stage by the subroutine PRELIM are similar to those handled by subroutine INITIAL of Program PHASE2. It will read and interpret the user's input on selection of options and also perform other initialization.

(i) Subroutine READIN

The user may specify the lower and upper time limits of analysis. Jobs that began their execution beyond these time limits will be ignored except in the evaluation of the job concurrency parameter, which will be discussed later. Other options include the

time interval (e.g., hourly) over which the system workload and performance parameters are to be evaluated, and the selection of full or partial printout of the results. The user may also redefine the job classification, which will then override the classification of jobs by the computer centre. The classification scheme used by this program is based on the number of CPU seconds or System Resource Units (SRU) consumed by the job, and on whether the job required magnetic tapes. The subroutine DFINEJC performs this reclassification and the subroutine PRINTJC prints out a table of the classification scheme according to user specifications. A sample table for such a redefined classification is shown in Figure 13. All the above options are described in more detail in the User's Guide (Appendix B).

(ii) Subroutine SETDATE

The data written on the header of the Job Summary File is read and again written on the header of each of the output files.

(iii) Subroutine INITNXT

Before the parameters characterizing the system workload and performance for the next time period may be evaluated, they must be initialized. Subroutine INITNXT introduces these variables which are grouped

```
 OPTION SELECTION INPUT
 0800 2400

 PERIOD OF ANALYSIS FROM   08.00.00. TO  24.00.00.
 AT INTERVALS OF    60 MINUTES

 JOB CLASS REDEFINITION INPUT
JCCPU   10   20   50  100

 JOB CLASSES REDEFINED ACCORDING TO  CPU SECS
```

JOB CLASS	RANGE OF CPU SECS		TAPE
0	0	10	NO
1	0	10	YES
2	10	20	NO
3	10	20	YES
4	20	50	NO
5	20	50	YES
6	50	100	NO
7	50	100	YES
8	100	AND UP	NO
9	100	AND UP	YES

Figure 13. Job Class Redefinition Printout

into labelled COMMON blocks, and initializes them if necessary. These COMMON blocks are:

a. /JCOUNT/

It contains variables that keep count of the number of jobs in each category.

b. /SUMS/

The total amount of various system resources consumed over a period of time by all jobs executing during that time are stored in variables of this block.

c. /MEANS/

The program computes the average amount of various system resources consumed by a job during each time interval. These average values are stored in variables belonging to this block.

d. /SUMTM/,/AVTIME/

Variables in these blocks are used for evaluating the average processing time and turnaround time over a time interval for jobs in each class.

e. /FRACSUM/

Evaluation of the system workload and performance parameters is done at regular time intervals. Some of the jobs, especially terminal jobs, may remain in the system for a period of time that spans over more than one time interval. The

amount of certain system resources consumed by a job of this kind should be distributed among these time intervals. The way in which this distribution is handled will be discussed further later. The variables required for this purpose are grouped in the COMMON block/FRACSUM/.

3. Processing

Subroutine ANALYSE is the main module for analyzing the Job Summary File. The flow chart for the ANALYSE program logic is shown in Figure 14. The objectives of this module are to produce from the Job Summary File three separate output files containing the information on job concurrency, system workload and system performance.

(i) Job Concurrency

This is written by the subroutine WRTCONC. It contains information on the average number of jobs that are processed "concurrently" in the system during a time period, the system being one of multi-programming environment. This information is obtained for every time interval up to the upper time limit specified by the user. The term "concurrency" is defined as follows. During a period of time from T_1 to T_2, a total of N jobs are processed by the system, and the length of time job i spends in the system is t_i. The mean system concurrency c during this period is given by

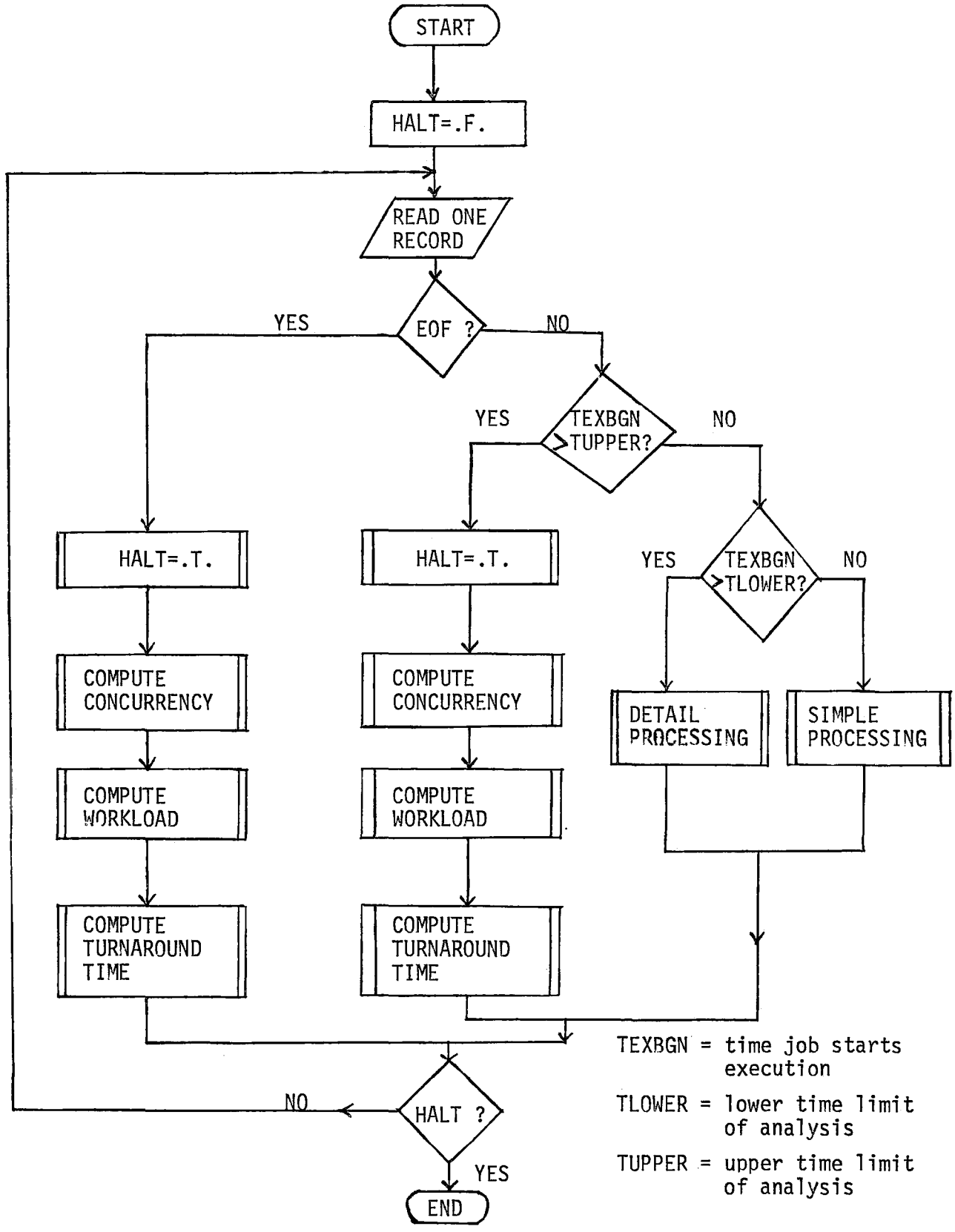


Figure 14. Flow Chart for Subroutine ANALYSE

$$c = \frac{\sum_{i=1}^{N} t_i}{T_2 - T_1}$$

During program development it was anticipated that this information on system job concurrency might be used by programs to be developed in a separate project for terminal job response time measurements. The concurrency is computed separately for batch and terminal originated jobs in this program. A sample printout is shown in Figure 15.

(ii) System Workload

The System Workload File written by the subroutine SYSLOAD has values of parameters that are considered to characterize the workload. For simplicity in file organization, it also includes parameters that may be considered to characterize the internal performance of the system, i.e., system throughput rate and CPU productivity. The information written on this file is given in Figure 16, which is a sample printout by the subroutine TABLE2.

(iii) System Performance

This file written by the subroutine SYSPFM contains information on the external performance of the system as viewed by the users. The information is collected by averaging over all batch jobs in each

ANALYSIS OF JOB SUMMARY FILE FOR 79/08/10.

TABLE OF AVERAGE NUMBER OF USERS IN SYSTEM ON 79/08/10.

08.00 - 09.00	09.00 - 10.00	10.00 - 11.00	11.00 - 12.00	12.00 - 13.00	13.00 - 14.00	
.25	3.18	8.12	10.82	9.48	8.73	NON TIME-SHARING
1.27	5.29	5.32	5.77	6.05	5.62	TIME-SHARING

14.00 - 15.00	15.00 - 16.00	16.00 - 17.00	17.00 - 18.00	18.00 - 19.00	19.00 - 20.00	
8.34	12.43	11.44	11.86	8.67	3.01	NON TIME-SHARING
6.73	6.94	7.03	3.89	.99	.52	TIME-SHARING

20.00 - 21.00	21.00 - 22.00	22.00 - 23.00	23.00 - 24.00			
6.60	6.71	5.05	3.35			
.52	.68	.49	1.11			

Figure 15. Printout of System Job Concurrency

TABLE OF SYSTEM LOAD PARAMETERS FOR 79/08/10.

	12.00 - 13.00	13.00 - 14.00	14.00 - 15.00	15.00 - 16.00
TOTAL NUMBER OF JOBS ENTERING SYSTEM	68	63	63	88
NUMBER OF TERMINAL USERS LOGGED ON	17	18	18	13
NUMBER OF BATCH JOBS ENTERING SYSTEM	51	45	45	75
AVERAGE CPU SECONDS PER JOB	29.640	27.584	39.959	30.323
AVERAGE SRU USED PER JOB	18.818	21.015	14.562	12.268
AVERAGE MASS STORAGE UNITS USED PER JOB	18.460	8.136	9.595	5.250
AVERAGE PERMANENT FILE UNITS USED PER JOB	.090	.055	.105	.073
AVERAGE NUMBER OF ACCESSES TO DIRECT PF	2.926	2.111	2.175	2.182
AVERAGE NUMBER OF ACCESSES TO INDIRECT PF	3.426	2.603	3.968	2.477
AVERAGE CENTRAL MEMORY USED IN OCTAL	57363	53500	56846	52906
NUMBER OF JOBS REQUIRING TAPES	9	5	1	4
AVERAGE NUMBER OF DRIVES USED PER TAPE JOB	1.000	1.000	1.000	1.000
AVERAGE DRIVE TIME IN MINUTES PER TAPE JOB	1.791	3.177	3.967	1.638
AVERAGE NUMBER OF CARDS READ PER BATCH JOB	145	261	110	188
AVERAGE NUMBER OF LINES PRINTED PER BATCH JOB	1444	1145	1352	630
CPU PRODUCTIVITY	.589	.479	.673	.738
SYSTEM THROUGHPUT (JOBS PER HOUR)	71.588	62.522	60.634	87.572

Figure 16. Printout of System Workload Parameters

class for each time interval, and includes the following:

a. turnaround time, which is the time elapsed between read-in of a job and completion of the corresponding printout;

b. processing time, which is the elapsed time between the start and end of job execution in the system;

c. input queuing time, which is the time between read-in of a job and the time execution starts;

d. output queuing time, which is the elapsed time between the end of job execution and completion of its printout;

f. External Delay Factor, which is defined as the ratio between turnaround time and processing time.

A sample printout of this information is shown in Figure 17.

In evaluating the job concurrency of the system, the processing time of a job that spans more than one time interval has to be distributed among these intervals. Similarly when evaluating the CPU productivity, the amount of CPU time consumed by such an "overflow" job should also be prorated to reflect more closely the proper share of the CPU time taken by this job during these intervals. Consequently this proration has to be followed through from the very beginning of the Job Summary File even if the user of the program has specified a later time as the lower time limit for the analysis.

79/08/10

15.00 - 16.00	JOBCLASS	NO. IN CLASS	TURNAROUND TIME	PROCESS TIME	TIME IN IN. QUEUE	TIME IN OUT. QUEUE	EXT. DELAY FAC
	0	58	76.047	1.984	20.081	53.981	38.321
	1	2	154.700	.417	29.542	124.742	371.280
	2	3	90.239	5.222	69.933	15.083	17.280
	3	0	-	-	-	-	-
	4	4	35.942	31.142	.033	4.767	1.154
	5	1	48.633	46.700	.483	1.450	1.041
	6	4	83.138	24.921	54.767	3.450	3.336
	7	1	302.133	58.183	181.717	62.233	5.193
	8	2	202.033	20.542	160.183	21.308	9.835
	9	0	-	-	-	-	-
WEIGHTED MEANS			82.960	6.691	28.738	47.531	40.812

79/08/10

16.00 - 17.00	JOBCLASS	NO. IN CLASS	TURNAROUND TIME	PROCESS TIME	TIME IN IN. QUEUE	TIME IN OUT. QUEUE	EXT. DELAY FAC
	0	25	8.410	1.363	5.145	1.901	6.169
	1	3	2.261	1.333	.011	.917	1.696
	2	10	65.247	9.660	47.238	8.348	6.754
	3	0	-	-	-	-	-
	4	7	33.683	28.107	.162	5.414	1.198
	5	0	-	-	-	-	-
	6	6	98.172	28.114	52.386	17.672	3.492
	7	1	156.417	63.917	88.733	3.767	2.447
	8	2	125.450	59.233	58.950	7.267	2.118
	9	1	286.367	166.600	118.517	1.250	1.719
WEIGHTED MEANS			43.418	15.438	22.575	5.405	4.811

Figure 17. Printout of System Timeliness Parameters

This has led to the need for two different types of processing for a Job Summary record, which consists of a simplified examination by the subroutine SIMPLE of records for jobs that entered the system prior to the specified lower time limit, and a detailed examination by the Subroutine DETAIL for the rest. The flow charts for these two subroutines are shown in Figures 18 and 19.

The technique developed in this program for handling "overflow" jobs employs a data structure to simulate "overflow buckets". For each overflow job an overflow bucket is provided which stores the remaining processing time, CPU time etc. that should be allotted to the next time interval(s). Before processing the first job record within a time interval, these overflow buckets are scanned to retrieve the allotments given to this interval by jobs that have already begun execution. If a job is found to spill over still to the next time interval in this scan, a new bucket is provided to store the information after the appropriate allotments are taken for the current time interval.

Analysis of a Job Summary record also includes the computation of accumulated usage of various system resources by the subroutine ADDUP, the computation of "timeliness" parameters by the subroutine TART and setting the job class according to user specification by the subroutine SETJC.

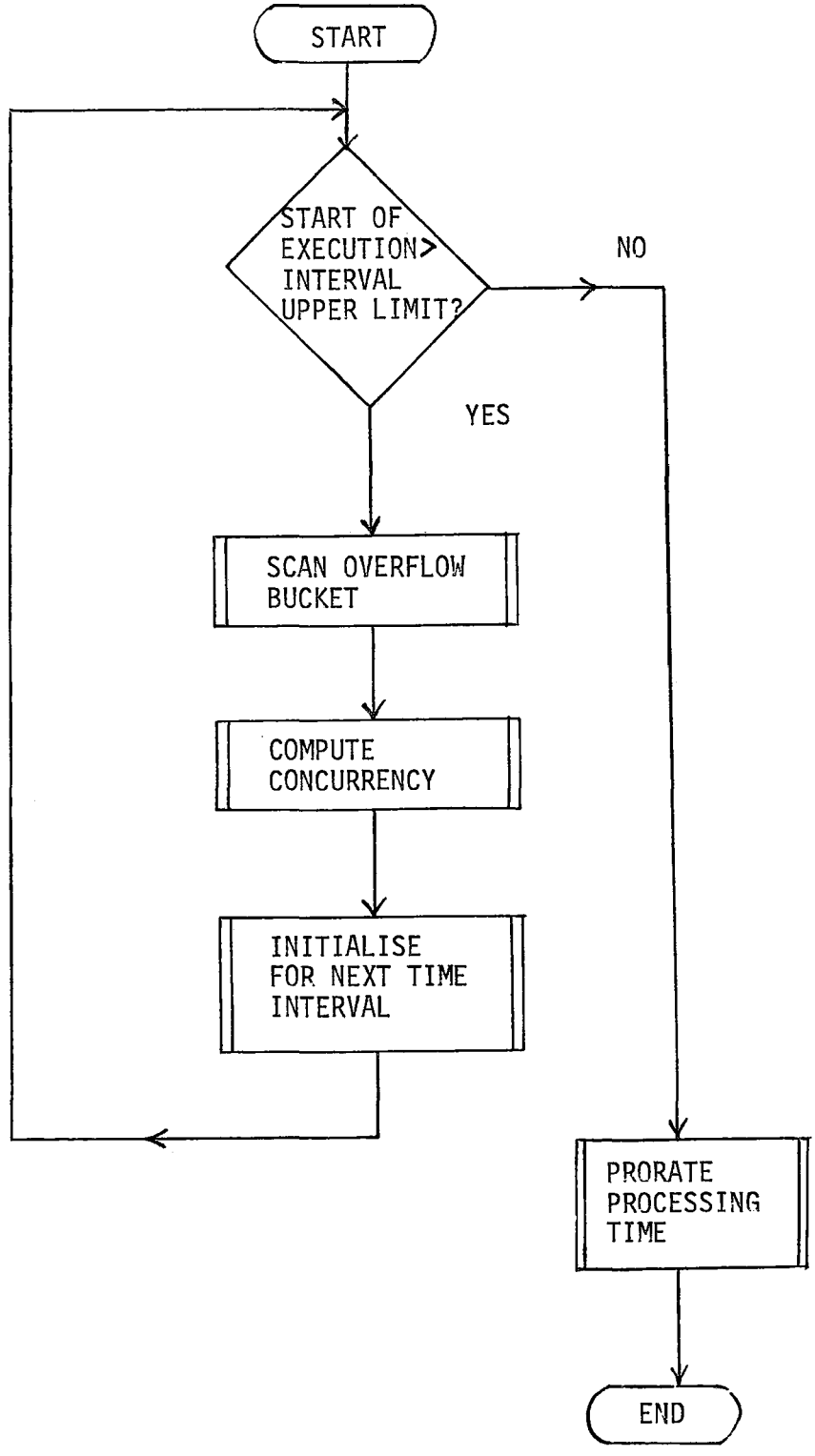


Figure 18. Flow Chart for Subroutine SIMPLE

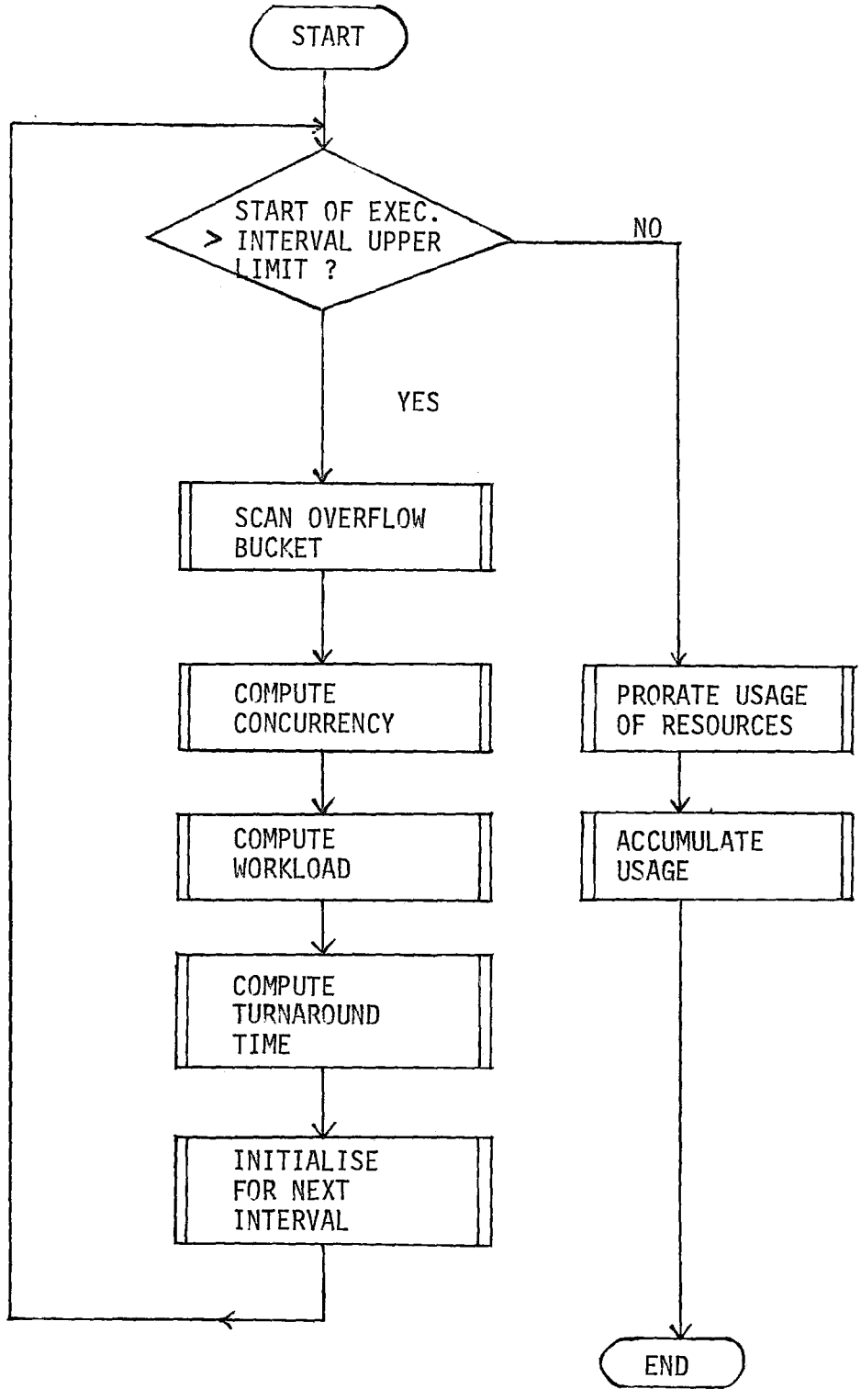


Figure 19. Flow Chart for Subroutine DETAIL

4. Display of Results

On completion of processing of the Job Summary File, the subroutine TIDY is called to display the results of analysis. The information written on the three output files is read back and presented in three separate tables as previously described. This is performed by the three subroutines TABLE1, TABLE2, and TABLE3.

Subroutine FIGURE displays the results in graphical form, i.e., line-printer plots and histograms by calling the following subroutines:

a. PLCONC plots the system job concurrency vs. the time of the day
b. PLCPSR plots the average CPU time and SRU's per job vs. time of the day
c. PLFL plots the mean field length required per job vs. time of the day
d. PLPROD plots the CPU productivity vs. time of the day
e. PLTHRU plots the system throughput rate vs. time of the day
f. PLTADF plots the turnaround time and external delay factor vs. time of the day
g. HISTJC produces hitogram giving the frequency distribution of jobs processed by the system for the whole period of analysis. The job categories included in this histo-

gram are batch jobs in each job class, terminal jobs and jobs requiring magnetic tapes.

h. HISTTA produces histograms giving the frequency distributions of the turnaround time, one for each job class.

The turnaround time classes used for these plots are defined by the program in subroutine PRELIM, and are printed out by subroutine TACODE along with each turnaround time histogram.

Examples of these graphical printouts are shown in Figures 20-29. Some library routines from the IMSL package are used to produce these plots [7]. They include:

a. USPLX, which provides a printer plot of up to 10 functions superimposed upon the same plot;

b. USHIST, which provides a vertical histogram,

c. USMNMX, which locates the minimum and maximum values of a vector.

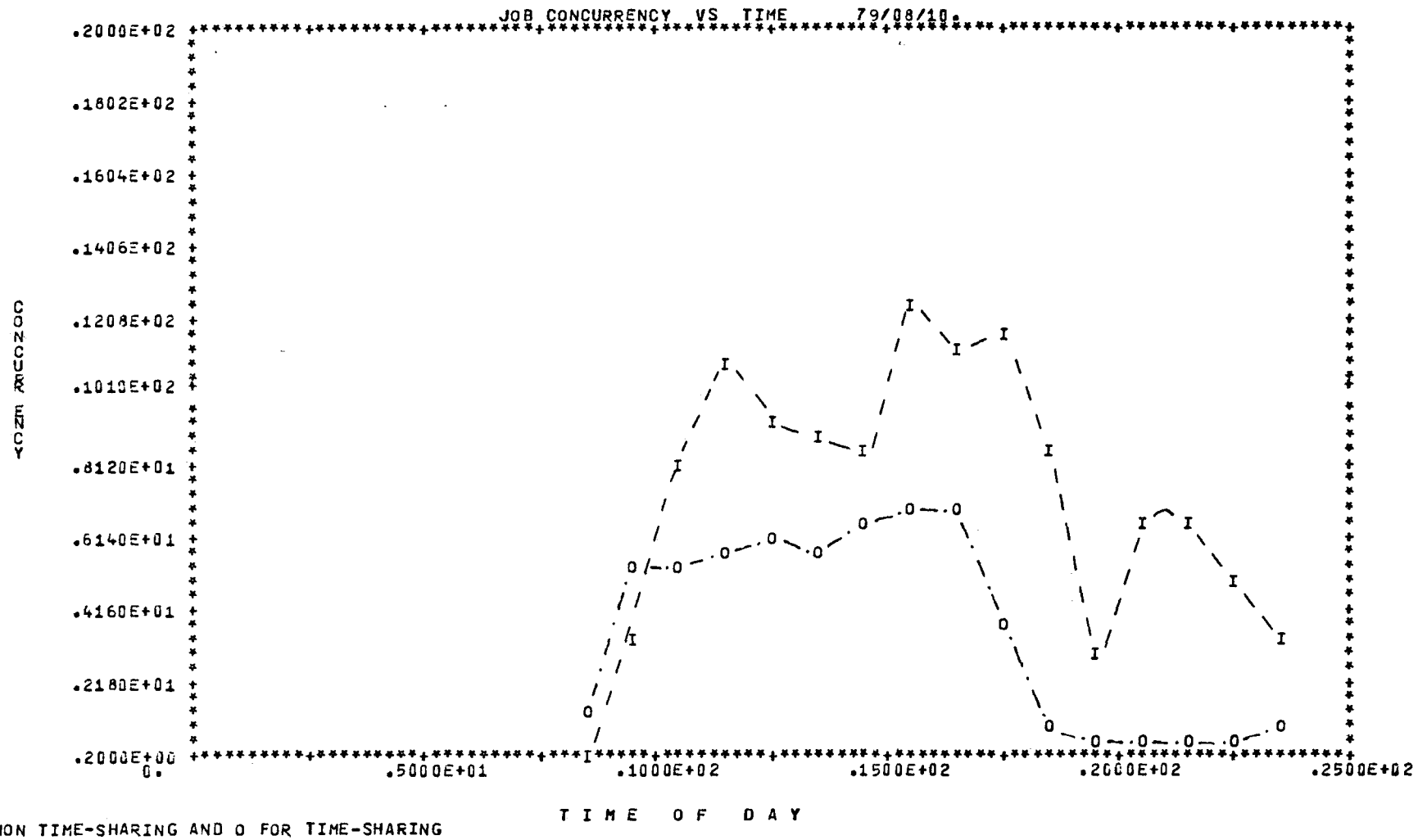


Figure 20. Line-Printer Plot of Job Concurrency vs. Time of the Day
(lines connecting points were put in later by hand.)

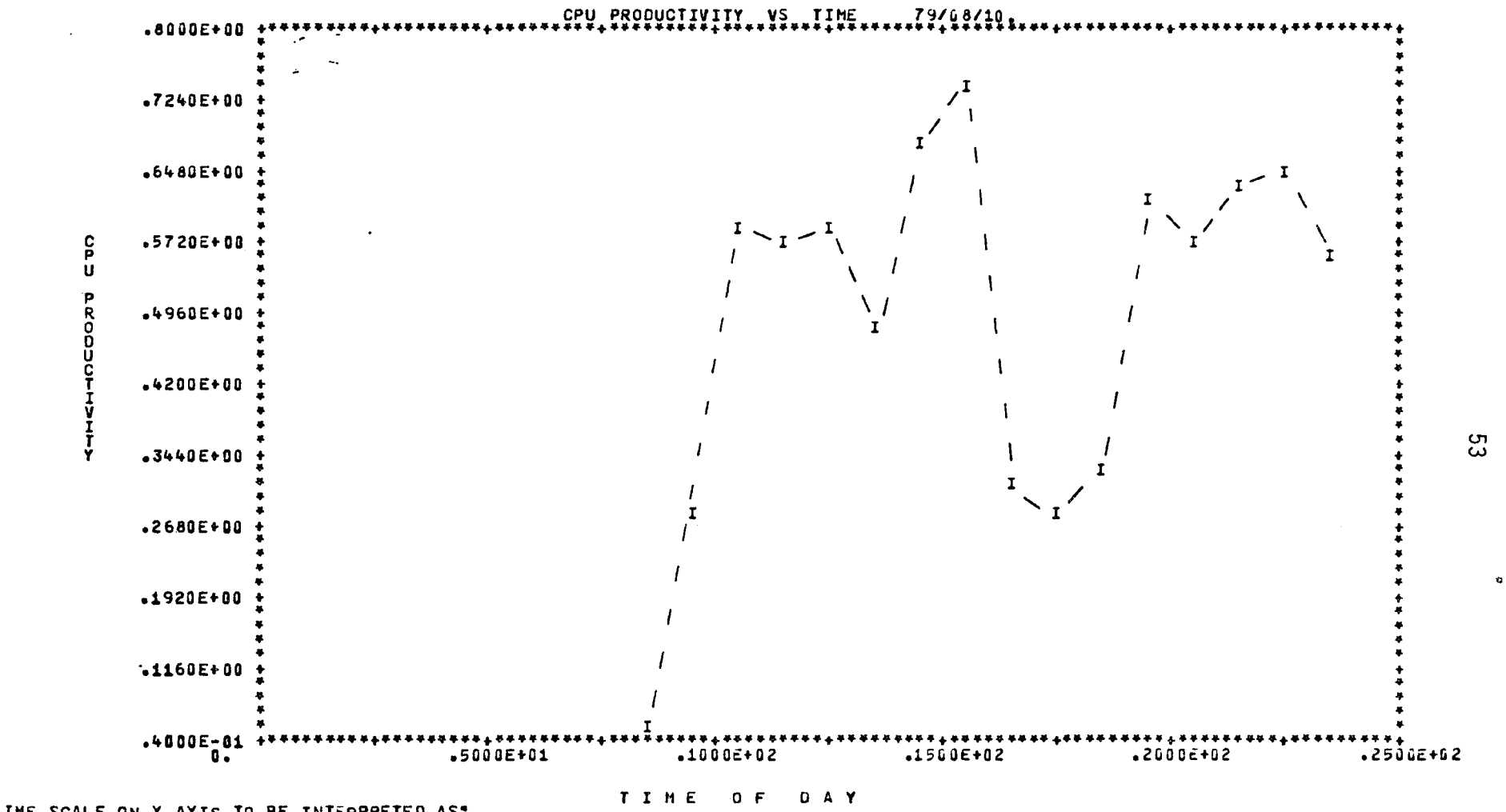


Figure 21. Line-Printer Plot of CPU Productivity vs. Time of the Day
(Connecting line was put in later by hand.)

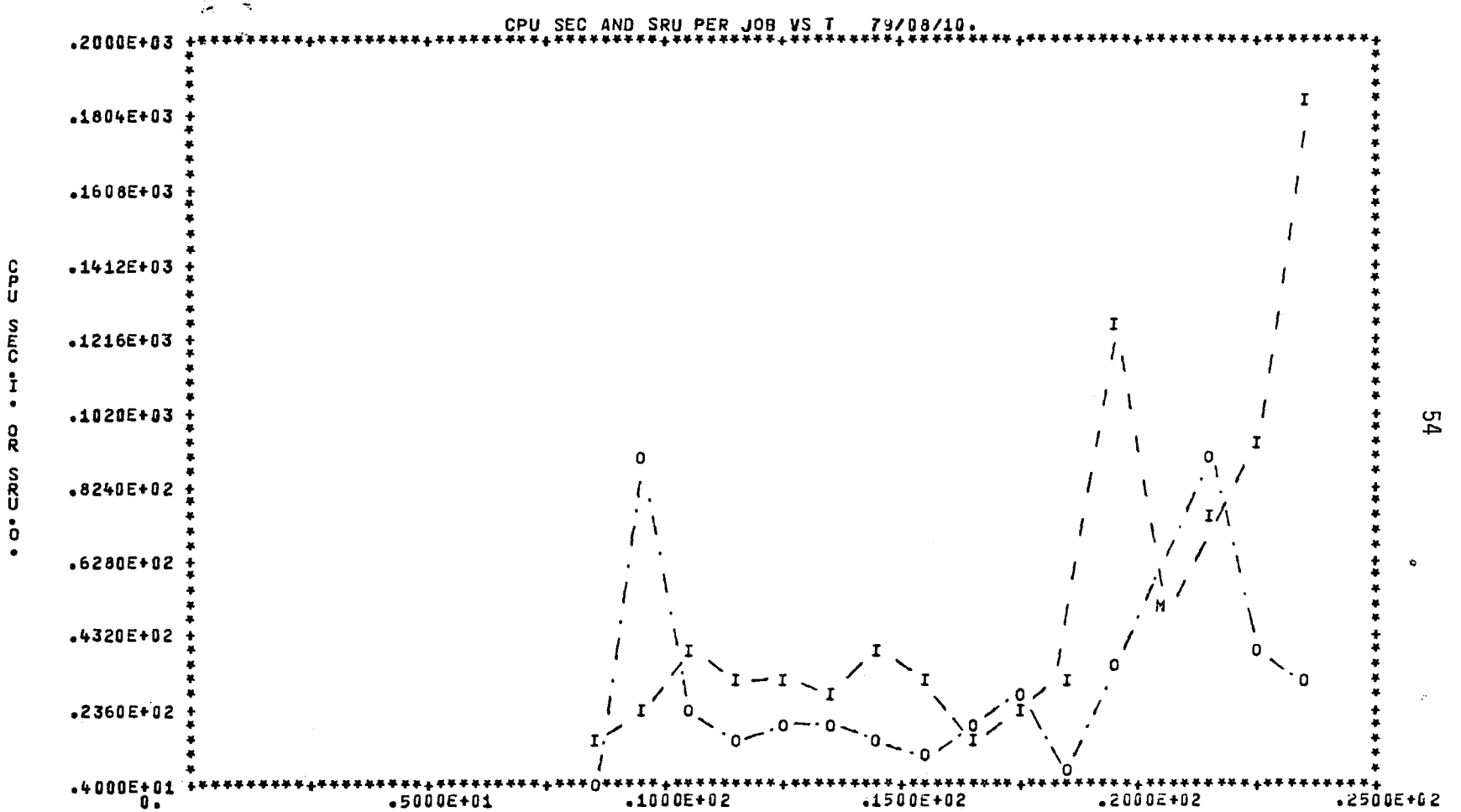


Figure 22. Line-Printer Plot of CPU Seconds and SRU's per Job vs. Time of the Day (lines connecting points were put in later by hand)

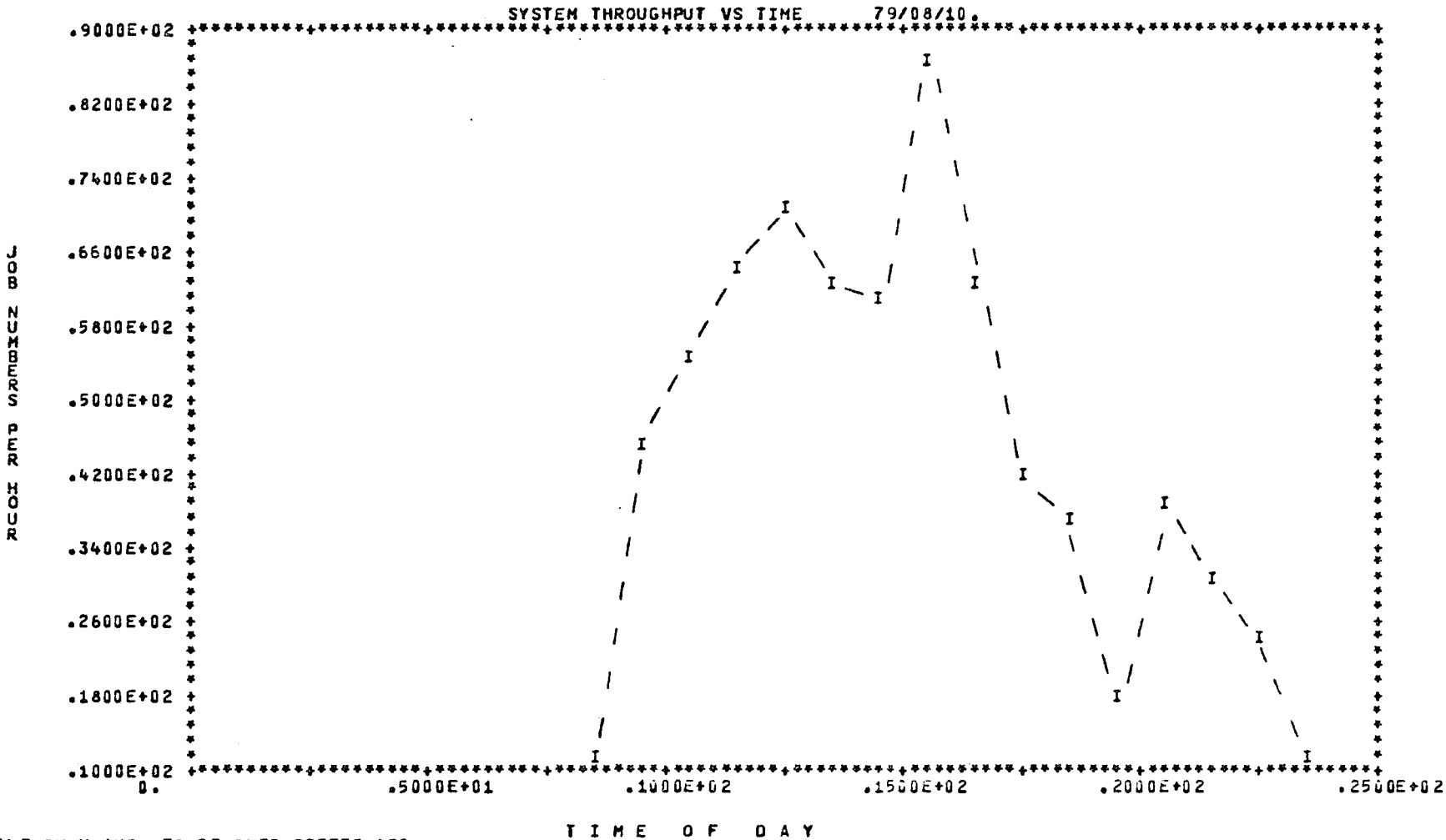


Figure 23. Line-Printer Plot of System Throughput Rate vs. Time of the Day (connecting line was put in later by hand).

