1620 GENERAL PROGRAM LIBRARY

IBM 1620 Critical Path and Man Scheduling

40K Version	10.3.028
60K Version	10.3.029

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40K Version - File No. 10.3.028

60K Version - File No. 10.3.029

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Modifications or revisions to this program, as they occur, will be announced in the appropriate Catalog of Programs for IBM Data Processing Systems. When such an announcement occurs, users should order a complete new program from the Program Information Department.

40K VERSION

DECK KEY

(1) Phase I (Less) Object Deck - sequence # in cc 77-80, 366 cards

(2) Phase II (MAN SCHEDULING) Object Deck - sequence # in cc 77-80, 937 cards

(3) FORTRAN Subroutines with Divide - sequence # in cc 76-80, 380 cards

(4) FORTRAN Source Deck for Phase I (LESS) - 136 cards

(5) FORTRAN Source Deck for Phase II (MAN SCHEDULING) - 412 cards

(6) Test Data for Phase I - 34 cards

(7) Test Data for Phase II - 37 cards

(8) Test Output from Phase I - 34 cards

(9) Test Output from Phase II - 266 cards

60K VERSION

DECK KEY

(1) Phase I (LESS) Object Deck - sequence # in cc. 77-80, 367 cards

(2) Phase II (MAN SCHEDULING) Object Deck - sequence # in cc. 77-80, 1062 cards.

(3) FORTRAN Subroutines with Divide - sequence # in cc. 76-80, 380 cards

(4) FORTRAN Source Deck for Phase I (LESS) - 137 cards

(5) FORTRAN Source Deck for Phase II (MAN SCHEDULING) - 475 cards

(6) Test Data for Phase I - 34 cards

(7) Test Data for Phase II - 37 cards

(8) Test Output from Phase I - 34 cards

(9) Test Output from Phase II - 266 cards

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PROGRAM BRIEF

A. Purpose: This program provides solutions to the problems of critical path and man scheduling. However, it provides only partial solutions to the ultimate scheduling problem since least cost scheduling is not considered and since the man scheduling phase is not an optimizing routine; i. e., it does not level the manpower requirements. Instead, it allows management to level its manpower as it wishes. The 1620 man scheduling program generally gives a near optimum feasible solution to a realistic problem.

B. Method: The program contains two phases. Phase I, the Critical Path or LESS phase, develops a schedule of early and late short dates and total float, using the Critical Path concept. Phase I ignores the manpower requirements and operates only on durations and the interrelationship of jobs. Phase II, the Man Scheduling phase, developes schedules of **start** dates using the information generated by Phase I and the various sets of manpower restrictions imposed by the user.

C. Restrictions:

1) 40K Version:
   - a) Phase I: 740 jobs; I, J numbers $\leq$ 999
   - b) Phase II: Queues of at most 70 for both in process and waiting lines.

2) 60K Version:
   - a) Phase I: 1440 jobs; I, J numbers $\leq$ 999
   - b) Phase II: Queues of at most 180 for both in process and waiting lines.

D. Accuracy: Near optimum solution in most cases.

E. Machine Configuration: 1620 with 40K core storage for 40K version and 60K core storage for 60K version; 1622 card read punch.

F. Program Requirements:
For 40K version: 40K core storage
For 60K version: 60K core storage

G. Source Language: FORTRAN with Format

H. Program Execution Time: Approximately 1 hour per 100 jobs input.

I. Check-Out Status: Successfully employed on projects of 500 jobs.

J. Sample Problem Running Time: The sample problem as indicated will take approximately 30 minutes.

K. Comments: The program and its documentation were written by an IBM employee. It was developed for a specific purpose and submitted for general distribution to interested parties in the hope that it might prove helpful to other members of the data processing community. The program and its documentation are essentially in the author's original form. IBM serves only as the distributing agency in supplying this program. Questions concerning the use of the program should be directed to the author's attention.

Detailed Program Description

A. Phase I - Critical Path - LESS

This phase, after printing an instruction message commences to initialize the indicators and setup constants. Then the I number, J number, and the duration time are read in from cards. Then, depending upon the value of the I number the program will: 1) Stop if the I number equals zero; 2) proceed if the I number is greater than zero; 3) if I is less than zero the program substitutes the absolute value of I and K=2, types "Reload Data" and proceeds.

Floating point arithmetic is now established and the calculations are begun. The early start time is computed then converted to fixed point numbers. Next the duration time is computed and immediately transferred to fixed point form. Then early finish time, late finish time, late start time, and total float time are computed and then all switched to fixed point format. Depending upon the sense switch selection, the output is then prepared. The options available are: 1) no output; 2) printed output; and 3) punched output.

B. Phase II - Man Scheduling

This phase begins by testing the sense switch output options and then immediately types and/or punches the headings. Then, after initializing the constants, the craft availabilities, corrections, and all data are read in to storage. If the card is a manpower availability master this information is placed in storage. If the card is a manpower update card the relevant manpower abilities are updated and corrected. The data is now processed and the jobs are placed in a waiting line. The program then checks to see if a job can logically begin. The manpower must then be adjusted providing, of course, that enough manpower is available. The finish date is then computed and the job is placed in progress. The waiting line is then advanced. If a critical job is waiting, the program checks to see if this job can logically be started. First we must determine if manpower can be released from another job already in progress to facilitate the completion of this critical job. Hence we must locate men in the proper craft class to fill the needs of the critical job and see if these men can be acquired from an in-process job. If the job in progress cannot be delayed the critical job cannot be started. If this job can be delayed, the available relevant manpower is released and the interrupted job is stored in the waiting queue. Meanwhile, the in-process jobs are now checked. If a job has

ended on the current date the manpower from that job is released. The computer signifies this completion in the output. When the last job has been completed a "project complete" message is printed and the computer stops.

INPUT-OUTPUT FORMAT

A. **Input to Phase I, Pass 1 and Pass 2**

Each number should be less than 999 and right justified in its field. The Format Statements indicate I4, or four columns, for each field. One of these columns is assumed to contain a sign whether the sign is punched or not. A four digit number will cause an input error and if I5 is used to permit usage of a 4 digit number plus sign, an error will be generated in the Critical Path Program. Consequently, under present coding the field size is restricted to a 3 digit number and a sign, which may be omitted.

Columns 2-5 **The I number**

Columns 6-9 **The J number**

Columns 10-13 **The duration, this can be any unit (eg. minutes, hours, days, etc.) the user desires. All durations in the same project should be in the same units of time.**

Columns 14-33 **Should be left blank**

Columns 34-37 **Should contain the craft identification number of one of the crafts the job uses.**

Columns 38-41 **Should contain the number of units of the craft described in columns 34-37 that the job uses.**

Columns 42-45 Should contain the code which will be described later.

Columns 46-49 Should contain the identification number of a second craft the job may use.

Columns 50-53 Should contain the number of units of the craft described in columns 46-49 that the job uses.

Columns 54-57 Identification of a third craft.

Columns 58-61 Number of units of the third craft used.

Note in 40K version only 3 crafts per job are recognized - See operating tips to see how to overcome this. In 60K version.

Columns 62-65 Identification of fourth craft used. (Leave blank in 40K version).

Columns 66-69 Number of units of the fourth craft used. (Leave blank in 40K version).

If a job doesn't use four (three in 40K version) crafts the respective fields may be left blank. If no crafts are needed (eg. certain types of delays or dummy jobs columns 34-41 and 46-69 may be left blank).

Data input must be sorted J within I sequence (Columns 2-9).

*Note last input card to Phase I must have a minus I number, minus in column 1.

B. Input to Phase II

Craft Availabilities

1. The first set of cards should be craft availabilities and the user may have up to 20 of these cards. Each craft availability card should have the following format. All numbers are right justified and less than or equal to 999.

Columns	34-37	The craft number. This can be any number not necessarily in order or between 1 and 20.
Columns	38-41	The number of units of this craft available.
Columns	44-45	The number 11 should appear here to tell the program this is a craft availability card.

2. The rest of the data cards consist of output from Phase 1 pass 2, craft availability updates, and clock update cards.

Job Information

The format of the output of Phase 1, pass 2 and subsequent input to Phase 2 is as follows:

Columns	2-5	I number
Columns	6-9	J number
Columns	10-13	Duration of job
Columns	14-17	Early start time
Columns	18-21	Late start time
Columns	22-25	Early finish time
Columns	26-29	Late finish time
Columns	30-33	Float time
Columns	34-69	Same as input to Phase I

This is the format of the card output. The typewriter differs somewhat and is as shown in the sample Output section.

All of the above numbers are right justified fixed point numbers less than or equal to 999.

The output from Critical Path Scheduling may be sorted as desired for listing. For input to Phase II, Man Scheduling, these cards must be sorted first by total float then by early start (eg. they should be ordered by total float within early start). Note last card after sort must have a code of 31 or 32 (see section on code number).

Availability Update

3. Interspersed with the preceeding cards may be resource availability update cards. These update cards may increase or decrease the availability of resources of any craft. The updating of the availability due to these update cards will take place at a time equal to the early start date of the last job and read in before this update card (see operating tips). The format for this card follows:

Columns	34-37	Craft number whose availability is to be updated.
Columns	38-41	Plus or minus change in availability. Number should be between 999 and -999.
Columns	44-45	22

All numbers should be right adjusted fixed point numbers.