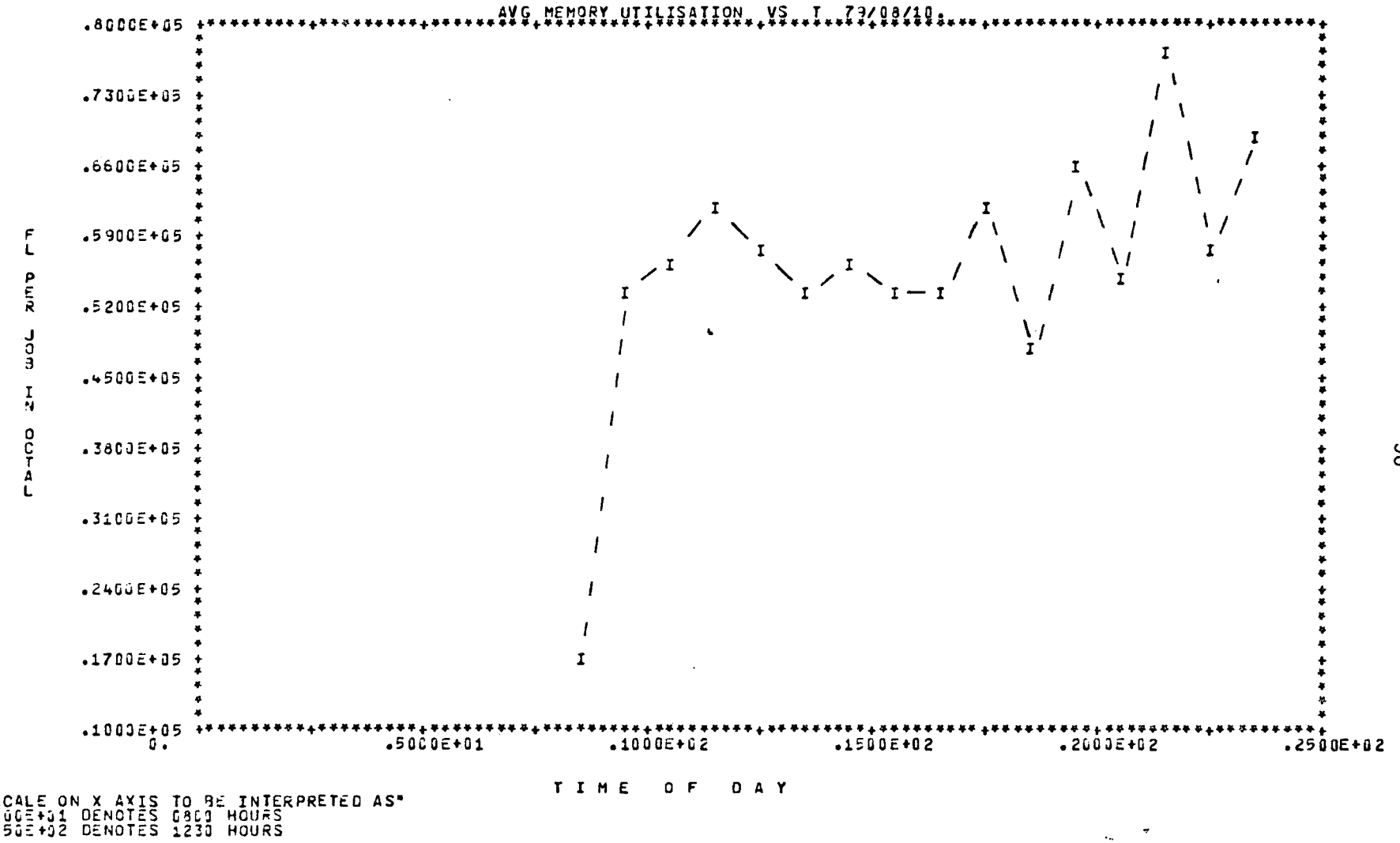
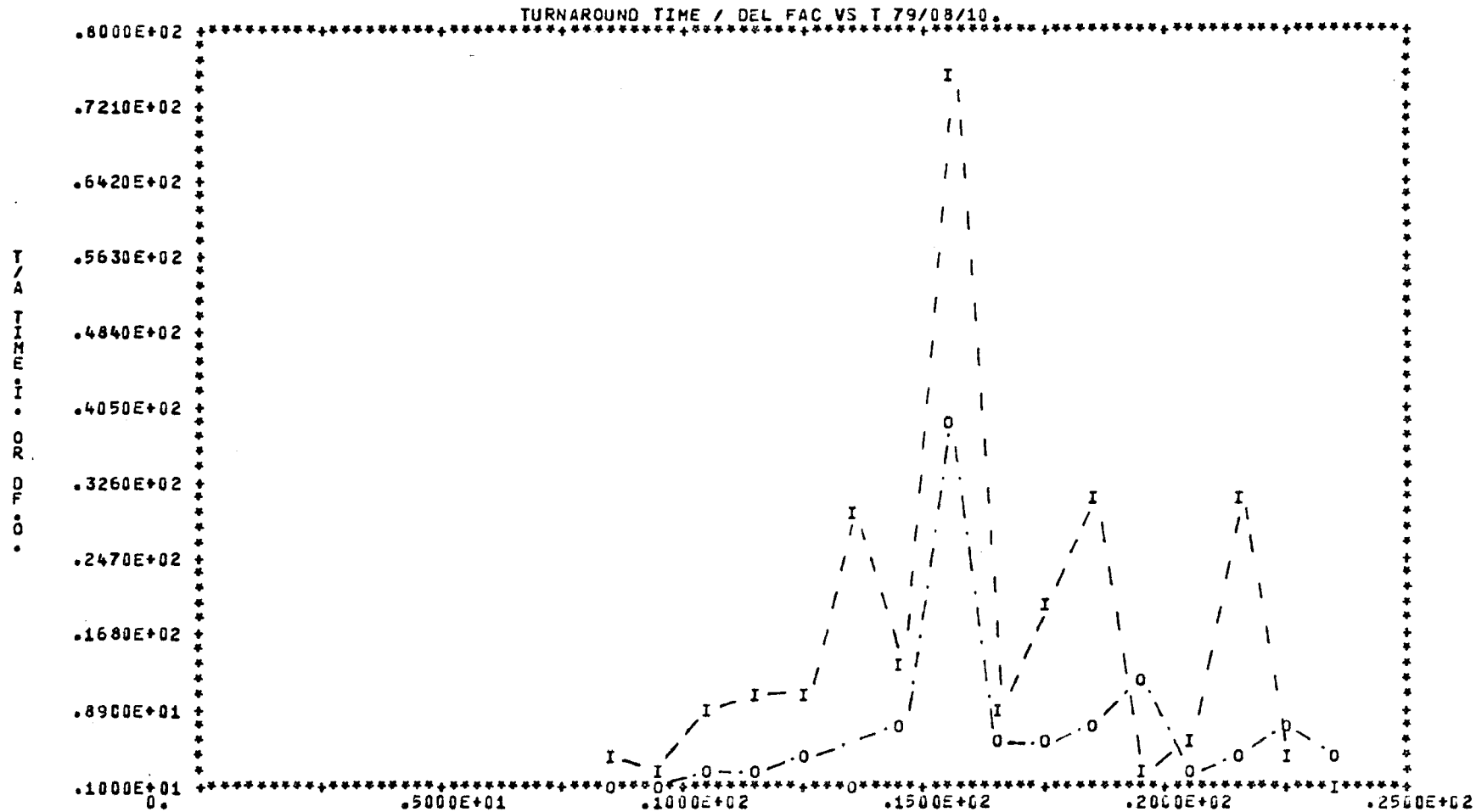


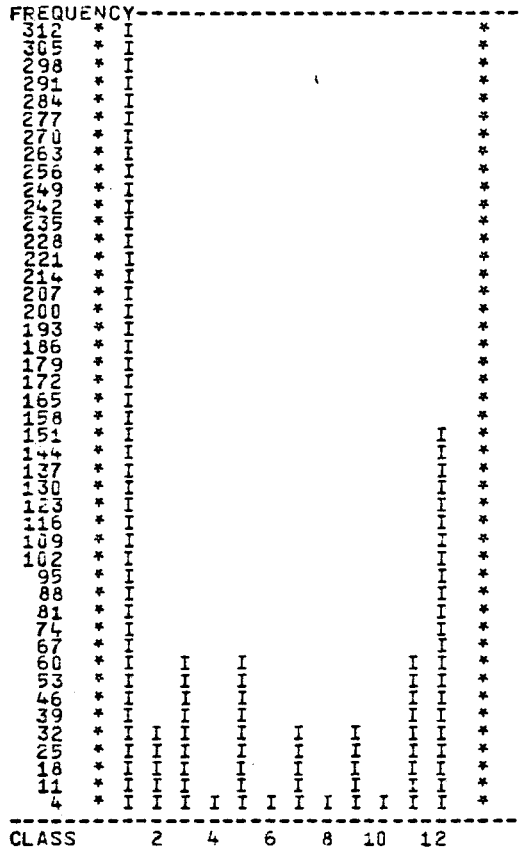
Figure 24. Line=Printer Plot of Memory Utilization vs. Time of the Day
(connecting line was put in later by hand.)



FOR JOB CLASS 0

TIME SCALE ON X AXIS TO BE INTERPRETED AS*
.8000E+01 DENOTES 0800 HOURS
.1250E+02 DENOTES 1230 HOURS
POINTS MARKED M AT Y=1.0 INDICATE NO JOBS IN THIS CLASS DURING THAT PERIOD

Figure 25. Line=Printer Plot of Turnaround Time and Delay Factor vs. Time of the Day for Job Class 0 (connecting lines were put in later by hand.)

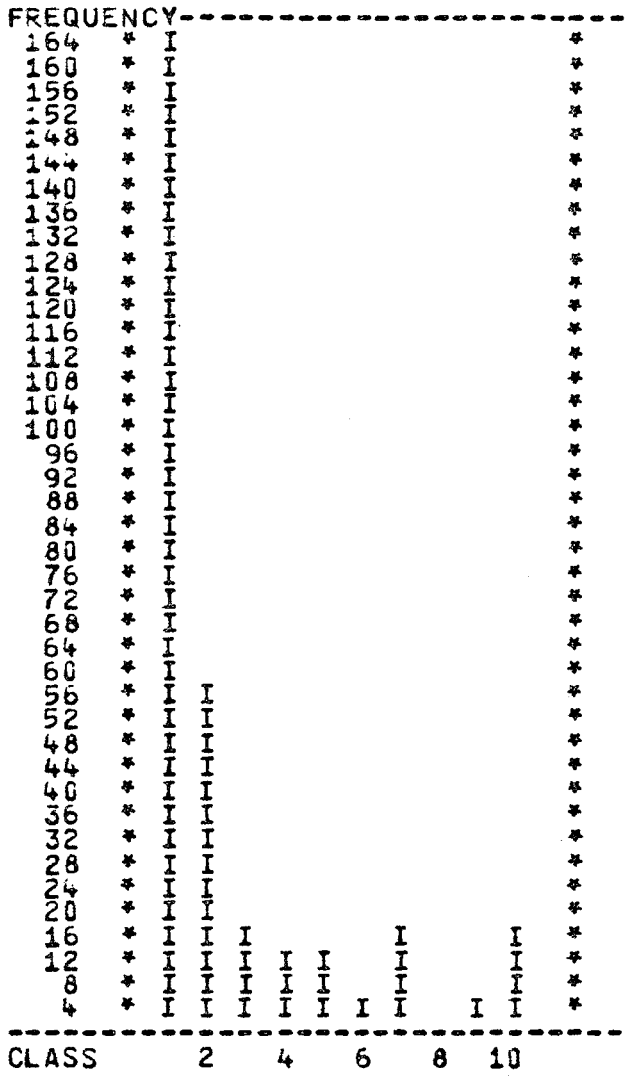


NUMBER OF JOBS PROCESSED THIS DAY BY CLASS

CLASS CODE 1 = JOBCLASS 0
CLASS CODE 2 = JOBCLASS 1
CLASS CODE 3 = JOBCLASS 2
CLASS CODE 4 = JOBCLASS 3
CLASS CODE 5 = JOBCLASS 4
CLASS CODE 6 = JOBCLASS 5

CLASS CODE 7 = JOBCLASS 6
CLASS CODE 8 = JOBCLASS 7
CLASS CODE 9 = JOBCLASS 8
CLASS CODE 10 = JOBCLASS 9
CLASS CODE 11 = JOBS REQUIRING TAPE(S)
CLASS CODE 12 = TIME-SHARING JOBS

Figure 26. Histogram showing Number of Jobs Processed by Class



FREQUENCY PLOT OF TURNAROUND TIME FOR JOBCLASS 0

CLASS CODE 1 = 0 TO 5 MINUTES

CLASS CODE 2 = 5 TO 10 MINUTES

CLASS CODE 3 = 10 TO 15 MINUTES

CLASS CODE 4 = 15 TO 20 MINUTES

CLASS CODE 5 = 20 TO 25 MINUTES

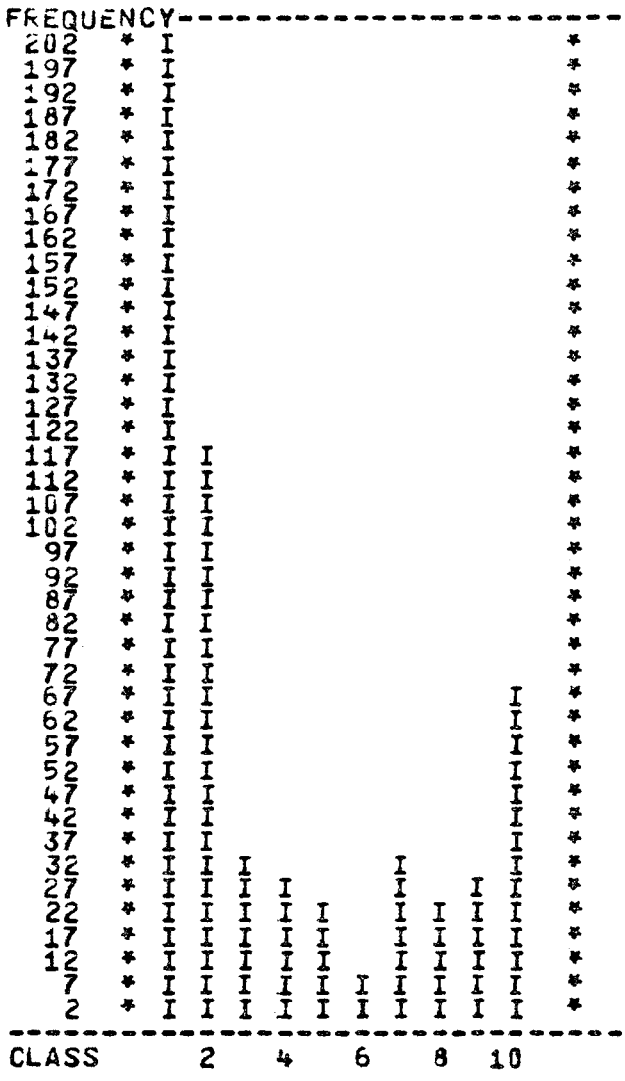
CLASS CODE 6 = 25 TO 30 MINUTES

CLASS CODE 7 = 30 TO 45 MINUTES

CLASS CODE 8 = 45 TO 60 MINUTES

CLASS CODE 9 = 60 - 120 MINUTES

CLASS CODE 10 = 120 MINUTES AND UP

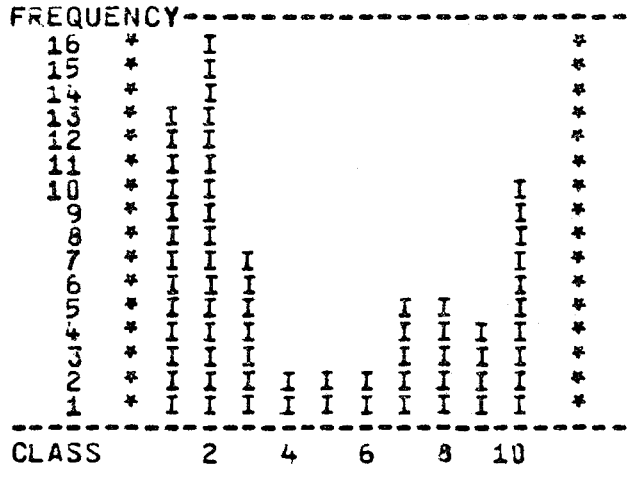


FREQUENCY PLOT OF TURNAROUND TIME IRRESPECTIVE OF JOB CLASS

CLASS CODE 1 = 0 TO 5 MINUTES
CLASS CODE 2 = 5 TO 10 MINUTES
CLASS CODE 3 = 10 TO 15 MINUTES
CLASS CODE 4 = 15 TO 20 MINUTES
CLASS CODE 5 = 20 TO 25 MINUTES
CLASS CODE 6 = 25 TO 30 MINUTES
CLASS CODE 7 = 30 TO 45 MINUTES

CLASS CODE 8 = 45 TO 60 MINUTES
CLASS CODE 9 = 60 - 120 MINUTES
CLASS CODE 10 = 120 MINUTES AND UP

Figure 28.
Histogram of Turnaround Time irrespective of Class



FREQUENCY PLOT OF TURNAROUND TIME FOR JOBCLASS 2

CLASS CODE 1 = 0 TO 5 MINUTES
CLASS CODE 2 = 5 TO 10 MINUTES
CLASS CODE 3 = 10 TO 15 MINUTES
CLASS CODE 4 = 15 TO 20 MINUTES
CLASS CODE 5 = 20 TO 25 MINUTES
CLASS CODE 6 = 25 TO 30 MINUTES
CLASS CODE 7 = 30 TO 45 MINUTES
CLASS CODE 8 = 45 TO 60 MINUTES
CLASS CODE 9 = 60 - 120 MINUTES
CLASS CODE 10 = 120 MINUTES AND UP

Figure 29. Histogram of Turnaround Time for Job Class 2

CHAPTER III

DISCUSSION OF TEST RESULTS

A. OVERVIEW

The programs developed in this project were tested on a number of account dayfiles for the system B computer during the month of August, 1979. This is a typical period in the summer when there are almost no undergraduate student users on the computer. In these test runs various parameters that characterize the system workload and performance were evaluated at hourly intervals between 0800 and 2400 hours. A number of observations were made on these test results. It must be noted however, that these interpretations have been made from the results of analysis of a very limited number of account dayfiles. They are discussed here primarily for the purpose of illustrating how the results from this type of analysis may be correlated with each other, and how they may, hopefully, assist management personnel in determining actions for tuning the system.

B. THE JOB SUMMARY FILE

Some information about the CDC system B in general may be obtained from the Job Summary Files examined.

a. Typically there are 20,000 to 30,000 records written on an account dayfile.

b. Between 800 to 1,000 jobs are processed by the system each day, of which about 15-20 percent are terminal originated and less than 5 percent are STALL jobs.

c. Batch jobs require much more CPU time than terminal jobs. CPU times in thousands of seconds are not uncommon among STALL jobs.

d. On the average terminal jobs make three times as many accesses as batch jobs to indirect access permanent files. This reflects the more frequent use of this type of permanent file in terminal jobs for storing programs and data, and for program development which often requires backup files. Furthermore, although there are few time-sharing ports on System B, it is likely that more than one program would be executed in one terminal session.

e. Very few jobs that require magnetic tapes use more than one tape drive.

C. PEAK PERIOD

One of the features that may emerge from a system performance evaluation study and one that would interest the system management personnel is the identification of the "busy" or peak periods of the system. There are a number of indicators of peak activity, as shown by the test results.

a. System Job Concurrency

The system may be considered "busy" when the number

of jobs that are processed "concurrently" in a multiprogramming environment is large. The test results show that the system job concurrency tends to peak around 3 to 4 p.m. during each day, reaching a value of 12 to 15. Two other peak periods of less intensity may be identified at 10-11 a.m. and at 9-10 p.m. (Figure 20).

b. CPU Productivity

The CPU productivity appears to reach its maxima at the same times as the system job concurrency. However, the CPU productivity during the evening peak period is often as high as or even higher than that during the afternoon peak period (Figure 21), reaching the 80-90 percent level on two consecutive Fridays. An explanation for this behaviour may be obtained by correlating these results with the information in the job summary files. Records from these files show that the evening peak period generally coincides with the starting of execution of STALL jobs, most of which require large amounts of CPU time. This explains the heavy CPU utilization together with only moderate job concurrency for that period of time. Supporting evidence for this conclusion may also be found from a plot of the average CPU seconds per job vs. time of day. Figure 22 shows that the average CPU seconds per job rises from about 30 during the day to about 90 at around 9 p.m.

c. System Throughput Rate

Once again the system throughput rate tends to reach a maximum at 10 a.m. and again at 3 to 4 p.m., at about 70 to 90 jobs per hour. However, Figure 23 shows that it only reaches a value of about 30 jobs per hour in the evening peak period after dipping to a value of 10 between 5 and 7 p.m. This lends further support to the conclusion that the evening peak period is mainly due to the execution of STALL jobs by the system.

d. Core Memory Utilization

The average amount of field length required by each job appears to be rather stable, fluctuating between 50K and 65K words throughout the day (Figure 24) with little or no apparent increase during the peak periods, including the evening peak period. The limit placed on the field length of terminal originated jobs may be a contributing factor to this stable average value.

D. TURNAROUND TIME AND DELAY FACTOR

Turnaround times may be tabulated and graphically displayed by job class by the Phase Three program. For these test runs, the job classes were redefined with the following limits on CPU seconds: 10, 20, 50 and 100. This is an option available with the Phase Three program.

The turnaround time for jobs requiring less than 10 CPU

seconds (class 0) generally is slowest at around 3 p.m., which is the busy period of the day. It becomes slow again at about 9 p.m., probably due to the execution of STALL jobs. (See Figure 25).

Almost 40 percent of the jobs require less than 10 CPU seconds and thus fall into job class 0 in our definition. During an hourly or half-hourly interval, there may be only one or two jobs in each of the other classes. Caution must be exercised in interpreting their turnaround time results. The following example may help to illustrate this point.

Analysis of one of the dayfiles showed the turnaround time for job class 2 was unusually long (160 minutes) around 7 p.m. Reference to the turnaround time table shows that the time spent in the input queue was 151 minutes and thus was responsible for the delay. However the table also shows that there were only two jobs in this class. From the job summary file it was found that at least one job could be identified as having such a long turnaround time during that time of the day. Its job summary record indicates that the job was declared by the user as belonging to class 6, and thereby could have been given a low priority in the input queue. This job might have encountered abnormal termination during its execution, with the result that only a few CPU seconds were actually used.

Some other interesting features are found from the turnaround time analysis. The first are the characteristics of the

frequency distributions. From the histograms of turnaround times, naturally one would expect the highest frequency to shift from fast turnaround time for jobs in lower classes to slow turnaround time for jobs in higher classes. However, for jobs that require 10-50 CPU seconds, the distribution appears to be bi-modal, i.e., there is a high frequency of occurrence at the slow end (60 minutes) and also at the fast end (5 minutes). Such a typical distribution is shown in Figure 29. The same characteristics are also observed in the frequency distribution of turnaround time for all jobs irrespective of classes. This seemingly strange behaviour may be explained by the fact that the time interval used in classifying turnaround time increases progressively from 5 to 60 minutes.

Another feature that has emerged from these test results concerns the external delay factors. The external delay factor measures the delay in job turnaround due to queuing or peripheral processing. It seems that for periods that show relatively large external delay factors, the major contribution to the long turnaround time comes from the time spent in the output queue. This might suggest that the line-printers are at times incapable of handling the workload.

E. SUGGESTIONS FOR FUTURE WORK

Post-analysis of the account dayfiles indeed furnishes important information about the system workload and performance. However, a complete evaluation study still requires information

from other evaluation aids. To complement results from the current work the following studies may be considered:

a. Subsystem Software Utilization

Information on the utilization of the principal language processors like FTN, COBOL, BASIC and APL would assist system management personnel to establish user patterns and trends in various language utilizations. As the MIME system (McMaster Instructional Multi-language Executive) becomes an important program development tool for this user community, its utilization should also be studied. The format of the account dayfile can be changed to incorporate the identification of these subsystems and the programs developed in this work may then be expanded to process such information.

b. Disk File Space Utilization

As more and more information is stored and processed by the computer, file space will continue to be a problem for the computer system. An analysis of the permanent file directories would give us more information on the utilization of disk file space. This type of information would assist management personnel in setting policies regarding periodic purging of permanent files.

c. User Response Time Study

Although another project[1] is currently underway to measure the system response times to certain "benchmark" type

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[1] Please see footnote 1 on page 14.

commands, data on user "think-time" are still needed. Such information should be useful in considerations of operating system tuning, especially with regard to setting priorities in job queues and time slices for time-sharing jobs.

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APPENDIX A

Dayfile Record Identifiers Recognized By Program Phase Two

CODE	DESCRIPTION
ABUN	user number is entered
ACST	a STALL job is identified
AEPQ	job leaves input or print or punch queue
AESR	the number of System Resource Units (SRU) used by job is given
AMAS	tape drive is assigned to job
AMRT	tape drive is released
IBJC	a job class card is processed
IBEQ	job enters a queue (input, print or punch)
IEFL	maximum field length used by job is given
SIUN	illegal user number is encountered
SPAT	denotes direct-access permanent file activity
SPGT	denotes indirect-access permanent file activity
UCCR	number of cards read is given
UCLP	number of lines printed is given
UECP	number of CPU seconds used by job is given
UEMS	number of mass storage units used is given
UEMT	number of tape storage units used is given
UEPF	number of permanent file units is given

APPENDIX B

User's Guide

There are three separate programs for the complete analysis of the account dayfile. These programs are called PHASE1, PHASE2 and PHASE3. It is recommended that these programs be run in two stages. The first stage produces a Job Summary File from the system Dayfile by executing programs PHASE1 and PHASE2. The Job Summary File is saved as a permanent file at the end of this stage. This permanent file is fetched in the second stage when program PHASE3 is executed.

Control Cards

A procedure file ANALDF has been constructed to incorporate the major control statements required for the first stage. These control statements will be inserted in the user control statement sequence when the procedure file is called:

```
ANALDF
FETCH,PHASE1/UN=1003993.
SETTL,300.
PHASE1.
RETURN,PHASE1.
RETURN,TAPE1.
REWIND,TAPE2.
FETCH,PHASE2/UN=1003993.
FILE(TAPE2,BT=C,RT=Z,FL=80)
```

```
FILE(TAPE1,BT=C,RT=Z,FL=80)
RFL,100000.
PHASE2.
REPLACE,TAPE3=JSONE.
REPLACE,TAPE4=JSTWO.
```

The two sections of the Job Summary File are saved as the user's private indirect access permanent files JSONE and JSTWO.

Program PHASE3 requires a field length of more than 120000_8 words to load. Therefore it has been organized into overlays and the overlay file name is PH3. Another procedure file ANALJS has been constructed for running the program in the second stage. The control statements incorporated in ANALJS are:

```
ANALJS
FETCH,PH3=PHASE3/UN=1003993.
FETCH,TAPE3=JSONE.
FETCH,TAPE4=JSTWO.
FILE(TAPE3,BT=C,RT=W,MRL=100)
FILE(TAPE1,BT=C,RT=W,MRL=100)
FILE(TAPE4,BT=C,RT=W,MRL=120)
FILE(TAPE2,BT=C,RT=W,MRL=120)
RFL,110000.
SETTL,50.
PH3.
```

User Input Cards

1. Program PHASE1.

Card	Field	Columns	Format
1	TBEGIN	1-5	A5
	TEND	6-10	A5

TBEGIN = beginning time of analysis. Any entries in the Dayfile before this time will be ignored. It is in the form of a four-digit time preceded by a blank, i.e., bhhmn where hh is the hours and mn is the minutes, e.g., b0830. Default is b0000.

TEND = ending time of analysis. Any entries made after this time will be ignored. Same format as TBEGIN. Default is b9999.

The whole card may be omitted or blank if the whole Dayfile is to be analyzed. Any field that is left blank will activate the default value for that field.

2. Program PHASE2

Card	Field	Columns	Format
1	OPTION(1)	1-5	A5
	OPTION(2)	6-10	A5
	OPTION(3)	11-15	A5
	OPTION(4)	16-20	A5

OPTION(1) = beginning time of analysis of the modified Dayfile. Same format as TBEGIN in Program PHASE1.

OPTION(2) = ending time of analysis, same format as OPTION(1). However, if a job enters the system before this specified time, all the entries in the Dayfile associated with that job will be processed even if they were entered after this time.

OPTION(3) = full or partial printout selection. Columns 11-14 should be left blank. A character L in column 15 selects full printout of the Job Summary File contents. The character S in Column 15 selects a short printout of the file. Default (all blanks in columns 11-15) is for no printout at all.

OPTION(4) = selection of a printout for the explanation of table headings. Any non-blank character in columns 16-20 will select to enable this printout.

Once again the card may be omitted or blank and all default options will be activated.

3. Program PHASE3

Card	Field	Columns	Format
1	TLOWER	1-5	A5
	TUPPER	6-10	A5
	INTERVAL	11-15	I5
	OPTION	16-20	A5
2	UNITS	1-5	A5
	CLIMIT	6-25	4I5

TLOWER = same as TBEGIN in Program PHASE1.

TUPPER = same as TEND in Program PHASE1.

INTERVAL = time interval in minutes. Analysis will be performed at regular intervals specified here between TUPPER and TLOWER. It should not be less than 30 if lengthy printout options are selected (see OPTION) since shorter intervals require excessive field length for the printer plots. Default value is 60 minutes.

OPTION = any non blank character in this field will suppress all printouts except the contents of the system job concurrency file.

UNITS = JCCPU/JCSRU in columns 1-5 if a job is to be reclassified according to the number of CPU seconds/SRU's used.

CLIMIT = Upper limits of CPU seconds or SRU's for the job.

Sample Decks

Example 1.

The following sample deck is for running a job for the first stage of the analysis. The original Account Dayfile is on a direct-access permanent file AC1. The file will be analyzed from start to midnight. A full printout of the Job Summary File is selected and an explanation of names used in printout is required.

```
Jobname(JC4)
USER(usernumber)
CHARGE(chargenumber)
ATTACH,TAPE1=AC1/UN=SYSTEMX.
FETCH,ANALDF/UN=1003993.
CALL, ANALDF.
end of record
      2400
end of record
     2400    L  YES
end of record
```

Example 2.

The following sample deck is for running a job for the second stage of the analysis. Analysis is to be done for the period of time from 0800 to 2400 at regular intervals of 30 minutes. All printouts are required. The job classification scheme is redefined according to number of CPU second used by the job. These class limits are 10,20,50 and 100 seconds.

```
Jobname(JC2)
USER(usernumber)
CHARGE(chargenumber)
FETCH,ANALJS/UN=1003993.
CALL,ANALJS.
end of record
 0800 2400   30
JCCPU   10   20   50  100
end of record
```