4. **Inserted with the input to Phase II might be a clock up**date card. If no clock update card is used the clock will increment in time units of 1 and all queues will be inspected each unit of time. If a clock update card is used (eg. saying the clock should be incremented by N units) then the clock will be incremented by N units and the queues will be inspected every N units of time. This clock update may be inserted anywhere in the deck and will take effect at the early start time or closest increment thereafter of the preceeding job card (see operating tips). The unit of time used by the man scheduling program is up to the discretion of the user in that it will be the same unit of time that the user uses for his job duration times.

After each end of project the time increment is automatically made equal to 1 unit. If an error should occur and the user desires to restart, the time increment will be equal to the time increment being used when the error stop occurred.

Clock Update Card Format

Column	10-13	A right adjusted plus number equal to or less than 999.
Column	45	The number 1

Code Number

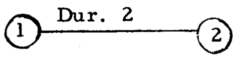
The code number appears as a right adjusted fixed point number less than or equal to 99 in columns 44-45. Its value should be:

01 if the card is a clock update card.
11 if the card is a craft availability master
22 if the card is a craft availability update
30 if this job cannot be delayed after it has begun. In other words, once the job has been started and it partly finished, it cannot be stopped and restarted at a later date to allow a more critical job to start.
31 if this job card is last card and this job cannot be delayed after it has begun.
32 if card is last card and other than type described by code 31.

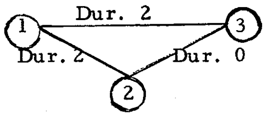
*Note a job card (output of Phase I) must be last card input to Phase II.

Operating tips

1. If a job requires more than 4 crafts (3 crafts in a 40K) then the job can be broken into 2 or more jobs as follows:



Here job 1-2 requires crafts A, B, C, D, E, F



Here job 1-3 requires crafts A, B, C. Job 1-2 requires crafts D, E, F.

2. If the user desires to update the craft availabilities at a specific time (eg., to account for overtime), or change the clock increment at a specific time. He might insert into the output from Phase I with the update card a dummy job card with an early start date and late start date equal to the time the updating is to take place. The I, J number should be ones not used elsewhere in the program; all other fields should be zero. Of course, these two cards must be placed in the proper spot in the deck (by total float within early start date) and the dummy job card should precede the update card. This dummy job card should not be placed in the phase 1 input and will not affect the man-scheduling program. However, it will show up in the output as a finished job indication and exhibit in the labor summary the new availabilities.

If a negative craft availability adjustment is made (e.g., at the end of overtime shift) and the availability pool is too small to fill the requirement of the adjustment, jobs in progress will be delayed until the requirement of the adjustments are met. If, however, all jobs in progress which can be delayed are delayed and the requirement of the adjustment still is not met, the total requirement will not be met until some undelayable jobs in progress are finished and enough units of the proper craft are released to meet the remainder of the requirements. In the meantime, those jobs which were delayed will remain delayed and part of the requirement of the adjustment will be filled. If a negative craft adjustment is fulfilled at a later time than the user had desired, resulting from conditions explained above, a printout will occur with the word finish and the craft number at the time this adjustment is fulfilled.

3. A time increment other than 1 might be used if computer time needs to be saved.

Changing the time increment may reduce the computing time proportionally (e.g., time increment of 5 will go almost four times as fast). The larger the time increment, the faster the computer run is; but the less accurate the scheduling is unless the increment corresponds to the duration increments. If the user only desires a rough estimate of the schedule (or a part of the schedule) the user may introduce a large time increment for the whole run of the program (or only part of the program).

4. If a 40K user desires the more extensive treatment of the 60K program and finds the queue sizes are more than he needs he can change the fortran source program of the 60K deck in the following manner:

   i) Change all 180 and 170 numbers to 45 in the 3 dimension cards at the beginning of the program.

   ii) The card in front of the card with statement number 36 should be changed from - IF (NWL - 180) 36, 36, 1902 to: IF (NWL - 45) 36, 36, 1902

   iii) The card 2 cards in front of the card with statement number 91 should be changed from - IF (NIP - 170) 91, 91, 904 to: IF (NIP - 45) 91, 91, 904

   iv) The card in front of the card with statement number 277 should be changed -
   from: IF (NWL - 180) 277, 277, 1902
   to: IF (NWL - 45) 277, 277, 1902

   These changes will allow the 40K user the same things as the 60K user gets (eg. 4 crafts per job, complete diagnostics).

5. If the 60K user desires a large queue capacity for projects too large for the present 60K version he may make the following changes in the 40K fortran source deck to get up to 220 in each queue.

   i) Change all 70 numbers to 220 in the 3 dimension cards at the beginning of the program.

   ii) The card in front of the card with statement number 36 should be changed from - IF (NWL - 70) 36, 36, 1902 to: IF (NWL - 220) 36, 36, 1902

   iii) The card 2 cards in front of the card with statement number 91 should be changed from - IF (NIP - 70) 91, 91, 1902 to: IF (NIP - 220) 91, 91, 1902

   iv) The card in front of the card with statement number 277 should be changed from - IF (NWL - 70) 277, 277, 1902 to: IF (NWL - 220) 277, 277, 1902

   These changes will mean that the user must have at most 3 crafts per job and he will not have complete diagnostics.

Interpretation of Output of Man Scheduling (Note the following discussions refers to typewriter output. Output on cards uses the same format also 1 card per line)

1. Everytime a job starts - finishes - or is delayed, after it has been in progress for a time, a print out occurs. This print out contains information about the job (see sample print out) on 1 line and then is followed by 1 line for each craft this job uses (0 to 4 lines). On each of these lines the craft number and quantity used are typed.

   A minus sign next to the late start date of jobs just starting means the job has started after its late start date.

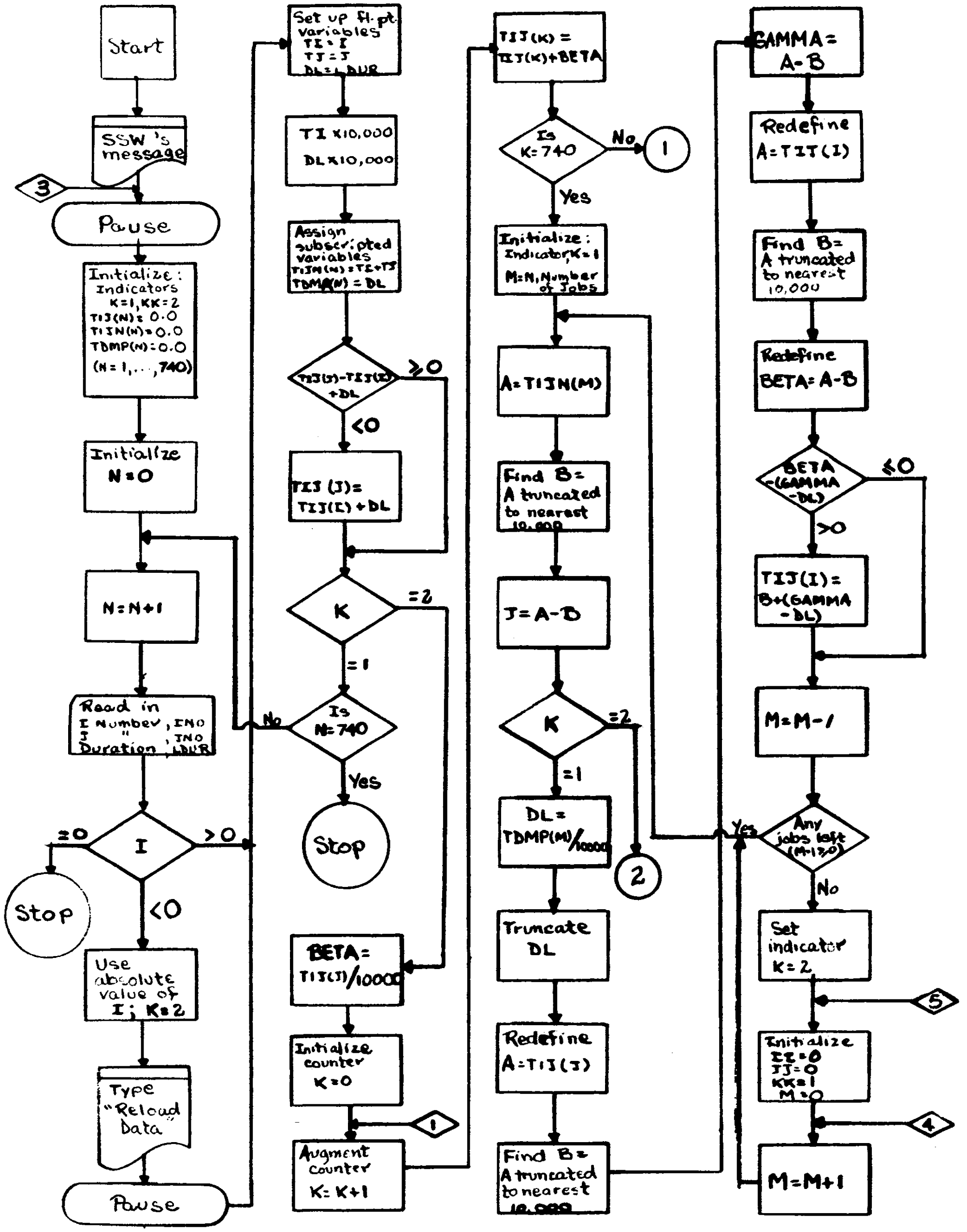
   On the 60K version only, a minus early start date may appear. The minus sign here is a signal to the user that this job did not start earlier because there was not enough resources at an earlier point in time. The early start date which appears after the minus sign will be the time period that the unavailability of resources became the only reason that this job could not start. This early start date (in the case of the minus sign) may not be the same as the early start date which was calculated in Phase I. In all other cases, (when no minus sign appears before the early start date) the early start date printed out will be the same as the one calculated during Phase I.

2. Every time period during which a job is started, finished or delayed a craft summary will appear. Each labor summary will appear on a separate line. These lines will contain the craft number, the number of units of this craft not in use and thus available, and the number of units of this craft which are in use and are unavailable at this time period.

3. Dummy jobs (jobs with 0 duration) will be shown only as finished jobs. Other jobs (jobs with other than 0 time duration) will be shown as started jobs, perhaps delayed jobs and finished jobs.

4. Delayed jobs will have their durations, early and late start dates recalculated, As a result, when they are restarted and finished their output information will differ from the output information they had when they were initially started.

BLOCK DIAGRAM FOR CRITICAL PATH



60K VERSION CHANGES TO

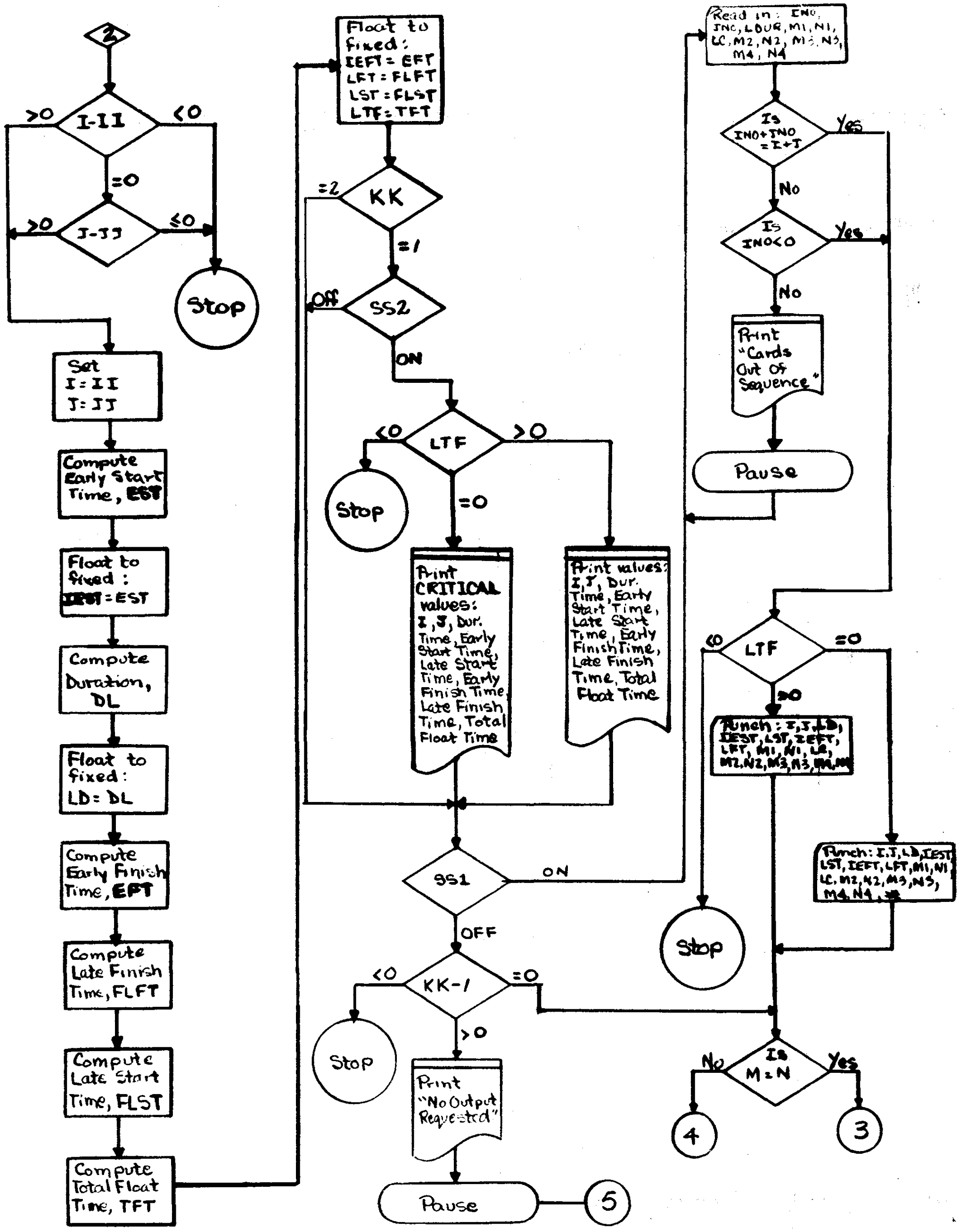
CRITICAL PATH BLOCK DIAGRAM

1. Column 1 (leftmost column) 4th block from the top should read:

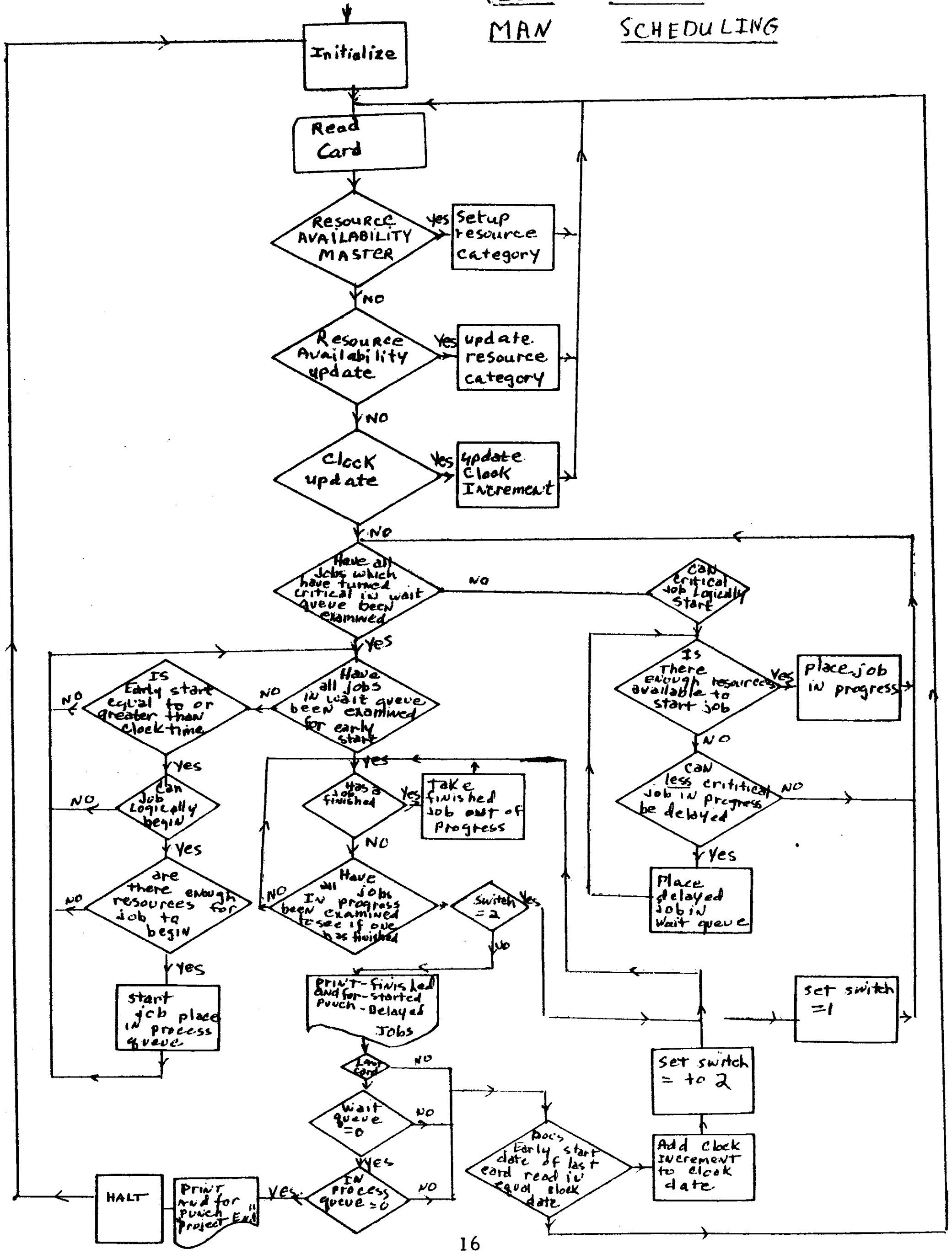
   Initialize Indicators: K=1, KK=2, TIJ (N) = 0.0,
   TIJN (N) = 0.0, TDMP (N) = 0.0, (N=1, . . . , 1400)

2. Column 2 (from the left), 7th block from the top should read:

   Is N = 1400?