APPENDIX C

PROGRAM LISTINGS

```
      PROGRAM PHASE1(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE1,TAPE2)   AUG16        1
C     ****************************************************************   PREP        3
C     *                                                              *   PREP        4
C     *                    MAIN PROGRAM                              *   PREP        5
C     *                                                              *   PREP        6
C     *  PURPOSE - CREAT A NEW FILE WITH MODIFIED TERMINAL           *   PREP        7
C     *            JOB NAMES IN THE DAYFILE OF CDC 6400              *   PREP        8
C     *            NEW **  00061ADT (0006=PORT#, 1AD=NEW NAME)       *   PREP        9
C     *           OLD **  XXXX300T (XXXX=IUSER ID, 006=PORT #)       *   PREP       10
C     *  INPUT - READ IN TBEGIN,TEND                                 *   PREP       11
C     *  OUTPUT - MODIFIED DAYFILE IN TAPE2                          *   PREP       12
C     *           WITH NEW TERMINAL JOB NAMES                        *   PREP       13
C     *  SUBROUTINES CALLED - INITIAL,OTHERS                         *   PREP       14
C     *                                                              *   PREP       15
C     ****************************************************************   PREP       16
C                                                                         PREP       17
      IMPLICIT INTEGER(A-Z)                                               PREP       18
      COMMON/VTIME/TBEGIN,TEND                                            PREP       19
C                                                                         PREP       20
CC                                                                        PREP       21
C***  SET DEFAULT TIME LIMITS                                             PREP       22
C                                                                         PREP       23
      TBEGIN=10H 00.00.00.                                                PREP       24
      TEND=10H 99.99.99.                                                  PREP       25
C                                                                         PREP       26
C***  READ IN TIME LIMITS OF ANALYSIS IN THE FORM OF FOUR-DIGIT TIME      PREP       27
C                                                                         PREP       28
      READ (5,800) T1,T2                                                  PREP       29
      IF (EOF(5)) 2,1                                                     PREP       30
C                                                                         PREP       31
C***     CONVERT INPUT TIME INTO DAYFILE FORMAT HH.MM.SS.                 PREP       32
C                                                                         PREP       33
    1    IF (T1.NE.5H     ) TBEGIN=INTIME(T1)                           JULY27      1
         IF (T2.NE.5H     ) TEND=INTIME(T2)                             JULY27      2
C                                                                         PREP       36
    2 WRITE (6,900) TBEGIN,TEND                                           PREP       37
C                                                                         PREP       38
CC                                                                        PREP       39
C***  INITIALIZATION AND PROCESS THE FIRST RECORD                         PREP       40
C                                                                         PREP       41
      CALL INITIAL                                                        PREP       42
C                                                                         PREP       43
C***  PROCESS SUBSEQUENT RECORDS                                          PREP       44
C                                                                         PREP       45
      CALL OTHERS                                                         PREP       46
C                                                                         PREP       47
  800 FORMAT (2A5)                                                        PREP       48
  900 FORMAT(1H1,//10X,"STARTING TIME =  ",A10,10X,"FINISHING TIME =  ",  PREP       49
     +A10//)                                                              PREP       50
      STOP                                                                PREP       51
      END                                                                 PREP       52
```

```
      SUBROUTINE INITIAL                                                PREP      53
C     ******************************************************************PREP      54
CC    *                                                                *PREP      55
CC    *                    SUBROUTINE INITIAL                          *PREP      56
CC    *                                                                *PREP      57
CC    *  FUNCTION - PRINT HEADING,INPUY INFORM.,INITALIZATION,         *PREP      58
CC    *             MODIFY SYSTEM RECORD $ FIRST JOB RECORD            *PREP      59
CC    *  INPUT - TBEGIN,TEND                                           *PREP      60
CC    *  OUTPUT - INPUT INF.,TITLE,MODIFIED SYSTEM RECORD,             *PREP      61
CC    *           FIRST RECORD IN OFILE                                *PREP      62
CC    *  SUBROUTINES CALLED - PROG                                     *PREP      63
CC    *                                                                *PREP      64
CC    ******************************************************************PREP      65
C                                                                       PREP      66
      IMPLICIT INTEGER(A-Z)                                             PREP      67
      COMMON/VTIME/TBEGIN,TEND                                          PREP      68
      COMMON/JREC/TIME,ID,JNAME,TYPE,CODE,MESG(56)                      PREP      69
      COMMON/ARAY/TABLE(100),NEWN(3)                                    PREP      70
      LOGICAL JFLAG(100)                                                PREP      71
      COMMON/FLAG/JFLAG                                                 PREP      72
C                                                                       PREP      73
C***  READ SYSTEM MESSAGE WHICH IS AT THE TOP OF DAYFILE                PREP      74
C     CORRECTION OF CHARACTERS AT JNAME POSITIONS IS REQUIRED  TO       PREP      75
C     MAKE SURE IT STAYS AT THE TOP EVEN AFTER SUBSEQUENT SORTING       PREP      76
C                                                                       PREP      77
      READ(1,800) TIME,ID,JNAME,TYPE,CODE,MESG                          PREP      78
C                                                                       PREP      79
      JNAME=3H                                                          PREP      80
C                                                                       PREP      81
C***  WRITE IT BACK TO TAPE2                                            PREP      82
C                                                                       PREP      83
      WRITE(2,800) TIME,ID,JNAME,TYPE,CODE,MESG                         PREP      84
C                                                                       PREP      85
C***  FIRST NEW NAME FOR FIRST TERMINAL JOB IS 0AA,THE DISPLAYED        PREP      86
C     CODE OF WHICH ARE 27(338),1,1 RESPECTIVELY                        PREP      87
C                                                                       PREP      88
      NEWN(1)=27                                                        PREP      89
      NEWN(2)=1                                                         PREP      90
      NEWN(3)=1                                                         PREP      91
C                                                                       PREP      92
C***  INITIALIZE TABLE $ JFLAG ARRAYS IN WHICH JOBNAMES  AND            PREP      93
C     LOF OFF FLAG FOR TERMINAL JOBS ARE STORED . THE INDEX             PREP      94
C     FOR THE ARRAYS CORRESPONDS TO THE TERMINAL NUMBER                 PREP      95
C                                                                       PREP      96
      DO 50 J=1,100                                                     PREP      97
         TABLE(J)="999"                                                 PREP      98
         JFLAG(J)=.TRUE.                                                PREP      99
 50   CONTINUE                                                          PREP     100
C                                                                       PREP     101
C***  LOOK FOR FIRST JOB RECORD AND PROCESS IT WITH SUBROUTINE PROG     PREP     102
C                                                                       PREP     103
 5    READ(1,800) TIME,ID,JNAME,TYPE,CODE,MESG                          PREP     104
      IF(EOF(1)) 4,6                                                    PREP     105
 6    IF(TIME.LT.TBEGIN) GOTO 5                                         PREP     106
      CALL PROG                                                         PREP     107
```

```
      RETURN                                                                    PREP      108
C                                                                               PREP      109
 4    WRITE(6,910)                                                             PREP      110
 800  FORMAT(A10,A4,2A3,A4,56A1)                                               PREP      111
 910  FORMAT(1H/,///" TBEGIN INPUT ERROR - OUT OF RANGE")                      PREP      112
      RETURN                                                                    PREP      113
      END                                                                       PREP      114



      SUBROUTINE OTHERS                                                         PREP      115
C     ****************************************************************          PREP      116
CC    *                                                              *          PREP      117
CC    *                    SUBROUTINE OTHERS                         *          PREP      118
CC    *                                                              *          PREP      119
CC    *  FUNCTION - PROCESS ALL JOB RECORDS EXCEPT THE FIRST         *          PREP      120
CC    *  CALLED FROM - MAIN PROGRAM                                  *          PREP      121
CC    *  INPUT - TPERIOD,TEND                                        *          PREP      122
CC    *  OUTPUT - AS IN MAIN PROGRAM EXCEPT THOSE FROM INITIAL       *          PREP      123
CC    *  SUBROUTINES CALL - PROG                                     *          PREP      124
CC    *                                                              *          PREP      125
CC    ****************************************************************          PREP      126
C                                                                               PREP      127
      IMPLICIT INTEGER(A-Z)                                                     PREP      128
      COMMON/VTIME/TBEGIN,TEND                                                  PREP      129
      COMMON/JREC/TIME,ID,JNAME,TYPE,CODE,MESG(56)                              PREP      130
      COMMON/ARAY/TABLE(100),NEWN(3)                                            PREP      131
C                                                                               PREP      132
      LOGICAL NXDAY                                                             PREP      133
      DATA LATE/10H 22.00.00./                                                  PREP      134
C                                                                               PREP      135
      NXDAY=.FALSE.                                                             PREP      136
C                                                                               PREP      137
C***  READ A RECORD AND CHECK THE TIME AFTER IT"S CONVERTED TO SECONDS.         PREP      138
C                                                                               PREP      139
C     LOOP1                                                                     PREP      140
 7    READ(1,800) TIME,ID,JNAME,TYPE,CODE,MESG                                  PREP      141
C                                                                               PREP      142
C***  CHECK FINISHING TIME                                                      PREP      143
C                                                                               PREP      144
      IF(TIME.GT.TEND) GOTO 3                                                   PREP      145
C                                                                               PREP      146
C                                                                               PREP      147
C***  THE FOLLOWING SECTION WAS INSERTED BY H.N. NG TO HANDLE ENTRIES           PREP      148
C***  RECORDED AFTER MIDNIGHT NEXT DAY BY ADDING 24 HOURS TO TIME.              PREP      149
C                                                                               PREP      150
      IF (ID.EQ.4HSYST) GOTO 5                                                  PREP      151
      IF (TIME.GE.LATE) NXDAY=.TRUE.                                            PREP      152
      IF (NXDAY.AND.(TIME.LT.LATE)) TIME=HR25(TIME)                             PREP      153
C                                                                               PREP      154
C***  PROCESS THE RECORD                                                        PREP      155
C                                                                               PREP      156
      CALL PROG                                                                 PREP      157
C                                                                               PREP      158
```

```
C***   WRITE NEW RECORD ON TAPE2                                                PREP      159
C                                                                               PREP      160
       WRITE(2,800) TIME,ID,JNAME,TYPE,CODE,MESG                                PREP      161
    5  IF (EOF(1)) 3,7                                                          PREP      162
C      ENDLOOP1                                                                 PREP      163
C                                                                               PREP      164
       ENDFILE 2                                                                PREP      165
C                                                                               PREP      166
  3    WRITE(6,910)                                                             PREP      167
  800  FORMAT(A10,A4,2A3,A4,56A1)                                               PREP      168
  910  FORMAT(1H0,"  END OF PROCESSING")                                        PREP      169
       RETURN                                                                   PREP      170
       END                                                                      PREP      171



       SUBROUTINE PROG                                                          PREP      172
C      ***************************************************************          PREP      173
C      *                                                             *          PREP      174
C      *                    SUBROUTINE PROG                          *          PREP      175
C      *                                                             *          PREP      176
C      *  CALLED FROM - INITIAL AND OTHERS                           *          PREP      177
C      *  INPUT - JNAME,,NTJOB,NBJOB,TIME,ID,TYPE,CODE,MESG          *          PREP      178
C      *  OUTPUT - MODIFIED TERMINAL RECORD                          *          PREP      179
C      *           OR NOTHING FOR BATCH JOBS                         *          PREP      180
C      *  SUBROUTINES CALL - NEWNAME                                 *          PREP      181
C      *                                                             *          PREP      182
C      ***************************************************************          PREP      183
C                                                                               PREP      184
       IMPLICIT INTEGER(A-Z)                                                    PREP      185
       COMMON/VTIME/TBEGIN,TEND                                                 PREP      186
       COMMON/JREC/TIME,ID,JNAME,TYPE,CODE,MESG(56)                             PREP      187
       COMMON/ARAY/TABLE(100),NEWN(3)                                           PREP      188
       LOGICAL JFLAG(100)                                                       PREP      189
       COMMON/FLAG/JFLAG                                                        PREP      190
C                                                                               PREP      191
CC                                                                              PREP      192
C                                                                               PREP      193
C***   CHECK JOB TYPE(TERMINAL OR BATCH). RETURN IF BATCH JOB ENCOUNTERED       PREP      194
C                                                                               PREP      195
       IF(JNAME.LE."ZZZ") RETURN                                                PREP      196
C                                                                               PREP      197
C***   ASSIGN PROPER NAME TO TERMINAL JOB                                       PREP      198
C***   RESERVE TERMINAL PORT NO. IN ID OF THE RECORD                            PREP      199
C                                                                               PREP      200
       ZERO=27                                                                  PREP      201
       ENCODE(10,200,ID) ZERO,JNAME                                             PREP      202
C                                                                               PREP      203
C***   CONVERT ALPHANUMERIC TERMINAL NO. TO NUMERIC FORM                        PREP      204
C                                                                               PREP      205
       DECODE(10,100,JNAME) NTERML                                              PREP      206
C                                                                               PREP      207
C***   IS THIS A NEW ENTRY                                                      PREP      208
       IF(TABLE(NTERML).EQ."999") 40,10                                         PREP      209
```

```
C                                                                       PREP    210
C***   A NAME ALREADY IN THE TABLE,CHECK JFLAG FOR LOG OFF INDICATION   PREP    211
C      FOR LAST JOB(JFLAG=.FALSE.)                                      PREP    212
 10    IF(.NOT.JFLAG(NTERML)) GOTO 20                                   PREP    213
C                                                                       PREP    214
C***   THE LAST ONE WASN"T LOG OFF. GIVE TABLE NAME TO JNAME.           PREP    215
C      ALSO CHECK IS THE CURRENT RECORD CONTAINS A LOG OFF CODE.         PREP    216
       JNAME=TABLE(NTERML)                                              PREP    217
       IF(CODE.EQ."AESR")JFLAG(NTERML)=.FALSE.                          PREP    218
       RETURN                                                           PREP    219
C                                                                       PREP    220
C***   THE LAST RECORD HAS LOG OFF CODE. IS THE CURRENT A NEW JOB?      PREP    221
 20    IF(CODE.EQ."ABUN") 30,50                                         PREP    222
C                                                                       PREP    223
C***   RESET JFLAG FOR NEW JOB. ASSIGN NEW NAME                         PREP    224
 30    JFLAG(NTERML)=.TRUE.                                             PREP    225
C                                                                       PREP    226
C***   NEW ENTRY ALSO ASSIGNED A NEW NAME                               PREP    227
 40    ENCODE(10,300,JNAME) NEWN                                        PREP    228
C                                                                       PREP    229
C***   STORE NEWNAME ON TABLE AND UPDATE NEXT NEW NAME                  PREP    230
C                                                                       PREP    231
       TABLE(NTERML)=JNAME                                              PREP    232
       CALL NEWNAME(NEWN)                                               PREP    233
       RETURN                                                           PREP    234
C                                                                       PREP    235
***   THERE ARE CASES THAT LAST RECORD HAS LOF OFF CODE,BUT             PREP    236
C      THE OUTPUT IS ROUTED TO BATCH MODE OR OTHER MODES THAN TERMINAL  PREP    237
C      MODES FOR  A CONTINUATION OF THE PRESENT JOB. USE THE SAME       PREP    238
C      NAME IN THE TABLE THEN.                                          PREP    239
 50    JNAME=TABLE(NTERML)                                              PREP    240
C                                                                       PREP    241
 100   FORMAT(I3)                                                       PREP    242
 200   FORMAT(R1,A3)                                                    PREP    243
 300   FORMAT(3R1)                                                      PREP    244
       RETURN                                                           PREP    245
       END                                                              PREP    246


       SUBROUTINE NEWNAME(A)                                            PREP    247
C      ***************************************************************  PREP    248
C      *                                                             *  PREP    249
C      *                    SUBROUTINE NEWNAME                       *  PREP    250
C      *                                                             *  PREP    251
C      *   CALLED FROM - NEWJN                                       *  PREP    252
C      *   INPUT - NEWN(INDEICE FOR CURRENT NEW NAME)                *  PREP    253
C      *   OUTPUT - NEWN FOR NEXT NEW NAME                           *  PREP    254
C      *                                                             *  PREP    255
CC     ***************************************************************  PREP    256
C                                                                       PREP    257
       IMPLICIT INTEGER(A-Z)                                            PREP    258
       DIMENSION A(3)                                                   PREP    259
C                                                                       PREP    260
```

```
      A(3)=A(3)+1                                                       PREP      261
      IF(A(3).GT.328) GOTO 10                                           PREP      262
      RETURN                                                            PREP      263
 10   A(3)=1                                                            PREP      264
      A(2)=A(2)+1                                                       PREP      265
      IF(A(2).GT.328) GOTO 20                                           PREP      266
      RETURN                                                            PREP      267
 20   A(2)=1                                                            PREP      268
      A(1)=A(1)+1                                                       PREP      269
      IF(A(1).GT.44B) A(1)=27                                           PREP      270
      RETURN                                                            PREP      271
      END                                                               PREP      272



      FUNCTION INTIME (T)                                               PREP      273
C                                                                       PREP      274
C*** FUNCTION INTIME  TAKES TIME T IN FOUR-DIGIT FORMAT (HRMN)          PREP      275
C*** AND RETURNS THE TIME IN DAYFILE FORMAT XX.YY.ZZ. ( HOUR.MIN.SEC.)  PREP      276
C                                                                       PREP      277
      IMPLICIT INTEGER (A-Z)                                            PREP      278
      DATA BLANK,PERIOD,SEC/1H ,1H.,2H00/                               PREP      279
C                                                                       PREP      280
      DECODE (5,100,T) HR,MIN                                           PREP      282
      ENCODE (10,200,ANT)  BLANK,HR,PERIOD,MIN,PERIOD,SEC,PERIOD        PREP      283
      INTIME=ANT                                                        PREP      284
C                                                                       PREP      285
  100 FORMAT (1X,2A2)                                                   PREP      286
  200 FORMAT (3(A1,A2),A1)                                              PREP      287
C                                                                       PREP      288
      RETURN                                                            PREP      289
      END                                                               PREP      290



      FUNCTION HR25(T)                                                  PREP      291
C                                                                       PREP      292
C***  THIS FUNCTION TAKES TIME T IN DAYFILE FORMAT, INCREMENT HOUR      PREP      293
C***  BY 24 AND RETURNS THE NEW TIME IN SAME FORMAT.                    PREP      294
C                                                                       PREP      295
      INTEGER HR,SEC                                                    PREP      296
      DIMENSION CHAR(10)                                                PREP      297
      DATA BLANK,PERIOD,ZERO/1H ,1H.,1H0/                               PREP      298
C                                                                       PREP      299
      DECODE (10,1000,T) HR,MIN,SEC                                     PREP      300
 1000 FORMAT (3(1X,I2))                                                 PREP      301
      HR=HR+24                                                          PREP      302
      ENCODE (10,6000,THEN) BLANK,HR,PERIOD,MIN,PERIOD,SEC,PERIOD       PREP      303
 6000 FORMAT (3(A1,I2),A1)                                              PREP      304
C                                                                       PREP      305
C***  REPLACE BLANKS WITH ZERO                                          PREP      306
C                                                                       PREP      307
      DECODE (10,1010,THEN) CHAR                                        PREP      308
```

```
1010  FORMAT (10A1)                                                    PREP      309
      DO 10 I=2,10                                                     PREP      310
         IF (CHAR(I).EQ.BLANK) CHAR(I)=ZERO                            PREP      311
 10   CONTINUE                                                         PREP      312
      ENCODE (10,1010,THEN) CHAR                                       PREP      313
      HR25=THEN                                                        PREP      314
      RETURN                                                           PREP      315
      END                                                              PREP      316
```

```
      PROGRAM PHASE2(INPUT,OUTPUT,TAPE1,TAPE2,TAPE3,TAPE4,TAPE5=INPUT,    PHASE2      2
     $ TAPE6=OUTPUT)                                                      PHASE2      3
C                                                                         PHASE2      4
C     ****************************************************************    PHASE2      5
C     *                                                              *    PHASE2      6
C     * PROGRAM PHASE2 IS THE SECOND PHASE OF A PROJECT FOR ANALYSIS*    PHASE2      7
C     * OF JOB ACCOUNTING DAYFILE FOR THE CDC 6400 COMPUTER UNDER   *    PHASE2      8
C     * NOS,IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR AN M. SC.*    PHASE2      9
C     * DEGREE IN COMPUTATION AT MCMASTER UNIVERSITY.               *    PHASE2     10
C     *                                                             *    PHASE2     11
C     *              AUTHOR      HOK-NAM NG                         *    PHASE2     12
C     *           SUPERVISOR     DR. N.P. ARCHER                    *    PHASE2     13
C     *                DATE      SUMMER, 1979                       *    PHASE2     14
C     *                                                             *    PHASE2     15
C     * INPUT FILE                                                  *    PHASE2     16
C     *    TAPE2 IS THE ACCOUNT DAYFILE PRODUCED AFTER PREPROCESSING*    PHASE2     17
C     *    BY PROGRAM PHASE1                                        *    PHASE2     18
C     *                                                             *    PHASE2     19
C     * SCRATCH FILE                                                *    PHASE2     20
C     *    TAPE1 IS THE SORTED DAYFILE WITH ALL RECORDS BELONGING   *    PHASE2     21
C     *    TO ONE JOB GROUPED TOGETHER                              *    PHASE2     22
C     *    BOTH ARE CODED WITH EACH RECORD 80 CHARACTERS LONG       *    PHASE2     23
C     *                                                             *    PHASE2     24
C     * OUTPUT FILES                                                *    PHASE2     25
C     *    TAPE3 AND TAPE4 ARE THE TWO SECTIONS OF A JOB SUMMARY    *    PHASE2     26
C     *    FILE.   FOR EACH JOB WITH COMPLETE RECORDS A RECORD IS   *    PHASE2     27
C     *    WRITTEN (UNFORMATTED) ON THESE FILES                     *    PHASE2     28
C     *                                                             *    PHASE2     29
C     ****************************************************************    PHASE2     30
C                                                                         PHASE2     31
C                                                                         PHASE2     32
      CALL SORTDF                                                         PHASE2     33
      CALL INITIAL                                                        PHASE2     34
      CALL PROCESS                                                        PHASE2     35
      CALL RESULT                                                         PHASE2     36
      STOP                                                                PHASE2     37
      END                                                                 PHASE2     38
```

```
      SUBROUTINE SORTDF                                                 SORTDF     2
C                                                                       SORTDF     3
CCCCC SUBROUTINE SORTDF TAKES THE PREPROCESSED ACCOUNT DAYFILE (TAPE2)  SORTDF     4
CCCCC AND SORTS IT SO THAT ALL RECORDS BELONGING TO ONE JOB ARE GROUPED SORTDF     5
CCCCC TOGETHER AND WRITTEN ON TAPE1.    SORTING IS DONE BY MAKING       SORTDF     6
CCCCC FORTRAN EXTENDED SUBROUTINE CALLS TO ROUTINES UTILISING THE       SORTDF     7
CCCCC SORTMERGE UTILITIES.  REFER CDC SORTMERGE MANUAL FOR DETAILS.     SORTDF     8
C                                                                       SORTDF     9
      CALL SMSORT (80)                                                  SORTDF    10
      CALL SMFILE (4HSORT,5HCODED,2)                                    SORTDF    11
      CALL SMFILE (6HOUTPUT,5HCODED,1)                                  SORTDF    12
      CALL SMKEY (15,1,3,0,7HDISPLAY)                                   SORTDF    13
      CALL SMKEY (11,1,4,0,7HDISPLAY)                                   SORTDF    14
      CALL SMOPT (6HRETAIN)                                             SORTDF    15
      CALL SMEND                                                        SORTDF    16
      REWIND 1                                                          SORTDF    17
      REWIND 2                                                          SORTDF    18
      RETURN                                                            SORTDF    19
      END                                                               SORTDF    20


      SUBROUTINE VOCAB                                                  VOCAB      2
C                                                                       VOCAB      3
CCCC  SUBROUTINE VOCAB PRINTS A DICTIONARY OF NAMES USED IN HEADINGS    VOCAB      4
CCCC  OF PRINTOUT TABLES                                                VOCAB      5
C                                                                       VOCAB      6
      WRITE (6,6000)                                                    VOCAB      7
      WRITE (6,6010)                                                    VOCAB      8
      WRITE (6,6020)                                                    VOCAB      9
      WRITE (6,6030)                                                    VOCAB     10
      WRITE (6,6040)                                                    VOCAB     11
      WRITE (6,6050)                                                    VOCAB     12
      WRITE (6,6060)                                                    VOCAB     13
      WRITE (6,6070)                                                    VOCAB     14
      WRITE (6,6080)                                                    VOCAB     15
      WRITE (6,6090)                                                    VOCAB     16
      WRITE (6,6100)                                                    VOCAB     17
      WRITE (6,6110)                                                    VOCAB     18
      WRITE (6,6120)                                                    VOCAB     19
      WRITE (6,6130)                                                    VOCAB     20
      WRITE (6,6140)                                                    VOCAB     21
      WRITE (6,6142)                                                    VOCAB     22
      WRITE (6,6150)                                                    VOCAB     23
      WRITE (6,6160)                                                    VOCAB     24
      WRITE (6,6170)                                                    VOCAB     25
      WRITE (6,6180)                                                    VOCAB     26
      WRITE (6,6190)                                                    VOCAB     27
      WRITE (6,6200)                                                    VOCAB     28
      WRITE (6,6210)                                                    VOCAB     29
      WRITE (6,6220)                                                    VOCAB     30
      WRITE (6,6230)                                                    VOCAB     31
      WRITE (6,6240)                                                    VOCAB     32
C                                                                       VOCAB     33
```

```
 6000  FORMAT (1H1,40X,*DICTIONARY FOR TABLE PRINTOUTS*)                      VOCAB      34
 6010  FORMAT (41X,*---------- --- ----- ---------*///)                       VOCAB      35
 6020  FORMAT (1H ,*   NO. = RECORD NUMBER*/)                                 VOCAB      36
 6030  FORMAT (1H ,*   JOBNAME = SYSTEM JOBNAME*/)                           VOCAB      37
 6040  FORMAT (1H ,*   TYPE = B FOR BATCH JOB*)                              VOCAB      38
 6050  FORMAT (1H ,*          T FOR TERMINAL JOB*)                           VOCAB      39
 6060  FORMAT (1H ,*          S FOR SYSTEM JOB*)                             VOCAB      40
 6070  FORMAT (1H ,*          E FOR REMOTE BATCH JOB*/)                      VOCAB      41
 6080  FORMAT (1H ,*   CLASS = JOB CLASS AS DECLARED BY USER OR ASSIGNED 8   VOCAB      42
     $Y SYSTEM*/)                                                           VOCAB      43
 6090  FORMAT (1H ,*   TIME IN = TIME AT WHICH JOB WAS READ IN*/)             VOCAB      44
 6100  FORMAT (1H ,*   TIME OUT = TIME AT WHICH PRINTOUT IS COMPLETED*/)     VOCAB      45
 6110  FORMAT (1H ,*   EXC BEGIN = TIME AT WHICH PROCESSING OF JOB STARTS*   VOCAB      46
     $/)                                                                    VOCAB      47
 6120  FORMAT (1H ,*   EXC END = TIME AT WHCIH JOB PROCESSING STOPS*/)       VOCAB      48
 6130  FORMAT (1H ,*   CPU SECS = THE NUMBER OF CPU SECONDS USED BY JOB*/)   VOCAB      49
 6140  FORMAT (1H ,*   REMARKS = ST FOR STALL JOB*)                          VOCAB      50
 6142  FORMAT (*                 AB FOR ABORTED JOB (E.G., ILLEGAL ID)*/)    VOCAB      51
 6150  FORMAT (1H ,*   SRUS = NUMBER OF SYSTEM RESOURCE UNITS CONSUMED*/)    VOCAB      52
 6160  FORMAT (1H ,*   MAX FL = MAXIMUM FIELD LENGTH REQUIRED OR REQUESTED   VOCAB      53
     $ IN OCTAL MEMORY WORDS*/)                                             VOCAB      54
 6170  FORMAT(1H ,*   DPF ACC = NUMBER OF ACCESSES TO DIRECT ACCES PERMANE   VOCAB      55
     $NT FILES*/)                                                           VOCAB      56
 6180  FORMAT (1H ,*   IDPF ACC = NUMBER OF ACCESSES TO INDIRECT ACCESS PE   VOCAB      57
     $RMANENT FILES*/)                                                      VOCAB      58
 6190  FORMAT (1H ,*   PF UNITS = KILOUNITS OF PERMANENT FILE USAGE*/)       VOCAB      59
 6200  FORMAT (1H ,*   MS UNITS = KILOUNITS OF MASS STORAGE USAGE*/)         VOCAB      60
 6210  FORMAT (1H ,*   LINES PRT = NUMBER OF LINES PRINTED FOR JOB*/)        VOCAB      61
 6220  FORMAT (1H ,*   CARDS RD = NUMBER OF CARDS READ IN FOR JOB*/)         VOCAB      62
 6230  FORMAT (1H ,*   TP DRIVES = MAXIMUM NUMBER OF TAPE DRIVES OCCUPIED    VOCAB      63
     $AT ANY ONE TIME DURING JOB PROCESSING*/)                              VOCAB      64
 6240  FORMAT(1H ,*   TP TIME = TOTAL TIME IN MINUTES OF TAPE DRIVE ASSIGN   VOCAB      65
     $MENTS*/)                                                              VOCAB      66
C                                                                           VOCAB      67
      RETURN                                                                VOCAB      68
      END                                                                   VOCAB      69


      SUBROUTINE INITIAL                                                    INITIAL     2
C                                                                           INITIAL     3
CC    SUBROUTINE INITIAL PERFORMS THE FOLLOWING FUNCTIONS:                  INITIAL     4
C        READS USER INPUT FOR CONTROL (READIN)                              INITIAL     5
C        INITIALISES WORK AREA (GLOBEVAR)                                   INITIAL     6
C        GETS DATE OF ACCOUNT DAYFILE TO BE ANALYSED (SETDATE)              INITIAL     7
C        PRINTS EXPLANATION OF PRINTOUTS IF USER SO DESIRES (VOCAB)         INITIAL     8
C                                                                           INITIAL     9
      COMMON /CHOICE/TLOWER,TUPPER,TABLE1,TABLE2,SKIP                       INITIAL    10
      LOGICAL SKIP                                                          INITIAL    11
      CALL READIN                                                           INITIAL    12
      CALL GLOBVAR                                                          INITIAL    13
      CALL SETPARA                                                          INITIAL    14
      CALL SETDATE                                                          INITIAL    15
      IF (SKIP) RETURN                                                      INITIAL    16
```

```
      CALL VOCAB                                                        INITIAL     17
      RETURN                                                            INITIAL     18
      END                                                               INITIAL     19



      SUBROUTINE SETDATE                                                SETDATE      2
C                                                                       SETDATE      3
CCC   SUBROUTINE SETDATE READS THE FIRST ENTRY FROM THE ACCOUNT DAYFILE SETDATE      4
CCCC  AND GETS THE DATE FOR THE FILE                                    SETDATE      5
CCCC                                                                    SETDATE      6
CCCC  LOCAL VARIABLES:                                                  SETDATE      7
CCCC     HEADER = ALPHANUMERIC STRING OF FIRST ENTRY IN DAYFILE         SETDATE      8
CCCC     KEY = KEY WORD ENTRY, SHOULD BE ABSY                           SETDATE      9
CCCC     DATE = DATE OF FILE AS INDICATED BY THIS ENTRY                 SETDATE     10
CCCC     BLANK=PADDING FOR FIRST ENTRY (DATE) IN OUTPUT FILES           SETDATE     11
CCC      TZERO=ZERO TIME TO ENSURE FIRST ENTRY REMAIN FIRST AFTER SORT  SETDATE     12
C                                                                       SETDATE     13
      DIMENSION HEADER(6)                                               SETDATE     14
      DATA BLANK,TZERO/10H          ,10H       00./                   JUL19        1
C                                                                       SETDATE     16
CCC   OBTAIN DATE FROM DAYFILE                                          SETDATE     17
C                                                                       SETDATE     18
      READ (1,100) HEADER                                               SETDATE     19
      DECODE (60,200,HEADER) KEY,DATE                                   SETDATE     20
      IF (KEY.EQ.4HABSY) 1,2                                            SETDATE     21
    1    WRITE (6,300) DATE                                             SETDATE     22
         WRITE (6,320)                                                  SETDATE     23
         GOTO 3                                                         SETDATE     24
C                                                                       SETDATE     25
CCC   ELSE                                                              SETDATE     26
C                                                                       SETDATE     27
    2    WRITE (6,400)                                                  SETDATE     28
         WRITE (6,500)                                                  SETDATE     29
         DATE=10H DATE(--)                                              JULY18       1
C                                                                       SETDATE     31
CCC   END IF                                                            SETDATE     32
CCCC                                                                    SETDATE     33
CCCC  WRITE HEADER ON TWO OUTPUT FILES                                  SETDATE     34
C                                                                       SETDATE     35
    3 WRITE (3) DATE,BLANK,BLANK,BLANK,BLANK,BLANK,TZERO,BLANK,BLANK,   SETDATE     36
     $     BLANK                                                        SETDATE     37
      WRITE (4) DATE,BLANK,BLANK,BLANK,BLANK,BLANK,BLANK,BLANK,BLANK,   SETDATE     38
     $      BLANK,BLANK,TZERO                                          SETDATE     39
      RETURN                                                            SETDATE     40
C                                                                       SETDATE     41
  100 FORMAT (6A10)                                                     SETDATE     42
  200 FORMAT (T21,A4,T27,A10)                                           SETDATE     43
  300 FORMAT (T35,* ANALYSIS OF ACCOUNT DAYFILE FOR *,A10)              SETDATE     44
  320 FORMAT(T35,* -------- -- ------- ------- ---  ---------*////)      SETDATE     45
  400 FORMAT (*  FIRST ENTRY OF ACCOUNT DAYFILE IS NOT /ABSY/*)         SETDATE     46
  500 FORMAT (*  DATE OF FILE CANNOT BE DETERMINED*//)                  SETDATE     47
C                                                                       SETDATE     48
      END                                                               SETDATE     49
```

```
      SUBROUTINE GLOBVAR                                                GLOBVAR     2
C                                                                       GLOBVAR     3
C     SUBROUTINE GLOBVAR  INTRODUCES GLOBAL VARIABLES FOR THIS PROGRAM  GLOBVAR     4
C     AND INITIALISES THEM IF NECESSARY                                 GLOBVAR     5
C     ALL THE COMMON BLOCKS ARE LISTED HERE, WHICH ARE:                 GLOBVAR     6
C                                                                       GLOBVAR     7
C        FLAGS = BOOLEAN VARIABLES FOR LOGIC FLOW CONTROL               GLOBVAR     8
C           ENTER = TRUE IF PROPER FIRST ENTRY OF JOB IS ENCOUNTERED    GLOBVAR     9
C           LEAVE = TRUE IF PROPER LAST ENTRY FOR JOB IS ENCOUNTERED    GLOBVAR    10
C           CMPLETE = TRUE IF BOTH ENTER AND LEAVE ARE TRUE             GLOBVAR    11
C                                                                       GLOBVAR    12
C        CHOICE = USER SPECIFIED OPTIONS                                GLOBVAR    13
C           TLOWER = LOWER TIME LIMIT FOR ANALYSIS IN DAYFILE FORMAT    GLOBVAR    14
C           TUPPER = UPPER TIME LIMIT OF ANALYSIS IN DAYFILE FORMAT     GLOBVAR    15
C           TABLE1 = TRUE IF TABLE 1 IS TO BE PRINTED                   GLOBVAR    16
C           TABLE2 = TRUE IF TABLE 2 IS TO BE PRINTED                   GLOBVAR    17
C           SKIP = TRUE IF NO DICTIONARY OF NAMES IS TO BE PRINTED      GLOBVAR    18
C                                                                       GLOBVAR    19
C        STRING = CHARACTER STRING FROM AN ENTRY OF THE SORTED ACCOUNT D GLOBVAR    20
C           TIME = TIME OF CURRENT ENTRY IN DAYFILE                     GLOBVAR    21
C           JNAME = SYSTEM JOB NAME OF ENTRY                            GLOBVAR    22
C           JTYPE = JOB TYPE OF CURRENT ENTRY                           GLOBVAR    23
C           CODE = KEY CODE WORD OF CURRENT ENTRY                       GLOBVAR    24
C           MESSAGE = INFORMATIVE MESSAGE FOLLOWING KEY WORD            GLOBVAR    25
C                                                                       GLOBVAR    26
C        LIST1 = PARAMETERS WRITTEN ON TAPE2 AND PRINTED IN TABLE1      GLOBVAR    27
C        LIST2 = PARAMETERS WRITTEN ON TAPE3 AND PRINTED IN TABLE2      GLOBVAR    28
C           FOR COMMON BLOCKS LIST1 AND LIST2 REFER TO SUBROUTINE       GLOBVAR    29
C           VOCAB FOR EXPLANATION OF VARIABLE NAMES                     GLOBVAR    30
C                                                                       GLOBVAR    31
C        COUNTS = COUNTS OF NUMBER OF RECORDS IN VARIOUS CATEGORIES     GLOBVAR    32
C           FOR COMMON BLOCK COUNTS REFER TO SUBROUTINE STAT FOR        GLOBVAR    33
C           EXPLANATION OF VARIABLE NAMES                               GLOBVAR    34
C                                                                       GLOBVAR    35
C        TAPEVAR = VARIABLES FOR TAPE JOB PROCESSING                    GLOBVAR    36
C           NTP = NUMBER OF TAPES REQUESTED BY JOB                      GLOBVAR    37
C           NCURDR = NUMBER OF TAPE DRIVES CURRENTLY TAKEN BY JOB       GLOBVAR    38
C           DEVICE = TAPE DRIVE DEVICE IDENTIFICATION                   GLOBVAR    39
C           TASSIGN = TIME OF DEVICE ASSIGNMENT                         GLOBVAR    40
C           TRELEAS = TIME OF DEVICE RELEASE                            GLOBVAR    41
C                                                                       GLOBVAR    42
C                                                                       GLOBVAR    43
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                 GLOBVAR    44
      COMMON /CHOICE/TLOWER,TUPPER,TABLE1,TABLE2,SKIP                   GLOBVAR    45
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   GLOBVAR    46
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      GLOBVAR    47
     $              TEXEND,REMARK,CPUSEC                                GLOBVAR    48
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, GLOBVAR   49
     $              NCARDS,NTPDR,TPTIME                                 GLOBVAR    50
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,     GLOBVAR    51
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL     GLOBVAR    52
      COMMON /TAPEVAR/NTP,NCURDR,DEVICE(10),TASSIGN(10),TRELEAS(10)     GLOBVAR    53
C                                                                       GLOBVAR    54
      INTEGER TASSIGN,TRELEAS                                           GLOBVAR    55
      LOGICAL ENTER,LEAVE,CMPLETE                                       GLOBVAR    56
```

```
      DATA NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,NCRMTB,          GLOBVAR    57
     $     NRTS,NRNONTS,NTERML,NBATCH,NSYST,NSTALL/14*0/                  GLOBVAR    58
C                                                                         GLOBVAR    59
      JOBREC=0                                                            GLOBVAR    60
      JOBNAME=6000 0000 0000 0000 0000 B                                  GLOBVAR    61
      ENTER=.FALSE.                                                       GLOBVAR    62
      LEAVE=.FALSE.                                                       GLOBVAR    63
      CMPLETE=.FALSE.                                                     GLOBVAR    64
      RETURN                                                              GLOBVAR    65
      END                                                                 GLOBVAR    66



      SUBROUTINE READIN                                                   READIN     2
C                                                                         READIN     3
CCC   SUBROUTINE READIN READS USER OPTION INPUT SPECIFICATIONS AND        READIN     4
CCC   PROCESSES THESE SPECIFICATIONS.                                     READIN     5
CCC   THE USER MAY SPECIFY THE PERIOD OF TIME FOR WHICH THE DAYFILE       READIN     6
CCC   IS TO BE PROCESSED,WHETHER PROCESSED RECORDS ARE TO BE PRINTED      READIN     7
CCC   AND IF EXPLANATION OF NAMES IN LISTING IS TO BE PRINTED.            READIN     8
CCC   THE RESULTING OPTIONS ARE RETURNED THROUGH THE COMMON BLOCK CHOICE  READIN     9
CCC                                                                       READIN    10
CCC   USER OPTION INPUT CARD FORMAT                                       READIN    11
CCC      OPTION(1) = LOWER TIME LIMIT FOR ANALYSIS IN COL. 2-5            READIN    12
CCC                  A FOUR-DIGIT TIME OF HOURS AND MINUTES               READIN    13
CCC                  DEFAULT IS FOR NO LIMIT                              READIN    14
CCC      OPTION(2) = UPPER TIME LIMIT OF ANALYSIS IN COL. 6-10            READIN    15
CCC                  SAME FORM AS OPTION(1)                               READIN    16
CCC                  DEFAULT IS FOR NO LIMIT                              READIN    17
CCC      OPTION(3) = L IN COL. 15 IF ALL PRINTOUTS ARE REQUIRED           READIN    18
CCC                  S IN COL. 15 IF ONLY TABLE 1 IS REQUIRED             READIN    19
CCC                  BLANK IN COLS. 11-15 IF NO PRINTOUT IS REQUIRED      READIN    20
CCC      OPTION(4) = ANY NON-BLANK CHARACTERS IN COLS. 16-20 WILL         READIN    21
CCC                  CAUSE A DICTIONARY OF NAMES USED IN PRINTOUT TABLES  READIN    22
CCC                  TO BE PRINTED                                        READIN    23
CCC      ANY FIELD THAT IS LEFT BLANK WILL ACTIVATE DEFAULT VALUE FOR     READIN    24
CCC      THAT FIELD                                                       READIN    25
CCC      IF NO INPUT CARD IS PRESENT, ALL DEFAULT VALUES ARE USED         READIN    26
CCC                                                                       READIN    27
CCC   LOCAL VARIABLES                                                     READIN    28
CCC      OPTION, TB1, TB2, T1, T2                                         READIN    29
C                                                                         READIN    30
      COMMON /CHOICE/TLOWER,TUPPER,TABLE1,TABLE2,SKIP                     READIN    31
      DIMENSION OPTION(5)                                                 READIN    32
      LOGICAL TABLE1,TABLE2,SKIP,TB1,TB2                                  READIN    33
C                                                                         READIN    34
CCC   SET DEFAULT VALUES                                                  READIN    35
C                                                                         READIN    36
      TLOWER=10H 00.00.00.                                                READIN    37
      TUPPER=10H 99.99.99.                                                READIN    38
      TABLE1=.FALSE.                                                      READIN    39
      TABLE2=.FALSE.                                                      READIN    40
      SKIP=.TRUE.                                                         READIN    41
C                                                                         READIN    42
```

```
      T1=3HYES                                                          READIN     43
      T2=3HYES                                                          READIN     44
      READ (5,100) OPTION                                               READIN     45
C                                                                       READIN     46
      IF (EOF(5)) 1,2                                                   READIN     47
C                                                                       READIN     48
CC       ABSENCE OF CONTROL CARD MEANS DEFAULT OPTIONS FOR ALL          READIN     49
CC                                                                      READIN     50
    1    WRITE (6,400)                                                 READIN     51
         GOTO 3                                                        READIN     52
C                                                                       READIN     53
      ELSE                                                              READIN     54
CC       ECHO PRINT INPUT                                               READIN     55
CC       INTEPRETE OPTICN SPECIFICATIONS                                READIN     56
C                                                                       READIN     57
    2    WRITE (6,300)                                                 READIN     58
         WRITE (6,200) OPTION                                          READIN     59
         IF (OPTION(4).NE.5H     ) SKIP=.FALSE.                        READIN     60
         CALL TIMING (OPTION(1),TLOWER)                                READIN     61
         CALL TIMING (OPTION(2),TUPPER)                                READIN     62
         CALL PRNTOPT (CPTION(3),TABLE1,TABLE2)                        READIN     63
C                                                                       READIN     64
CC       END IF                                                         READIN     65
C                                                                       READIN     66
 3    WRITE (6,500)                                                    READIN     67
      IF (.NOT.TABLE1) T1=3HNO                                          READIN     68
      IF (.NOT.TABLE2) T2=3HNO                                          READIN     69
      WRITE (6,600) TLOWER,TUPPER,T1,T2                                 READIN     70
C                                                                       READIN     71
 100  FORMAT (5A5)                                                      READIN     72
 200  FORMAT (2X,5A5//)                                                 READIN     73
 300  FORMAT (1H1,* OPTION SELECTION INPUT*/)                           READIN     74
 400  FORMAT (*  NO USER SPECIFIED OPTIONS, DEFAULT VALUES USED.*/)     READIN     75
 500  FORMAT (*     OUTPUT RECORDS    FROM          TO       TABLE1    READIN     76
     $TABLE2*/)                                                         READIN     77
 600  FORMAT (20X,A10,2X,A10,4X,A3,10X,A3///)                           READIN     78
C                                                                       READIN     79
      RETURN                                                            READIN     80
      END                                                               READIN     81
```

```
      SUBROUTINE TIMING (WORD,T)                                        TIMING      2
C                                                                       TIMING      3
CCC   SUBROUTINE TIMING INTERPRETS USER INPUT WORD ON TIME LIMIT        TIMING      4
CCC   AND RETURNS THE TIME T IN DAYFILE FORMAT XX.YY.ZZ                 TIMING      5
C                                                                       TIMING      6
      DATA BLANK,PERIOD,SEC/1H ,1H.,2H00/                               TIMING      7
C                                                                       TIMING      8
      IF (WORD.EQ.5H     ) RETURN                                       TIMING      9
C     ELSE                                                            TIMING     10
         DECODE (5,100,WORD) HR,MIN                                     TIMING     11
C                                                                       TIMING     12
         IF (HR.GT.2H27.OR.MIN.GT.2H59) GOTO 1                          TIMING     13
```

```
            ENCODE (10,200,T) BLANK,HR,PERIOD,MIN,PERIOD,SEC,PERIOD      TIMING     14
            GOTO 2                                                       TIMING     15
C         ELSE                                                           TIMING     16
     1       WRITE (6,300)                                               TIMING     17
     2    CONTINUE                                                       TIMING     18
C         END IF                                                         TIMING     19
CC                                                                       TIMING     20
C       END IF                                                           TIMING     21
```

```
 100   FORMAT (1X,2A2)                                                        TIMING     22
 200   FORMAT (3(A1,A2),A1)                                                   TIMING     23
 300   FORMAT(*  IMPROPERLY SPECIFIED TIME, RESET TO DEFAULT VALUE*/)         TIMING     24
C                                                                            TIMING     25
       RETURN                                                                TIMING     26
       END                                                                   TIMING     27
C                                                                            TIMING     28
                                                                             TIMING     29


       SUBROUTINE PRNTOPT (WORD,L1,L2)                                       PRNTOPT     2
C                                                                            PRNTOPT     3
CC     SUBROUTINE PRNTOPT INTERPRETES USER INPUT SPECIFICATION WORD          PRNTOPT     4
CC    TO DECIDE WHAT PROCESSED RECORDS ARE TO BE PRINTED                     PRNTOPT     5
CC     THE OPTIONS ARE                                                       PRNTOPT     6
CC        1. NO TABLES ARE PRINTED (DEFAULT)                                 PRNTOPT     7
CC        2. ONLY TABLE 1 IS PRINTED                                         PRNTOPT     8
CC        3. BOTH TABLE 1 AND TABLE 2 ARE PRINTED                            PRNTOPT     9
CC     THE RESULTS ARE RETURNED VIA THE LOGICAL VARIABLE PARAMETERS          PRNTOPT    10
CC     L1 AND L2                                                             PRNTOPT    11
C                                                                            PRNTOPT    12
       LOGICAL L1,L2                                                         PRNTOPT    13
C                                                                            PRNTOPT    14
CC      CASE OF WORD                                                         PRNTOPT    15
CC                                                                           PRNTOPT    16
          IF (WORD.EQ.5H    S) GOTO 1                                        PRNTOPT    17
          IF (WORD.EQ.5H    L) GOTO 2                                        PRNTOPT    18
C                                                                            PRNTOPT    19
CC        IF WORD IS BLANK OR SOMETHING ELSE                                 PRNTOPT    20
C                                                                            PRNTOPT    21
          L1=.FALSE.                                                         PRNTOPT    22
          L2=.FALSE.                                                         PRNTOPT    23
          GOTO 3                                                             PRNTOPT    24
C                                                                            PRNTOPT    25
CC        WORD IS SHORT                                                      PRNTOPT    26
C                                                                            PRNTOPT    27
    1     L1=.TRUE.                                                          PRNTOPT    28
          L2=.FALSE.                                                         PRNTOPT    29
          GOTO 3                                                             PRNTOPT    30
C                                                                            PRNTOPT    31
CC        WORD IS LONG                                                       PRNTOPT    32
C                                                                            PRNTOPT    33
    2     L1=.TRUE.                                                          PRNTOPT    34
          L2=.TRUE.                                                          PRNTOPT    35
C                                                                            PRNTOPT    36
```

```
C      END CASE                                                          PRNTOPT    37
C                                                                        PRNTOPT    38
     3 RETURN                                                           PRNTOPT    39
       END                                                              PRNTOPT    40



       SUBROUTINE LOOKUP (K,TABLE,N,MATCH)                              LOOKUP      2
C                                                                       LOOKUP      3
C SUBROUTINE LOOKUP PERFORMS BINARY ORDERED TABLE SEARCH                LOOKUP      4
C                                                                       LOOKUP      5
C PARAMETERS                                                            LOOKUP      6
C    K = ITEM TO BE SEARCHED                                            LOOKUP      7
C    TABLE = TABLE OF CONTENTS TO BE LOOKED UP                          LOOKUP      8
C    N = DIMENSION OF TABLE                                             LOOKUP      9
C    MATCH = INDEX OF TABLE ENTRY IF SEARCH IS SUCCESSFUL               LOOKUP     10
C            A VALUE OF 0 IS RETURNED IF SEARCH IS UNSUCCESSFUL         LOOKUP     11
C LOCAL VARIABLES                                                       LOOKUP     12
C    LB = LOWER LIMIT OF AREA OF SEARCH                                 LOOKUP     13
C    UB = UPPER LIMIT OF AREA OF SEARCH                                 LOOKUP     14
C    MIDPT = MID POINT OF AREA WHERE SEARCH IS TO TAKE PLACE CURRENTLY  LOOKUP     15
C                                                                       LOOKUP     16
       INTEGER TABLE(N),LB,UB                                           LOOKUP     17
C                                                                       LOOKUP     18
CC     INITIALIZATION                                                   LOOKUP     19
C                                                                       LOOKUP     20
       MATCH=0                                                          LOOKUP     21
       LB=1                                                             LOOKUP     22
       UB=N                                                             LOOKUP     23
C                                                                       LOOKUP     24
CC     SEARCH LOOP                                                      LOOKUP     25
C                                                                       LOOKUP     26
     1 MIDPT=(LB+UB)/2                                                  LOOKUP     27
         IF (K.LT.TABLE(MIDPT)) GOTO 2                                  LOOKUP     28
         IF (K.GT.TABLE(MIDPT)) GOTO 3                                  LOOKUP     29
C                                                                       LOOKUP     30
CC       SEARCH SUCCESSFUL, SET TERMINATION CONDITIONS                  LOOKUP     31
C                                                                       LOOKUP     32
         MATCH=MIDPT                                                    LOOKUP     33
         LB=UB+1                                                        LOOKUP     34
         GOTO 4                                                         LOOKUP     35
C                                                                       LOOKUP     36
CC       SEARCH LOWER HALF                                              LOOKUP     37
C                                                                       LOOKUP     38
     2   UB=MIDPT-1                                                     LOOKUP     39
         GOTO 4                                                         LOOKUP     40
C                                                                       LOOKUP     41
CC       SEARCH UPPER HALF                                              LOOKUP     42
C                                                                       LOOKUP     43
     3   LB=MIDPT+1                                                     LOOKUP     44
C                                                                       LOOKUP     45
CC       SEARCH TERMINATES WHEN UB IS .LT. LB                           LOOKUP     46
C                                                                       LOOKUP     47
     4   IF (UB.LT.LB) GOTO 5                                           LOOKUP     48
```

```
      GOTO 1                                                                    LOOKUP     49
C                                                                               LOOKUP     50
CC    END SEARCH LOOP                                                           LOOKUP     51
C                                                                               LOOKUP     52
    5 RETURN                                                                    LOOKUP     53
      END                                                                       LOOKUP     54



      SUBROUTINE PROCESS                                                        PROCESS     2
C                                                                               PROCESS     3
CC    SUBROUTINE PROCESS IS THE MAIN MODULE THAT PROCESSES THE SORTED           PROCESS     4
CC    ACCOUNT DAYFILE                                                           PROCESS     5
CC                                                                              PROCESS     6
CC    TWO BOOLEAN FLAGS ARE USED TO CONTROL FLOW OF PROCESS                     PROCESS     7
CC       HALT:  SET TO TRUE IF EOF ENCOUNTERED OR                               PROCESS     8
CC              IF TIME OF ENTRY EXCEEDS LIMITS SPECIFIED                       PROCESS     9
CC       IGNORE:  SET TO TRUE BY SUBROUTINE CURSORY IF DETAIL EXAMINATIO        PROCESS    10
CC                OF RECORD NOT REQUIRED                                        PROCESS    11
C                                                                               PROCESS    12
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                           PROCESS    13
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                         PROCESS    14
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,             PROCESS    15
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL             PROCESS    16
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,              PROCESS    17
     $              TEXEND,REMARK,CPUSEC                                        PROCESS    18
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,        PROCESS    19
     $              NCARDS,NTPDR,TPTIME                                         PROCESS    20
C                                                                               PROCESS    21
      LOGICAL HALT,IGNORE                                                       PROCESS    22
C                                                                               PROCESS    23
      HALT=.FALSE.                                                              PROCESS    24
      IGNORE=.FALSE.                                                            PROCESS    25
C                                                                               PROCESS    26
CC    LOOP                                                                      PROCESS    27
CC                                                                              PROCESS    28
CC       READ ONE RECORD FROM DAYFILE                                           PROCESS    29
C                                                                               PROCESS    30
    1    READ (1,100) TIME,JNAME,JTYPE,CODE,MESSAGE                             PROCESS    31
C                                                                               PROCESS    32
         IF (EOF(1)) 2,3                                                        PROCESS    33
    2       HALT=.TRUE.                                                         PROCESS    34
            GOTO 4                                                              PROCESS    35
C                                                                               PROCESS    36
CC       ELSE                                                                   PROCESS    37
CC          PRELIMINARY EXAMINATION OF RECORD TO DETERMINE IF FURTHER           PROCESS    38
CC          ANALYSIS IS REQUIRED                                                PROCESS    39
C                                                                               PROCESS    40
    3       CALL CURSORY (IGNORE,HALT)                                          PROCESS    41
               IF (IGNORE) GOTO 4                                               PROCESS    42
C              ELSE                                                             PROCESS    43
                  CALL DETAIL                                                   PROCESS    44
C              END IF                                                           PROCESS    45
CC                                                                              PROCESS    46
```

```
C         END IF                                                                PROCESS     47
C                                                                               PROCESS     48
    4     IF (HALT) 5,1                                                         PROCESS     49
C                                                                               PROCESS     50
CC      END LOOP                                                                PROCESS     51
C                                                                               PROCESS     52
    5   RETURN                                                                  PROCESS     53
C                                                                               PROCESS     54
  100   FORMAT (A10,T11,A7,T18,A1,T21,A4,T27,3A10)                              PROCESS     55
C                                                                               PROCESS     56
      END                                                                       PROCESS     57



      SUBROUTINE CURSORY (FLAG1,FLAG2)                                          CURSORY      2
C                                                                               CURSORY      3
CC    SUBROUTINE CURSORY PERFORMS PRELIMINARY EXAMINATION OF A RECORD           CURSORY      4
CC    TO DECIDE IF FURTHER DETAILED ANALYSIS IS REQUIRED                        CURSORY      5
CC      PARAMETERS                                                              CURSORY      6
CC            FLAG1 IS SET TO TRUE IF RECORD REQUIRES NO FURTHER EXAMINA        CURSORY      7
CC            FLAG2 IS SET TO TRUE IF NO MORE RECORDS ARE TO BE PROCESSE        CURSORY      8
C                                                                               CURSORY      9
      COMMON /CHOICE/TLOWER,TUPPER,TABLE1,TABLE2,SKIP                           CURSORY     10
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                           CURSORY     11
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                         CURSORY     12
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,              CURSORY     13
     $              TEXEND,REMARK,CPUSEC                                       CURSORY     14
C                                                                               CURSORY     15
      LOGICAL FLAG1,FLAG2                                                       CURSORY     16
C                                                                               CURSORY     17
      FLAG1=.FALSE.                                                             CURSORY     18
      FLAG2=.FALSE.                                                             CURSORY     19
C                                                                               CURSORY     20
      IF (TIME.LT.TLOWER) 1,2                                                   CURSORY     21
C                                                                               CURSORY     22
CC       TIME OUT OF LIMIT NO FURTHER PROCESSING                                CURSORY     23
C                                                                               CURSORY     24
    1     FLAG1=.TRUE.                                                          CURSORY     25
          GOTO 6                                                                CURSORY     26
C                                                                               CURSORY     27
CC    ELSE   CHECK IF RECORD IS FROM A NEW JOB                                  CURSORY     28
C                                                                               CURSORY     29
    2     IF (JNAME.EQ.JOBNAME) 6,3                                             CURSORY     30
C                                                                               CURSORY     31
CC       IF NEW JOB, OUTPUT RESULTS FOR LAST JOB SET FLAGS                      CURSORY     32
C                                                                               CURSORY     33
    3        CALL OUTLAST                                                       CURSORY     34
             IF (TIME.GT.TUPPER) 4,5                                            CURSORY     35
C                                                                               CURSORY     36
CC              NEW JOB TIME OUT OF LIMIT, HALT PROCESSING                      CURSORY     37
C                                                                               CURSORY     38
    4           FLAG1=.TRUE.                                                    CURSORY     39
                FLAG2=.TRUE.                                                    CURSORY     40
                GOTO 6                                                          CURSORY     41
```

```
C                                                                               CURSORY     42
CCC         ELSE  PREPARE FOR NEW JOB PROCESSING                                CURSORY     43
C                                                                               CURSORY     44
    5       CALL INITNEW                                                        CURSORY     45
C                                                                               CURSORY     46
CCC         END IF                                                              CURSORY     47
CCCCC                                                                           CURSORY     48
CCCCC     END IF                                                                CURSORY     49
CCCCC                                                                           CURSORY     50
CCC     END IF                                                                  CURSORY     51
C                                                                               CURSORY     52
    6 RETURN                                                                    CURSORY     53
      END                                                                       CURSORY     54



      SUBROUTINE OUTLAST                                                        OUTLAST      2
C                                                                               OUTLAST      3
CCCC  SUBROUTINE OUTLAST WRITES RESULTS OF PROCESSING ON TWO DISK FILES         OUTLAST      4
CCCC  ONE FOR EACH OUTPUT TABLE.   NO OUTPUT IS WRITTEN IF JOB RECORD           OUTLAST      5
CCC   IS FLAGGED INCOMPLETE                                                     OUTLAST      6
C                                                                               OUTLAST      7
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                         OUTLAST      8
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,             OUTLAST      9
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL             OUTLAST     10
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,              OUTLAST     11
     $              TEXEND,REMARK,CPUSEC                                        OUTLAST     12
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,        OUTLAST     13
     $              NCARDS,NTPDR,TPTIME                                         OUTLAST     14
      LOGICAL ENTER,LEAVE,CMPLETE                                               OUTLAST     15
C                                                                               OUTLAST     16
      CMPLETE=ENTER.AND.LEAVE                                                   OUTLAST     17
      IF (CMPLETE) 1,5                                                          OUTLAST     18
    1    JOBREC=JOBREC+1                                                        OUTLAST     19
C                                                                               OUTLAST     20
CCC      SPECIAL CASES HANDLING                                                 OUTLAST     21
C                                                                               OUTLAST     22
         IF (JOBTYPE.EQ.1HT) MAXFL=54000                                        OUTLAST     23
         IF (CPUSEC.LT.0.001) REMARK=2HAB                                       OUTLAST     24
         IF ((JOBTYPE.NE.1HS).AND.(NDPFACC.NE.0)) NDPFACC=NDPFACC-1             OUTLAST     25
C                                                                               OUTLAST     26
CCC      WRITE JOB RECORD ON OUTPUT FILES                                       OUTLAST     27
C                                                                               OUTLAST     28
         WRITE (3) JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,               OUTLAST     29
     $   TEXEND,REMARK,CPUSEC                                                   OUTLAST     30
         WRITE (4) JOBREC,SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,         OUTLAST     31
     $      NLINES,NCARDS,NTPDR,TPTIME,TEXBGN                                   OUTLAST     32
C                                                                               OUTLAST     33
CCCC     COUNT COMPLETE JOB RECORDS IN EACH CATEGORY                            OUTLAST     34
         CASE OF JOBTYPE                                                        OUTLAST     35
C                                                                               OUTLAST     36
            IF (JOBTYPE.EQ.1HT) GOTO 2                                          OUTLAST     37
            IF (JOBTYPE.EQ.1HS) GOTO 3                                          OUTLAST     38
            IF (JOBTYPE.EQ.1HE) GOTO 4                                          OUTLAST     39
```

```
C                                                                               OUTLAST    40
            NCBAT=NCBAT+1                                                       OUTLAST    41
            GOTO 9                                                              OUTLAST    42
    2       NCTS=NCTS+1                                                         OUTLAST    43
            GOTO 9                                                              OUTLAST    44
    3       NCSYST=NCSYST+1                                                     OUTLAST    45
            GOTO 9                                                              OUTLAST    46
    4       NCRMTB=NCRMTB+1                                                     OUTLAST    47
            GOTO 9                                                              OUTLAST    48
C                                                                               OUTLAST    49
CC        END CASE                                                              OUTLAST    50
CC                                                                              OUTLAST    51
CC      ELSE                                                                    OUTLAST    52
C                                                                               OUTLAST    53
    5     INCMPL=INCMPL+1                                                       OUTLAST    54
C                                                                               OUTLAST    55
CC        COUNT LEFTOVER JOBS AT BEGINNING OF ANALYSIS                          OUTLAST    56
C                                                                               OUTLAST    57
          IF (LEAVE.AND.(.NOT.ENTER)) 6,9                                       OUTLAST    58
    6       IF (JOBTYPE.EQ.1HT) 7,8                                             OUTLAST    59
    7          NRTS=NRTS+1                                                      OUTLAST    60
               GOTO 9                                                           OUTLAST    61
    8          NRNONTS=NRNONTS+1                                                OUTLAST    62
C                                                                               OUTLAST    63
CC        END IF                                                                OUTLAST    64
CC                                                                              OUTLAST    65
CC      END IF                                                                  OUTLAST    66
CC                                                                              OUTLAST    67
CC    END IF                                                                    OUTLAST    68
C                                                                               OUTLAST    69
    9 RETURN                                                                    OUTLAST    70
      END                                                                       OUTLAST    71
```

```
      SUBROUTINE INITNEW                                                        INITNEW     2
C                                                                               INITNEW     3
CC     SUBROUTINE INITNEW PERFORMS INITIALISATION FOR PROCESSING A              INITNEW     4
CC    NEW JOB                                                                   INITNEW     5
C                                                                               INITNEW     6
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                         INITNEW     7
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                           INITNEW     8
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,             INITNEW     9
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL             INITNEW    10
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,              INITNEW    11
     $              TEXEND,REMARK,CPUSEC                                        INITNEW    12
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,        INITNEW    13
     $              NCARDS,NTPDR,TPTIME                                         INITNEW    14
C                                                                               INITNEW    15
      LOGICAL ENTER,LEAVE,CMPLETE,ENTRY1                                        INITNEW    16
C                                                                               INITNEW    17
CC    CHANGE JOB NAME AND INITIALISE NEW JOB PARAMETERS                         INITNEW    18
C                                                                               INITNEW    19
      JOBNAME=JNAME                                                             INITNEW    20
```

```
      CALL SETPARA                                                      INITNEW     21
C                                                                       INITNEW     22
CC    DETERMINE IF FIRST ENTRY IS LEGAL FOR NEW JOB                     INITNEW     23
C                                                                       INITNEW     24
      ENTER=ENTRY1(JTYPE,CODE)                                          INITNEW     25
      IF (ENTER) 1,5                                                    INITNEW     26
    1    JOBTYPE=JTYPE                                                  INITNEW     27
C                                                                       INITNEW     28
CC       COUNT JOB ENTERING FOR EACH TYPE                               INITNEW     29
CC       CASE OF JOBTYPE                                                INITNEW     30
C                                                                       INITNEW     31
            IF (JOBTYPE.EQ.1HT) GOTO 2                                  INITNEW     32
            IF (JOBTYPE.EQ.1HS) GOTO 3                                  INITNEW     33
C                                                                       INITNEW     34
CC          BATCH JOB                                                   INITNEW     35
C                                                                       INITNEW     36
            NBATCH=NBATCH+1                                             INITNEW     37
            GOTO 4                                                      INITNEW     38
C                                                                       INITNEW     39
CC          TIME SHARING JOB                                            INITNEW     40
C                                                                       INITNEW     41
    2       NTERML=NTERML+1                                             INITNEW     42
            GOTO 4                                                      INITNEW     43
C                                                                       INITNEW     44
CC          SYSTEMS JOB                                                 INITNEW     45
C                                                                       INITNEW     46
    3       NSYST=NSYST+1                                               INITNEW     47
C                                                                       INITNEW     48
CC       END CASE                                                       INITNEW     49
CC                                                                      INITNEW     50
C                                                                       INITNEW     51
    4    CONTINUE                                                       INITNEW     52
C                                                                       INITNEW     53
CC    END IF                                                            INITNEW     54
C                                                                       INITNEW     55
    5 RETURN                                                            INITNEW     56
      END                                                               INITNEW     57
```

```
      SUBROUTINE SETPARA                                                SETPARA      2
C                                                                       SETPARA      3
CC    SUBROUTINE SETPARA INITIALISES PARAMETERS CHARACTERISING A JOB    SETPARA      4
CC    THESE ARE MAINLY PARAMETERS OUTPUT IN JOB SUMMARY FILES           SETPARA      5
CC    NOTE JOBNAME,JOBTYPE,ENTER HAVE BEEN SET IN INITNEW               SETPARA      6
C                                                                       SETPARA      7
      INTEGER TASSIGN,TRELEAS                                           SETPARA      8
      COMMON /TAPEVAR/NTP,NCURDR,DEVICE(10),TASSIGN(10),TRELEAS(10)     SETPARA      9
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      SETPARA     10
     $              TEXEND,REMARK,CPUSEC                                SETPARA     11
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, SETPARA    12
     $              NCARDS,NTPDR,TPTIME                                 SETPARA     13
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                 SETPARA     14
C                                                                       SETPARA     15
```

```
      LOGICAL ENTER,LEAVE,CMPLETE                                       SETPARA    16
      DATA INDEF/0/                                                     SETPARA    17
C                                                                       SETPARA    18
      LEAVE=.FALSE.                                                     SETPARA    19
      CMPLETE=.FALSE.                                                   SETPARA    20
      JCLASS=1H-                                                        SETPARA    21
      TIN=10H    -                                                      SETPARA    22
      TOUT=10H    -                                                     SETPARA    23
      TEXBGN=10H    -                                                   SETPARA    24
      TEXEND=10H    -                                                   SETPARA    25
      REMARK=2H                                                         SETPARA    26
      CPUSEC=0.0                                                        SETPARA    27
      SRUSED=0.0                                                        SETPARA    28
      MAXFL=0                                                           SETPARA    29
      MAXFL=0                                                           SETPARA    30
      NDPFACC=0                                                         SETPARA    31
      IDPFACC=0                                                         SETPARA    32
      PFUSAGE=0.0                                                       SETPARA    33
      USAGEMS=0.0                                                       SETPARA    34
      NLINES=0                                                          SETPARA    35
      NCARDS=0                                                          SETPARA    36
      NTPDR=0                                                           SETPARA    37
      NTP=0                                                             SETPARA    38
      NCURDR=0                                                          SETPARA    39
      TPTIME=0.0                                                        SETPARA    40
      DO 1 I=1,10                                                       SETPARA    41
         DEVICE(I)=2H--                                                 SETPARA    42
         TASSIGN(I)=INDEF                                               SETPARA    43
         TRELEAS(I)=INDEF                                               SETPARA    44
    1 CONTINUE                                                          SETPARA    45
C                                                                       SETPARA    46
      RETURN                                                            SETPARA    47
      END                                                               SETPARA    48
      LOGICAL FUNCTION ENTRY1 (TYPE,KEY)                                ENTRY1      2
C                                                                       ENTRY1      3
CC    FUNCTION ENTRY1 RETURNS A BOOLEAN VALUE TRUE TO INDICATE THAT THE ENTRY1      4
CC    CODE WORD FOR CURRENT RECORD IS A LEGAL FIRST ENTRY FOR A JOB     ENTRY1      5
CC    THE DETERMINATION DEPENDS ON WHETHER JOB IS TERMINAL OR BATCH TYPE ENTRY1     6
C                                                                       ENTRY1      7
      LOGICAL FIRST,ENTRY1                                              ENTRY1      8
      FIRST=.FALSE.                                                     ENTRY1      9
      IF (TYPE.EQ.1HT) 1,2                                              ENTRY1     10
    1    IF (KEY.EQ.4HA8UN) FIRST=.TRUE.                                ENTRY1     11
         GOTO 3                                                         ENTRY1     12
C                                                                       ENTRY1     13
CC    ELSE                                                              ENTRY1     14
C                                                                       ENTRY1     15
    2    IF ((KEY.EQ.4HUCCR).OR.(KEY.EQ.4HIBJC).OR.(KEY.EQ.4HIBEQ))     ENTRY1     16
     $             FIRST=.TRUE.                                         ENTRY1     17
C                                                                       ENTRY1     18
CC    END IF                                                            ENTRY1     19
C                                                                       ENTRY1     20
    3 ENTRY1=FIRST                                                      ENTRY1     21
      RETURN                                                            ENTRY1     22
      END                                                               ENTRY1     23
```

```
      SUBROUTINE DETAIL                                                 DETAIL     2
C                                                                       DETAIL     3
CC    SUBROUTINE DETAIL EXAMINES THE KEY WORD ENTRY IN A RECORD IN THE  DETAIL     4
CC    SORTED ACCOUNT DAYFILE AND CALLS THE APPROPRIATE ROUTINE TO PROCES DETAIL     5
CC    THAT RECORD                                                       DETAIL     6
C                                                                       DETAIL     7
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   DETAIL     8
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,     DETAIL     9
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL     DETAIL    10
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      DETAIL    11
     $              TEXEND,REMARK,CPUSEC                                DETAIL    12
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, DETAIL    13
     $              NCARDS,NTPDR,TPTIME                                 DETAIL    14
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                 JULY18     2
C                                                                       JULY18     3
      LOGICAL ENTER                                                     JULY18     4
C                                                                       DETAIL    15
CC    DEFINE KEYWORD TABLE                                              DETAIL    16
C                                                                       DETAIL    17
      DIMENSION KEYWD(18)                                               DETAIL    18
      DATA NKEY/18/                                                     DETAIL    19
      DATA KEYWD(1)/4HABUN/                                             DETAIL    20
      DATA KEYWD(2)/4HACST/                                             DETAIL    21
      DATA KEYWD(3)/4HAEPQ/                                             DETAIL    22
      DATA KEYWD(4)/4HAESR/                                             DETAIL    23
      DATA KEYWD(5)/4HAMAS/                                             DETAIL    24
      DATA KEYWD(6)/4HAMRT/                                             DETAIL    25
      DATA KEYWD(7)/4HI8EQ/                                             DETAIL    26
      DATA KEYWD(8)/4HI8JC/                                             DETAIL    27
      DATA KEYWD(9)/4HIEFL/                                             DETAIL    28
      DATA KEYWD(10)/4HSIUN/                                            DETAIL    29
      DATA KEYWD(11)/4HSPAT/                                            DETAIL    30
      DATA KEYWD(12)/4HSPGT/                                            DETAIL    31
      DATA KEYWD(13)/4HUCCR/                                            DETAIL    32
      DATA KEYWD(14)/4HUCLP/                                            DETAIL    33
      DATA KEYWD(15)/4HUECP/                                            DETAIL    34
      DATA KEYWD(16)/4HUEMS/                                            DETAIL    35
      DATA KEYWD(17)/4HUEMT/                                            DETAIL    36
      DATA KEYWD(18)/4HUEPF/                                            DETAIL    37
C                                                                       DETAIL    38
      NENTRY=NENTRY+1                                                   DETAIL    39
C                                                                       DETAIL    40
CC    LOOK UP KEY WORD TABLE TO OBTAIN ENTRY INDEX                      DETAIL    41
C                                                                       DETAIL    42
      CALL LOOKUP (CODE,KEYWD,NKEY,INDEX)                               DETAIL    43
C                                                                       DETAIL    44
CC    PROCESS RECORD IF KEYWORD RELEVENT AND LEGAL FIRST ENTRY PRESENT  JULY18     5
C                                                                       JULY18     6
      IF ((INDEX.EQ.0).OR.(.NOT.ENTER)) GOTO 19                         JULY18     7
         NPROC=NPROC+1                                                  DETAIL    48
         GOTO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18), INDEX     DETAIL    49
C                                                                       DETAIL    50
CCC      CASE OF KEYWORD                                                DETAIL    51
CCC                                                                     DETAIL    52
C                       *ABUN*                                          DETAIL    53
```

```
     1        CALL ISABUN                                          DETAIL      54
              GOTO 20                                              DETAIL      55
C                             *ACST*                              DETAIL      56
     2        CALL ISACST                                          DETAIL      57
              GOTO 20                                              DETAIL      58
C                             *AEPQ*                              DETAIL      59
     3        CALL ISAEPQ                                          DETAIL      60
              GOTO 20                                              DETAIL      61
C                             *AESR*                              DETAIL      62
     4        CALL ISAESR                                          DETAIL      63
              GOTO 20                                              DETAIL      64
C                             *AMAS*                              DETAIL      65
     5        CALL ISAMAS                                          DETAIL      66
              GOTO 20                                              DETAIL      67
C                             *AMRT*                              DETAIL      68
     6        CALL ISAMRT                                          DETAIL      69
              GOTO 20                                              DETAIL      70
C                             *IBEQ*                              DETAIL      71
     7        CALL ISIBEQ                                          DETAIL      72
              GOTO 20                                              DETAIL      73
C                             *IBJC*                              DETAIL      74
     8        CALL ISIBJC                                          DETAIL      75
              GOTO 20                                              DETAIL      76
C                             *IEFL*                              DETAIL      77
     9        CALL ISIEFL                                          DETAIL      78
              GOTO 20                                              DETAIL      79
C                             *SIUN*                              DETAIL      80
    10        CALL ISSIUN                                          DETAIL      81
              GOTO 20                                              DETAIL      82
C                             *SPAT*                              DETAIL      83
    11        CALL ISSPAT                                          DETAIL      84
              GOTO 20                                              DETAIL      85
C                             *SPGT*                              DETAIL      86
    12        CALL ISSPGT                                          DETAIL      87
              GOTO 20                                              DETAIL      88
C                             *UCCR*                              DETAIL      89
    13        CALL ISUCCR                                          DETAIL      90
              GOTO 20                                              DETAIL      91
C                             *UCLP*                              DETAIL      92
    14        CALL ISUCLP                                          DETAIL      93
              GOTO 20                                              DETAIL      94
C                             *UECP*                              DETAIL      95
    15        CALL ISUECP                                          DETAIL      96
              GOTO 20                                              DETAIL      97
C                             *UEMS*                              DETAIL      98
    16        CALL ISUEMS                                          DETAIL      99
              GOTO 20                                              DETAIL     100
C                             *UEMT*                              DETAIL     101
    17        CALL ISUEMT                                          DETAIL     102
              GOTO 20                                              DETAIL     103
C                             *UEPF*                              DETAIL     104
    18        CALL ISUEPF                                          DETAIL     105
              GOTO 20                                              DETAIL     106
C                                                                  DETAIL     107
C         END CASE                                                 DETAIL     108
```

```
C                                                                       DETAIL     109
CC      ELSE  IF KEY WORD NOT OF INTEREST                               DETAIL     110
C                                                                       DETAIL     111
   19     NOTPROC=NOTPROC+1                                             DETAIL     112
C                                                                       DETAIL     113
CC      END IF                                                          DETAIL     114
C                                                                       DETAIL     115
   20   RETURN                                                          DETAIL     116
        END                                                             DETAIL     117



        SUBROUTINE RESULT                                               RESULT       2
C                                                                       RESULT       3
CC      SUBROUTINE RESULT TABULATES THE RESULT OF ANALYSIS              RESULT       4
C                                                                       RESULT       5
        ENDFILE 3                                                       RESULT       6
        REWIND 3                                                        RESULT       7
        ENDFILE 4                                                       RESULT       8
        REWIND 4                                                        RESULT       9
        CALL LISTING                                                    RESULT      10
        CALL STAT                                                       RESULT      11
        RETURN                                                          RESULT      12
        END                                                             RESULT      13



        SUBROUTINE LISTING                                              LISTING      2
C                                                                       LISTING      3
CCC     SUBROUTINE LISTING PRINTS RESULTS OF ANALYSIS IN THE FORM OF    LISTING      4
CCCCC   TWO TABLES.    EACH TABLE HAS ONE ENTRY FOR EACH JOB.           LISTING      5
C                                                                       LISTING      6
CCCCC   LOCAL VARIABLES                                                 LISTING      7
CC         DISCARD, DUMMY, ENDLIST, NPAGE, N, NXLIST,DATE               LISTING      8
C                                                                       LISTING      9
        COMMON /CHOICE/TLOWER,TUPPER,TABLE1,TABLE2,SKIP                 LISTING     10
        COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,    LISTING     11
     $                TEXEND,REMARK,CPUSEC                             LISTING     12
        COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, LISTING  13
     $                NCARDS,NTPDR,TPTIME                              LISTING     14
C                                                                       LISTING     15
        DIMENSION DISCARD(9),DUMMY(2)                                   LISTING     16
        LOGICAL ENDLIST,NXLIST,TABLE1,TABLE2                            LISTING     17
        DATA BLANK/1H-/                                                 LISTING     18
C                                                                       LISTING     19
        IF ((.NOT.TABLE1).AND.(.NCT.TABLE2)) RETURN                     LISTING     20
C                                                                       LISTING     21
CCC     OBTAIN DATE FROM FILE HEADER AND INITIALISE                     LISTING     22
C                                                                       LISTING     23
        READ (3) DATE,DISCARD                                           LISTING     24
        READ (4) DATE,DISCARD,DUMMY                                     LISTING     25
        ENDLIST=.FALSE.                                                 LISTING     26
        NPAGE=0                                                         LISTING     27
```

```
C                                                                       LISTING     28
CC     LOOP TO PRINT ONE PAGE OF EACH TABLE                             LISTING     29
C                                                                       LISTING     30
     1     N=0                                                          LISTING     31
           NPAGE=NPAGE+1                                                LISTING     32
           NXLIST=.FALSE.                                               LISTING     33
           WRITE (6,100) DATE,NPAGE                                     LISTING     34
           WRITE (6,120)                                                LISTING     35
           WRITE (6,200)                                                LISTING     36
           WRITE (6,201)                                                LISTING     37
C                                                                       LISTING     38
CC         LOOP TO PRINT ONE PAGE OF TABLE 1                            LISTING     39
C                                                                       LISTING     40
     2        READ (3)          JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT, LISTING     41
      $                         TEXBGN,TEXEND,REMARK,CPUSEC             LISTING     42
C                                                                       LISTING     43
              IF (EOF(3)) 3,4                                           LISTING     44
     3           NXLIST=.TRUE.                                          LISTING     45
                 ENDLIST=.NOT.TABLE2                                    LISTING     46
                 GOTO 5                                                 LISTING     47
C                                                                       LISTING     48
CC           ELSE                                                       LISTING     49
C                                                                       LISTING     50
     4           WRITE(6,300) JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT, LISTING     51
      $                       TEXBGN,TEXEND,CPUSEC,REMARK               LISTING     52
                 N=N+1                                                  LISTING     53
C                                                                       LISTING     54
CC           END IF                                                     LISTING     55
C                                                                       LISTING     56
     5        IF ((N.GE.55).OR.NXLIST) GOTO 6                           LISTING     57
              GOTO 2                                                    LISTING     58
C                                                                       LISTING     59
CC         END LOOP                                                     LISTING     60
C                                                                       LISTING     61
     6     IF (TABLE2) 7,15                                             LISTING     62
     7        N=0                                                       LISTING     63
              WRITE (6,100) DATE,NPAGE                                  LISTING     64
              WRITE (6,120)                                             LISTING     65
              WRITE (6,400)                                             LISTING     66
              WRITE (6,401)                                             LISTING     67
C                                                                       LISTING     68
CC            LOOP TO PRINT ONE PAGE OF TABLE2                          LISTING     69
C                                                                       LISTING     70
     8           READ (4) JOBREC,SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE, LISTING     71
      $             USAGEMS,NLINES,NCARDS,NTPDR,TPTIME,DUMMY(1)       LISTING     72
                 IF (EOF(4)) 9,10                                       LISTING     73
     9              ENDLIST=.TRUE.                                     LISTING     74
                    N=999                                               LISTING     75
                    GOTO 14                                             LISTING     76
C                                                                       LISTING     77
CC                 ELSE                                                LISTING     78
C                                                                       LISTING     79
    10                IF (NTPDR.EQ.0) 11,12                             LISTING     80
C                                                                       LISTING     81
CC                      SUPPRESS ZEROS ON PRINTOUT IF NO TAPE USED      LISTING     82
```

```
C                                                                                LISTING     83
   11                WRITE (6,500) JOBREC,SRUSED,MAXFL,NDPFACC,IDPFACC,          LISTING     84
     $               PFUSAGE,USAGEMS,NLINES,NCARDS,BLANK,BLANK                   LISTING     85
                     GOTO 13                                                     LISTING     86
C                                                                                LISTING     87
CC                 ELSE                                                          LISTING     88
C                                                                                LISTING     89
   12                WRITE (6,600) JOBREC,SRUSED,MAXFL,NDPFACC,IDPFACC,          LISTING     90
     $               PFUSAGE,USAGEMS,NLINES,NCARDS,NTPDR,TPTIME                  LISTING     91
C                                                                                LISTING     92
CC                 END IF                                                        LISTING     93
C                                                                                LISTING     94
   13              N=N+1                                                         LISTING     95
C                                                                                LISTING     96
CC               END IF                                                          LISTING     97
C                                                                                LISTING     98
   14            IF (N.LT.55) GOTO 8                                             LISTING     99
C                                                                                LISTING    100
CC             END LOOP                                                          LISTING    101
CC                                                                               LISTING    102
CC         END IF                                                                LISTING    103
C                                                                                LISTING    104
   15      IF (.NOT.ENDLIST) GOTO 1                                              LISTING    105
C                                                                                LISTING    106
CC      END LOOP                                                                 LISTING    107
C                                                                                LISTING    108
        REWIND 3                                                                 LISTING    109
        REWIND 4                                                                 LISTING    110
        RETURN                                                                   LISTING    111
C                                                                                LISTING    112
  100  FORMAT (1H1,50X,*JOB SUMMARY *,A9,40X,*PAGE *,I3)                         JULY18       8
  120  FORMAT (T52,*--- ------- ---------*//)                                    JUL 18       1
  200  FORMAT (*    NO.      JOBNAME   TYPE   CLASS   TIME IN    TIME OUT       LISTING    115
     $    EXC BEGIN    EXC END       CPU SECS  REMARKS*)                       LISTING    116
  201  FORMAT (*    --       -------   ----    -----   -------    --------       LISTING    117
     $    ---------    -------    --------  -------*//)                         LISTING    118
  300  FORMAT (T3,I5,T13,A7,T25,A1,T32,A2,T36,A9,T48,A9,T60,A9,T73,A9,           LISTING    119
     $  T84,F10.3,T100,A2)                                                       LISTING    120
  400  FORMAT (*    NO.          SRUS         MAX FL       DPF ACC  IDPF ACC     LISTING    121
     $   PF UNITS    MS UNITS   LINES PRT    CARDS RD    TP DRIVES    TP TIME   LISTING    122
     $ *)                                                                        LISTING    123
  401  FORMAT (*    --           ----         ------       -------  --------     LISTING    124
     $  --------    --------   ---------    --------    ---------    -------    LISTING    125
     $ *//)                                                                      LISTING    126
  500  FORMAT (T3,I5,T11,F10.3,T28,I6,T42,I3,T50,I3,T57,F10.3,T68,F10.3,         LISTING    127
     $  T83,I6,T95,I6,T110,A1,T120,A1)                                           LISTING    128
  600  FORMAT (T3,I5,T11,F10.3,T28,I6,T42,I3,T50,I3,T57,F10.3,T68,F10.3,         LISTING    129
     $  T83,I6,T95,I6,T110,I1,T117,F6.3)                                         LISTING    130
C                                                                                LISTING    131
        END                                                                      LISTING    132
```

```
      SUBROUTINE STAT                                                   STAT     2
C                                                                       STAT     3
CC    SUBROUTINE STAT PRINTS COUNTS OF RECORDS IN VARIOUS CATEGORIES    STAT     4
C                                                                       STAT     5
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      STAT     6
     $              TEXEND,REMARK,CPUSEC                               STAT     7
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,     STAT     8
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL     STAT     9
      DIMENSION DUMMY(9)                                                STAT    10
C                                                                       STAT    11
      REWIND 3                                                          STAT    12
      READ (3) DATE,DUMMY                                               STAT    13
      WRITE (6,100) DATE                                                STAT    14
      WRITE (6,120)                                                     STAT    15
      WRITE (6,200) NENTRY                                              STAT    16
      WRITE (6,300) NPROC                                               STAT    17
      WRITE (6,400) NOTPROC                                             STAT    18
      WRITE (6,500) JOBREC                                              STAT    19
      WRITE (6,600) NCTS                                                STAT    20
      WRITE (6,700) NCSYST                                              STAT    21
      WRITE (6,800)  NCRMTB                                             STAT    22
      WRITE (6,900) NCBAT                                               STAT    23
      WRITE (6,1100) NSTALL                                             STAT    24
      WRITE (6,1200)  INCMPL                                            STAT    25
      WRITE (6,1300) NRTS                                               STAT    26
      WRITE (6,1400) NRNONTS                                            STAT    27
      NJIN=NTERML+NBATCH+NSYST                                          STAT    28
      WRITE (6,1500) NJIN                                               STAT    29
      WRITE (6,1600) NTERML                                             STAT    30
      WRITE (6,1700) NSYST                                              STAT    31
      WRITE (6,1800) NBATCH                                             STAT    32
      RETURN                                                            STAT    33
C                                                                       STAT    34
  100 FORMAT (1H1,T50,*STATISTICS FOR DAYFILE *,A9)                     STAT    35
  120 FORMAT (T50,*---------- --- ------- ----------*///)               STAT    36
  200 FORMAT (*  TOTAL NUMBER OF RECORDS READ FROM SORTED DAYFILE      STAT    37
     $        =*,I6/)                                                  STAT    38
  300 FORMAT (*      NUMBER OF RECORDS USED IN THIS ANALYSIS           STAT    39
     $        =*,I6/)                                                  STAT    40
  400 FORMAT (*      NUMBER OF RECORDS NOT USED IN THIS ANALYSIS       STAT    41
     $        =*,I6//)                                                 STAT    42
  500 FORMAT (*  TOTAL NUMBER OF JOB RECORDS WRITTEN ON JOB-SUMMARY FILE STAT    43
     $        =*,I6/)                                                  STAT    44
  600 FORMAT (*      NUMBER OF TIME-SHARING JOBS                       STAT    45
     $        =*,I6/)                                                  STAT    46
  700 FORMAT (*      NUMBER OF SYSTEM JOBS                             STAT    47
     $        =*,I6/)                                                  STAT    48
  800 FORMAT (*      NUMBER OF REMOTE BATCH JOBS                       STAT    49
     $        =*,I6/)                                                  STAT    50
  900 FORMAT (*      NUMBER OF BATCH JOBS                              STAT    51
     $        =*,I6/)                                                  STAT    52
 1100 FORMAT (*        OF WHICH THE NUMBER OF STALL JOBS               STAT    53
     $        =*,I6//)                                                 STAT    54
 1200 FORMAT (*  TOTAL NUMBER OF JOBS FOR WHICH RECORDS ARE INCOMPLETE  STAT    55
     $        =*,I6/)                                                  STAT    56
```

```
 1300 FORMAT (*      NUMBER OF TIME-SHARING JOBS ALREADY IN SYSTEM AT STA  STAT        57
     $RT      =*,I6/)                                                     STAT        58
 1400 FORMAT (*      NUMBER OF NON TS JOBS ALREADY IN SYSTEM AT START      STAT        59
     $        =*,I6//)                                                    STAT        60
 1500 FORMAT (*  DURING PERIOD OF ANALYSIS NUMBER OF JOBS ENTERING SYSTE   STAT        61
     $M       =*,I6/)                                                     STAT        62
 1600 FORMAT (*      TIME-SHARING JOBS                                     STAT        63
     $        =*,I6/)                                                     STAT        64
 1700 FORMAT (*      SYSTEM JOBS                                           STAT        65
     $        =*,I6/)                                                     STAT        66
 1800 FORMAT (*      BATCH JOBS INCLUDING REMOTE BATCH                     STAT        67
     $        =*,I6/)                                                     STAT        68
C                                                                        STAT        69
      END                                                                STAT        70



      SUBROUTINE ISIBEQ                                                  IBEQ         2
C                                                                        IBEQ         3
CC    IBEQ TO BE WRITTEN                                                 IBEQ         4
C                                                                        IBEQ         5
      RETURN                                                             IBEQ         6
      END                                                                IBEQ         7



      SUBROUTINE ISABUN                                                  ABUN         2
C                                                                        ABUN         3
CC     FOR ABUN ENTRY SET TIME THAT EXECUTION STARTS                     ABUN         4
C                                                                        ABUN         5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                    ABUN         6
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,       ABUN         7
     $              TEXEND,REMARK,CPUSEC                                ABUN         8
C                                                                        ABUN         9
      TEXBGN=TIME                                                        ABUN        10
      RETURN                                                             ABUN        11
      END                                                                ABUN        12



      SUBROUTINE ISACST                                                  ACST         2
C                                                                        ACST         3
CC     FOR ACST ENTRY INCREMENT COUNT OF STALL JOB                       ACST         4
CC                                                                       ACST         5
C                                                                        ACST         6
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                    ACST         7
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,       ACST         8
     $              TEXEND,REMARK,CPUSEC                                ACST         9
      COMMON /COUNTS/NENTRY,NPROC,NOTPROC,INCMPL,NCBAT,NCTS,NCSYST,      ACST        10
     $               NCRMTB,NRTS,NRNONTS,NTERML,NSYST,NBATCH,NSTALL      ACST        11
C                                                                        ACST        12
      NSTALL=NSTALL+1                                                    ACST        13
```

```
      REMARK=2HST                                                       ACST        14
      RETURN                                                            ACST        15
      END                                                               ACST        16



      SUBROUTINE ISAEPQ                                                 AEPQ         2
C                                                                       AEPQ         3
CC     FOR AEPQ ENTRY DETERMINE TYPE OF QUEUE AND TIME                  AEPQ         4
C                                                                       AEPQ         5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   AEPQ         6
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      AEPQ         7
     $              TEXEND,REMARK,CPUSEC                                AEPQ         8
C                                                                       AEPQ         9
      DECODE (30,1,MESSAGE) QTYPE                                       AEPQ        10
    1 FORMAT (A2)                                                       AEPQ        11
      IF (QTYPE.EQ.2HIN) TEXBGN=TIME                                    AEPQ        12
      IF (QTYPE.EQ.2HPR) TOUT=TIME                                      AEPQ        13
C                                                                       AEPQ        14
CC     IGNORE PUNCH QUEUE                                               AEPQ        15
C                                                                       AEPQ        16
      RETURN                                                            AEPQ        17
      END                                                               AEPQ        18



      SUBROUTINE ISAESR                                                 AESR         2
C                                                                       AESR         3
CC     AESR ENTRY SIGNIFIES END OF JOB RUN                              AESR         4
C                                                                       AESR         5
      INTEGER TASSIGN,TRELEAS                                           AESR         6
      COMMON /TAPEVAR/NTP,NCURDR,DEVICE(10),TASSIGN(10),TRELEAS(10)     AESR         7
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   AESR         8
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,AESR         9
     $              NCARDS,NTPDR,TPTIME                                 AESR        10
      COMMON /FLAGS/ENTER,LEAVE,CMPLETE                                 AESR        11
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      AESR        12
     $              TEXEND,REMARK,CPUSEC                                AESR        13
      LOGICAL LEAVE                                                     AESR        14
      DATA INDEF/0/                                                     AESR        15
C                                                                       AESR        16
      LEAVE=.TRUE.                                                      AESR        17
      TEXEND=TIME                                                       AESR        18
      DECODE (30,1,MESSAGE) SRUSED                                      AESR        19
    1 FORMAT (F10.3)                                                    AESR        20
C                                                                       AESR        21
CC     FIND DURATION OF TAPE DRIVE OCCUPATION IN MINUTES                AESR        22
C                                                                       AESR        23
      IF (NTP.EQ.0) RETURN                                              AESR        24
      ITPSEC=0                                                          AESR        25
      NOW=LOGTIME(TIME)                                                 AESR        26
      DO 2 I=1,NTP                                                      AESR        27
         IF (TRELEAS(I).EQ.INDEF) TRELEAS(I)=NOW                        AESR        28
```

```
      ITPSEC=ITPSEC+(TRELEAS(I)-TASSIGN(I))                                  AESR        29
    2 CONTINUE                                                               AESR        30
      TPTIME=(FLOAT(ITPSEC))/60.                                             AESR        31
      RETURN                                                                 AESR        32
      END                                                                    AESR        33



      SUBROUTINE ISAMAS                                                      AMAS         2
C                                                                            AMAS         3
CC     FOR AMAS ENTRY RECORD TAPE DEVICE ASSIGNMENT AND TIME                 AMAS         4
C                                                                            AMAS         5
      INTEGER TASSIGN,TRELEAS                                                AMAS         6
      COMMON /TAPEVAR/NTP,NCURDR,DEVICE(10),TASSIGN(10),TRELEAS(10)          AMAS         7
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                        AMAS         8
      COMMON /LIST2/SRUSED,MAXFL,NOPFACC,IOPFACC,PFUSAGE,USAGEMS,NLINES,     AMAS         9
     $              NCARDS,NTPDR,TPTIME                                      AMAS        10
C                                                                            AMAS        11
      NTP=NTP+1                                                              AMAS        12
      NCURDR=NCURDR+1                                                        AMAS        13
      IF (NCURDR.GT.NTPDR) NTPDR=NCURDR                                      AMAS        14
C                                                                            AMAS        15
CC     STORE DEVICE NUMBER                                                   AMAS        16
C                                                                            AMAS        17
      DECODE (30,100,MESSAGE) DEVICE(NTP)                                    AMAS        18
  100 FORMAT (A2)                                                            AMAS        19
C                                                                            AMAS        20
CC     RECORD DRIVE ASSIGNMENT TIME IN SECONDS SINCE MIDNIGHT                AMAS        21
C                                                                            AMAS        22
      TASSIGN(NTP)=LOGTIME(TIME)                                             AMAS        23
      RETURN                                                                 AMAS        24
      END                                                                    AMAS        25



      FUNCTION LOGTIME (T)                                                   LOGTIME      2
C                                                                            LOGTIME      3
CC     THIS FUNCTION RETURNS THE TIME IN SECONDS RELATIVE TO 00.00.00        LOGTIME      4
C                                                                            LOGTIME      5
      IMPLICIT INTEGER (A-Z)                                                 LOGTIME      6
      DECODE (10,100,T) HRS,MINS,SECS                                        LOGTIME      7
  100 FORMAT (3(1X,I2))                                                      LOGTIME      8
      LOGTIME=3600*HRS+60*MINS+SECS                                          LOGTIME      9
      RETURN                                                                 LOGTIME     10
      END                                                                    LOGTIME     11
                                                                             LOGTIME     12
```

```
      SUBROUTINE ISAMRT                                                 AMRT      2
C                                                                       AMRT      3
CC    FOR AMRT ENTRY RECORD TAPE DRIVE RELEASE                          AMRT      4
CC                                                                      AMRT      5
C                                                                       AMRT      6
      INTEGER TASSIGN,TRELEAS                                           AMRT      7
      COMMON /TAPEVAR/NTP,NCURDR,DEVICE(10),TASSIGN(10),TRELEAS(10)     AMRT      8
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   AMRT      9
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, AMRT     10
     $              NCARDS,NTPDR,TPTIME                                 AMRT     11
      DATA INDEF/0/                                                     AMRT     12
C                                                                       AMRT     13
      NCURDR=NCURDR-1                                                   AMRT     14
      DECODE (30,100,MESSAGE) DR                                        AMRT     15
  100 FORMAT (A2)                                                       AMRT     16
      I=0                                                               AMRT     17
C      LOOK UP DRIVE ASSIGNMENT TABLE LOOP                              AMRT     18
C                                                                       AMRT     19
    2    I=I+1                                                          AMRT     20
C                                                                       JULY18    9
CC       AVOID INFINITE LOOP IN CASE CORRESPONDING AMAS RECORD MISSING  JULY18   10
C                                                                       JULY18   11
         IF (I.GT.NTP) RETURN                                           JULY18   12
C                                                                       JULY18   13
         IF ((DR.EQ.DEVICE(I)).AND.(TRELEAS(I).EQ.INDEF)) GOTO 3        AMRT     21
         GOTO 2                                                         AMRT     22
C                                                                       AMRT     23
CC    END LOOP                                                          AMRT     24
C                                                                       AMRT     25
    3 TRELEAS(I)=LOGTIME(TIME)                                          AMRT     26
      RETURN                                                            AMRT     27
      END                                                               AMRT     28


      SUBROUTINE ISIBJC                                                 IBJC      2
C                                                                       IBJC      3
CC    FOR IBJC ENTRY THE JOB CLASS DEFINED BY MUCC IS RECORDED          IBJC      4
C                                                                       IBJC      5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   IBJC      6
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      IBJC      7
     $              TEXEND,REMARK,CPUSEC                                IBJC      8
C                                                                       IBJC      9
      DECODE (30,100,MESSAGE) JCLASS                                    IBJC     10
  100 FORMAT (T2,A1)                                                    IBJC     11