2
I-II
>0
<0
=0
J-JJ
>0
≤0
Stop
Set
I=II
J=JJ
Compute Early Start Time, EST
Float to fixed: IEST=EST
Compute Duration, DL
Float to fixed: LD=DL
Compute Early Finish Time, EFT
Compute Late Finish Time, FLFT
Compute Late Start Time, FLST
Compute Total Float Time, TFT
Float to fixed: IEFT=EFT LFT=FLFT LST=FLST LTF=TFT
=2
KK
=1
Off
SS2
ON
<0
LTF
>0
Stop
=0
Print CRITICAL values: I, J, Dur. Time, Early Start Time, Late Start Time, Early Finish Time, Late Finish Time, Total Float Time
Print values: I, J, Dur. Time, Early Start Time, Late Start Time, Early Finish Time, Late Finish Time, Total Float Time
SS1
ON
OFF
<0
KK-1
=0
>0
Stop
Print "No Output Requested"
Pause
5
Read in: INO, JNO, LDUR, M1, N1, LC, M2, N2, M3, N3, M4, N4
Is INO+JNO =I+J
Yes
No
Is INO<O
Yes
No
Print "Cards Out Of Sequence"
Pause
<0
LTF
=0
>0
Punch: I, J, LD, IEST, LST, IEFT, LFT, M1, N1, LC, M2, N2, M3, N3, M4, N4
Punch: I, J, LD, IEST, LST, IEFT, LFT, M1, N1, LC, M2, N2, M3, N3, M4, N4,
Stop
Is M=N
No
Yes
4
3

FLOW CHART for MAN SCHEDULING


Initialize
Read Card
Resource AVAILABILITY MASTER
Yes
Setup resource category
NO
Resource Availability update
Yes
update resource category
NO
Clock update
Yes
update Clock Increment
NO
Have all Jobs which have turned critical in wait queue been examined
NO
Can critical Job Logically Start
Yes
Have all jobs in wait queue been examined for early start
NO
Is Early start equal to or greater than clock time
NO
Yes
Can Job Logically begin
NO
Yes
are there enough resources for job to begin
NO
Yes
start job place in process queue
Yes
Has a job finished
Yes
Take finished job out of Progress
NO
Have all jobs in progress been examined to see if one has finished
NO
Switch =2
Yes
No
Print-finished and for-started Punch-Delayed Jobs
Last card
NO
Wait queue =0
NO
Yes
IN Process queue =0
NO
Yes
Print and for Punch "Project End"
HALT
Is There Enough resources available to start job
Yes
place job in progress
NO
Can less critical job in progress be delayed
NO
Yes
Place delayed job in Wait queue
set switch =1
Set switch = to 2
Does Early start date of last card read in equal clock date
Add Clock Increment to clock date

OPERATING INSTRUCTIONS

Phase I

1. Clear memory: 160001000000 Release and Start
2. Load Less (Phase I) Object Program: Press Load
3. Enter Subroutines: Press Start
4. Set sense switches:
   SSW 1 on for punching (SSW 1 must be on if output of Phase I is to be used as input to Phase II.)
   SSW 2 on for printing
5. Pass 1: Enter job data cards; last job card should have a negative I number Press Start
6. Pass 2: When message "Reload Data" appears on typewriter, reenter job data cards and Press Start.
7. Phase I is completed when machine halts in manual mode (without any "Stop" message.)

Phase II

1. Sort output of Phase I first on total float and then on early Start date.
2. Clear memory: 160001000000 Release and Start.
3. Load Man Scheduling (Phase II) Object Program: Press Load.
4. Enter data cards: Press start
5. Set sense switches:
   SSW 1 on for punching
   SSW 2 on for printing
6. Press start

40K VERSION

HALT AND MESSAGE LIST

LESS - PHASE I

Cause	Message	Operator Procedure
Sense switches must be set	SSW 1 on=Punch, SSW 2 on=Print	Set SSW 1 and SSW 2. Press Start.
I number equals zero	STOP	None
Last I number greater than zero	STOP	None
Pass 2 begins	RELOAD DATA	Reenter data. Press Start.
Cards not sorted J within I sequence	STOP	None
Total float time is negative	STOP	None
Sequence of data cards altered before reloading data	CARDS OUT OF SEQUENCE	Remove cards from card reader, sort cards J within I sequence, replace cards in card reader, and press start.
Phase I completed	None	Phase I can be restarted by entering new data cards and pressing Start

MAN SCHEDULING - PHASE II

Cause	Message	Operator Procedure
One of the queues is larger than 70	QUEUE CAP. EXCEEDED	After the queue is reduced to 70, data must be reentered according to operating instructions 4 - 6 of Phase II.
Project completed	PROJECT COMPLETE	Phase II can be restarted by entering new data cards and pressing start

60K VERSION

HALT AND MESSAGE LIST

LESS - PHASE I

Cause	Message	Operator Procedure
Sense switches must be set.	SSW 1 ON=PUNCH SSW 2 ON=PRINT	Set SSW 1 and SSW 2. Press Start.
I number equals zero	STOP	None
Last I number greater than zero	STOP	None
Pass 2 begins	RELOAD DATA	Reenter data. Press Start.
Cards not sorted J within I sequence	STOP	None
Total float time is negative.	STOP	None
Sequence of data cards altered before reloading data.	CARDS OUT OF SEQUENCE	Remove cards from card reader, sort cards J within I sequence, replace cards in card reader, and press start.
Phase I completed	None	Phase I can be restarted by entering new data cards and pressing Start.

MAN SCHEDULING - PHASE II

Cause	Message	Operator Procedure
Sense switches must be set	SW 1 ON TO PRINT, SW 2 ON TO PUNCH	Set SW 1 and SW 2. Press Start.
More than 20 different master craft cards have been used.	CRAFTS EXCEED 20	After number of master craft cards has been limited to 20, data must be reentered according to operating instructions 4 - 6 of Phase II.

Illegal craft	CORR. CARD HAS ILLEGAL CRAFT	Option 1: Press Non Process Run Out to Obtain card containing illegal craft. Correct card, turn SW 3 on, and reenter data according to operating instructions 4 - 6 of Phase II. Option 2: Card containing illegal craft can be skipped. Turn SW 3 off and press Start.
Job card requires more men than appear in the combined sum of the in use and available pools.	TOO MANY MEN REQUESTED	Same options available as in illegal craft message.
Card with job xxxxxxxxx has erroneous craft number	ERROR IN CRAFT NO. xxxxxxxxx	After job card has been corrected, data must be reentered according to operating instructions 4-6 of Phase II.
Cards not sorted total float time within early start time.	CARD OUT OF SEQUENCE	Same options available as in illegal craft message.
Waiting queue is larger than 180	QUEUE CAP. EXCEEDED	After the queue is reduced to 180, data must be reentered according to operating instructions 4-6 of Phase II.
In process queue is larger than 180.	IN PROCESS QUEUE EXCEEDED	After queue is reduced to 180, data must be reentered according to operating instructions 4 - 6 of Phase II.
Project completed	PROJECT COMPLETE	Phase II can be restarted by entering new data cards and pressing Start

SAMPLE PROBLEM

Input Phase 1

1	2	10	0+0	
2	3	15	1+9	
2	4	5	2+20	30
2	5	20	2+18	
3	6	0	0+0	
3	10	5	1+10	
4	9	10	3+27	
5	6	5	3+30	
6	7	15	1+5	
6	8	15	3+5	
7	9	0	0+0	30
8	9	0	0+0	
9	23	5	2+10	
10	12	5	1+10	
10	13	5	2+20	
10	14	5	3+30	
10	15	10	1+8	
12	19	0	0+0	30
13	19	0	0+0	
14	19	0	0+0	
15	16	25	1+5	
15	17	25	3+10	
15	18	25	2+5	
16	19	0	0+0	
17	19	0	0+0	
18	19	0	0+0	
19	20	5	3+10	
19	21	5	2+10	
19	22	5	1+10	
19	24	5	2+5	
20	23	0	0+0	
21	23	0	0+0	
22	23	0	0+0	
-23	24	10	3+15	32

Typewriter Output Phase 1

```
SSW 1 ON - PUNCH, SSW 2 ON - PRINT, HIT START
    1    2   10    0    0   10   10    0   CRITICAL
    2    3   15   10   10   25   25    0   CRITICAL
    2    4    5   10   50   15   55   40
    2    5   20   10   25   30   45   15
    3    6    0   25   50   25   50   25
    3   10    5   25   25   30   30    0   CRITICAL
    4    9   10   15   55   25   65   40
    5    6    5   30   45   35   50   15
    6    7   15   35   50   50   65   15
    6    8   15   35   50   50   65   15
    7    9    0   50   65   50   65   15
    8    9    0   50   65   50   65   15
    9   23    5   50   65   55   70   15
   10   12    5   30   60   35   65   30
   10   13    5   30   60   35   65   30
   10   14    5   30   60   35   65   30
   10   15   10   30   30   40   40    0   CRITICAL
   12   19    0   35   65   35   65   30
   13   19    0   35   65   35   65   30
   14   19    0   35   65   35   65   30
   15   16   25   40   40   65   65    0   CRITICAL
   15   17   25   40   40   65   65    0   CRITICAL
   15   18   25   40   40   65   65    0   CRITICAL
   16   19    0   65   65   65   65    0   CRITICAL
   17   19    0   65   65   65   65    0   CRITICAL
   18   19    0   65   65   65   65    0   CRITICAL
   19   20    5   65   65   70   70    0   CRITICAL
   19   21    5   65   65   70   70    0   CRITICAL
   19   22    5   65   65   70   70    0   CRITICAL
   19   24    5   65   75   70   80   10
   20   23    0   70   70   70   70    0   CRITICAL
   21   23    0   70   70   70   70    0   CRITICAL
   22   23    0   70   70   70   70    0   CRITICAL
   23   24   10   70   70   80   80    0   CRITICAL
```

OUTPUT PHASE 2

```
SW1 ON TO PRINT ,SW2 ON TO PUNCH

TIME                        JOB     DURA  E. ST  L. ST


      CRAFT  USE   AVAIL



   0  START                 1     2   10     0    -0


   0  LABOR SUMMARY
           1     0    10
           2     0    20
           3     0    30


  10            FINISH      1     2   10

  10  START                 2     3   15    10   -10
           1     9

  10  START                 2     5   20    10    25
           2    18

  10  LABOR SUMMARY
           1     9     1
           2    18     2
           3     0    30


  25            FINISH      2     3   15
           1     9

  25            FINISH      3     6    0

  25  START                 3    10    5    25   -25
           1    10

  25  LABOR SUMMARY
           1    10     0
           2    18     2
           3     0    30


  30            FINISH      2     5   20
           2    18

  30            FINISH      3    10    5
           1    10

  30  START                10    15   10    30   -30
           1     8

  30  START                 2     4    5   -10    50
```

```
          2     20

 30  START                 5      6      5     30     45
          3     30

 30  LABOR SUMMARY
          1      8       2
          2     20       0
          3     30       0


 35             FINISH     2      4      5
          2     20

 35             FINISH     5      6      5
          3     30

 35  START                 4      9     10     15     55
          3     27

 35  START                10     13      5    -30     60
          2     20

 35  LABOR SUMMARY
          1      8       2
          2     20       0
          3     27       3


 40             FINISH    10     15     10
          1      8

 40             FINISH    10     13      5
          2     20

 40             FINISH    13     19      0

 40  START                15     16     25     40    -40
          1      5

 40  START                 6      7     15    -35     50
          1      5

 40  START                15     17     25     40    -40
          3     10

 40  START                 6      8     15    -35     50
          3      5

 40  START                15     18     25     40    -40
          2      5

 40       DELAY            4      9
          3     27

 40  LABOR SUMMARY
          1     10       0
          2      5      15
          3     15      15
```

```
 55             FINISH     6      7     15
          1      5

 55             FINISH     6      8     15
          3      5

 55             FINISH     7      9      0

 55             FINISH     8      9      0

 55  LABOR SUMMARY
          1      5       5
          2      5      15
          3     10      20


 65             FINISH    15     16     25
          1      5

 65             FINISH    15     17     25
          3     10

 65             FINISH    15     18     25
          2      5

 65             FINISH    16     19      0

 65             FINISH    17     19      0

 65             FINISH    18     19      0

 65  START                 4      9      5    -40    -60
          3     27

 65  START                10     12      5    -30    -60
          1     10

 65  LABOR SUMMARY
          1     10       0
          2      0      20
          3     27       3


 70             FINISH     4      9      5
          3     27

 70             FINISH    10     12      5
          1     10

 70             FINISH    12     19      0

 70  START                10     14      5    -30    -60
          3     30

 70  START                 9     23      5     50    -65
          2     10

 70  LABOR SUMMARY
          1      0      10
          2     10      10
```

```
           3    30     0


  75            FINISH    10    14     5
           3    30

  75            FINISH     9    23     5
           2    10

  75            FINISH    14    19     0

  75  START               19    20     5    65   -65
           3    10

  75  START               19    21     5    65   -65
           2    10

  75  START               19    22     5    65   -65
           1    10

  75  START               19    24     5    65   -75
           2     5


  75  LABOR SUMMARY
           1    10     0
           2    15     5
           3    10    20


  80            FINISH    19    20     5
           3    10

  80            FINISH    19    21     5
           2    10

  80            FINISH    19    22     5
           1    10

  80            FINISH    19    24     5
           2     5

  80            FINISH    20    23     0

  80            FINISH    21    23     0

  80            FINISH    22    23     0

  80  START               23    24    10    70   -70
           3    15


  80  LABOR SUMMARY
           1     0    10
           2     0    20
           3    15    15
```

```
  90            FINISH    23    24    10
           3    15
PROJECT COMPLETE
```

PROGRAM LISTING OF PHASE I
40K VERSION (CRITICAL PATH-LESS

```
    DIMENSION TIJ(740),TIJN(740),TDMP(740)
111 FORMAT(I5,I4,I4)
222 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4)
223 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4,12H    CRITICAL)
224 FORMAT(19HNO OUTPUT REQUESTED)
225 FORMAT(45HSSW 1 ON = PUNCH, SSW 2 ON = PRINT, HIT START)
822 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4)
823 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,2H *)
824 FORMAT(21HCARDS OUT OF SEQUENCE)
825 FORMAT (I5,I4,I4,20X,I4,I4,I4,I4,I4,I4,I4,I4,I4)
830 FORMAT (11HRELOAD DATA)
    PRINT 225
 99 PAUSE
100 K=1
    KK=2
    DO 50 N=1,740
    TIJ(N)=0.0
    TIJN(N)=0.0
 50 TDMP(N)=0.0
    DO 10 N=1,740
     READ 111,INO,JNO,LDUR
    IF (INO)2,3,4
  3 STOP 1
  2 INO=-INO
    K=2
    PRINT 830
    PAUSE
  4 I=INO
    J=JNO
    TI=I
    TI=TI*10000.
    TJ=J
    TIJN(N)=TI+TJ
    DL=LDUR
    DL=DL*10000.
    TDMP(N)=DL
    IF(TIJ(J)-(TIJ(I)+DL))5,9,9
  5 TIJ(J)=(TIJ(I)+DL)
  9 GO TO (10,20),K
 10 CONTINUE
    STOP 2
 20 BETA=TIJ(J)/10000.
    DO 30 K=1,740
 30 TIJ(K)=TIJ(K)+BETA
    K=1
    M=N
 45 A=TIJN(M)
    B=A/10000.
    I=B
    B=I
    B=B*10000.
    J=A-B
    GO TO(70,80),K
 70 DL=TDMP(M)/10000.
    LD=DL
    DL=LD
    A=TIJ(J)
    B=A/10000.
```

```
    L=B
    B=L
    B=B*10000.
    GAMA=A-B
    A=TIJ(I)
    B=A/10000.
    L=B
    B=L
    B=B*10000.
    BETA=A-B
    IF(BETA-(GAMA-DL))40,40,42
 42 TIJ(I)=B+(GAMA-DL)
 40 M=M-1
    IF(M-1)44,45,45
 44 K=2
 81 II=0
    JJ=0
    KK=1
 52 DO 65 M=1,N
    GO TO 45
 80 IF(I-II)61,62,63
 61 STOP 5
 62 IF(J-JJ)64,60,63
 60 STOP 9
 64 STOP 6
 63 II=I
    JJ=J
    EST=TIJ(I)/10000.
    IEST=EST
    EST=IEST
    DL=TDMP(M)/10000.
    LD=DL
    DL=LD
    DX=DL*10000.
    EFT=EST+DL
    FLFT=TIJ(J)
    A=FLFT/10000.
    L=A
    A=L
    A=A*10000.
    FLFT=FLFT-A
    FLST=FLFT-DL
    TFT=FLST-EST
    PIJ=TIJN(M)+90000000.
    PDEST=(DL*10000.)+EST+90000000.
    PLSEF=(FLST*10000.)+EFT+90000000.
    PLFTF=(FLFT*10000.)+TFT+90000000.
    IEFT=EFT
    LFT=FLFT
    LST=FLST
    LTF=TFT
    GO TO (66,67),KK
 66 IF (SENSE SWITCH 2) 866,67
```

```
866 IF (LTF)68,71,72
 68 STOP 7
  71 PRINT 223,I,J,LD,IEST,LST,IEFT,LFT,LTF
    GO TO 67
  72 PRINT 222,I,J,LD,IEST,LST,IEFT,LFT,LTF
 67 IF(SENSE SWITCH 1)74,73
 73 IF(KK-1)75,76,77
 75 STOP 8
 76 GO TO 65
 77 PRINT 224
977 PAUSE
    GO TO 81
  74 READ 825,INO,JNO,LDUR,M1,N1,LC,M2,N2,M3,N3,M4,N4
     IF (INO + JNO-I-J) 800,874,800
800 IF (INO)  874,801,801
801  PRINT 824
     PAUSE
     GO TO 74
 874 IF (LTF) 68,211,212
 211 PUNCH 823,I,J,LD,IEST,LST,IEFT,LFT,LTF,M1,N1,LC,M2,N2,M3,N3,M4,N4
     GO TO 65
 212 PUNCH 822,I,J,LD,IEST,LST,IEFT,LFT,LTF,M1,N1,LC,M2,N2,M3,N3,M4,N4
 65 CONTINUE
    GO TO 99
    END
```