      TEXBGN=TIME                                                       IBJC     12
      RETURN                                                            IBJC     13
      END                                                               IBJC     14
```

```
      SUBROUTINE ISIEFL                                                 IEFL      2
C                                                                       IEFL      3
CC    FOR IEFL ENTRY THE MAX FIELD LENGTH USED FOR THE JOB IS RECORDED  IEFL      4
C                                                                       IEFL      5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   IEFL      6
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, IEFL     7
     $              NCARDS,NTPDR,TPTIME                                 IEFL      8
C                                                                       IEFL      9
      DECODE (30,100,MESSAGE) MAXFL                                     IEFL     10
  100 FORMAT (T13,I6)                                                   IEFL     11
      RETURN                                                            IEFL     12
      END                                                               IEFL     13


      SUBROUTINE ISSIUN                                                 SIUN      2
C                                                                       SIUN      3
CC    FOR SIUN ENTRY THE JOB HAS BEEN ABORTED                           SIUN      4
C                                                                       SIUN      5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   SIUN      6
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      SIUN      7
     $              TEXEND,REMARK,CPUSEC                                SIUN      8
C                                                                       SIUN      9
      REMARK=2HAB                                                       SIUN     10
      RETURN                                                            SIUN     11
      END                                                               SIUN     12


      SUBROUTINE ISSPAT                                                 SPAT      2
C                                                                       SPAT      3
CC    FOR SPAT ENTRY DIRECT PERMANENT FILE ACCESS IS RECORDED           SPAT      4
C                                                                       SPAT      5
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, SPAT     6
     $              NCARDS,NTPDR,TPTIME                                 SPAT      7
CC                                                                      SPAT      8
C                                                                       SPAT      9
      NDPFACC=NDPFACC+1                                                 SPAT     10
      RETURN                                                            SPAT     11
      END                                                               SPAT     12
```

```
      SUBROUTINE ISSPGT                                                 SPGT          2
C                                                                       SPGT          3
CC    FOR SPGT ENTRY THE INDIRECT ACCESS PERMANENT FILE ACCESS IS RECORD SPGT          4
C                                                                       SPGT          5
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, SPGT          6
     $              NCARDS,NTPDR,TPTIME                                 SPGT          7
C                                                                       SPGT          8
      IDPFACC=IDPFACC+1                                                 SPGT          9
      RETURN                                                            SPGT         10
      END                                                               SPGT         11


      SUBROUTINE ISUCCR                                                 UCCR          2
C                                                                       UCCR          3
CC    FOR UCCR ENTRY A BATCH JOB ENTERS THE SYSTEM                      UCCR          4
C                                                                       UCCR          5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   UCCR          6
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      UCCR          7
     $              TEXEND,REMARK,CPUSEC                                UCCR          8
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, UCCR          9
     $              NCARDS,NTPDR,TPTIME                                 UCCR         10
C                                                                       UCCR         11
      TIN=TIME                                                          UCCR         12
      CALL LPCR (NCARDS)                                                UCCR         13
      RETURN                                                            UCCR         14
      END                                                               UCCR         15


      SUBROUTINE ISUCLP                                                 UCLP          2
C                                                                       UCLP          3
CC                                                                      UCLP          4
CC    FOR UCLP ENTRY THE PRINTOUT AFTER JOB EXECUTION IS FINISHED       UCLP          5
C                                                                       UCLP          6
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   UCLP          7
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      UCLP          8
     $              TEXEND,REMARK,CPUSEC                                UCLP          9
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, UCLP         10
     $              NCARDS,NTPDR,TPTIME                                 UCLP         11
C                                                                       UCLP         12
      TOUT=TIME                                                         UCLP         13
      CALL LPCR (NLINES)                                                UCLP         14
      RETURN                                                            UCLP         15
      END                                                               UCLP         16
```

```
      SUBROUTINE LPCR (N)                                                LPCR      2
C                                                                        LPCR      3
C     SUBROUTINE LPCR RETURNS THE NUMBER OF CARDS READ OR LINES PRINTED  LPCR      4
C     BY ANALYSING THE RELEVENT ENTRY IN THE ACCOUNT DAYFILE             LPCR      5
C                                                                        LPCR      6
C     LOCAL VARIABLES                                                    LPCR      7
C        CHAR1 = FIRST CHARACTER OF MESSAGE PART OF ENTRY                LPCR      8
C        KUNS = KILO UNITS OF CARDS OR LINES                             LPCR      9
C                                                                        LPCR     10
      REAL KUNS                                                          LPCR     11
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                    LPCR     12
C                                                                        LPCR     13
      DECODE (30,100,MESSAGE) CHAR1                                      LPCR     14
      IF (CHAR1.EQ.1H,) 1,2                                              LPCR     15
    1    DECODE (30,200,MESSAGE) KUNS                                    LPCR     16
         GOTO 3                                                          LPCR     17
C                                                                        LPCR     18
C     ELSE                                                               LPCR     19
C                                                                        LPCR     20
    2    DECODE (30,300,MESSAGE) KUNS                                    LPCR     21
C                                                                        LPCR     22
C     END IF                                                             LPCR     23
C                                                                        LPCR     24
    3 N=KUNS*1000.                                                       LPCR     25
      RETURN                                                             LPCR     26
C                                                                        LPCR     27
  100 FORMAT (A1)                                                        LPCR     28
  200 FORMAT (2X,F10.3)                                                  LPCR     29
  300 FORMAT (4X,F10.3)                                                  LPCR     30
C                                                                        LPCR     31
      END                                                                LPCR     32


      SUBROUTINE ISUECP                                                  UECP      2
C                                                                        UECP      3
CC    FOR  UECP ENTRY THE CPU TIME FOR THE JOB IN SECONDS IS RECORDED    UECP      4
C                                                                        UECP      5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                    UECP      6
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,       UECP      7
     $              TEXEND,REMARK,CPUSEC                                 UECP      8
C                                                                        UECP      9
      DECODE (30,100,MESSAGE) CPUSEC                                     UECP     10
  100 FORMAT (F10.3)                                                     UECP     11
      RETURN                                                             UECP     12
      END                                                                UECP     13
```

```
      SUBROUTINE ISUEMS                                                 UEMS          2
C                                                                       UEMS          3
CC    FOR UEMS ENTRY THE MASS STORAGE UNITS USED FOR THE JOB IS RECORDED UEMS         4
C                                                                       UEMS          5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   UEMS          6
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IOPFACC,PFUSAGE,USAGEMS,NLINES, UEMS         7
     $              NCARDS,NTPDR,TPTIME                                UEMS          8
C                                                                       UEMS          9
      DECODE (30,100,MESSAGE) USAGEMS                                   UEMS         10
  100 FORMAT (F10.3)                                                    UEMS         11
      RETURN                                                            UEMS         12
      END                                                               UEMS         13


      SUBROUTINE ISUEPF                                                 UEPF          2
C                                                                       UEPF          3
CC    FOR UEPF ENTRY THE PERMANENT FILES USAGE IN UNITS IS RECORDED     UEPF          4
C                                                                       UEPF          5
      COMMON /STRING/TIME,JNAME,JTYPE,CODE,MESSAGE(3)                   UEPF          6
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IOPFACC,PFUSAGE,USAGEMS,NLINES, UEPF         7
     $              NCARDS,NTPDR,TPTIME                                UEPF          8
C                                                                       UEPF          9
      DECODE (30,100,MESSAGE) PFUSAGE                                   UEPF         10
  100 FORMAT (F10.3)                                                    UEPF         11
      RETURN                                                            UEPF         12
      END                                                               UEPF         13


      SUBROUTINE ISUEMT                                                 UEMT          2
      RETURN                                                            UEMT          3
      END                                                               UEMT          4
```

```
      OVERLAY (PH3,0,0)


      PROGRAM PHASE3 (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE2,
     $ TAPE1,TAPE3,TAPE4,TAPE8,TAPE9,TAPE10)
C
C
C         ************************************************************
C         *                                                          *
C         *                                                          *
C         * PROGRAM PHASE3 IS THE THIRD PHASE OF A PROJECT FOR       *
C         * ANALYSIS OF JOB ACCOUNT DAYFILE FOR THE CDC 6400 COMPUTER *
C         * IT TAKES THE OUTPUT FILES WRITTEN BY PROGRAM PHASE2, I.E. *
C         * THE JOB SUMMARY FILES, AND PRODUCES AN ANALYSIS OF THE   *
C         * SYSTEM LOAD AND PERFORMANCE AT REGULAR TIME INTERVALS    *
C         * SPECIFIED BY THE USER                                    *
C         *                                                          *
C         *              AUTHOR            HOK-NAM NG                *
C         *          SUPERVISOR            DR. N.P. ARCHER           *
C         *                DATE            SUMMER,1979               *
C         *                                                          *
C         * INPUT FILES                                              *
C         *    TAPE3 AND TAPE4 = TWO SECTIONS OF JOB SUMMARY FILES   *
C         *    WRITTEN BY PROGRAM PHASE2 WITH RECORDS FOR NON TIME-  *
C         *    SHARING JOBS PRECEDING THOSE OF TIME-SHARING JOBS     *
C         *                                                          *
C         * SCRATCH FILES                                            *
C         *    TAPE1 AND TAPE2 = OBTAINED BY SORTING TAPE3 AND TAPE4 *
C         *    SUCH THAT RECORDS ARE IN CHRONOLOGICAL ORDER OF       *
C         *    STARTING TIME OF EXECUTION                            *
C         *                                                          *
C         * OUTPUT FILES                                             *
C         *    TAPE8 = INFORMATION ON JOB CONCURRENCY IN SYSTEM      *
C         *    TAPE9 = PARAMETERS CHARACTERISING LOAD OF SYSTEM      *
C         *    TAPE10 = TURNAROUND TIME AND DELAY FACTORS            *
C         * ALL FILES ARE UNFORMATTED                                *
C         *                                                          *
C         *                                                          *
C         ************************************************************
C
C
      CALL SORTJS
      CALL PRELIM
      CALL ANALYSE
      CALL OVERLAY (3HPH3,1,0,0)
      STOP
      END
```

```
      SUBROUTINE SORTJS                                                 PRELIM     47
C                                                                       PRELIM     48
CCC   SUBROUTINE SORTJS TAKES THE OUTPUT FILES ON JOB SUMMARY WRITTEN   PRELIM     49
CCC   BY PROGRAM PHASE2 (TAPE3 AND TAPE4)  AND SORTS THEM SO THAT       PRELIM     50
CCC   TIME-SHARING AND NON TIME-SHARING JOB RECORDS ARE MERGED IN       PRELIM     51
CCC   CHRONOLOGICAL ORDER OF ENTRY                                      PRELIM     52
CCC                                                                     PRELIM     53
CCC   SORT FIRST SECTION TAPE3                                          PRELIM     54
C                                                                       PRELIM     55
      CALL SMSORT (100)                                                 PRELIM     56
      CALL SMFILE (4HSORT,6HBINARY,3)                                   PRELIM     57
      CALL SMFILE (6HOUTPUT,6HBINARY,1)                                 PRELIM     58
      CALL SMKEY (61,1,10,0,7HDISPLAY)                                  PRELIM     59
      CALL SMOPT (6HRETAIN)                                             PRELIM     60
      CALL SMEND                                                        PRELIM     61
C                                                                       PRELIM     62
CCC   SORT SECOND SECTION TAPE4                                         PRELIM     63
C                                                                       PRELIM     64
      CALL SMSORT (120)                                                 PRELIM     65
      CALL SMFILE (4HSORT,6HBINARY,4)                                   PRELIM     66
      CALL SMFILE (6HOUTPUT,6HBINARY,2)                                 PRELIM     67
      CALL SMKEY (111,1,10,0,7HDISPLAY)                                 JULY19      1
      CALL SMOPT (6HRETAIN)                                             PRELIM     69
      CALL SMEND                                                        PRELIM     70
C                                                                       PRELIM     71
      REWIND 1                                                          PRELIM     72
      REWIND 2                                                          PRELIM     73
      RETURN                                                            PRELIM     74
      END                                                               PRELIM     75
```

```
      SUBROUTINE PRELIM                                                 PRELIM     76
C                                                                       PRELIM     77
CCC   SUBROUTINE PRELIM PERFORMS INITIAL PREPARATIONS BEFORE PROCESSING PRELIM     78
CCC   THE JOB SUMMARY FILE.                                             PRELIM     79
CCC                                                                     PRELIM     80
CCC   PARAMETERS                                                        PRELIM     81
CCC      FOR COMMON BLOCK CHOICE SEE SUBROUTINE READIN                  PRELIM     82
CCC                                                                     PRELIM     83
CCC      NTAC = NUMBER OF CLASSES OF TURNAROUND TIME                    PRELIM     84
CCC      NJOBTA = NUMBER OF JOBS IN THE DAY, FIRST INDEX DENOTES JOB    PRELIM     85
CCC               CLASS, SECOND INDEX DENOTES TURNAROUND TIME CLASS     PRELIM     86
CCC               AS DEFINED BY TALMT                                   PRELIM     87
CCC      TALMT = LIMITS OF TURNAROUDN TIME CLASSIFICATION               PRELIM     88
CCC                                                                     PRELIM     89
CCC      NSP = CURRENT NUMBER OF NON-EMPTY OVERFLOW BUCKETS USED        PRELIM     90
CCC            TO STORE PORTIONS OF PROCESS TIME ETC. ASCRIBED TO NEXT  PRELIM     91
CCC            TIME SLOTS                                               PRELIM     92
CCC      ITREM = REMAINING PROCESS TIME OF JOB ASCRIBED TO FUTURE SLOTS PRELIM     93
CCC      REMCPU = REMAINING CPU SECONDS                                 PRELIM     94
CCC      REMSRU = REMAINING SRUS                                        PRELIM     95
CCC      REMJOB = REMAINING PORTION OF JOB                              PRELIM     96
C        ITYPE = 1  FOR NON TIME-SHARING JOB                            PRELIM     97
```

```
C              2 FOR TIME-SHARING JOB                                    PRELIM      98
C                                                                        PRELIM      99
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                          PRELIM     100
      COMMON /SLOT/FROM,TO                                               PRELIM     101
      COMMON /BUCKET/NSP,ITREM(50),REMCPU(50),REMSRU(50),REMJOB(50),     PRELIM     102
     $ ITYPE(50)                                                         PRELIM     103
      COMMON /CLTA/NTAC,TALMT(10),NJOBTA(10,10)                          PRELIM     104
C                                                                        PRELIM     105
CCC   DEFINE LIMITS OF TURNAROUND TIME CLASSES                           PRELIM     106
C                                                                        PRELIM     107
      DATA NTAC/10/                                                      PRELIM     108
      DATA TALMT(1)/5.0/                                                 PRELIM     109
      DATA TALMT(2)/10.0/                                                PRELIM     110
      DATA TALMT(3)/15.0/                                                PRELIM     111
      DATA TALMT(4)/20.0/                                                PRELIM     112
      DATA TALMT(5)/25.0/                                                PRELIM     113
      DATA TALMT(6)/30.0/                                                PRELIM     114
      DATA TALMT(7)/45.0/                                                PRELIM     115
      DATA TALMT(8)/60.0/                                                PRELIM     116
      DATA TALMT(9)/120.0/                                               PRELIM     117
      DATA TALMT(10)/99999./                                             PRELIM     118
C                                                                        PRELIM     119
CCC    READ AND INTERPRET USER INPUT ON OPTIONS                          PRELIM     120
C                                                                        PRELIM     121
      CALL READIN                                                        PRELIM     122
C                                                                        PRELIM     123
CCC   SET FIRST TIME SLOT LIMITS                                         PRELIM     124
C                                                                        PRELIM     125
      FROM=TLOWER                                                        PRELIM     126
      TO=ADDTIME(TLOWER,INTERVL)                                         PRELIM     127
C                                                                        PRELIM     128
CCC   INITIALISE OVERFLOW BUCKET                                         PRELIM     129
C                                                                        PRELIM     130
      NSP=0                                                              PRELIM     131
      DO 10 I=1,50                                                       PRELIM     132
         REMSRU(I)=0.0                                                   PRELIM     133
         REMCPU(I)=0.0                                                   PRELIM     134
         REMJOB(I)=0.0                                                   PRELIM     135
   10 CONTINUE                                                           PRELIM     136
C                                                                        PRELIM     137
CCC   INITIALISE JOB COUNTS FOR TURNAROUND TIME ANALYSIS                 PRELIM     138
C                                                                        PRELIM     139
      DO 30 I=1,NTAC                                                     PRELIM     140
         DO 20 K=1,10                                                    PRELIM     141
            NJOBTA(I,K)=0                                                PRELIM     142
   20    CONTINUE                                                        PRELIM     143
   30 CONTINUE                                                           PRELIM     144
C                                                                        PRELIM     145
CCC   OBTAIN DATE ON JOB SUMMARY FILE                                    PRELIM     146
C                                                                        PRELIM     147
      CALL SETDATE                                                       PRELIM     148
C                                                                        PRELIM     149
CCC   INITIALISES PARAMETERS FOR PROCESSING RECORDS WITHIN THE           PRELIM     150
CCC   FIRST TIME SLOT                                                    PRELIM     151
C                                                                        PRELIM     152
```

```
      CALL INITNXT                                                      PRELIM     153
C                                                                       PRELIM     154
      RETURN                                                            PRELIM     155
      END                                                               PRELIM     156



      SUBROUTINE READIN                                                 READIN       2
C                                                                       READIN       3
CCC   SUBROUTINE READIN READS USER INPUT SPECIFYING                     READIN       4
CCC      1. PERIOD AND INTERVAL OF ANALYSIS, AND OPTION TO PRINT        READIN       5
CCC         ALL TABLES OR ONLY JOB CONCURRENCY TABLE                    READIN       6
CCC      2. DEFINITION OF JOB CLASSIFICATION                            READIN       7
CCC        JOBS MAY BE RECLASSIFIED ACCORDING TO CPU SECONDS USED       READIN       8
CCC        OR SRU UNITS, AND IF TAPE S ARE USED                         READIN       9
CCC                                                                     READIN      10
CCC   USER INPUT CARD SPECIFICATIONS                                    READIN      11
CCC                                                                     READIN      12
CCC      1. TIME AND PRINT OPTION CARD -- TUPPER,TLOWER,INTERVL,OPTION  READIN      13
CCC         TLOWER = LOWER TIME LIMIT OF ANALYSIS  IN CLO. 1-5          READIN      14
CCC                  IN THE FORM OF FOUR-DIGIT TIME (HOURS AND MINUTES) READIN      15
CCC                  PRECEDED BY A BLANK, E.G.,  0830  DEFAULT NO LIMIT READIN      16
CCC         TUPPER = UPPER TIME LIMIT OF ANALYSIS IN COL. 5-10          READIN      17
CCC                  SAME FORM AS TLOWER.  DEFAULT NO LIMIT             READIN      18
CCC         INTERVL = INTERVAL IN MINUTES IN COL. 11-15, RIGHT JUSTIFIED READIN      19
CCC                  DEFAULT VALUE 60 MINUTES                           READIN      20
CCC                  IT SHOULD NOT BE LESS THAN 30 WHENEVER POSSIBLE    READIN      21
CCC                  OR FIELD LENGTH MAY NOT BE SUFFICIENT FOR PLOTS    READIN      22
CCC         OPTION = PRINT OPTION IN COL. 16-20                         READIN      23
CCC                  ANY NON-BLANK CHARACTERS IN THIS FIELD WILL CAUSE   READIN      24
CCC                  TABLE 2 AND TABLE 3 NOT BEING PRINTED OUT          READIN      25
CCC                  DEFAULT IS TO PRINT ALL TABLES                     READIN      26
CCC         DEFAULT VALUE WILL BE USED IF ANY FIELD IS LEFT BLANK       READIN      27
CCC         ENTIRE CARD MAY BE OMITTED IF ALL DEFAULT VALUES TO BE USED READIN      28
CCC                                                                     READIN      29
CCC      2. JOB CLASS REDEFINITION CARD - UNITS,CLIMITS                 READIN      30
CCC         REQUIRED ONLY IF JOB CLASS AS DEFINED BY COMPUTING CENTRE   READIN      31
CCC         NOT TO BE USED.                                             READIN      32
CCC         UNITS = JCCPU/JCSRU IN COL. 1-5 IF JOB CLASS IS TO BE       READIN      33
CCC                  DEFINED ACCORDING TO CPU SECONDS/SRUS USED BY JOB   READIN      34
CCC         CLIMITS = UPPER LIMITS OF SRU OR CPU FOR JOB CLASSES IN     READIN      35
CCC                   INCREASING ORDER FORMAT (4I5).                    READIN      36
CCC                   UP TO FOUR LIMITS MAY BE SPECIFIED, CORRESPONDING READIN      37
CCC                   TO A TOTAL OF 10 JOB CLASSES SINCE EACH CLASS WITH READIN      38
CCC                   SPECIFIED LIMITS IS FURTHER SUBDIVIDED INTO TWO   READIN      39
CCC                   ACCORDING TO WHETHER JOB REQUIRES TAPE UNITS      READIN      40
C                                                                       READIN      41
      COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                             READIN      42
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                         READIN      43
      DIMENSION USERIN(10)                                              READIN      44
      LOGICAL SKIP                                                      READIN      45
C                                                                       READIN      46
CCC   SET DEFAULT VALUES                                                READIN      47
C                                                                       READIN      48
```

```
      TUPPER=10H 99.99.99.                                                  READIN     49
      TLOWER=10H 00.00.00.                                                  READIN     50
      SKIP=.FALSE.                                                          READIN     51
      INTERVL=60                                                            READIN     52
      JCCODE=0                                                              READIN     53
      NJC=4                                                                 READIN     54
C                                                                           READIN     55
      READ (5,100) USERIN                                                   READIN     56
      IF (EOF(5)) 1,2                                                       READIN     57
C                                                                           READIN     58
CC       NO INPUT CARDS AT ALL                                              READIN     59
C                                                                           READIN     60
    1    WRITE (6,200)                                                      READIN     61
         WRITE (6,900) TLOWER,TUPPER                                        READIN     62
         WRITE (6,950) INTERVL                                              READIN     63
         GOTO 5                                                             READIN     64
C                                                                           READIN     65
CC     ELSE                                                                 READIN     66
C                                                                           READIN     67
    2    DECODE (5,400,USERIN(1)) ID                                        READIN     68
         IF (ID.EQ.2HJC) 3,4                                                READIN     69
C                                                                           READIN     70
CC          FIRST CARD ABSENT                                               READIN     71
C                                                                           READIN     72
    3       WRITE (6,200)                                                   READIN     73
            WRITE (6,900) TLOWER,TUPPER                                     READIN     74
            WRITE (6,950) INTERVL                                           READIN     75
            GOTO 5                                                          READIN     76
C                                                                           READIN     77
CC          ELSE FIRST CARD PRESENT                                         READIN     78
C                                                                           READIN     79
    4       WRITE (6,500)                                                   READIN     80
            WRITE (6,600) USERIN                                            READIN     81
            IF (USERIN(4).NE.5H     .OR.USERIN(5).NE.5H     )               READIN     82
     $         SKIP=.TRUE.                                                  READIN     83
            CALL TIMING (USERIN(1),TLOWER)                                  READIN     84
            CALL TIMING (USERIN(2),TUPPER)                                  READIN     85
            DECODE (5,700,USERIN(3)) INTERVL                                READIN     86
            IF (INTERVL.EQ.0) INTERVL=60                                    READIN     87
            WRITE (6,900) TLOWER,TUPPER                                     READIN     88
            WRITE (6,950) INTERVL                                           READIN     89
            READ (5,100) USERIN                                             READIN     90
C                                                                           READIN     91
CC          END IF                                                          READIN     92
CCC                                                                         READIN     93
CC       END IF                                                             READIN     94
C                                                                           READIN     95
    5  IF (EOF(5)) 6,7                                                      READIN     96
    6     WRITE (6,300)                                                     READIN     97
          GOTO 8                                                            READIN     98
C                                                                           READIN     99
CC       ELSE SECOND CARD PRESENT                                           READIN    100
C                                                                           READIN    101
    7     WRITE (6,800)                                                     READIN    102
          WRITE (6,600) USERIN                                              READIN    103
```

```
         CALL DFINEJC(USERIN)                                                    READIN    104
         CALL PRNTJC                                                             READIN    105
C                                                                                READIN    106
CC     END IF                                                                    READIN    107
C                                                                                READIN    108
    8  RETURN                                                                    READIN    109
C                                                                                READIN    110
  100  FORMAT (10A5)                                                             READIN    111
  200  FORMAT (1H1,*  NO TIME OF ANALYSIS SPECIFIED, DEFAULT VALUES USED*        READIN    112
     $/)                                                                         READIN    113
  300  FORMAT (*  NO REDEFINITION OF JOB CLASS, COMPUTER CENTRE CLASSIFIC        READIN    114
     $ATIONS USED*/)                                                           READIN    115
  400  FORMAT (A2)                                                               READIN    116
  500  FORMAT (1H1,* OPTION SELECTION INPUT*/)                                   READIN    117
  600  FORMAT (1X,10A5//)                                                        READIN    118
  700  FORMAT (I5)                                                               READIN    119
  800  FORMAT (*  JOB CLASS REDEFINITION INPUT*/)                               READIN    120
  900  FORMAT (*  PERIOD OF ANALYSIS FROM  *,A10,* TO *,A10/)                   READIN    121
  950  FORMAT (*  AT INTERVALS OF *,I5,* MINUTES*///)                           READIN    122
C                                                                                READIN    123
      END                                                                        READIN    124



      SUBROUTINE DFINEJC (W)                                                     DFJC        2
C                                                                                DFJC        3
CC    SUBROUTINE DFINEJC DEFINES JOB CLASSIFICATION FROM USER INPUT W            DFJC        4
CC    THE RESULTS ARE RETURNED THROUGH THE COMMON BLOCK JCPARAM                  DFJC        5
CC    THE CLASSIFICATION DEPENDS ON EITHER SRU USED OR CPU SECONDS USED          DFJC        6
CC    AND IT DEPENDS ON WHETHER TAPES ARE USED IN THE JOB                        DFJC        7
CC                                                                               DFJC        8
CC     PARAMETERS                                                                DFJC        9
CC     W = EACH IS A FIVE-CHARACTER ALPHANUMERIC WORD, FROM USER INPUT           DFJC       10
CC     JCCODE =1 IF CLASSIFIED ACCORDING TO CPU SECONDS USED                     DFJC       11
CC     JCCODE =2  IF CLASSIFIED ACCORDING TO SRUS USED                           DFJC       12
CC     JCCODE =0  IF COMPUTER CENTRE CLASSIFICATION IS USED                      DFJC       13
CC     NJC = NUMBER OF CLASSES (IRRESPECTIVE OF TAPE USE)                        DFJC       14
CC     CLIMIT = LIMITS OF CLASSES                                                DFJC       15
CC                                                                               DFJC       16
CC    LOCAL VARIABLES                                                            DFJC       17
CC     NUMBER = INTEGER UPPER LIMIT OF CLASS IN CPU SECONDS OR SRUS              DFJC       18
C                                                                                DFJC       19
      DIMENSION W(10)                                                            DFJC       20
      COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                                      DFJC       21
C                                                                                DFJC       22
CC    SET JOB CLASS CODE                                                         DFJC       23
C                                                                                DFJC       24
      JCCODE=1                                                                   DFJC       25
      IF (W(1).EQ.5HJCSRU) JCCODE=2                                              DFJC       26
C                                                                                DFJC       27
CC    SCAN LIMITS OF CLASSES                                                     DFJC       28
C                                                                                DFJC       29
      NJC=0                                                                      DFJC       30
C                                                                                DFJC       31
```

```
C      LOOP                                                                    DFJC      32
C                                                                              DFJC      33
   10     NJC=NJC+1                                                           DFJC      34
          IF (NJC.GT.5) 20,30                                                 DFJC      35
   20        WRITE (6,6000)                                                   DFJC      36
             NJC=5                                                            DFJC      37
             GOTO 40                                                          DFJC      38
C                                                                              DFJC      39
CC         ELSE                                                              DFJC      40
C                                                                              DFJC      41
   30        I=NJC+1                                                         DFJC      42
          IF (W(I).EQ.5H      ) GOTO 40                                       DFJC      43
             DECODE (5,1000,W(I)) NUMBER                                      DFJC      44
             CLIMIT(NJC)=FLOAT(NUMBER)                                        DFJC      45
             GOTO 10                                                          DFJC      46
CC                                                                             DFJC      47
CC     END LOOP                                                                DFJC      48
C                                                                              DFJC      49
   40  CLIMIT(NJC)=9999.                                                       DFJC      50
       RETURN                                                                 DFJC      51
C                                                                              DFJC      52
 1000  FORMAT (I5)                                                           DFJC      53
 6000  FORMAT (1H0,* TOO MANY JOB CLASSES, TRUNCATED TO A TOTAL OF 10*/)       DFJC      54
C                                                                              DFJC      55
       END                                                                    DFJC      56
```



```
       SUBROUTINE SETJC (JC)                                                   DFJC      57
C                                                                              DFJC      58
CC     SUBROUTINE SETJC SETS THE JOB CLASS JC ACCORDING TO JCCODE              DFJC      59
CCC    AND THE JOB CLASS DEFINITION.   JC IS AN INTEGER.                       DFJC      60
CCCC                                                                           DFJC      61
CCCC   LOCAL VARIABLES                                                         DFJC      62
CCCC      UN = UNIT IN CPU SECONDS OR SRUS                                     DFJC      63
CCC                                                                            DFJC      64
C                                                                              DFJC      65
       COMMON /LIST1/JOBJEC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,            DFJC      66
      $              TEXEND,REMARK,CPUSEC                                     DFJC      67
       COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,      DFJC      68
      $              NCARDS,NTPDR,TPTIME                                      DFJC      69
       COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                                   DFJC      70
C                                                                              DFJC      71
       IF (JCCODE.EQ.0) 10,20                                                  DFJC      72
C                                                                              DFJC      73
CC        JOB CLASS NOT REDEFINED, CONVERT ALPHANUMERIC JC TO INTEGER          DFJC      74
C                                                                              DFJC      75
  10      DECODE (1,1000,JCLASS) JC                                            DFJC      76
 1000     FORMAT (I1)                                                          DFJC      77
          GOTO 50                                                              DFJC      78
C                                                                              DFJC      79
CC     ELSE JOB CLASS REDEFINED, FIND PROPER CLASS                             DFJC      80
C                                                                              DFJC      81
  20      UN=CPUSEC                                                            DFJC      82
```

```
      IF (JCCODE.EQ.2) UN=SRUSED                                        DFJC       83
      I=0                                                               DFJC       84
                                                                        DFJC       85
C     LOOP TO FIND RANGE CPU OR SRU FALLS IN                            DFJC       86
C                                                                       DFJC       87
30       I=I+1                                                          DFJC       88
         IF (UN.LT.CLIMIT(I)) GOTO 40                                   DFJC       89
         GOTO 30                                                        DFJC       90
C                                                                       DFJC       91
CC    END LOOP                                                          DFJC       92
CC                                                                      DFJC       93
CC    EVEN CLASSES FOR NON-TAPE JOBS, ODD CLASSES FOR TAPE JOBS         DFJC       94
C                                                                       DFJC       95
40    JC=(I-1)*2                                                        DFJC       96
      IF (NTPDR.GT.0) JC=JC+1                                           DFJC       97
C                                                                       DFJC       98
CC    END IF                                                            DFJC       99
C                                                                       DFJC      100
50    RETURN                                                            DFJC      101
      END                                                               DFJC      102



      SUBROUTINE PRNTJC                                                 PTJC        2
C                                                                       PTJC        3
CC     SUBROUTINE PRNTJC PRINTS TABLE OF JOB CLASSIFICATION             PTJC        4
CCC                                                                     PTJC        5
CCC   LOCAL VARIABLES                                                   PTJC        6
CCC      FMT, UNIT, LASTMAX, LINE, MAX, MIN, TP                         PTJC        7
CCC                                                                     PTJC        8
C                                                                       PTJC        9
      DIMENSION FMT(2)                                                  PTJC       10
      COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                             PTJC       11
C                                                                       PTJC       12
      FMT(1)=10H(5X,3I10,9                                              PTJC       13
      FMT(2)=10HX,A3/)                                                  PTJC       14
      UNIT=10H CPU SECS                                                 PTJC       15
      IF (JCCODE.EQ.2) UNIT=10H SRU UNITS                               PTJC       16
      LASTMAX=0                                                         PTJC       17
C                                                                       PTJC       18
CC    SET CLASS NUMBER, UPPER AND LOWER LIMITS FOR CLASS AND TAPE USE   PTJC       19
C                                                                       PTJC       20
      WRITE (6,100) UNIT                                                PTJC       21
      WRITE (6,200) UNIT                                                PTJC       22
      WRITE (6,300)                                                     PTJC       23
C                                                                       PTJC       24
CC    LOOP                                                              PTJC       25
C                                                                       PTJC       26
      DO 4 I=1,NJC                                                      PTJC       27
         LINE=2*I-2                                                     PTJC       28
C                                                                       PTJC       29
         IF (I.EQ.NJC) 1,2                                              PTJC       30
    1       FMT(1)=10H(5X,2I10,A                                        PTJC       31
            FMT(2)=10H10,9X,A3/)                                        PTJC       32
```

```
            MAX=10H     AND UP                                                  PTJC        33
            GOTO 3                                                              PTJC        34
C                                                                               PTJC        35
CC        ELSE                                                                  PTJC        36
C                                                                               PTJC        37
     2       MAX=CLIMIT(I)                                                      PTJC        38
C                                                                               PTJC        39
CC        END IF                                                                PTJC        40
C                                                                               PTJC        41
     3     MIN=LASTMAX                                                         PTJC        42
           TP=3H NO                                                            PTJC        43
           WRITE (6,FMT) LINE,MIN,MAX,TP                                       PTJC        44
           TP=3HYES                                                            PTJC        45
           LINE=LINE+1                                                         PTJC        46
           WRITE (6,FMT) LINE,MIN,MAX,TP                                       PTJC        47
           LASTMAX=CLIMIT(I)                                                   PTJC        48
     4  CONTINUE                                                              PTJC        49
C                                                                               PTJC        50
CC      END LOOP                                                              PTJC        51
C                                                                               PTJC        52
        RETURN                                                                PTJC        53
C                                                                               PTJC        54
  100   FORMAT(*  JOB CLASSES REDEFINED ACCORDING TO *,A10//)                 PTJC        55
  200   FORMAT (9X,*JOB CLASS    RANGE OF *,A10,*    TAPE*)                   PTJC        56
  300   FORMAT (*          ---------   ------------------    ----*//)         PTJC        57
C                                                                               PTJC        58
        END                                                                   PTJC        59
```



```
        SUBROUTINE SETDATE                                                    SETDT        2
C                                                                               SETDT        3
CC      SUBROUTINE SETDATE READS THE DATE WRITTEN AS FIRST ENTRY IN           SETDT        4
CC      JOB SUMMARY FILES (TAPE 2 AND 3) AND PRINTS OUT THE DATE              SETDT        5
CC                                                                            SETDT        6
CC      LOCAL VARIABLES                                                       SETDT        7
CC         DUMMY, GARBAGE, DATE, SAME                                         SETDT        8
CC                                                                            SETDT        9
C                                                                               SETDT       10
        DIMENSION DUMMY(9),GARBAGE(2)                                         SETDT       11
C                                                                               SETDT       12
CC      FIRST ENTRIES IN TAPE2 AND TAPE3 ARE PADDED FOR SORTING PURPOSES      SETDT       13
C                                                                               SETDT       14
        READ (1) DATE,DUMMY                                                   SETDT       15
        READ (2) SAME,DUMMY,GARBAGE                                           SETDT       16
        IF (DATE.EQ.SAME) 1,2                                                 SETDT       17
     1     WRITE (6,100) DATE                                                 SETDT       18
            WRITE (6,110)                                                     SETDT       19
            GOTO 3                                                            SETDT       20
C                                                                               SETDT       21
CC      ELSE                                                                  SETDT       22
C                                                                               SETDT       23
     2     WRITE (6,200)                                                      SETDT       24
           WRITE (6,300) DATE,SAME                                            SETDT       25
```

```
C                                                                               SETDT       26
      END IF                                                                    SETDT       27
C                                                                               SETDT       28
CCCC   WRITE HEADER ON OUTPUT FILES                                             SETDT       29
C                                                                               SETDT       30
    3 WRITE (8) DATE                                                            SETDT       31
      WRITE (9) DATE                                                            SETDT       32
      WRITE (10) DATE                                                           SETDT       33
      RETURN                                                                    SETDT       34
C                                                                               SETDT       35
  100 FORMAT (1H1,45X,*ANALYSIS OF JOB SUMMARY FILE FOR *,A10)                  SETDT       36
  110 FORMAT (46X,*-------- -- --- ------- ---- ---  ---------*,////)           SETDT       37
  200 FORMAT (10X,15H*** WARNING ***/)                                          SETDT       38
  300 FORMAT (*   DIFFERENT DATES ON TWO SECTIONS OF SUMMARY FILE *,            SETDT       39
     $ A10,* , *,A10//)                                                         SETDT       40
C                                                                               SETDT       41
      END                                                                       SETDT       42



      SUBROUTINE INITNXT                                                        INITNX       2
C                                                                               INITNX       3
CCCC  SUBROUTINE INITNXT INITIALISES PARAMETERS BEFORE PROCESSING               INITNX       4
CCCC  RECORDS WITHIN A TIME SLOT                                                INITNX       5
C                                                                               INITNX       6
       COMMON /JCOUNT/NJTS,NJBATCH(10),NJB,NTPJOB,NJOBS                         INITNX       7
      COMMON /SUMS/SMSU,SPFU,NDPF,NIDPF,MSFL,NSCARD,NSLINE,NTAPE,STPTIME        INITNX       8
      COMMON /SUMTM/IPRCC(10),ITA(10),IQIN(10),IQOUT(10)                        INITNX       9
      COMMON /AVTIME/AVPRCT(10),AVTA(10),AVQIN(10),AVQOUT(10),DELAY(10)         INITNX      10
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                                  INITNX      11
      COMMON /MEANS/MCARD,MLINE,AVTP,AVTPME,AVCPU,AVSRU,MEANFL,AVMS,            INITNX      12
     $              AVPFU,AVDPF,AVIDPF,CPUSAGE,THRUPUT                          INITNX      13
C                                                                               INITNX      14
CCCC  COMMON BLOCK JCOUNT                                                       INITNX      15
CCCC     NTJS = NUMBER OF TS JOBS ENTERING SYSTEM DURING TIME SLOT              INITNX      16
CCCC     NJB = NUMBER OF NON TS JOBS ENTERING DURING SAME PERIOD                INITNX      17
CCCC     NJBATCH = NUMBER OF BATCH JOBS ENTERING SYSTEM BY JOB CLASS            INITNX      18
CCCC     NTPJOB = NUMBER OF JOBS REQUIRING TAPES IN THAT PERIOD                 INITNX      19
CCCC     NJOBS = TOTAL NUMBER OF JOBS ENTERING SYSTEM                           INITNX      20
C                                                                               INITNX      21
      NJTS=0                                                                    INITNX      22
      NJB=0                                                                     INITNX      23
      NTPJOB=0                                                                  INITNX      24
      NJOBS=0                                                                   INITNX      25
      DO 10 I=1,10                                                              INITNX      26
         NJBATCH(I)=0                                                           INITNX      27
   10 CONTINUE                                                                  INITNX      28
C                                                                               INITNX      29
CCCC  COMMON BLOCK SUMS                                                         INITNX      30
CCCC     SMSU = TOTAL MASS STORAGE UNITS USED DURING TIME SLOT                  INITNX      31
CCCC     SPFU = TOTAL PERMANENT FILE UNITS USED                                 INITNX      32
CCCC     NDPF = TOTAL NUMBER OF DIRECT PF ACCESSES                              INITNX      33
CCCC     NIDPF = TOTAL NUMBER OF INDIRECT PF ACCESSES                           INITNX      34
CC       MSFL = TOTAL MAXIMUM FIELD LENGTH REQUESTED                            INITNX      35
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C        NSLINE = TOTAL NUMBER OF LINES PRINTED                                  INITNX     36
CC       NSCARD = TOTAL NUMBER OF CARDS READ                                     INITNX     37
CC       NTAPE = TOTAL NUMBER OF TAPE DRIVES REQUESTED                           INITNX     38
CC       STPTIME = TOTAL TIME IN MINUTES OF TAPE DRIVES OCCUPATION               INITNX     39
C                                                                                INITNX     40
      SMSU=0.0                                                                   INITNX     41
      SPFU=0.0                                                                   INITNX     42
      NDPF=0                                                                     INITNX     43
      NIDPF=0                                                                    INITNX     44
      MSFL=0                                                                     INITNX     45
      NSLINE=0                                                                   INITNX     46
      NSCARD=0                                                                   INITNX     47
      NTAPE=0                                                                    INITNX     48
      STPTIME=0.0                                                                INITNX     49
C                                                                                INITNX     50
CC    COMMON BLOCK FRACSUM                                                       INITNX     51
CC       STEXC = PRORATED TOTAL AMOUNT OF PROCESS TIME OF JOBS IN SECS.          INITNX     52
CC             1 FOR NON T/S JOBS, 2 FOR T/S JOBS                                INITNX     53
CC       SCPU = PRORATED TOTAL CPU SECONDS USED BY JOBS                          INITNX     54
CC       SSRU = PRORATED TOTAL SRUS USED BY JOBS                                 INITNX     55
CC       SFJOB = PRORATED NUMBER OF JOBS HANDLED BY SYSTEM                       INITNX     56
C                                                                                INITNX     57
      STEXC(1)=0.0                                                               INITNX     58
      STEXC(2)=0.0                                                               INITNX     59
      SCPU=0.0                                                                   INITNX     60
      SSRU=0.0                                                                   INITNX     61
      SFJOB=0.0                                                                  INITNX     62
C                                                                                INITNX     63
CC    COMMON BLOCKS SUMTM AND AVTIME                                             INITNX     64
CC       FOLLOWING VARIABLES ARE ACCORDING TO JOB CLASS                          INITNX     65
CC       IPROC = TOTAL PROCESSING TIME OF JOBS ENTERING SYSTEM                   INITNX     66
CC       ITA = TOTAL TURNAROUND TIME                                             INITNX     67
CC       IQIN = TOTAL TIME BETWEEN JOB READ IN AND STARTING OF EXECUTION         INITNX     68
CC       IQOUT = TOTAL TIME BETWEEN END OF EXECUTION AND OUTPUT PRINTED          INITNX     69
CC       AVPRCT = AVERAGE PROCESSING TIME FOR A JOB DURING PERIOD                INITNX     70
CC       AVTA = AVERAGE TURNAROUND TIME                                          INITNX     71
CC       AVQIN = AVERAGE TIME SPENT IN WAITING FOR EXECUTION                     INITNX     72
CC       AVQOUT = AVERAGE TIME SPENT IN PRINT QUEUE                              INITNX     73
CC       DELAY = AVERAGE DELAY FACTOR DEFINED AS AVTA/AVPRCT                     INITNX     74
C                                                                                INITNX     75
      DO 20 I=1,10                                                               INITNX     76
         IPROC(I)=0                                                              INITNX     77
         ITA(I)=0                                                                INITNX     78
         IQIN(I)=0                                                               INITNX     79
         IQOUT(I)=0                                                              INITNX     80
         AVPRCT(I)=0.0                                                           INITNX     81
         AVTA(I)=0.0                                                             INITNX     82
         AVQIN(I)=0.0                                                            INITNX     83
         AVQOUT(I)=0.0                                                           INITNX     84
         DELAY(I)=0.0                                                            INITNX     85
   20 CONTINUE                                                                   INITNX     86
C                                                                                INITNX     87
CC    COMMON BLOCK MEANS                                                         INITNX     88
CC       MCARD = AVERAGE CARDS READ PER BATCH JOB DURING TIME PERIOD             INITNX     89
C        MLINE = AVERAGE LINES PRINTED                                           INITNX     90
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C          AVTP = AVERAGE TAPE DRIVES REQUESTED PER TAPE JOB                    INITNX      91
CC         AVTPME = AVERAGE TIME IN MINUTES OF TAPE DRIVE OCCUPATION            INITNX      92
CC         AVCPU = AVERAGE CPU SECONDS FOR JOB                                  INITNX      93
CC         AVSRU = AVERAGE SRUS FOR JOB                                         INITNX      94
CC         MEANFL = AVERAGE MAX FIELD LENGTH REQUESTED                          INITNX      95
CC         AVMS = AVERAGE MASS STORAGE UNITS USED                               INITNX      96
CC         AVPFU = AVERAGE PERMANENT FILE UNITS USED                            INITNX      97
C          AVDPF = AVERAGE NUMBER OF DIRECT PF ACCESSES                         INITNX      98
C          AVIDPF = AVERAGE NUMBER OF INDIRECT PF ACCESSES                      INITNX      99
CC         CPUSAGE = CPU PRODUCTIVITY DURING TIME PERIOD                        INITNX     100
CC         THRUPUT = SYSTEM THROUGHPUT DURING TIME PERIOD, DEFINED AS           INITNX     101
C                    NUMBER OF JOBS (PRORATED) HANDLED BY SYSTEM PER HOUR       INITNX     102
C                                                                               INITNX     103
      MCARD=0                                                                   INITNX     104
      MLINE=0                                                                   INITNX     105
      AVTP=0.0                                                                  INITNX     106
      AVTPME=0.0                                                                INITNX     107
      AVCPU=0.0                                                                 INITNX     108
      AVSRU=0.0                                                                 INITNX     109
      MEANFL=0                                                                  INITNX     110
      AVMS=0.0                                                                  INITNX     111
      AVPFU=0.0                                                                 INITNX     112
      AVDPF=0.0                                                                 INITNX     113
      AVIDPF=0.0                                                                INITNX     114
      CPUSAGE=0.0                                                               INITNX     115
      THRUPUT=0.0                                                               INITNX     116
C                                                                               INITNX     117
      RETURN                                                                    INITNX     118
      END                                                                       INITNX     119
```

```
      SUBROUTINE ANALYSE                                                        ANALYSE     2
C                                                                               ANALYSE     3
C     SUBROUTINE ANALYSE IS THE MAIN MODULE FOR PROCESSING THE                  ANALYSE     4
C     JOB SUMMARY FILE                                                          ANALYSE     5
C                                                                               ANALYSE     6
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                                 ANALYSE     7
      COMMON /SLOT/FROM,TO                                                      ANALYSE     8
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,              ANALYSE     9
     $              TEXEND,REMARK,CPUSEC                                        ANALYSE    10
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,        ANALYSE    11
     $              NCARDS,NTPDR,TPTIME                                         ANALYSE    12
C                                                                               ANALYSE    13
      LOGICAL HALT                                                              ANALYSE    14
C                                                                               ANALYSE    15
      HALT=.FALSE.                                                              ANALYSE    16
C                                                                               ANALYSE    17
CC    LOOP                                                                      ANALYSE    18
C                                                                               ANALYSE    19
10    READ (1) JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,                   ANALYSE    20
     $         TEXEND,REMARK,CPUSEC                                           ANALYSE    21
      IF (EOF(1)) 20,30                                                         ANALYSE    22
20       HALT=.TRUE.                                                            ANALYSE    23
```

```
C                                                                                ANALYSE    24
CC          COMPUTE RESULTS AND OUTPUT FOR TIME SLOT                             ANALYSE    25
C                                                                                ANALYSE    26
            CALL WRTCONC                                                         ANALYSE    27
            CALL SYSLOAD                                                         ANALYSE    28
            CALL SYSPFM                                                          ANALYSE    29
            GOTO 80                                                              ANALYSE    30
C                                                                                ANALYSE    31
CCC       ELSE                                                                   ANALYSE    32
CCC                                                                              ANALYSE    33
CCC         IGNORE ABORTED JOBS                                                  ANALYSE    34
C                                                                                ANALYSE    35
   30       IF ((CPUSEC.LT.0.002).OR.(TEXBGN.EQ.10H     -      )) GOTO 80        ANALYSE    36
            IF (TEXBGN.GT.TUPPER) 40,50                                          ANALYSE    37