PROGRAM LISTING OF PHASE II

(MAN SCHEDULING)

```
C  LESS MAN SCHEDULE
C  INPUT REQUIREMENTS - (1) = AVAILABILITY MASTER, LC = 11
C                     - (2) = AVAILABILITY CHANGE, LC = 22
C                     -       ENTER MODIFIERS IN MR, + OR -
C                     - (3) = ALL DATA, LC = BLANK
C                     - (4) = IF NO DELAY OF JOB, LC = 30 OR 31
C                     - (5) = LAST CARD, LC = 31 OR 32
C  SENSE SWITCH SETTINGS FOR OUTPUT REQUIREMENTS
C                     - (1) ON - OUTPUT ON TYPEWRITER
C                     -     OFF - NO TYPEWRITTEN OUTPUT
C                     - (2) ON - PUNCH OUTPUT
C                     -     OFF - NO OUTPUT PUNCHED
      DIMENSION L(21),M(21),MC(21),AMW(3,70),AMP(3,70),AM(4),N(6)
      DIMENSION AIW( 70),ANDW(70),AISW(70),AIP(70)
      DIMENSION ANDP( 70),AISP(70),JF(70)
      KDN=1
 1998 IF(SENSE SWITCH 1)2000,2001
 2000 PRINT 901
      PRINT 902
  901 FORMAT(4HTIME,24X,3HJOB,5X,18HDURA  E. ST  L. ST/)
  902 FORMAT(6X,18HCRAFT  USE   AVAIL//)
      IF(SENSE SWITCH 2)2002,5
 2001 IF(SENSE SWITCH 2)2002,1998
 2002 PUNCH 901
      PUNCH 902
C  ZERO AND INITIALIZE
    5 KDAY=0
      NWL=0
      NIP=0
      IIISW=1
      IIIIS=1
      DO 11 J=1,21
      L(J)=0
      MC(J)=0
   11 M(J)=0
C  READ AVAILABILITIES,CORRECTIONS, AND ALL DATA
      MT=2
   20 READ2,I,J,ND,IS,LS,NF,N(1),N(2),LC,N(3),N(4),N(5),N(6)
    2 FORMAT(I5,I4,I4,I4,I4,8X,I4,I4,I4,I4,I4,I4,I4,I4)
C  CHECK TO SEE IF CARD IS AVAILABILITY MASTER.
      IF(LC-11)25,24,25
C  STORE MANPOWER AVAILABILITIES
   24 MC(MT)=N(1)
      M(MT)=N(2)
      MT=MT+1
      GO TO 20
C  CHECK TO SEE IF CARD IS MANPOWER UPDATE CARD
   25 IF(LC-22)33,29,33
C   UPDATE AND CORRECT MANPOWER AVAILABILITIES.
   29 DO 28 MK=1,21
      IF(MC(MK)-N(1))28,27,28
   27 M(MK)=M(MK)+N(2)
      IF(M(MK))7721,20,20
 7721 N(2)=0
      GO TO 7722
   28 CONTINUE
   33 IF(LC-1)355,34,355
   34 KDN=ND
      GO TO 20
C  PROCESS DATA.
  355 LCI=LC
  826 IS1=IS
C  SET SWITCHES
 7722 ISW1=1
      IISW=1
C  ADD JOB TO WAITING LINE
      NWL=NWL+1
      IF(NWL- 70)36,36,1902
   36 ANDW(NWL)=ND
      WORK=LC
      ANDW(NWL)=ANDW(NWL)*10000.+WORK
      AIW(NWL)=I
      WORK=J
      AIW(NWL)=AIW(NWL)*10000.+WORK
      AISW(NWL)=IS
      WORK=LS
      AISW(NWL)=AISW(NWL)*10000.+WORK
      DO 40 I=1,3
      J=2*I-1
      AMW(I,NWL)=N(J)
      WORK=N(J+1)
   40 AMW(I,NWL)=AMW(I,NWL)*10000.+WORK
      IF(LC-30)7231,7231,140
 7231 IF(KDAY-IS1)140,20,20
C  CAN A WAITING JOB START
   80 IISW=2
      JAG=1
      IF(NWL)1250,1250,81
    81 DO 85 LL=JAG,NWL
      ISW=AISW(LL)/10000.
      IF(ISW-KDAY)7890,88,85
 7890 IF(IIISW-1)85,85,88
C  CHECK TO SEE IF JOB CAN LOGICALLY BEGIN.
   88 DO 86 J=1,NWL
      IW=AIW(LL)/10000.
      JW=AIW(J)
      IF(IW-JW)86,85,86
   86 CONTINUE
      IF(NIP)4282,4282,862
  862 DO 87 J=1,NIP
      JW=AIP(J)
      IF(IW-JW)87,85,87
   87 CONTINUE
 4282 ND=ANDW(LL)/10000.
      IF(ND)7867,7867,82
C  IS ENOUGH MANPOWER AVAILABLE TO START A JOB
   82 DO 1186 I=1,3
      MCW=AMW(I,LL)/10000.
      MNW=AMW(I,LL)
      DO 84J=1,21
      IF(MCW-MC(J))84,83,84
   84 CONTINUE
```

```
   83 IF(MNW-M(J))1186,1186,85
1186 CONTINUE
      GO TO 90
   85 CONTINUE
      GO TO 1250
   90 NWL=NWL-1
      NIP=NIP+1
      IF(NIP-70)91,91,1902
C  ADJUST MANPOWER
   91 DO 94 I=1,3
      MCW=AMW(I,LL)/10000.
      MNW=AMW(I,LL)
      DO 92 J=1,21
      IF(MCW-MC(J))92,93,92
   92 CONTINUE
   93 M(J)=M(J)-MNW
   94 L(J)=L(J)+MNW
C  COMPUTE FINISH DATE
      NDW=ANDW(LL)/10000.
      JF(NIP)=KDAY+NDW
C  PLACE JOB IN PROGRESS
      AIP(NIP)=AIW(LL)
      IW=ANDW(LL)
      IF(IW-199)98,98,97
   97 ANDW(LL)=ANDW(LL)-300.
   98 ANDP(NIP)=ANDW(LL)+100.
      AISP(NIP)=AISW(LL)
      DO999 I=1,3
  999 AMP(I,NIP)=AMW(I,LL)
      GO TO 129
C  MOVE UP WAITING LINE
 7867 NWL=NWL-1
      JW= AIW(LL)
      IIISW=2
      IF(SENSE SWITCH 1)7868,7869
 7868 PRINT 4,KDAY,IW,JW,ND
 7869 IF(SENSE SWITCH 2) 7870,129
 7870 PUNCH 4,KDAY,IW,JW,ND
  129 IF(LL-NWL)130,130,1140
  130 DO 135 I=LL,NWL
      AIW(I)=AIW(I+1)
      ANDW(I)=ANDW(I+1)
      AISW(I)=AISW(I+1)
      DO 1135 J=1,3
 1135 AMW(J,I)=AMW(J,I+1)
  135 CONTINUE
      JAG=LL
      GO TO (140,81),IISW
 1140 GO TO(80,1250),IISW
C  IS A CRITICAL JOB WAITING
  140 LL=1
      IF(NWL)80,80,9993
 9993 DO 145 I=LL,NWL
```

```
      LSW = AISW(I)
 9992 IF(LSW-KDAY)7881,141,145
 7881 IF(IIISW-1)145,145,141
  141 LL=I
C  YES
C  CHECK TO SEE IF JOB CAN LOGICALLY BEGIN
      DO 148 J=1,NWL
      IW=AIW(LL)/10000.
      JW=AIW(J)
      IF(IW-JW)148,145,148
  148 CONTINUE
      IF(NIP)4541,4541,9991
 9991 DO 149 J=1,NIP
      JW=AIP(J)
      IF(IW-JW)149,145,149
  149 CONTINUE
 4541 ND=ANDW(LL)/10000.
      IISW=1
      IF(ND)7867,7867,541
C  CAN THE WAITING CRITICAL JOB START
  541 DO 142 IK=1,3
      MCW=AMW(IK,LL)/10000.
      MNW=AMW(IK,LL)
      DO 143 J=1,21
      IF(MCW-MC(J))143,144,143
  143 CONTINUE
  144 IF(MNW-M(J))142,142,251
  142 CONTINUE
C  YES
      IISW=1
      GO TO 90
C  CAN MEN BE RELEASED FOR CRITICAL JOB BY A JOB IN PROGESS
  251 DO 260 K=1,NIP
      LSP=AISP(K)
      IF(LSP-LSW)260,260,252
C  IS MANPOWER IN PROPER CLASS
  252 DO 255 IAA=1,3
      MCP=AMP(IAA,K)/10000.
      MNP=AMP(IAA,K)
      IF(MCP)2255,255,2255
2255  IF(MCW-MCP)255,254,255
  255 CONTINUE
      GO TO 260
C  CAN JOB BE DELAYED
  254 IW=ANDP(K)
      IF(IW-99)262,262,261
  261 IW=IW-100
  262 IF(IW-30)253,260,253
  253 IF(IW-31)8255,260,8255
C  YES
 8255 KK=K
      GO TO 270
C  JOB IN PROGRESS WILL NOT BE DELAYED
  260 CONTINUE
C  CRITICAL JOB CAN NOT START
  145 CONTINUE
      GO TO 80
C  RELEASE MANPOWER
  270 DO 870 I=1,3
```

```
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      DO 272 J=1,21
      IF(MCP-MC(J))272,271,272
  271 M(J)=M(J)+MNP
  870 L(J)=L(J)-MNP
  272 CONTINUE
C  STORE DELAYED JOB IN WAITING QUEUE
C  ENLARGE WAITING QUEUE
      IIISW=2
      NWL=NWL+1
      IF(NWL-70)277,277,1902
  277 IW=NWL-1
      DO 39 I=1,IW
      IJK=(NWL-I+1)
      IJKL=(NWL-I)
      AIW(IJK)=AIW(IJKL)
      ANDW(IJK)=ANDW(IJKL)
      AISW(IJK)=AISW(IJKL)
      DO 41 J=1,3
   41 AMW(J,IJK)=AMW(J,IJKL)
   39 CONTINUE
      AIW(1)=AIP(KK)
      IW=ANDP(KK)/10000.
      AIWS=IW
      AND=JF(KK)-KDAY
      AISW(1)=AISP(KK)-AND+AIWS
      IW=ANDP(KK)
      IF(IW-99)274,274,273
  273 AIWS=IW-300
  274 AIWS=IW+200
  275 ANDW(1)=AND*10000.+AIWS
      DO 276 I=1,3
  276 AMW(I,1)=AMP(I,KK)
      LL=LL+1
C  SET SW1=2
      ISW1=2
C  MOVE UP JOBS IN PROGRESS
  300 JJJ=1
  301 NIP=NIP-1
      IF(KK-NIP)302,302,312
  302 DO 310 K=KK,NIP
      AIP(K)=AIP(K+1)
      ANDP(K)=ANDP(K+1)
      AISP(K)=AISP(K+1)
      JF(K)=JF(K+1)
      DO 303 I=1,3
  303 AMP(I,K)=AMP(I,K+1)
  310 CONTINUE
  312 GO TO(9991,200),JJJ
C  HAS A JOB-ENDED ON CURRENT DATE
  200 IF(NIP)208,208,212
  212 DO 210 K=1,NIP
```

```
      IF(KDAY-JF(K))210,205,205
  210 CONTINUE
  208 IF(LC-30)5208,5208,140
 5208 IF(KDAY-IS1)140,20,20
C  YES
  205 KK=K
C  RELEASE MANPOWER
      DO 224I=1,3
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      DO 223 J=1,21
      IF(MCP-MC(J))223,221,223
  223 CONTINUE
  221 M(J)=M(J)+MNP
      L(J)=L(J)-MNP
  224 CONTINUE
C  PRINT/PUNCH FINISHED JOB
  230 IP=AIP(KK)/10000.
      IIISW=2
      IIIIS=2
      JP=AIP(KK)
      ND=ANDP(KK)/10000.
 6858 IF(SENSE SWITCH 1)241,242
  241 PRINT 4 ,KDAY,IP,JP,ND
    4 FORMAT(/I4,12X,6HFINISH,I6,I6,I6)
      DU 247 I=1,3
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      IF(MCP)242,242,247
  247 PRINT 105,MCP,MNP
  242 IF(SENSE SWITCH 2)243,244
  243 PUNCH 4, KDAY,IP,JP,ND
      DO 245 I=1,3
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      IF(MCP)244,244,245
   245 PUNCH 105,MCP,MNP
C  MOVE UP JOBS IN PROGRESS
  244 JJJ=2
      GO TO 301
C  HAVE ALL JOBS FINISHED
 1250 IIISW=1
 1258 IF(LC-30)1270,1270,1251
 1251 IF(NWL)1252,1252,1270
 1252 IF(NIP)1253,1253,1270
C  UPDATE CLOCK
 1270 IF(LC-30)1500,1500,1502
C  DOES TIME=START TIME OF JOB READ IN
 1500 IF(KDAY-IS1)1502,20,20
 1502 IF(NIP)295,295,96
C  PRINT/PUNCH JOB START
   96 DO 113 LL=1,NIP
      LSP=ANDP(LL)
      IF(LSP-99)113,113,99
   99 ANDP(LL)= ANDP(LL)-100.
      LSW=AISP(LL)
      IF(LSW-KDAY)121,121,122
  121 LSW=-LSW
  122 IW=AIP(LL)/10000.
```

```
      JW=AIP(LL)
      ND=ANDP(LL)/10000.
      ISP=AISP(LL)/10000.
      IIIIS=2
      DO 101 J=1,3
      I=J*2-1
      N(I)=AMP(J,LL)/10000.
  101 N(I+1)=AMP(J,LL)
      IF(SENSE SWITCH 1)115,117
  115 PRINT 1,KDAY,IW,JW,ND,ISP,LSW
    1 FORMAT(/I4,7H  START11X,I6,I6,I6,I6,I6)
      DO 104 I=1,6,2
      IF(N(I))117,117,104
  104 PRINT 105,N(I),N(I+1)
  105 FORMAT(6X,I6,I6,I6)
  117 IF(SENSE SWITCH 2)119,113
  119 PUNCH 1,KDAY,IW,JW,ND,ISP,LSW
      DO 106 I=1,6,2
      IF(N(I))113,113,106
  106 PUNCH 105,N(I),N(I+1)
  113 CONTINUE
C  PRINT/PUNCH JOB DELAY
  295 IF(NWL)1501,1501,296
  296 DO 294K=1,NWL
      IW=ANDW(K)
      IF(IW-199)294,294,297
  297 IW=AIW(K)/10000.
      ANDW(K)=ANDW(K)-200.
      JW=AIW(K)
      DO 298 J=1,3
      I=J*2-1
      N(I)=AMW(J,K)/10000.
  298 N(I+1)=AMW(J,K)
      IIISW=2
      IIIIS=2
      IF(SENSE SWITCH 1)291,292
  291 PRINT 3,KDAY,IW,JW
    3 FORMAT(/I4,7X,5HDELAY,6X,I6,I6)
      DO 107 I=1,6,2
      IF(N(I))292,292,107
  107 PRINT 105,N(I),N(I+1)
  292 IF(SENSE SWITCH 2)293,294
  293 PUNCH 3,KDAY,IW,JW
      DO 108 I=1,6,2
      IF(N(I))294,294,108
  108 PUNCH 105,N(I),N(I+1)
  294 CONTINUE
 1501 GO TO(3334,3335),IIIIS
 3335 IIIIS=1
      IF(SENSE SWITCH 1)299,400
  299 PRINT 3333,KDAY
 3333 FORMAT(//,I4,15H  LABOR SUMMARY)
      J=MT-1
      DO 109 I=2,J
  109 PRINT 105 ,MC(I),L(I),M(I)
      PRINT 3333
  400 IF(SENSE SWITCH 2)401,3334
  401 PUNCH 3333,KDAY
      DO 402 I=2,MT
  402 PUNCH 105,MC(I),L(I),M(I)
      PUNCH 3333
 3334 KDAY=KDAY+KDN
      GO TO 200
C   YES-PROJECT COMPLETE
 1253 PRINT 7
    7 FORMAT(16HPROJECT COMPLETE)
      IF(SENSE SWITCH 2)1255,1260
 1255 PUNCH 7
 1260 PAUSE
      KDN =1
      GO TO 1998
 1901 FORMAT(19HQUEUE CAP. EXCEEDED)
 1902 PRINT 1901
      PAUSE
      GO TO 1998
      END
```

PROGRAM LISTING OF PHASE I

60K VERSION (CRITICAL PATH-LESS)

```
 LESS - CRITICAL PATH SCHEDULING - PART 2
    DIMENSION TIJ(1400),TIJN(1400),TDMP(1400)
 111 FORMAT(I5,I4,I4)
 222 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4)
 223 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4,12H    CRITICAL)
224 FORMAT(19HNO OUTPUT REQUESTED)
225 FORMAT(45HSSW 1 ON = PUNCH, SSW 2 ON = PRINT, HIT START)
 822 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4)
 823 FORMAT(I5,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4,2H *)
 824 FORMAT(21HCARDS OUT OF SEQUENCE)
825 FORMAT (I5,I4,I4,20X,I4,I4,I4,I4,I4,I4,I4,I4,I4)
830 FORMAT (11HRELOAD DATA)
    PRINT 225
 99 PAUSE
100 K=1
    KK=2
    DO 50 N=1,1400
    TIJ(N)=0.0
    TIJN(N)=0.0
 50 TDMP(N)=0.0
    DO 10 N=1,1400
     READ 111,INO,JNU,LDUR
    IF (INO)2,3,4
  3 STOP 1
  2 INO=-INO
    K=2
    PRINT 830
    PAUSE
  4 I=INO
    J=JNO
    TI=I
    TI=TI*10000.
    TJ=J
    TIJN(N)=TI+TJ
    DL=LDUR
    DL=DL*10000.
    TDMP(N)=DL
    IF(TIJ(J)-(TIJ(I)+DL))5,9,9
  5 TIJ(J)=(TIJ(I)+DL)
  9 GO TO (10,20),K
 10 CONTINUE
    STOP 2
 20 BETA=TIJ(J)/10000.
    DO 30 K=1,1400
 30 TIJ(K)=TIJ(K)+BETA
    K=1
    M=N
 45 A=TIJN(M)
    B=A/10000.
    I=B
    B=I
    B=B*10000.
    J=A-B
```

```
      GO TO(70,80),K
   70 DL=TDMP(M)/10000.
      LD=DL
      DL=LD
      A=TIJ(J)
      B=A/10000.
      L=B
      B=L
      B=B*10000.
      GAMA=A-B
      A=TIJ(I)
      B=A/10000.
      L=B
      B=L
      B=B*10000.
      BETA=A-B
      IF(BETA-(GAMA-DL))40,40,42
   42 TIJ(I)=B+(GAMA-DL)
   40 M=M-1
      IF(M-1)44,45,45
   44 K=2
   81 II=0
      JJ=0
      KK=1
   52 DO 65 M=1,N
      GO TO 45
   80 IF(I-II)61,62,63
   61 STOP 5
   62 IF(J-JJ)64,60,63
   60 STOP 9
   64 STOP 6
   63 II=I
      JJ=J
      EST=TIJ(I)/10000.
      IEST=EST
      EST=IEST
      DL=TDMP(M)/10000.
      LD=DL
      DL=LD
      DX=DL*10000.
      EFT=EST+DL
      FLFT=TIJ(J)
      A=FLFT/10000.
      L=A
      A=L
      A=A*10000.
      FLFT=FLFT-A
      FLST=FLFT-DL
      TFT=FLST-EST
      PIJ=TIJN(M)+90000000.
      PDEST=(DL*10000.)+EST+90000000.
      PLSEF=(FLST*10000.)+EFT+90000000.
      PLFTF=(FLFT*10000.)+TFT+90000000.
      IEFT=EFT
      LFT=FLFT
      LST=FLST
      LTF=TFT
      GO TO (66,67),KK
    66 IF (SENSE SWITCH 2) 866,67
```

```
  866 IF (LTF)68,71,72
   68 STOP 7
    71 PRINT 223,I,J,LD,IEST,LST,IEFT,LFT,LTF
      GO TO 67
    72 PRINT 222,I,J,LD,IEST,LST,IEFT,LFT,LTF
   67 IF(SENSE SWITCH 1)74,73
   73 IF(KK-1)75,76,77
   75 STOP 8
   76 GO TO 65
   77 PRINT 224
  977 PAUSE
      GO TO 81
    74 READ 825,INO,JNO,LDUR,M1,N1,LC,M2,N2,M3,N3,M4,N4
      IF (INO + JNO-I-J) 800,874,800
  800 IF (INO)  874,801,801
  801  PRINT 824
      PAUSE
      GO TO 74
   874 IF (LTF) 68,211,212
   211 PUNCH 823,I,J,LD,IEST,LST,IEFT,LFT,LTF,M1,N1,LC,M2,N2,M3,N3,M4,N4
      GO TO 65
   212 PUNCH 822,I,J,LD,IEST,LST,IEFT,LFT,LTF,M1,N1,LC,M2,N2,M3,N3,M4,N4
   65 CONTINUE
      GO TO 99
      END
```