   40         HALT=.TRUE.                                                       ANALYSE    38
              CALL WRTCONC                                                      ANALYSE    39
              CALL SYSLOAD                                                      ANALYSE    40
              CALL SYSPFM                                                       ANALYSE    41
              GOTO 80                                                           ANALYSE    42
C                                                                               ANALYSE    43
CC          ELSE                                                                ANALYSE    44
C                                                                               ANALYSE    45
   50         READ (2) JOBREC,SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,            ANALYSE    46
     $                 USAGEMS,NLINES,NCARDS,NTPDR,TPTIME,DUMMY                 ANALYSE    47
              IF (TEXBGN.GT.TLOWER) 60,70                                       ANALYSE    48
   60           CALL DETAIL                                                     ANALYSE    49
                GOTO 80                                                         ANALYSE    50
C                                                                               ANALYSE    51
CCC           ELSE                                                              ANALYSE    52
C                                                                               ANALYSE    53
   70             CALL SIMPLE                                                  ANALYSE    54
C                                                                               ANALYSE    55
CCC           END IF                                                            ANALYSE    56
CCC                                                                             ANALYSE    57
CCC         END IF                                                              ANALYSE    58
CCC                                                                             ANALYSE    59
CC        END IF                                                                ANALYSE    60
C                                                                               ANALYSE    61
   80     IF (.NOT.HALT) GOTO 10                                                ANALYSE    62
C                                                                               ANALYSE    63
CC      END LOOP                                                                ANALYSE    64
C                                                                               ANALYSE    65
        RETURN                                                                  ANALYSE    66
        END                                                                     ANALYSE    67
```

```
      SUBROUTINE SIMPLE                                                 SIMPLE      2
C                                                                       SIMPLE      3
CC    SUBROUTINE SIMPLE IS CALLED WHEN ONLY JOB CONCURRENCY INFORMATION SIMPLE      4
CC    IS REQUIRED IN THE PROCESSING                                     SIMPLE      5
C                                                                       SIMPLE      6
      COMMON /SLOT/FROM,TO                                              SIMPLE      7
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                         SIMPLE      8
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      SIMPLE      9
     $             TEXEND,REMARK,CPUSEC                                 SIMPLE     10
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                          AUG2        1
C                                                                       SIMPLE     11
CC    LOOP TO LOCATE TIME SLOT JOB IS IN                                SIMPLE     12
C                                                                       SIMPLE     13
   10 IF (TEXBGN.GT.TO) 20,30                                           SIMPLE     14
C                                                                       SIMPLE     15
CC       RECORD NOT IN CURRENT TIME SLOT, OUTPUT FOR CURRENT SLOT       SIMPLE     16
C                                                                       SIMPLE     17
   20    CALL WRTCONC                                                   AUG2        2
C                                                                       SIMPLE     20
CC       REINITIALISE FOR NEXT TIME PERIOD                              SIMPLE     21
C                                                                       SIMPLE     22
         FROM=TO                                                        SIMPLE     23
         TO=ADDTIME(FROM,INTERVL)                                       SIMPLE     24
C                                                                       AUG2        3
CC       REINITIALISE PRORATED SUMS ABD SCAN OVERFLOW AREA              AUG2        4
C                                                                       AUG2        5
         STEXC(1)=0.0                                                   AUG2        6
         STEXC(2)=0.0                                                   AUG2        7
         SCPU=0.0                                                       AUG2        8
         SSRU=0.0                                                       AUG2        9
         SFJOB=0.0                                                      AUG2       10
         CALL SCANBCK                                                   AUG2       11
         GOTO 10                                                        SIMPLE     25
C                                                                       SIMPLE     26
CC    END LOOP                                                          SIMPLE     27
CC                                                                      SIMPLE     28
CC    ANALYSE CURRENT RECORD FOR JOB CONCURRENCY AND PRORATED PARAMETERS SIMPLE     29
C                                                                       SIMPLE     30
   30 CALL PRORATE                                                      SIMPLE     31
      RETURN                                                            SIMPLE     32
      END                                                               SIMPLE     33


      SUBROUTINE WRTCONC                                                WRTC        2
C                                                                       WRTC        3
CC    SUBROUTINE WRTCONC WRITES JOB CONCURRENCY  FILE                   WRTC        4
CC    CONCURRENCY CONCUCY IS DEFINED AS TOTAL PROCESS TIME REQUIRED BY  WRTC        5
CC    ALL JOBS DIVIDED BY THE DURATION OF TIME PERIOD                   WRTC        6
C                                                                       WRTC        7
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                          WRTC        8
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                         WRTC        9
      COMMON /SLOT/FROM,TO                                              WRTC       10
      DIMENSION CONCUCY(2)                                              WRTC       11
```

```
C                                                                       WRTC      12
      DO 10 I=1,2                                                       WRTC      13
         CONCUCY(I)=STEXC(I)/FLOAT(INTERVL*60)                          WRTC      14
   10 CONTINUE                                                          WRTC      15
      WRITE (8) FROM,TO,CONCUCY                                         WRTC      16
      RETURN                                                            WRTC      17
      END                                                               WRTC      18



      SUBROUTINE SYSLOAD                                                SYSLD      2
C                                                                       SYSLD      3
CC    SUBROUTINE SYSLOAD  COMPUTES VARIOUS PARAMETERS CHARACTERISING    SYSLD      4
CC    THE LOAD OF THE SYSTEM FOR THE TIME SLOT JUST PROCESSED           SYSLD      5
CC    AND WRITES THE RESULTS ON TAPE9.                                  SYSLD      6
C                                                                       SYSLD      7
       COMMON /JCOUNT/NJTS,NJBATCH(10),NJB,NTPJOB,NJOBS                 SYSLD      8
      COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                             SYSLD      9
      COMMON /MEANS/MCARD,MLINE,AVTP,AVTPME,AVCPU,AVSRU,MEANFL,AVMS,    SYSLD     10
     $              AVPFU,AVDPF,AVIDPF,CPUSAGE,THRUPUT                  SYSLD     11
      COMMON /SUMS/SMSU,SPFU,NDPF,NIDPF,MSFL,NSCARD,NSLINE,NTAPE,STPTIME SYSLD     12
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                         SYSLD     13
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                          SYSLD     14
      COMMON /SLOT/FROM,TO                                              SYSLD     15
C                                                                       SYSLD     16
CC    COUNT TOTAL NUMBER OF BATCH JOBS                                  SYSLD     17
C                                                                       SYSLD     18
      NC=2*NJC                                                          SYSLD     19
      DO 10 I=1,NC                                                      SYSLD     20
         NJB=NJB+NJBATCH(I)                                             SYSLD     21
   10 CONTINUE                                                          SYSLD     22
       NJOBS=NJB+NJTS                                                   SYSLD     23
C                                                                       SYSLD     24
CC    COMPUTE SYSTEM LOAD PARAMETERS                                    SYSLD     25
C                                                                       SYSLD     26
      IF (NJOBS.EQ.0) GOTO 30                                           SYSLD     27
      IF (NJB.EQ.0) GOTO 20                                             SYSLD     28
      MCARD=NSCARD/NJB                                                  SYSLD     29
      MLINE=NSLINE/NJB                                                  SYSLD     30
      IF (NTPJOB.EQ.0) GOTO 20                                          SYSLD     31
      RNTPJ=FLOAT(NTPJOB)                                               SYSLD     32
      AVTP=FLOAT(NTAPE)/RNTPJ                                           SYSLD     33
      AVTPME=STPTIME/RNTPJ                                              SYSLD     34
   20 RNJ=FLOAT(NJOBS)                                                  SYSLD     35
      AVCPU=SCPU/SFJOB                                                  SYSLD     36
      AVSRU=SSRU/SFJOB                                                  SYSLD     37
      MEANFL=MSFL/NJOBS                                                 SYSLD     38
      AVMS=SMSU/RNJ                                                     SYSLD     39
      AVPFU=SPFU/RNJ                                                    SYSLD     40
      AVDPF=FLOAT(NDPF)/RNJ                                             SYSLD     41
      AVIDPF=FLCAT(NIDPF)/RNJ                                           SYSLD     42
      CPUSAGE=SCPU/(FLOAT(INTERVL)*60.)                                 SYSLD     43
      THRUPUT=(SFJOB/FLOAT(INTERVL))*60.0                               SYSLD     44
C                                                                       SYSLD     45
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C       WRITES RESULTS ON TAPE                                                  SYSLD      46
C                                                                               SYSLD      47
   30  WRITE (9)       FROM,TO,NJOBS,NJTS,NJB,AVCPU,AVSRU,AVMS,AVPFU,           SYSLD      48
     $   AVDPF,AVIDPF,MEANFL,NTPJOB,AVTP,AVTPME,MCARD,MLINE,CPUSAGE,            SYSLD      49
     $   THRUPUT                                                                SYSLD      50
       RETURN                                                                   SYSLD      51
       END                                                                      SYSLD      52



       SUBROUTINE SYSPFM                                                        SYSPFM      2
C                                                                               SYSPFM      3
CC     SUBROUTINE SYSPFM  COMPUTES VARIOUS PARAMETERS THAT CHARACTERISES        SYSPFM      4
CC     THE PERFORMANCE OF THE SYSTEM (MAINLY TURNAROUND TIME AND DELAY          SYSPFM      5
C      TIME ACCORDING TO JOB CLASS .   THE RESUTL IS WRITTEN ON FILE 10.        SYSPFM      6
C                                                                               SYSPFM      7
        COMMON /JCOUNT/NJTS,NJBATCH(10),NJB,NTPJOB,NJOBS                        SYSPFM      8
       COMMON /SUMTM/IPROC(10),ITA(10),IQIN(10),IQOUT(10)                       SYSPFM      9
       COMMON /AVTIME/AVPRCT(10),AVTA(10),AVQIN(10),AVQOUT(10),DELAY(10)        SYSPFM     10
       COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                                    SYSPFM     11
       COMMON /SLOT/FROM,TO                                                     SYSPFM     12
C                                                                               SYSPFM     13
       N=NJC*2                                                                  SYSPFM     14
       DO 10 I=1,N                                                              SYSPFM     15
          IF (NJBATCH(I).EQ.0) GOTO 10                                          SYSPFM     16
          RN=FLOAT(NJBATCH(I))                                                  SYSPFM     17
          AVTA(I)=(FLOAT(ITA(I))/RN)/60.0                                       SYSPFM     18
          AVPRCT(I)=(FLOAT(IPROC(I))/RN)/60.0                                   SYSPFM     19
          AVQIN(I)=(FLOAT(IQIN(I))/RN)/60.0                                     SYSPFM     20
          AVQOUT(I)=(FLOAT(IQOUT(I))/RN)/60.0                                   SYSPFM     21
          DELAY(I)=AVTA(I)/AVPRCT(I)                                            SYSPFM     22
   10  CONTINUE                                                                 SYSPFM     23
C                                                                               SYSPFM     24
CC     WRITE RESULTS ON FILE 10                                                 SYSPFM     25
C                                                                               SYSPFM     26
       WRITE (10) FROM,TO,(NJBATCH(I),AVPRCT(I),AVTA(I),AVQIN(I),               SYSPFM     27
     $            AVQOUT(I),DELAY(I), I=1,N)                                   SYSPFM     28
       RETURN                                                                   SYSPFM     29
       END                                                                      SYSPFM     30



       SUBROUTINE PRORATE                                                       PRORATE     2
C                                                                               PRORATE     3
CC     SUBROUTINE PRORATE OBTAINS THE APPROPRIATE SHARE OF THE PROCESS          PRORATE     4
CC     TIME,CPU SECONDS AND SRUS FOR A JOB.    IF THE JOB STAYS IN              PRORATE     5
CC     SYSTEM BEYOND UPPER BOUND OF TIME SLOT CURRENTLY BEING EXAMINED,         PRORATE     6
CC     THESE PARAMETERS ARE PRORATED ACCORDINGLY.                               PRORATE     7
CC                                                                              PRORATE     8
CC                                                                              PRORATE     9
CC     LOCAL PARAMETERS                                                         PRORATE    10
CC        ISTART, IFINIS, ITOTAL, ISHARE, PORTION, SPILL, ID                    PRORATE    11
C                                                                               PRORATE    12
```

```
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,          PRORATE     13
     $             TEXEND,REMARK,CPUSEC                                     PRORATE     14
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,    PRORATE     15
     $             NCARDS,NTPDR,TPTIME                                      PRORATE     16
      COMMON /SLOT/FROM,TO                                                  PRORATE     17
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                              PRORATE     18
      COMMON /BUCKET/NSP,ITREM(50),REMCPU(50),REMSRU(50),REMJOB(50),        PRORATE     19
     $ ITYPE(50)                                                            PRORATE     20
C                                                                           PRORATE     21
CCC   DETERMINE JOBTYPE                                                     PRORATE     22
C                                                                           PRORATE     23
      ID=1                                                                  PRORATE     24
      IF (JOBTYPE.EQ.1HT) ID=2                                              PRORATE     25
C                                                                           PRORATE     26
CCC   CONVERT TIME ELAPSED INTO INTEGER SECONDS                             PRORATE     27
C                                                                           PRORATE     28
      ISTART=LTIME(TEXBGN)                                                  PRORATE     29
      IFINIS=LTIME(TEXEND)                                                  PRORATE     30
      ITOTAL=IFINIS-ISTART                                                  PRORATE     31
C                                                                           PRORATE     32
      IF (TEXEND.GT.TO) 10,20                                               PRORATE     33
C                                                                           PRORATE     34
CCC      PRORATING REQUIRED                                                 PRORATE     35
C                                                                           PRORATE     36
   10    ISHARE=LTIME(TO)-ISTART                                            PRORATE     37
         PORTION=FLOAT(ISHARE)/FLOAT(ITOTAL)                                PRORATE     38
         SPILL=1.0-PORTION                                                  PRORATE     39
         STEXC(ID)=STEXC(ID)+FLOAT(ISHARE)                                  PRORATE     40
         SCPU=SCPU+CPUSEC*PORTION                                           PRORATE     41
         SSRU=SSRU+SRUSED*PORTION                                           PRORATE     42
         SFJOB=SFJOB+PORTION                                                PRORATE     43
C                                                                           PRORATE     44
CCC      STORE REMAINING FRACTIONS IN OVERFLOW BUCKETS                      PRORATE     45
C                                                                           PRORATE     46
         NSP=NSP+1                                                          PRORATE     47
         ITYPE(NSP)=ID                                                      PRORATE     48
         ITREM(NSP)=ITOTAL-ISHARE                                           PRORATE     49
         REMCPU(NSP)=CPUSEC*SPILL                                           PRORATE     50
         REMSRU(NSP)=SRUSED*SPILL                                           PRORATE     51
         REMJOB(NSP)=SPILL                                                  PRORATE     52
         GOTO 30                                                            PRORATE     53
C                                                                           PRORATE     54
CCC   ELSE NO PRORATING                                                     PRORATE     55
C                                                                           PRORATE     56
   20    STEXC(ID)=STEXC(ID)+FLOAT(ITOTAL)                                  PRORATE     57
         SCPU=SCPU+CPUSEC                                                   PRORATE     58
         SSRU=SSRU+SRUSED                                                   PRORATE     59
         SFJOB=SFJOB+1.0                                                    PRORATE     60
C                                                                           PRORATE     61
CCC   END IF                                                                PRORATE     62
C                                                                           PRORATE     63
   30 RETURN                                                                PRORATE     64
      END                                                                   PRORATE     65
C                                                                           PRORATE     66
```

```
      SUBROUTINE SCANBCK                                                SCAN    2
C                                                                       SCAN    3
CC    SUBROUTINE SCANBCK SCANS THE OVERFLOW AREA FOR JOBS EXTENDING     SCAN    4
CC    BEYOND CURRENT TIME SLOT TO FIND OUT THE SHARE OF EXECUTION TIME  SCAN    5
CC    AND CARRIES OVER THE REMAINING TIME TO THE NEXT TIME SLOT         SCAN    6
CC    IT DOES THE SAME THING FOR CPU TIME AND SRU                       SCAN    7
CC                                                                      SCAN    8
CCC   LOCAL VARIABLES                                                   SCAN    9
CCC      NEWSP, INTVSEC, PORTION, SPILL, ID                             SCAN   10
C                                                                       SCAN   11
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                         SCAN   12
      COMMON /BUCKET/NSP,ITREM(50),REMCPU(50),REMSRU(50),REMJOB(50),    SCAN   13
     $ ITYPE(50)                                                        SCAN   14
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                          SCAN   15
C                                                                       SCAN   16
      IF (NSP.EQ.0) RETURN                                              SCAN   17
      NEWSP=0                                                           SCAN   18
      INTVSEC=INTERVL*60                                                SCAN   19
C                                                                       SCAN   20
CC    LOOP TO SCAN THE OVERFLOW AREA                                    SCAN   21
C                                                                       SCAN   22
      DO 60 I=1,NSP                                                     SCAN   23
         ID=ITYPE(I)                                                    SCAN   24
         IF (ITREM(I).GT.INTVSEC) 10,40                                 SCAN   25
C                                                                       SCAN   26
CCC         JOB DOES NOT END IN THIS TIME SLOT                          SCAN   27
CC                                                                      SCAN   28
   10       NEWSP=NEWSP+1                                              SCAN   29
            STEXC(ID)=STEXC(ID)+FLOAT(INTVSEC)                          SCAN   30
            ITYPE(NEWSP)=ID                                             SCAN   31
            ITREM(NEWSP)=ITREM(I)-INTVSEC                               SCAN   32
            IF (REMSRU(I).GT.0.001) 20,30                               SCAN   33
   20          PORTION=FLOAT(INTVSEC)/FLOAT(ITREM(I))                   SCAN   34
               SPILL=1.0-PORTION                                        SCAN   35
               SCPU=SCPU+REMCPU(I)*PORTION                              SCAN   36
               SSRU=SSRU+REMSRU(I)*PORTION                              SCAN   37
               SFJOB=SFJOB+REMJOB(I)*PORTION                            SCAN   38
               REMCPU(NEWSP)=REMCPU(I)*SPILL                            SCAN   39
               REMSRU(NEWSP)=REMSRU(I)*SPILL                            SCAN   40
               REMJOB(NEWSP)=REMJOB(I)*SPILL                            SCAN   41
C                                                                       SCAN   42
CCC         END IF                                                      SCAN   43
C                                                                       SCAN   44
   30       GOTO 60                                                    SCAN   45
C                                                                       SCAN   46
CCC      ELSE NO FURTHER OVERFLOW                                       SCAN   47
C                                                                       SCAN   48
   40       STEXC(ID)=STEXC(ID)+FLOAT(ITREM(I))                        SCAN   49
            IF (REMSRU(I).GT.0.0001) 50,60                              SCAN   50
   50          SCPU=SCPU+REMCPU(I)                                      SCAN   51
               SSRU=SSRU+REMSRU(I)                                      SCAN   52
               SFJOB=SFJOB+REMJOB(I)                                    SCAN   53
C                                                                       SCAN   54
CCC         END IF                                                      SCAN   55
C                                                                       SCAN   56
```

```
C        END IF                                                          SCAN        57
CC                                                                       SCAN        58
   60  CONTINUE                                                         SCAN        59
C                                                                        SCAN        60
CCC      END LOOP                                                        SCAN        61
C                                                                        SCAN        62
         NSP=NEWSP                                                       SCAN        63
         RETURN                                                          SCAN        64
         END                                                             SCAN        65



         SUBROUTINE DETAIL                                               DETAIL       2
C                                                                        DETAIL       3
CCC      SUBROUTINE DETAIL PROCESSES A RECORD IN JOB SUMMARY FILE FULLY  DETAIL       4
C                                                                        DETAIL       5
         COMMON /LIST1/JOBJEC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,    DETAIL       6
        $              TEXEND,REMARK,CPUSEC                             DETAIL       7
         COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                       DETAIL       8
         COMMON /SLOT/FROM,TO                                            DETAIL       9
C                                                                        DETAIL      10
CCC      LOOP TO LOCATE TIME SLOT JOB IS IN                              DETAIL      11
C                                                                        DETAIL      12
   10    IF (TEXBGN.GT.TO) 20,30                                         DETAIL      13
C                                                                        DETAIL      14
CCC         JOB NOT IN CURRENT TIME SLOT, WRITE OUTPUT FILES             DETAIL      15
C                                                                        DETAIL      16
   20       CALL WRTCONC                                                AUG2        28
            CALL SYSLOAD                                                DETAIL      19
            CALL SYSPFM                                                 DETAIL      20
            CALL INITNXT                                                DETAIL      21
            CALL SCANBCK                                                AUG2        13
C                                                                        DETAIL      22
CCC         GET NEXT TIME SLOT                                          DETAIL      23
C                                                                        DETAIL      24
            FROM=TO                                                     DETAIL      25
            TO=ADDTIME(FROM,INTERVL)                                    DETAIL      26
            GOTO 10                                                     DETAIL      27
C                                                                        DETAIL      28
CCC      END LOOP                                                        DETAIL      29
C                                                                        DETAIL      30
CCCCC    PROCESS CURRENT RECORD                                          DETAIL      31
C                                                                        DETAIL      32
   30    CALL PRORATE                                                    DETAIL      33
         CALL ADDUP                                                      DETAIL      34
         RETURN                                                          DETAIL      35
         END                                                             DETAIL      36
```

```
      SUBROUTINE ADDUP                                                  ADDUP     2
C                                                                       ADDUP     3
CCC   SUBROUTINE ADDUP SUMS THE VALUES OF VARIOUS PARAMETERS THAT       ADDUP     4
CCC   CHARACTERISES THE JOB.   THESES SUMS ARE TO BE AVERAGED OVER THE  ADDUP     5
CCC   PERIOD OF THE TIME SLOT CHOSEN.   PARAMETERS THAT ARE TO BE       ADDUP     6
CCC   PRORATED ARE PROCESSED BY SUBROUTINE PRORATE                      ADDUP     7
C                                                                       ADDUP     8
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      ADDUP     9
     $              TEXEND,REMARK,CPUSEC                               ADDUP    10
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES,ADDUP    11
     $              NCARDS,NTPDR,TPTIME                                ADDUP    12
      COMMON /SUMS/SMSU,SPFU,NDPF,NIDPF,MSFL,NSCARD,NSLINE,NTAPE,STPTIMEADDUP    13
      COMMON /FRACSUM/STEXC(2),SCPU,SSRU,SFJOB                          ADDUP    14
       COMMON /JCOUNT/NJTS,NJBATCH(10),NJB,NTPJOB,NJOBS                 ADDUP    15
C                                                                       ADDUP    16
CCC   STORE VARIOUS USAGE OF JOB                                        ADDUP    17
C                                                                       ADDUP    18
      SMSU=SMSU+USAGEMS                                                 ADDUP    19
      SPFU=SPFU+PFUSAGE                                                 ADDUP    20
      NIDPF=NIDPF+IDPFACC                                               ADDUP    21
       NDPF=NDPF+NDPFACC                                                ADDUP    22
      MSFL=MSFL+MAXFL                                                   ADDUP    23
C                                                                       ADDUP    24
CCC   SET JOB CLASS                                                     ADDUP    25
C                                                                       ADDUP    26
      CALL SETJC(JCLASS)                                                ADDUP    27
      J=JCLASS+1                                                        ADDUP    28
C                                                                       ADDUP    29
      IF (JOBTYPE.EQ.1HT) 10,20                                         ADDUP    30
   10    NJTS=NJTS+1                                                    ADDUP    31
         GOTO 50                                                        ADDUP    32
C                                                                       ADDUP    33
CCC   ELSE FOR NON TIME-SHARING JOBS                                    ADDUP    34
C                                                                       ADDUP    35
   20    NJBATCH(J)=NJBATCH(J)+1                                        ADDUP    36
         NSCARD=NSCARD+NCARDS                                           ADDUP    37
         NSLINE=NSLINE+NLINES                                           ADDUP    38
C                                                                       ADDUP    39
CCC      TAPE USAGE                                                     ADDUP    40
C                                                                       ADDUP    41
         IF (NTPDR.GT.0) 30,40                                          ADDUP    42
   30       NTPJOB=NTPJOB+1                                            ADDUP    43
            NTAPE=NTAPE+NTPDR                                           ADDUP    44
            STPTIME=STPTIME+TPTIME                                      ADDUP    45
C                                                                       ADDUP    46
CCC      END IF                                                         ADDUP    47
CCCCC                                                                   ADDUP    48
                                                                        ADDUP    49
CCC      PROCESS TURNARCUND TIME INFORMATION                            ADDUP    50
C                                                                       ADDUP    51
   40    CALL TART                                                      ADDUP    52
C                                                                       ADDUP    53
CCC   END IF                                                            ADDUP    54
C                                                                       ADDUP    55
   50 RETURN                                                            ADDUP    56
```

```
      SUBROUTINE TART                                                   TART    2
C                                                                       TART    3
CC    SUBROUTINE TART STORES TURNAROUND TIME INFORMATION OVER PERIOD OF  TART    4
CC    TIME SLOT                                                         TART    5
CC    IT WILL NOT BE CALLED IF THE JOB IS TIME-SHARING                  TART    6
CC                                                                      TART    7
CC    LOCAL VARIABLES                                                   TART    8
CC       LTIN,LTOUT,LTIO,LTEXBGN,LTEXEND,I,K,TIO                        TART    9
C                                                                       TART   10
      COMMON /LIST1/JOBREC,JOBNAME,JOBTYPE,JCLASS,TIN,TOUT,TEXBGN,      TART   11
     $              TEXEND,REMARK,CPUSEC                               TART   12
      COMMON /LIST2/SRUSED,MAXFL,NDPFACC,IDPFACC,PFUSAGE,USAGEMS,NLINES, TART  13
     $              NCARDS,NTPDR,TPTIME                                TART   14
      COMMON /SUMTM/IPROC(10),ITA(10),IQIN(10),IQOUT(10)                TART   15
      COMMON /CLTA/NTAC,TALMT(10),NJOBTA(10,10)                         TART   16
C                                                                       TART   17
      IF (TIN.EQ.10H     -     )TIN=TEXBGN                              TART   18
      IF (TOUT.EQ.10H    -      ) TOUT=TEXEND                           TART   19
C                                                                       TART   20
CC    CONVERT ALL APHANUMERIC TIME TO INTEGER SECONDS SINCE MIDNIGHT     TART   21
C                                                                       TART   22
      LTIN=LTIME(TIN)                                                   TART   23
      LTOUT=LTIME(TOUT)                                                 TART   24
      LTEXBGN=LTIME(TEXBGN)                                             TART   25
      LTEXEND=LTIME(TEXEND)                                             TART   26
      LTIO=LTOUT-LTIN                                                   TART   27
C                                                                       TART   28
CC    ARRAY INDEX HAS TO START FROM 1 ALTHOUGH JCLASS STARTS AT 0       TART   29
C                                                                       TART   30
      I=JCLASS+1                                                        TART   31
      ITA(I)=ITA(I)+LTIO                                                TART   32
      IPROC(I)=IPROC(I)+(LTEXEND-LTEXBGN)                               TART   33
      IQIN(I)=IQIN(I)+(LTEXBGN-LTIN)                                    TART   34
      IQOUT(I)=IQOUT(I)+(LTOUT-LTEXEND)                                 TART   35
C                                                                       TART   36
CC    LOCATE TURNAROUND TIME CLASS AND KEEP COUNT                       TART   37
C                                                                       TART   38
      TIO=FLOAT(LTIO)/60.0                                              TART   39
      K=0                                                               TART   40
C                                                                       TART   41
CC    LOOP TO LOCATE APPROPRIATE CLASS                                  TART   42
C                                                                       TART   43
   10    K=K+1                                                          TART   44
         IF (TIO.LT.TALMT(K)) GOTO 20                                   TART   45
         GOTO 10                                                        TART   46
C                                                                       TART   47
CC    END LOOP                                                          TART   48
C                                                                       TART   49
   20 CONTINUE                                                          TART   50
      NJOBTA(I,K)=NJOBTA(I,K)+1                                         TART   51
```

```
C                                                                       TART    52
      RETURN                                                            TART    53
      END                                                               TART    54


      FUNCTION LTIME(T)                                                 FNCS     2
C                                                                       FNCS     3
CC    THIS INTEGER FUNCTION RETURNS THE NUMBER OF SECONDS ELAPSED       FNCS     4
CC    AT TIME T SINCE 00.00.00.                                         FNCS     5
C                                                                       FNCS     6
      INTEGER HRS,SECS                                                  FNCS     7
      DECODE (10,1000,T) HRS,MINS,SECS                                  FNCS     8
 1000 FORMAT (3(1X,I2))                                                 FNCS     9
       LTIME=3600*HRS+60*MINS+SECS                                      FNCS    10
      RETURN                                                            FNCS    11
      END                                                               FNCS    12


      SUBROUTINE TIMING (WORD,T)                                        FNCS    13
C                                                                       FNCS    14
CC    SUBROUTINE TIMING INTERPRETES USER INPUT WORD WHICH IS A FOUR-    FNCS    15
CC    CHARACTER LONG AND RETURNS THE TIME T IN FORMAT HR.MN.SC.         FNCS    16
C                                                                       FNCS    17
      IMPLICIT INTEGER (A-Z)                                            FNCS    18
      DATA BLANK,PERIOD,SEC/1H ,1H.,2H00/                               FNCS    19
C                                                                       FNCS    20
      IF (WORD.EQ.5H     ) RETURN                                       FNCS    21
C     ELSE                                                              FNCS    22
C                                                                       FNCS    23
         DECODE (5,100,WORD) HR,MIN                                     FNCS    24
         IF (HR.GT.2H27.OR.MIN.GT.2H59) GOTO 1                          FNCS    25
            ENCODE (10,200,T) BLANK,HR,PERIOD,MIN,PERIOD,SEC,PERIOD     FNCS    26
            GOTO 2                                                      FNCS    27
C        ELSE                                                           FNCS    28
    1       WRITE (6,300)                                               FNCS    29
    2    CONTINUE                                                       FNCS    30
C                                                                       FNCS    31
CC       END IF                                                         FNCS    32
CC                                                                      FNCS    33
CC    END IF                                                            FNCS    34
C                                                                       FNCS    35
  100 FORMAT (1X,2A2)                                                   FNCS    36
  200 FORMAT (3(A1,A2),A1)                                              FNCS    37
  300 FORMAT (*  IMPROPERLY SPECIFIED TIME, RESET TO DEFAULT*/)         FNCS    38
C                                                                       FNCS    39
      RETURN                                                            FNCS    40
      END                                                               FNCS    41
```

```
      FUNCTION ADDTIME (TNOW,INC)                                       FNCS      42
C                                                                       FNCS      43
CC     FUNCTION ADDTIME TAKES TNOW IN ALPHANUMERIC FORM  HR.MN.SC.      FNCS      44
CC     INCREMENT IT BY INC MINUTES AND RETURNS THE TIME IN ALPHANUMERIC F FNCS     45
C                                                                       FNCS      46
      INTEGER HR,MIN,SEC                                                FNCS      47
      DIMENSION CHAR(10)                                                FNCS      48
      DATA BLANK,PERIOD,ZERO/1H ,1H.,1H0/                               FNCS      49
C                                                                       FNCS      50
      DECODE (10,1000,TNOW) HR,MIN,SEC                                  FNCS      51
 1000 FORMAT (3(1X,I2))                                                 FNCS      52
      MIN=MIN+INC                                                       FNCS      53
C                                                                       FNCS      54
CC     LOOP TO ADVANCE HOUR IF NECESSARY                                FNCS      55
C                                                                       FNCS      56
    5 IF (MIN.LT.60) GOTO 10                                            FNCS      57
        MIN=MIN-60                                                      FNCS      58
        HR=HR+1                                                         FNCS      59
        GOTO 5                                                          FNCS      60
C                                                                       FNCS      61
CC     END LOOP                                                         FNCS      62
C                                                                       FNCS      63
   10 ENCODE (10,6000,THEN) BLANK,HR,PERIOD,MIN,PERIOD,SEC,PERIOD       FNCS      64
 6000 FORMAT (3(A1,I2),A1)                                              FNCS      65
C                                                                       FNCS      66
CC     REPLACE BLANKS WITH ZEROES                                       FNCS      67
C                                                                       FNCS      68
      DECODE (10,1010,THEN) CHAR                                        FNCS      69
 1010 FORMAT (10A1)                                                     FNCS      70
      DO 20 I=2,10                                                      FNCS      71
        IF (CHAR(I).EQ.1H ) CHAR(I)=ZERO                                FNCS      72
   20 CONTINUE                                                          FNCS      73
      ENCODE (10,6020,THEN) CHAR                                        FNCS      74
 6020 FORMAT (10A1)                                                     FNCS      75
C                                                                       FNCS      76
      ADDTIME=THEN                                                      FNCS      77
      RETURN                                                            FNCS      78
      END                                                               FNCS      79



      FUNCTION MINUTE(T)                                                FNCS      80
C                                                                       FNCS      81
CC     FUNCTION MINUTE RETURNS AN INTEGER WHICH IS THE NUMBER OF MINUTES FNCS      82
CC     THAT HAVE ELAPSED SINCE MIDNIGHT AT TIME T. T IS IN THE DAYFILE  FNCS      83
CC     FORMAT, A TEN-CHARACTER TIME  HR.MN.SC.                          FNCS      84
C                                                                       FNCS      85
      INTEGER HR                                                        FNCS      86
C                                                                       FNCS      87
      DECODE (6,1000,T) HR,MIN                                          FNCS      88
 1000 FORMAT (2(1X,I2))                                                 FNCS      89
      MINUTE=HR*60+MIN                                                  FNCS      90
      RETURN                                                            FNCS      91
      END                                                               FNCS      92
```

```
      FUNCTION DECTIME (T2,T1)                                          FNCS      93
C                                                                       FNCS      94
C     FUNCTION DECTIME RETURNS A TIME AS A REAL NUMBER BY TAKING THE    FNCS      95
C     MIDPOINT OF T1 AND T2 (WITH T2.GT.T1) WHERE T1 AND T2 ARE TIME    FNCS      96
C     IN DAYFILE FORMAT OF TEN-CHARACTERS LONG                          FNCS      97
C                                                                       FNCS      98
C     LOCAL VARIABLES                                                   FNCS      99
C        TIME,INC,FHR,FMIN                                              FNCS     100
C                                                                       FNCS     101
      INC=(MINUTE(T2)-MINUTE(T1))/2                                     FNCS     102
      TIME=ADDTIME(T1,INC)                                              FNCS     103
      DECODE (7,1000,TIME) FHR,FMIN                                     FNCS     104
 1000 FORMAT (1X,2F3.0)                                                 FNCS     105
      DECTIME=FHR+FMIN/60.0                                             FNCS     106
      RETURN                                                            FNCS     107
      END                                                               FNCS     108


      FUNCTION SCAMAX (X)                                               FNCS     109
C                                                                       FNCS     110
C     FUNCTION SCAMAX FINDS A REASONABLE REAL NUMBER THAT IS GREATER    FNCS     111
C     THAN THE NUMBER X AND THAT MAY BE USED AS THE MAXIMUM VALUE FOR   FNCS     112
C     RANGE OF PLOTS.                                                   FNCS     113
C                                                                       FNCS     114
C       LOCAL VARIABLES*                                                FNCS     115
C        RANGE,STEP,VAL,I                                               FNCS     116
C                                                                       FNCS     117
      RANGE=0.001                                                       FNCS     118
C                                                                       FNCS     119
C     LOOP TO FIND APPRCXIMATE RANGE OF THE NUMBER X                    FNCS     120
C                                                                       FNCS     121
   10    RANGE=RANGE*10.                                                FNCS     122
         IF (X.LT.RANGE) GOTO 20                                        FNCS     123
         GOTO 10                                                        FNCS     124
C                                                                       FNCS     125
C     END LOOP                                                          FNCS     126
C                                                                       FNCS     127
   20 CONTINUE                                                          FNCS     128
      STEP=RANGE/10.0                                                   FNCS     129
      I=0                                                               FNCS     130
C                                                                       FNCS     131
C     LOOP TO NARROW DOWN RANGE OF X AND FIND VAL THAT IS JUST GT. X    FNCS     132
C                                                                       FNCS     133
   30    I=I+1                                                          FNCS     134
         VAL=STEP*FLOAT(I)                                              FNCS     135
         IF (X.LT.VAL) GOTO 40                                          FNCS     136
         GOTO 30                                                        FNCS     137
C                                                                       FNCS     138
C     END LOOP                                                          FNCS     139
C                                                                       FNCS     140
   40 SCAMAX=VAL                                                        FNCS     141
      RETURN                                                            FNCS     142
      END                                                               FNCS     143
```

```
      FUNCTION SCAMIN (X)                                                FNCS      144
C                                                                        FNCS      145
CC    FUNCTION SCAMIN FINDS A CONVENIENT REAL NUMBER THAT IS LESS        FNCS      146
CC    THAN THE NUMBER X AND THAT MAY BE USED AS THE MINIMUM VALUE        FNCS      147
CC    FOR RANGE OF PLOTS                                                 FNCS      148
CC                                                                       FNCS      149
CC     LOCAL VARIABLES*                                                  FNCS      150
CC       RANGE,VAL,I                                                     FNCS      151
C                                                                        FNCS      152
      RANGE=0.001                                                        FNCS      153
C                                                                        FNCS      154
CC    LOOP TO FIND APPROXIMATE RANGE OF THE NUMBER X                     FNCS      155
C                                                                        FNCS      156
   10 RANGE=RANGE*10.0                                                   FNCS      157
         IF (X.LT.RANGE) GOTO 20                                         FNCS      158
         GOTO 10                                                         FNCS      159
C                                                                        FNCS      160
CC    END LOOP                                                           FNCS      161
C                                                                        FNCS      162
   20  CONTINUE                                                          FNCS      163
      I=0                                                                FNCS      164
C                                                                        FNCS      165
CC    LOOP TO NARROW DOWN RANGE OF X AND FIND VAL THAT IS LT. X          FNCS      166
C                                                                        FNCS      167
   30    I=I+1                                                           FNCS      168
         VAL=RANGE*(1.0-(FLOAT(I)*0.1))                                  FNCS      169
         IF (X.GT.VAL) GOTO 40                                           FNCS      170
         GOTO 30                                                         FNCS      171
C                                                                        FNCS      172
CC    END LOOP                                                           FNCS      173
C                                                                        FNCS      174
   40 SCAMIN=VAL                                                         FNCS      175
      RETURN                                                             FNCS      176
      END                                                                FNCS      177



      SUBROUTINE SCALE(X,N,VMIN,VMAX)                                    FNCS      178
C                                                                        FNCS      179
CC    SUBROUTINE SCALE TAKES AN ARRAY X OF DIMENSION N BY 1              FNCS      180
CC    AND COMPUTES THE APPROPRIATE MINIMUM AND MAXIMUM VALUES IF X       FNCS      181
CC    IS TO BE USED IN A PLOT BY IMSL ROUTINE USPLX                      FNCS      182
CC    IT CALLS THE IMSL ROUTINE USMNMX TO FIND THE ACTUAL MIN AND MAX    FNCS      183
CC    AMONG VALUES IN X                                                  FNCS      184
C                                                                        FNCS      185
      DIMENSION X(100,1),XLIN(100)                                       FNCS      186
C                                                                        FNCS      187
CC    LINEARISE ARRAY X                                                  FNCS      188
C                                                                        FNCS      189
      DO 5 I=1,N                                                         FNCS      190
         XLIN(I)=X(I,1)                                                  FNCS      191
   5  CONTINUE                                                          FNCS      192
C                                                                        FNCS      193
      CALL USMNMX (XLIN,N,1,XMIN,XMAX)                                   FNCS      194
```

```
VMIN=SCAMIN(XMIN)                                    FNCS      195
VMAX=SCAMAX(XMAX)                                    FNCS      196
RETURN                                               FNCS      197
END                                                  FNCS      198
OVERLAY (PH3,1,0)                                    TABLES      2
```

```
      PROGRAM TIDY                                                      TABLES     3
C                                                                       TABLES     4
CC    SUBROUTINE TIDY  DOES HOUSEKEEPING OF FILES AND HANDLES PRINTOUTS TABLES     5
C                                                                       TABLES     6
      COMMON /CHOICE/TLOWER,TUPPER,INTERVL,SKIP                         TABLES     7
      LOGICAL SKIP                                                      TABLES     8
C                                                                       TABLES     9
      ENDFILE 8                                                         TABLES    10
      ENDFILE 9                                                         TABLES    11
      ENDFILE 10                                                        TABLES    12
      REWIND 8                                                          TABLES    13
      REWIND 9                                                          TABLES    14
      REWIND 10                                                         TABLES    15
      CALL TABLE1                                                       TABLES    16
      REWIND 8                                                          TABLES    17
      IF (SKIP) RETURN                                                  TABLES    18
      CALL TABLE2                                                       TABLES    19
      CALL TABLE3                                                       TABLES    20
      REWIND 9                                                          TABLES    21
      REWIND 10                                                         TABLES    22
      CALL OVERLAY (3HPH3,1,1,0)                                        TABLES    23
      RETURN                                                            TABLES    24
      END                                                               TABLES    25



      SUBROUTINE TABLE1                                                 TABLES    26
C                                                                       TABLES    27
CC    SUBROUTINE TABLE1 PRINTS A TABLE OF AVERAGE NUMBER OF USERS       TABLES    28
CCC   SIMULTANEUOSLY IN THE SYSTEM AT VARIOUS TIME SLOTS                TABLES    29
CCCC  INFORMATION REQUIRED IS TAKEN FROM TAPE8 WRITTEN BY SUBROUTINE    TABLES    30
CCCCC WRTCONC                                                           TABLES    31
C                                                                       TABLES    32
CC    ALL VARIABLES ARE LOCAL                                           TABLES    33
C                                                                       TABLES    34
      DIMENSION T1(6),T2(6),VALUE(6,2)                                  TABLES    35
      LOGICAL LAST                                                      TABLES    36
C                                                                       TABLES    37
      LAST=.FALSE.                                                      TABLES    38
      READ (8) DATE                                                     TABLES    39
      WRITE (6,6000) DATE                                               TABLES    40
C                                                                       TABLES    41
CC    LOOP                                                              TABLES    42
C                                                                       TABLES    43
   10   IC=1                                                           TABLES    44
```

```
C                                                                               TABLES     45
CC         LOOP TO READ SIX RECORDS                                             TABLES     46
C                                                                               TABLES     47
   20         READ (8) T1(IC),T2(IC),VALUE(IC,1),VALUE(IC,2)                    TABLES     48
              IF (EOF(8)) 30,40                                                 TABLES     49
   30            LAST=.TRUE.                                                    TABLES     50
                 GOTO 50                                                        TABLES     51
C                                                                               TABLES     52
CC            ELSE                                                              TABLES     53
C                                                                               TABLES     54
   40            IC=IC+1                                                        TABLES     55
C                                                                               TABLES     56
CC            END IF                                                            TABLES     57
C                                                                               TABLES     58
   50         IF ((IC.LE.6).AND.(.NOT.LAST)) GOTO 20                            TABLES     59
C                                                                               TABLES     60
CC         END LOOP                                                             TABLES     61
CC                                                                              TABLES     62
CC         PRINT OUT SIX RECORDS, IF ANY                                        TABLES     63
C                                                                               TABLES     64
           IC=IC-1                                                              TABLES     65
           IF (IC.EQ.0) GOTO 60                                                 TABLES     66
           WRITE (6,6010) (T1(J),T2(J), J=1,IC)                                 TABLES     67
           WRITE (6,6020) (VALUE(J,1),J=1,IC)                                   TABLES     68
           WRITE (6,6022) (VALUE(J,2),J=1,IC)                                   TABLES     69
           WRITE (6,6030)                                                       TABLES     70
   60      IF (LAST) 70,10                                                      TABLES     71
C                                                                               TABLES     72
CC       END LOOP                                                             TABLES     73
C                                                                               TABLES     74
   70   RETURN                                                                  TABLES     75
C                                                                               TABLES     76
 6000   FORMAT (1H0,40X,*TABLE OF AVERAGE NUMBER OF USERS IN SYSTEM ON *,       TABLES     77
     $          A10///)                                                        TABLES     78
 6010   FORMAT (6(5X,A6,2H -,A6)/)                                             TABLES     79
 6020   FORMAT (1H0,10X,5(F5.2,14X),F5.2,*      NON TIME-SHARING*)             TABLES     80
 6022   FORMAT (1H0,10X,5(F5.2,14X),F5.2,*      TIME-SHARING*)                 TABLES     81
 6030   FORMAT (1H0///)                                                        TABLES     82
C                                                                               TABLES     83
       END                                                                      TABLES     84



       SUBROUTINE TABLE2                                                        TABLES     85
C                                                                               TABLES     86
CC     SUBROUTINE TABLE2 PRINTS A TABLE OF SYSTEM LOAD PARAMETERS ACCORDI       TABLES     87
CC     TO TIME SLOTS                                                            TABLES     88
CC     THE INFORMATION REQUIRED IS TAKEN FROM TAPE9 WRITTEN BY                  TABLES     89
CC     SUBROUTINE SYSLOAD                                                       TABLES     90
CC                                                                              TABLES     91
CC     ALL VARIABLES ARE LOCAL                                                  TABLES     92
C                                                                               TABLES     93
       DIMENSION T1(4),T2(4),NJ(4),NT(4),NB(4),CP(4),SR(4),DS(4),PF(4),         TABLES     94
     $           PFD(4),PFI(4),FL(4),NTP(4),TP(4),TPM(4),NIN(4),NOUT(4),        TABLES     95
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```
     $          PROD(4),THRU(4)                                                  TABLES     96
      LOGICAL LAST                                                               TABLES     97
C                                                                                TABLES     98
      LAST=.FALSE.                                                               TABLES     99
      READ (9) DATE                                                              TABLES    100
C                                                                                TABLES    101
CC    LOOP TO PRINT ONE PAGE                                                     TABLES    102
CC                                                                               TABLES    103
   10    N=1                                                                     TABLES    104
         WRITE (6,6000) DATE                                                     TABLES    105
C                                                                                TABLES    106
CC       LOOP TO READ FOUR RECORDS                                               TABLES    107
C                                                                                TABLES    108
   20       READ (9) T1(N),T2(N),NJ(N),NT(N),NB(N),CP(N),SR(N),DS(N),           TABLES    109
     $                 PF(N),PFD(N),PFI(N),FL(N),NTP(N),TP(N),TPM(N),          TABLES    110
     $                 NIN(N),NOUT(N),PROD(N),THRU(N)                          TABLES    111
            IF (EOF(9)) 30,40                                                    TABLES    112
   30          LAST=.TRUE.                                                       TABLES    113
               GOTO 50                                                          TABLES    114
C                                                                                TABLES    115
CC          ELSE                                                                TABLES    116
C                                                                                TABLES    117
   40          N=N+1                                                             TABLES    118
C                                                                                TABLES    119
CC          END IF                                                              TABLES    120
C                                                                                TABLES    121
   50       IF ((N.LE.4).AND.(.NOT.LAST)) GOTO 20                               TABLES    122
C                                                                                TABLES    123
CC       END LOOP                                                                TABLES    124
CCC                                                                              TABLES    125
CCC      PRINT FOUR RECORDS, IF ANY                                              TABLES    126
C                                                                                TABLES    127
         N=N-1                                                                   TABLES    128
         IF (N.EQ.0) GOTO 60                                                     TABLES    129
         WRITE (6,6010) (T1(J),T2(J), J=1,N)                                     TABLES    130
         WRITE (6,6020) (NJ(J), J=1,N)                                           TABLES    131
         WRITE (6,6030) (NT(J), J=1,N)                                           TABLES    132
         WRITE (6,6040) (NB(J),J=1,N)                                            TABLES    133
         WRITE (6,6050) (CP(J), J=1,N)                                           TABLES    134
         WRITE (6,6060) (SR(J), J=1,N)                                           TABLES    135
         WRITE (6,6070) (DS(J), J=1,N)                                           TABLES    136
         WRITE (6,6080) (PF(J), J=1,N)                                           TABLES    137
         WRITE (6,6082) (PFD(J), J=1,N)                                          TABLES    138
         WRITE (6,6090) (PFI(J), J=1,N)                                          TABLES    139
         WRITE (6,6100) (FL(J), J=1,N)                                           TABLES    140
         WRITE (6,6110) (NTP(J), J=1,N)                                          TABLES    141
         WRITE (6,6120) (TP(J), J=1,N)                                           TABLES    142
         WRITE (6,6130) (TPM(J), J=1,N)                                          TABLES    143
         WRITE (6,6140) (NIN(J), J=1,N)                                          TABLES    144
          WRITE (6,6150) (NOUT(J), J=1,N)                                        TABLES    145
         WRITE (6,6160) (PROD(J), J=1,N)                                         TABLES    146
         WRITE (6,6170) (THRU(J), J=1,N)                                         TABLES    147
   60    IF (LAST) 70,10                                                         TABLES    148
C                                                                                TABLES    149
CC    END LOOP                                                                   TABLES    150
```

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C                                                                       TABLES     151
 6000 FORMAT (1H1,40X,*TABLE OF SYSTEM LOAD PARAMETERS FOR *,A10///)    TABLES     152
 6010 FORMAT (55X,4(4X,A6,2H -,A6)//)                                   TABLES     153
 6020 FORMAT (1H0,*  TOTAL NUMBER OF JOBS ENTERING SYSTEM          *,   TABLES     154
     $        4(12X,I6))                                               TABLES     155
 6030 FORMAT (1H0,*  NUMBER OF TERMINAL USERS LOGGED ON            *,   TABLES     156
     $        4(12X,I6))                                               TABLES     157
 6040 FORMAT (1H0,*  NUMBER OF BATCH JOBS ENTERING SYSTEM          *,   TABLES     158
     $        4(12X,I6))                                               TABLES     159
 6050 FORMAT (1H0,*  AVERAGE CPU SECONDS PER JOB                   *,   TABLES     160
     $        4X,4(8X,F10.3))                                          TABLES     161
 6060 FORMAT (1H0,*  AVERAGE SRU USED PER JOB                      *,   TABLES     162
     $        4X,4(8X,F10.3))                                          TABLES     163
 6070 FORMAT (1H0,*  AVERAGE MASS STORAGE UNITS USED PER JOB       *,   TABLES     164
     $        4X,4(8X,F10.3))                                          TABLES     165
 6080 FORMAT (1H0,*  AVERAGE PERMANENT FILE UNITS USED PER JOB     *,   TABLES     166
     $        4X,4(8X,F10.3))                                          TABLES     167
 6082 FORMAT (1H0,*  AVERAGE NUMBER OF ACCESSES TO DIRECT PF       *,   TABLES     168
     $        4X,4(8X,F10.3))                                          TABLES     169
 6090 FORMAT (1H0,*  AVERAGE NUMBER OF ACCESSES TO INDIRECT PF     *,   TABLES     170
     $        4X,4(8X,F10.3))                                          TABLES     171
 6100 FORMAT (1H0,*  AVERAGE CENTRAL MEMORY USED IN OCTAL          *,   TABLES     172
     $        4(12X,I6))                                               TABLES     173
 6110 FORMAT (1H0,*  NUMBER OF JOBS REQUIRING TAPES                *,   TABLES     174
     $        4(12X,I6))                                               TABLES     175
 6120 FORMAT (1H0,*  AVERAGE NUMBER OF DRIVES USED PER TAPE JOB    *,   TABLES     176
     $        4X,4(8X,F10.3))                                          TABLES     177
 6130 FORMAT (1H0,*  AVERAGE DRIVE TIME IN MINUTES PER TAPE JOB    *,   TABLES     178
     $        4X,4(8X,F10.3))                                          TABLES     179
 6140 FORMAT (1H0,*  AVERAGE NUMBER OF CARDS READ PER BATCH JOB    *,   TABLES     180
     $        4(12X,I6))                                               TABLES     181
 6150 FORMAT (1H0,*  AVERAGE NUMBER OF LINES PRINTED PER BATCH JOB *,   TABLES     182
     $        4(12X,I6))                                               TABLES     183
 6160 FORMAT (1H0,*  CPU PRODUCTIVITY                              *,   TABLES     184
     $        4X,4(8X,F10.3))                                          TABLES     185
 6170 FORMAT (1H0,*  SYSTEM THROUGHPUT (JOBS PER HOUR)             *,   TABLES     186
     $        4X,4(8X,F10.3))                                          TABLES     187
C                                                                       TABLES     188
   70 RETURN                                                            TABLES     189
      END                                                               TABLES     190


      SUBROUTINE TABLE3                                                 TABLES     191
C                                                                       TABLES     192
CC    SUBROUTINE TABLE3 PRINTS THE TABLE OF TURNAROUND TIME AND         TABLES     193
CC    DELAY FACTORS ACCORDING TO TIME SLOTS                             TABLES     194
CC    INFORMATION IS TAKEN FROM TAPE10 WRITTEN BY SUBROUTINE SYSPFM     TABLES     195
CC                                                                      TABLES     196
CC    ALL VARIABLES EXCEPT NJC ARE LOCAL                                TABLES     197
C                                                                       TABLES     198
      COMMON /JCPARAM/NJC,JJCODE,CLIMITS(10)                            TABLES     199
      DIMENSION NB(10),TA(10),PT(10),QIN(10),QOUT(10),DF(10)            TABLES     200
      DIMENSION WGTMEAN(5)                                              TABLES     201
```

```
      DATA DASH/10H      -    /                                                TABLES    202
C                                                                              TABLES    203
      READ(10) DATE                                                            TABLES    204
      WRITE (6,6000) DATE                                                      TABLES    205
      N=2*NJC                                                                  TABLES    206
C                                                                              TABLES    207
CC    LOOP TO PRINT INFORMATION FOR ONE SLOT                                   TABLES    208
C                                                                              TABLES    209
 10     READ (10) T1,T2,(NB(I),PT(I),TA(I),QIN(I),QOUT(I),DF(I),I=1,N)         TABLES    210
        IF (EOF(10)) 70,20                                                     TABLES    211
 20     WRITE (6,6010)                                                         TABLES    212
        WRITE (6,6012) DATE                                                    TABLES    213
        WRITE (6,6015) T1,T2                                                   TABLES    214
        NTOTAL=0                                                               TABLES    215
        SUMTA=0.0                                                              TABLES    216
        SUMPT=0.0                                                              TABLES    217
        SUMQIN=0.0                                                             TABLES    218
        SUMQOUT=0.0                                                            TABLES    219
        SUMDF=0.0                                                              TABLES    220
        DO 50 K=1,N                                                            TABLES    221
           JC=K-1                                                              TABLES    222
           IF (NB(K).EQ.0) 30,40                                               TABLES    223
 30           WRITE (6,6030) JC,NB(K),DASH,DASH,DASH,DASH,DASH                 TABLES    224
              GOTO 50                                                          TABLES    225
C                                                                              TABLES    226
CC         ELSE                                                                TABLES    227
C                                                                              TABLES    228
 40           WRITE (6,6020) JC,NB(K),TA(K),PT(K),QIN(K),QOUT(K),DF(K)         TABLES    229
              RN=FLOAT(NB(K))                                                  TABLES    230
              NTOTAL=NTOTAL+NB(K)                                              TABLES    231
              SUMTA=SUMTA+RN*TA(K)                                             TABLES    232
              SUMPT=SUMPT+RN*PT(K)                                             TABLES    233
              SUMQIN=SUMQIN+RN*QIN(K)                                          TABLES    234
              SUMQOUT=SUMQOUT+RN*QOUT(K)                                       TABLES    235
              SUMDF=SUMDF+RN*DF(K)                                             TABLES    236
 50     CONTINUE                                                               TABLES    237
C                                                                              TABLES    238
CC      WEIGHTED MEANS FOR THIS TIME PERIOD                                    TABLES    239
C                                                                              TABLES    240
        IF (NTOTAL.EQ.0) GOTO 60                                               TABLES    241
        RTJ=FLOAT(NTOTAL)                                                      TABLES    242
        WGTMEAN(1)=SUMTA/RTJ                                                   TABLES    243
        WGTMEAN(2)=SUMPT/RTJ                                                   TABLES    244
        WGTMEAN(3)=SUMQIN/RTJ                                                  TABLES    245
        WGTMEAN(4)=SUMQOUT/RTJ                                                 TABLES    246
        WGTMEAN(5)=SUMDF/RTJ                                                   TABLES    247
        WRITE (6,6040) WGTMEAN                                                 TABLES    248
 60     GOTO 10                                                                TABLES    249
C                                                                              TABLES    250
CC    END LOOP                                                                 TABLES    251
C                                                                              TABLES    252
 70   RETURN                                                                   TABLES    253
C                                                                              TABLES    254
6000  FORMAT (1H1,40X,*TURNAROUND TIME AND DELAY FACTOR FOR *,A10//)           TABLES    255
6010  FORMAT (1H0////)                                                         TABLES    256
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 6012 FORMAT (2X,A9/)                                                    TABLES     257
 6015 FORMAT (1H0,1X,A6,2H -,A6,2X,* JOBCLASS  NO. IN CLASS  TURNAROUND  TABLES     258
     $TIME   PROCESS TIME   TIME IN IN. QUEUE   TIME IN OUT. QUEUE   EXT TABLES     259
     $. DELAY FAC*//)                                                    TABLES     260
 6020 FORMAT (24X,I1,8X,I3,10X,F10.3,2(5X,F10.3),2(10X,F10.3)/)          TABLES     261
 6030 FORMAT (24X,I1,8X,I3,10X,A10,2(5X,A10),2(10X,A10)/)                TABLES     262
 6040 FORMAT (3X,* WEIGHTED MEANS  *,26X,F10.3,2(5X,F10.3),2(10X,F10.3)/ TABLES     263
     $//)                                                                TABLES     264
C                                                                        TABLES     265
      END                                                                TABLES     266
      OVERLAY (PH3,1,1)                                                  FIGURE       2



      PROGRAM FIGURE                                                     FIGURE       3
C                                                                        FIGURE       4
CCC   SUBROUTINE FIGURE PRODUCES LINE PRINTER PLOTS AND HISTOGRAMS       FIGURE       5
CCC   FOR THE FOLLOWING:                                                 FIGURE       6
CCC     1. JOB CONCURRENCY VS TIME OF DAY                                FIGURE       7
CCC     2. AVERAGE CPU SEC AND SRU PER JOB VS TIME OF DAY                FIGURE       8
CCC     3. AVERAGE MEMORY REQUIRED PER JOB VS TIME OF DAY                FIGURE       9
CCC     4. CPU PRODUCTIVITY VS TIME OF DAY                               FIGURE      10
CCC     5. SYSTEM THROUGHPUT RATE VS TIME OF DAY                         FIGURE      11
CCC     6. FREQUENCY DISTRIBUTION OF JOBS IN VARIOUS CLASSES             FIGURE      12
CCC     7. HISTOGRAM OF TURNAROUND TIME                                  FIGURE      13
CCC                                                                      FIGURE      14
CCC   THIS SUBROUTINE MAKES USE OF LIBRARY SUBROUTINES FROM IMSL,        FIGURE      15
CCC   SPECIFICALLY SUBROUTINE USPLX FOR PLOTS AND USHIST FOR HISTOGRAMS  FIGURE      16
CCC                                                                      FIGURE      17
C                                                                        FIGURE      18
      COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER,YONED(100,1)       FIGURE      19
      COMMON /CAPT/TITLE(3),XA(2),YA(2)                                  FIGURE      20
      COMMON /JCPARAM/NJC,JCCODE,CLIMIT(10)                              FIGURE      21
      DIMENSION DUMMY(4),DUM(10)                                         FIGURE      22
      DIMENSION CONC(50,2),NJDAY(12),CPSR(50,2),FL(50,1),PROD(50,1),     FIGURE      23
     $ THRU(50,1)                                                        FIGURE      24
      DIMENSION NBJ(10),TA(50,10),DF(50,10)                              FIGURE      25
      DATA BLANK/1H /                                                    FIGURE      26
C                                                                        FIGURE      27
CCC   OBTAIN DATE FROM FIRST ENTRIES ON EACH FILE                        FIGURE      28
C                                                                        FIGURE      29
      READ (8) DATE                                                      FIGURE      30
      READ (9) DATE                                                      FIGURE      31
      READ (10) DATE                                                     FIGURE      32
      DECODE (10,1000,DATE) (A(I),I=61,70)                               FIGURE      33
 1000 FORMAT (10A1)                                                      FIGURE      34
C                                                                        FIGURE      35
CC    FILL IN ARRAY A WITH BLANKS                                        FIGURE      36
C                                                                        FIGURE      37
      DO 10 I=1,30                                                       FIGURE      38
   10    A(I)=BLANK                                                      FIGURE      39
      DO 20 I=71,90                                                      FIGURE      40
   20    A(I)=BLANK                                                      FIGURE      41
      DO 30 I=111,130                                                    FIGURE      42
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   30     A(I)=BLANK                                                        FIGURE      43
          DO 40 I=151,160                                                   FIGURE      44
   40     A(I)=BLANK                                                        FIGURE      45
C                                                                           FIGURE      46
CC        SET UP MIN AND MAX OF X AND Y AND PLOT CHARACTERS                 FIGURE      47
C                                                                           FIGURE      48
          A(161)=0.0                                                        FIGURE      49
          A(162)=25.0                                                       FIGURE      50
          A(163)=3767 7777 7777 7777 7777 B                                 FIGURE      51
          A(164)=3767 7777 7777 7777 7777 B                                 FIGURE      52
          A(165)=1HI                                                        FIGURE      53
          A(166)=1HO                                                        FIGURE      54
C                                                                           FIGURE      55
CC        READ JOB CONCURRENCY FILE AND PREPARE PLOT                        FIGURE      56
C                                                                           FIGURE      57
          NP=0                                                              FIGURE      58
C                                                                           FIGURE      59
CC        LOOP TO SET UP X WHICH IS THE MEAN OF TIME SLOT, AND CONCCURRENCY FIGURE      60
C                                                                           FIGURE      61
   50     NP=NP+1                                                           FIGURE      62
          READ (8) T1,T2,CONC(NP,1),CONC(NP,2)                              FIGURE      63
          IF (EOF(8)) 70,60                                                 FIGURE      64
   60     X(NP)=DECTIME(T2,T1)                                              FIGURE      65
          GOTO 50                                                           FIGURE      66
C                                                                           FIGURE      67
CC        END LOOP                                                          FIGURE      68
C                                                                           FIGURE      69
   70  NP=NP-1                                                              FIGURE      70
       CALL PLCONC(CONC)                                                    FIGURE      71
C                                                                           FIGURE      72
CC                                                                          FIGURE      73
CC        INITIALISATION OF JOB COUNTS FOR THE DAY                          FIGURE      74
C                                                                           FIGURE      75
          NCL=2*NJC                                                         FIGURE      76
          K=NCL+2                                                           FIGURE      77
          DO 80 I=1,K                                                       FIGURE      78
             NJDAY(I)=0                                                     FIGURE      79
   80  CONTINUE                                                             FIGURE      80
C                                                                           FIGURE      81
CC        READ INFORMATION FROM SYSTEM LOAD FILE AND PERFORMANCE FILE AND   FIGURE      82
CC        AND PREPARE OTHER PLOTS                                           FIGURE      83
C                                                                           FIGURE      84
          NP=0                                                              FIGURE      85
C                                                                           FIGURE      86
CC        LOOP TO SET UP ALL X AND Y VALUES FOR PLOTS                       FIGURE      87
C                                                                           FIGURE      88
   90     NP=NP+1                                                           FIGURE      89
          READ (9) T1,T2,NJ,NTS,NB,CPSR(NP,1),CPSR(NP,2),DUMMY,MFL,         FIGURE      90
         $         NTPJ,DUMMY,PROD(NP,1),THRU(NP,1)                       FIGURE      91
          READ (10) T1,T2,(NBJ(I),DUM(I),TA(NP,I),DUM(I),DUM(I),DF(NP,I),  FIGURE      92
         $         I=1,NCL)                                               FIGURE      93
          IF (EOF(9)) 120,100                                               FIGURE      94
  100     X(NP)=DECTIME(T2,T1)                                              FIGURE      95
          FL(NP,1)=FLOAT(MFL)                                               FIGURE      96
C                                                                           FIGURE      97
```

```
C          COUNT JOBS OF VARIOUS CATEGORIES                                  FIGURE      98
C                                                                            FIGURE      99
           DO 110 I=1,NCL                                                    FIGURE     100
              NJDAY(I)=NJDAY(I)+NBJ(I)                                       FIGURE     101
  110      CONTINUE                                                          FIGURE     102
           NJDAY(NCL+1)=NJDAY(NCL+1)+NTPJ                                    FIGURE     103
           NJDAY(NCL+2)=NJDAY(NCL+2)+NTS                                     FIGURE     104
           GOTO 90                                                           FIGURE     105
C                                                                            FIGURE     106
CCC      END LOOP                                                          FIGURE     107
C                                                                            FIGURE     108
  120  NF=NP-1                                                             FIGURE     109
C                                                                            FIGURE     110
CCC      PLOT DIAGRAMS                                                     FIGURE     111
C                                                                            FIGURE     112
           CALL PLCPSR (CPSR)                                                FIGURE     113
           CALL PLPROD (PROD)                                                FIGURE     114
           CALL PLTHRU (THRU)                                                FIGURE     115
           CALL PLTADF (TA,DF,NCL)                                           FIGURE     116
           CALL PLFL (FL)                                                    FIGURE     117
           CALL HISTJC (NJDAY,K)                                             FIGURE     118
           CALL HISTTA (NCL)                                                 FIGURE     119
           RETURN                                                            FIGURE     120
           END                                                               FIGURE     121



           SUBROUTINE PLCONC (Y)                                             FIGURE     122
C                                                                            FIGURE     123
CCC        SUBROUTINE PLCONC CALLS IMSL ROUTINE TO PLOT JOB CONCURRENCY      FIGURE     124
CCC        AS A FUNCTION OF TIME OF THE DAY                                  FIGURE     125
C                                                                            FIGURE     126
           COMMON /CAPT/TITLE(3),XA(2),YA(2)                                 FIGURE     127
           COMMON /IMSLPT/ IMAG(5151),A(174),X(50),NP,IER,YONED(100,1)       FIGURE     128
           DIMENSION Y(50,2)                                                 FIGURE     129
C                                                                            FIGURE     130
CCC        SET UP TITLE AND LABELS OF AXES                                   FIGURE     131
C                                                                            FIGURE     132
           TITLE(1)=10HJOB CONCUR                                            FIGURE     133
           TITLE(2)=10HRENCY  VS                                             FIGURE     134
           TITLE(3)=10H  TIME                                                FIGURE     135
           XA(1)=10H  TIME OF                                                FIGURE     136
           XA(2)=10HDAY                                                      FIGURE     137
           YA(1)=10H    CONCUR                                               FIGURE     138
           YA(2)=10HRENCY                                                    FIGURE     139
           CALL SETCAP                                                       FIGURE     140
C                                                                            FIGURE     141
CCC        PLACE VALUES IN ARRAY Y INTO ARRAY YONED OF DIMENSION (2*NP,1)    FIGURE     142
C                                                                            FIGURE     143
           DO 10 I=1,NP                                                      FIGURE     144
              YONED(I,1)=Y(I,1)                                              FIGURE     145
              J=NP+I                                                         FIGURE     146
              YONED(J,1)=Y(I,2)                                              FIGURE     147
   10      CONTINUE                                                          FIGURE     148
```

```
C                                                                       FIGURE    149
CC      SET MIN AND MAX FOR SCALE                                       FIGURE    150
C                                                                       FIGURE    151
        LD=2*NP                                                         FIGURE    152
        CALL SCALE (YONED,LD,A(163),A(164))                             FIGURE    153
C                                                                       FIGURE    154
CC      CALL PLOTTING ROUTINE AND PRINT FOOTNOTES                       FIGURE    155
C                                                                       FIGURE    156
        CALL USPLX (X,Y,NP,2,1,50,A,IMAG4,IER)                          FIGURE    157
        WRITE (6,1000)                                                  FIGURE    158
 1000   FORMAT (3X,*I FOR NON TIME-SHARING AND 0 FOR TIME-SHARING*/)    FIGURE    159
        CALL FTNOTE                                                     FIGURE    160
        RETURN                                                          FIGURE    161
        END                                                             FIGURE    162



        SUBROUTINE SETCAP                                               FIGURE    163
C                                                                       FIGURE    164
CC      SUBROUTINE SETCAP SETS UP TITLE AND LABELS OF AXES OF PLOT      FIGURE    165
CC      BY PLACING CHARACTERS IN APPROPRIATE LOCATIONS WITHIN ARRAY A   FIGURE    166
CC      USED BY USPLX FOR LINE PRINTER PLOTS                            FIGURE    167
C                                                                       FIGURE    168
        COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER                 FIGURE    169
        COMMON /CAPT/TITLE(3),XA(2),YA(2)                               FIGURE    170
C                                                                       FIGURE    171
        DECODE (30,1000,TITLE) (A(I),I=31,60)                           FIGURE    172
        DECODE (20,1010,XA) (A(I),I=91,110)                             FIGURE    173
        DECODE (20,1010,YA) (A(I),I=131,150)                            FIGURE    174
 1000   FORMAT (30A1)                                                   FIGURE    175
 1010   FORMAT (20A1)                                                   FIGURE    176
        RETURN                                                          FIGURE    177
        END                                                             FIGURE    178



        SUBROUTINE FTNOTE                                               FIGURE    179
C                                                                       FIGURE    180
CC      SUBROUTINE FTNOTE PRINTS A FOOTNOTE AT THE END OF A LINE PRINTER FIGURE   181
CC      PLOT TO EXPLAIN LABELLING OF SCALE ON X AXIS, I.E., THE TIME SCALE FIGURE 182
C                                                                       FIGURE    183
        WRITE (6,6010)                                                  FIGURE    184
        WRITE (6,6020)                                                  FIGURE    185
        WRITE (6,6030)                                                  FIGURE    186
 6010   FORMAT (*   TIME SCALE ON X AXIS TO BE INTERPRETED AS* *)       FIGURE    187
 6020   FORMAT (*       .8000E+01 DENOTES 0800 HOURS*)                  FIGURE    188
 6030   FORMAT (*       .1250E+02 DENOTES 1230 HOURS*)                  FIGURE    189
        RETURN                                                          FIGURE    190
        END                                                             FIGURE    191
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      SUBROUTINE PLCPSR (Y)                                                  FIGURE     192
C                                                                            FIGURE     193
CCC    SUBROUTINE PLCPSR PLOTS THE CPU SECONDS AND SRU USED BY JOBS          FIGURE     194
CCC   AS AN AVERAGE ACCORDING TO TIME OF THE DAY BY CALLING IMSL             FIGURE     195
CCC   ROUTINE USPLX                                                          FIGURE     196
C                                                                            FIGURE     197
      DIMENSION Y(50,2)                                                      FIGURE     198
      COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER,YONED(100,1)           FIGURE     199
      COMMON /CAPT/TITLE(3),XA(2),YA(2)                                      FIGURE     200
CCC                                                                          FIGURE     201
CCC    SET UP TITLE AND AXIS LABELS                                          FIGURE     202
C                                                                            FIGURE     203
      TITLE(1)=10HCPU SEC AN                                                 FIGURE     204
      TITLE(2)=10HD SRU PER                                                  FIGURE     205
      TITLE(3)=10HJOB VS T                                                   FIGURE     206
      XA(1)=10H  TIME OF                                                     FIGURE     207
      XA(2)=10HDAY                                                           FIGURE     208
      YA(1)=10HCPU SEC.I.                                                    FIGURE     209
      YA(2)=10H OR SRU.O.                                                    FIGURE     210
      CALL SETCAP                                                            FIGURE     211
C                                                                            FIGURE     212
CCC   PLACE RELEVENT VALUES IN ARRAY Y INTO ANOTHER ARRAY YONED              FIGURE     213
CCC   OF DIMENSION (2*NP,1)                                                  FIGURE     214
C                                                                            FIGURE     215
      DO 10 I=1,NP                                                           FIGURE     216
         YONED(I,1)=Y(I,1)                                                   FIGURE     217
         J=NP+I                                                              FIGURE     218
         YONED(J,1)=Y(I,2)                                                   FIGURE     219
   10 CONTINUE                                                               FIGURE     220
C                                                                            FIGURE     221
CCC   SET MIN AND MAX SCALE                                                  FIGURE     222
C                                                                            FIGURE     223
      LD=2*NP                                                                FIGURE     224
      CALL SCALE(YONED,LD,A(163),A(164))                                     FIGURE     225
C                                                                            FIGURE     226
      CALL USPLX (X,Y,NP,2,1,50,A,IMAG4,IER)                                 FIGURE     227
      CALL FTNOTE                                                            FIGURE     228
      RETURN                                                                 FIGURE     229
      END                                                                    FIGURE     230


      SUBROUTINE PLFL (Y)                                                    FIGURE     231
C                                                                            FIGURE     232
CCC    SUBROUTINE PLFL PLOTS AVERAGE FIELD LENGTH REQUIRED BY A JOB          FIGURE     233
CCC   AS A FUNCTION OF TIME OF DAY.  IT CALLS IMSL ROUTINE USPLX             FIGURE     234
C                                                                            FIGURE     235
      COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER,YONED(100,1)           FIGURE     236
      COMMON /CAPT/TITLE(3),XA(2),YA(2)                                      FIGURE     237
      DIMENSION Y(50,1)                                                      FIGURE     238
C                                                                            FIGURE     239
      TITLE(1)=10HAVG MEMORY                                                 FIGURE     240
      TITLE(2)=10H UTILISATI                                                 FIGURE     241
      TITLE(3)=10HON  VS  T                                                  FIGURE     242
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      XA(1)=10H  TIME OF                                                FIGURE    243
      XA(2)=10HDAY                                                      FIGURE    244
      YA(1)=10HFL PER JOB                                               FIGURE    245
      YA(2)=10H IN OCTAL                                                FIGURE    246
      CALL SETCAP                                                       FIGURE    247
      CALL SCALE (Y,NP,A(163),A(164))                                   FIGURE    248
      CALL USPLX (X,Y,NP,1,1,50,A,IMAG4,IER)                            FIGURE    249
      CALL FTNOTE                                                       FIGURE    250
      RETURN                                                            FIGURE    251
      END                                                               FIGURE    252


      SUBROUTINE PLPROD(Y)                                              FIGURE    253
C                                                                       FIGURE    254
CC     SUBROUTINE PLPROD PLOTS CPU PRODUCTIVITY AS A FUNCTION OF TIME   FIGURE    255
CC    OF THE DAY BY CALLING IMSL ROUTINE USPLX                          FIGURE    256
C                                                                       FIGURE    257
      COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER,YONED(100,1)      FIGURE    258
      COMMON /CAPT/TITLE(3),XA(2),YA(2)                                 FIGURE    259
      DIMENSION Y(50,1)                                                 FIGURE    260
C                                                                       FIGURE    261
      TITLE(1)=10HCPU PRODUC                                            FIGURE    262
      TITLE(2)=10HTIVITY  VS                                            FIGURE    263
      TITLE(3)=10H  TIME                                                FIGURE    264
      XA(1)=10H  TIME OF                                                FIGURE    265
      XA(2)=10HDAY                                                      FIGURE    266
      YA(1)=10HCPU PRODUC                                               FIGURE    267
      YA(2)=10HTIVITY                                                   FIGURE    268
      CALL SETCAP                                                       FIGURE    269
      CALL SCALE (Y,NP,A(163),A(164))                                   FIGURE    270
      CALL USPLX (X,Y,NP,1,1,50,A,IMAG4,IER)                            FIGURE    271
      CALL FTNOTE                                                       FIGURE    272
      RETURN                                                            FIGURE    273
      END                                                               FIGURE    274


      SUBROUTINE PLTHRU (Y)                                             FIGURE    275
C                                                                       FIGURE    276
CC    SUBROUTINE PLTHRU PLOTS SYSTEM THROUGHPUT RATE AS A FUNCTION      FIGURE    277
CC    OF TIME OF DAY BY CALLING IMSL ROUTINE USPLX                      FIGURE    278
C                                                                       FIGURE    279
      COMMON /CAPT/TITLE(3),XA(2),YA(2)                                 FIGURE    280
      COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER,YONED(100,1)      FIGURE    281
      DIMENSION Y(50,1)                                                 FIGURE    282
C                                                                       FIGURE    283
      TITLE(1)=10HSYSTEM THR                                            FIGURE    284
      TITLE(2)=10HOUGHPUT VS                                            FIGURE    285
      TITLE(3)=10H TIME                                                 FIGURE    286
      XA(1)=10H  TIME OF                                                FIGURE    287
      XA(2)=10HDAY                                                      FIGURE    288
      YA(1)=10HJOB NUMBER                                               FIGURE    289
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      YA(2)=10HS PER HOUR                                                    FIGURE     290
      CALL SETCAP                                                            FIGURE     291
      CALL SCALE (Y,NP,A(163),A(164))                                        FIGURE     292
      CALL USPLX (X,Y,NP,1,1,50,A,IMAG4,IER)                                 FIGURE     293
      CALL FTNOTE                                                            FIGURE     294
      RETURN                                                                 FIGURE     295
      END                                                                    FIGURE     296



      SUBROUTINE PLTADF (Y1,Y2,N)                                            FIGURE     297
C                                                                            FIGURE     298
CCC    SUBROUTINE PLTADF PLOTS THE TURNAROUND TIME AND DELAY FACTOR          FIGURE     299
CCC   AS A FUNCTION OF TIME OF DAY.   IT PRODUCES ONE PLOT FOR EACH          FIGURE     300
CCC    JOB CLASS.     CALLS IMSL ROUTINE USPLX                               FIGURE     301
C                                                                            FIGURE     302
      COMMON /CAPT/TITLE(3),XA(2),YA(2)                                      FIGURE     303
      COMMON /IMSLPT/ IMAG4(5151),A(174),X(50),NP,IER,YONED(100,1)           FIGURE     304
      DIMENSION Y1(50,10),Y2(50,10),TADF(50,2)                               FIGURE     305
C                                                                            FIGURE     306
CCC    SET UP TITLE AND LABELS OF AXES                                       FIGURE     307
C                                                                            FIGURE     308
      TITLE(1)=10HTURNAROUND                                                 FIGURE     309
      TITLE(2)=10H TIME / DE                                                 FIGURE     310
      TITLE(3)=10HL FAC VS T                                                 FIGURE     311
      XA(1)=10H  TIME OF                                                     FIGURE     312
      XA(2)=10HDAY                                                           FIGURE     313
      YA(1)=10HT/A TIME.I                                                    FIGURE     314
      YA(2)=10H. OR DF.O.                                                    FIGURE     315
      CALL SETCAP                                                            FIGURE     316
C                                                                            FIGURE     317
CCC   LOOP TO PRODUCE ONE PLOT FOR EACH CLASS                                FIGURE     318
C                                                                            FIGURE     319
      DO 20 I=1,N                                                            FIGURE     320
C                                                                            FIGURE     321
CCC      LOOP TO SET UP Y VALUES FOR EACH PLOT                               FIGURE     322
C                                                                            FIGURE     323
         DO 10 J=1,NP                                                        FIGURE     324
C                                                                            FIGURE     325
CCC         ELIMINATE Y VALUES THAT ARE ZERO                                 FIGURE     326
C                                                                            FIGURE     327
            IF (Y1(J,I).LT.1.0) Y1(J,I)=1.0                                  FIGURE     328
            IF (Y2(J,I).LT.1.0) Y2(J,I)=1.0                                  FIGURE     329
C                                                                            FIGURE     330
CCC         PLACE VALID VALUES IN ARRAYS Y1 AND Y2 INTO ANOTHER ARRAY        FIGURE     331
            YONED OF DIMENSION (2*NP,1)                                      FIGURE     332
C                                                                            FIGURE     333
            TADF(J,1)=Y1(J,I)                                                FIGURE     334
            TADF(J,2)=Y2(J,I)                                                FIGURE     335
            YONED(J,1)=TADF(J,1)                                             FIGURE     336
            K=NP+J                                                           FIGURE     337
            YONED(K,1)=TADF(J,2)                                             FIGURE     338
   10    CONTINUE                                                            FIGURE     339
C                                                                            FIGURE     340
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C         END LOOP                                                                FIGURE     341
CC                                                                                FIGURE     342
CC        SET UP SCALES AND CALL PLOT                                             FIGURE     343
C                                                                                 FIGURE     344
          LD=2*NP                                                                 FIGURE     345
          CALL SCALE (YONED,LD,A(163),A(164))                                     FIGURE     346
          CALL USPLX (X,TADF,NP,2,1,50,A,IMAG4,IER)                               FIGURE     347
          IJC=I-1                                                                 FIGURE     348
          WRITE (6,6000) IJC                                                      FIGURE     349
          CALL FTNOTE                                                             FIGURE     350
          WRITE (6,6010)                                                          FIGURE     351
   20  CONTINUE                                                                   FIGURE     352
C                                                                                 FIGURE     353
CC      END LOOP                                                                  FIGURE     354
C                                                                                 FIGURE     355
 6000 FORMAT (*                                FOR JOB CLASS *,I2/)               FIGURE     356
 6010 FORMAT (*    POINTS MARKED M AT Y=1.0 INDICATE NO JOBS IN THIS CLAS        FIGURE     357
     $S DURING THAT PERIOD*)                                                      FIGURE     358
C                                                                                 FIGURE     359
      RETURN                                                                      FIGURE     360
      END                                                                         FIGURE     361



      SUBROUTINE HISTJC (NJ,NC)                                                   FIGURE     362
C                                                                                 FIGURE     363
CC     SUBROUTINE HISTJC PRODUCES HISTOGRAM OF NUMBER OF JOBS PROCESSED           FIGURE     364
CC     DURING THIS DAY IN VARIOUS CATEGORIES                                      FIGURE     365
C                                                                                 FIGURE     366
      COMMON /IMSLFQ/AL(28),W(8),IW(48)                                           FIGURE     367
      DIMENSION NJ(12),FREQ(12)                                                   FIGURE     368
C                                                                                 FIGURE     369
CC     CONVERT COUNTS TO REAL NUMBERS BEFORE CALLING IMSL ROUTINE                 FIGURE     370
C                                                                                 FIGURE     371
      DO 10 I=1,NC                                                                FIGURE     372
         FREQ(I)=FLOAT(NJ(I))                                                     FIGURE     373
   10 CONTINUE                                                                    FIGURE     374
C                                                                                 FIGURE     375
      CALL USHIST (FREQ,NC,1,AL,W,IW,IER)                                         FIGURE     376
C                                                                                 FIGURE     377
CC    PRINT EXPLANATION OF CLASS CODE                                             FIGURE     378
C                                                                                 FIGURE     379
      WRITE (6,6000)                                                              FIGURE     380
      WRITE (6,6010)                                                              FIGURE     381
      KC=NC-2                                                                     FIGURE     382
      DO 20 I=1,KC                                                                FIGURE     383
         K=I-1                                                                    FIGURE     384
         WRITE (6,6020) I,K                                                       FIGURE     385
   20 CONTINUE                                                                    FIGURE     386
      KC=KC+1                                                                     FIGURE     387
      WRITE (6,6030) KC                                                           FIGURE     388
      KC=KC+1                                                                     FIGURE     389
      WRITE (6,6040) KC                                                           FIGURE     390
C                                                                                 FIGURE     391
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 6000  FORMAT (1H0//)                                                    FIGURE     392
 6010  FORMAT (*       NUMBER OF JOBS PROCESSED THIS DAY BY CLASS*/)     FIGURE     393
 6020  FORMAT (*      CLASS CODE *,I2,* = JOBCLASS *,I2/)                FIGURE     394
 6030  FORMAT (*      CLASS CODE *,I2,* =  JOBS REQUIRING TAPE(S)*/)     FIGURE     395
 6040  FORMAT (*      CLASS CODE *,I2,* =  TIME-SHARING JOBS*/)          FIGURE     396
C                                                                       FIGURE     397
       RETURN                                                           FIGURE     398
       END                                                              FIGURE     399



       SUBROUTINE HISTTA (N)                                            FIGURE     400
C                                                                       FIGURE     401
CC     SUBROUTINE HISTTA PLOTS THE FREQUENCY DISTRIBUTION OF TURNAROUND FIGURE     402
C      TIME FOR RANGES OF TIME.   THE DATA IS OBTAINED VIA THE COMMON   FIGURE     403
C      BLOCK CLTA.    THER IS ONE DIAGRAM FOR EACH JOB CLASS PLUS       FIGURE     404
C      ONE FOR ALL JOB CLASSES                                          FIGURE     405
C                                                                       FIGURE     406
       COMMON /CLTA/NTAC,TALMT(10),NJOBTA(10,10)                        FIGURE     407
       COMMON /IMSLFQ/AL(28),W(8),IW(48)                                FIGURE     408
       DIMENSION FREQ(10),SFREQ(10)                                     FIGURE     409
C                                                                       FIGURE     410
CC     INITIALISE SFREQ FOR FREQUENCY IRRESPECTIVE OF JOB CLASS         FIGURE     411
C                                                                       FIGURE     412
       DO 10 I=1,NTAC                                                   FIGURE     413
          SFREQ(I)=0.0                                                  FIGURE     414
   10  CONTINUE                                                         FIGURE     415
C                                                                       FIGURE     416
CC     LOOP TO PRODUCE ONE HISTOGRAM FOR EACH CLASS OF JOB              FIGURE     417
C                                                                       FIGURE     418
       DO 30 I=1,N                                                      FIGURE     419
C                                                                       FIGURE     420
CC        SET UP FREQUENCIES FOR EACH HISTOGRAM                        FIGURE     421
C                                                                       FIGURE     422
          DO 20 K=1,NTAC                                                FIGURE     423
             FREQ(K)=FLOAT(NJOBTA(I,K))                                 FIGURE     424
             SFREQ(K)=SFREQ(K)+FREQ(K)                                  FIGURE     425
   20     CONTINUE                                                      FIGURE     426
C                                                                       FIGURE     427
          CALL USHIST (FREQ,NTAC,1,AL,W,IW,IER)                         FIGURE     428
C                                                                       FIGURE     429
CC        PRINT FOOTNOTE OF CLASS CODES                                 FIGURE     430
C                                                                       FIGURE     431
          WRITE (6,6000)                                                FIGURE     432
          IC=I-1                                                        AUG13        1
          WRITE (6,6010) IC                                             AUG13        2
          CALL TACODE                                                   FIGURE     434
   30  CONTINUE                                                         FIGURE     435
C                                                                       FIGURE     436
CC     END LOOP                                                         FIGURE     437
CC                                                                      FIGURE     438
CC     PLOT HISTOGRAM FOR ALL JOB CLASSES                               FIGURE     439
C                                                                       FIGURE     440
       CALL USHIST (SFREQ,NTAC,1,AL,W,IW,IER)                           FIGURE     441
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      WRITE (6,6000)                                                    FIGURE     442
      WRITE (6,6020)                                                    FIGURE     443
      CALL TACODE                                                       FIGURE     444
C                                                                       FIGURE     445
 6000 FORMAT (1H0//)                                                    FIGURE     446
 6010 FORMAT (*    FREQUENCY PLOT OF TURNAROUND TIME FOR JOBCLASS *,I2//) FIGURE     447
 6020 FORMAT (*    FREQUENCY PLOT OF TURNAROUND TIME IRRESPECTIVE OF JOB FIGURE     448
     $CLASS*//)                                                         FIGURE     449
C                                                                       FIGURE     450
      RETURN                                                            FIGURE     451
      END                                                               FIGURE     452



      SUBROUTINE TACODE                                                 FIGURE     453
C                                                                       FIGURE     454
CCC   SUBROUTINE TACODE PRINTS EXPLANATION OF TURNAROUND TIME CLASS     FIGURE     455
      CODE                                                              FIGURE     456
C                                                                       FIGURE     457
      WRITE (6,6020)                                                    FIGURE     458
      WRITE (6,6030)                                                    FIGURE     459
      WRITE (6,6040)                                                    FIGURE     460
      WRITE (6,6050)                                                    FIGURE     461
      WRITE (6,6060)                                                    FIGURE     462
      WRITE (6,6070)                                                    FIGURE     463
      WRITE (6,6080)                                                    FIGURE     464
      WRITE (6,6090)                                                    FIGURE     465
      WRITE (6,6100)                                                    FIGURE     466
      WRITE (6,6110)                                                    FIGURE     467
C                                                                       FIGURE     468
 6020 FORMAT (*    CLASS CODE  1 =   0 TO  5 MINUTES*/)                 FIGURE     469
 6030 FORMAT (*    CLASS CODE  2 =   5 TO 10 MINUTES*/)                 FIGURE     470
 6040 FORMAT (*    CLASS CODE  3 =  10 TO 15 MINUTES*/)                 FIGURE     471
 6050 FORMAT (*    CLASS CODE  4 =  15 TO 20 MINUTES*/)                 FIGURE     472
 6060 FORMAT (*    CLASS CODE  5 =  20 TO 25 MINUTES*/)                 FIGURE     473
 6070 FORMAT (*    CLASS CODE  6 =  25 TO 30 MINUTES*/)                 FIGURE     474
 6080 FORMAT (*    CLASS CODE  7 =  30 TO 45 MINUTES*/)                 FIGURE     475
 6090 FORMAT (*    CLASS CODE  8 =  45 TO 60 MINUTES*/)                 FIGURE     476
 6100 FORMAT (*    CLASS CODE  9 =  60 - 120 MINUTES*/)                 FIGURE     477
 6110 FORMAT (*    CLASS CODE 10 = 120  MINUTES AND UP*)                FIGURE     478
C                                                                       FIGURE     479
      RETURN                                                            FIGURE     480
      END                                                               FIGURE     481
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