PROGRAM LISTING OF PHASE II

(MAN SCHEDULING)

```
C  LESS MAN SCHEDULE
C  INPUT REQUIREMENTS - (1) = AVAILABILITY MASTER, LC = 11
C                     - (2) = AVAILABILITY CHANGE, LC = 22
C                     -       ENTER MODIFIERS IN MR, + OR -
C                     - (3) = ALL DATA, LC = BLANK
C                     - (4) = IF NO DELAY OF JOB, LC = 30 OR 31
C                     - (5) = LAST CARD, LC = 31 OR 32
C  SENSE SWITCH SETTINGS FOR OUTPUT REQUIREMENTS
C                     - (1) ON - OUTPUT ON TYPEWRITER
C                     -       OFF - NO TYPEWRITTEN OUTPUT
C                     - (2) ON - PUNCH OUTPUT
C                     -       OFF - NO OUTPUT PUNCHED
      DIMENSION L(21),M(21),MC(21),AMW(4,180),AMP(4,170),AM(4),N(8)
      DIMENSION AIW(180),ANDW(180),AISW(180),AIP(170)
      DIMENSION ANDP(170),AISP(170),JF(170)
      KDN=1
C  PRINT/PUNCH HEADINGS
 1998 PRINT 906
  906 FORMAT(32HSW1 ON TO PRINT ,SW2 ON TO PUNCH)
      PAUSE
      IF(SENSE SWITCH 1)2000,2001
 2000 PRINT 901
      PRINT 902
  901 FORMAT(4HTIME,24X,3HJOB,5X,18HDURA  E. ST  L. ST/)
  902 FORMAT(6X,18HCRAFT  USE   AVAIL//)
      IF(SENSE SWITCH 2)2002,5
 2001 IF(SENSE SWITCH 2)2002,1998
 2002 PUNCH 901
      PUNCH 902
C  ZERO AND INITIALIZE
    5 KDAY=0
      NWL=0
      NIP=0
      ISE=0
      NFF=0
      IIISW=1
      IIIIS=1
      DO 11 J=1,21
      L(J)=0
      MC(J)=0
   11 M(J)=0
C  READ AVAILABILITIES,CORRECTIONS, AND ALL DATA
      MT=2
   20 READ2,I,J,ND,IS,LS,NF,N(1),N(2),LC,N(3),N(4),N(5),N(6),N(7),N(8)
    2 FORMAT(I5,I4,I4,I4,I4,8X,I4,I4,I4,I4,I4,I4,I4,I4,I4,I4)
C  CHECK TO SEE IF CARD IS AVAILABILITY MASTER.
      IF(LC-11)25,21,25
   21 IF(MT-22)24,22,22
   22 PRINT 23
      PAUSE
      GO TO 1998
   23 FORMAT(20HNO. CRAFTS EXCEED 20)
C  STORE MANPOWER AVAILABILITIES
   24 MC(MT)=N(1)
      M(MT)=N(2)
      MT=MT+1
      GO TO 20
C  CHECK TO SEE IF CARD IS MANPOWER UPDATE CARD
   25 IF(LC-22)33,29,33
```

```
C  UPDATE AND CORRECT MANPOWER AVAILABILITIES.
   29 DO 28 MK=1,21
      IF(MC(MK)-N(1))28,27,28
   27 M(MK)=M(MK)+N(2)
      IF(M(MK))7721,20,20
 7721 N(2)=0
      IIISW=2
      GO TO 7722
   28 CONTINUE
      PRINT 32
      PAUSE
      GO TO 1900
   32 FORMAT(28HCORR. CARD HAS ILLEGAL CRAFT)
   33 IF(LC-1)355,34,355
   34 KDN=ND
      GO TO 20
C  PROCESS DATA.
  355 IF(IS-ISE)800,810,820
  810 IF(NF-NFF)800,820,820
  820 ISE=IS
      NFF=NF
      LCI=LC
      DO 823 II=1,8,2
      DO 821 JJ=1,21
      IF(N(II)-MC(JJ))821,822,821
  821 CONTINUE
  822 IF(N(II+1)-M(JJ)-L(JJ))823,823,824
  823 CONTINUE
      GO TO 826
  824 PRINT 825
      PAUSE
      GO TO 1900
  825 FORMAT(22HTOO MANY MEN REQUESTED)
  826 IS1=IS
C  SET SWITCHES
 7722 ISW1=1
      IISW=1
C  ADD JOB TO WAITING LINE
      NWL=NWL+1
      IF(NWL-180)36,36,1902
   36 ANDW(NWL)=ND
      WORK=LC
      ANDW(NWL)=ANDW(NWL)*10000.+WORK
      AIW(NWL)=I
      WORK=J
      AIW(NWL)=AIW(NWL)*10000.+WORK
      AISW(NWL)=IS
      WORK=LS
      AISW(NWL)=AISW(NWL)*10000.+WORK
      DO 40 I=1,4
      J=2*I-1
      AMW(I,NWL)=N(J)
      WORK=N(J+1)
   40 AMW(I,NWL)=AMW(I,NWL)*10000.+WORK  .
      IF (LC-30)7231,7231,140
 7231 IF(KDAY-IS1)140,20,20
C  CAN A WAITING JOB START
   80 IISW=2
      JAG=1
      IF(NWL)1250,1250,81
    81 DO 85 LL=JAG,NWL
      ISW=AISW(LL)/10000.
      IF(ISW-KDAY)7890,88,85
 7890 IF(IIISW-1)85,85,88
C  CHECK TO SEE IF JOB CAN LOGICALLY BEGIN.
   88 DO 86 J=1,NWL
      IW=AIW(LL)/10000.
      JW=AIW(J)
      IF(IW-JW)86,85,86
   86 CONTINUE
      IF(NIP)4282,4282,862
  862 DO 87 J=1,NIP
      JW=AIP(J)
      IF(IW-JW)87,85,87
   87 CONTINUE
 4282 ND=ANDW(LL)/10000.
      IF(ND)7867,7867,82
C  IS ENOUGH MANPOWER AVAILABLE TO START A JOB
   82 DO 1186 I=1,4
      MCW=AMW(I,LL)/10000.
      MNW=AMW(I,LL)
      DO 84J=1,21
      IF(MCW-MC(J))84,83,84
   84 CONTINUE
      PRINT 1111,AIW(LL)
      PAUSE
      GO TO 1998
 1111 FORMAT(18HERROR IN CRAFT NO.,F9.0)
   83 IF(MNW-M(J))1186,1186,863
 1186 CONTINUE
      GO TO 90
C  SET START DATE EQUAL TO DAY MANPOWER BECAME A RESTRICTION
  863 IF(ISW)85,865,865
  865 AKDAY=KDAY
      IW=AISW(LL)
      AIWS=IW
    AISW(LL)=(-AKDAY)*10000.-AIWS
   85 CONTINUE
      GO TO 1250
   90 NWL=NWL-1
      NIP=NIP+1
      IF(NIP-170)91,91,904
C  ADJUST MANPOWER
   91 DO 94 I=1,4
      MCW=AMW(I,LL)/10000.
      MNW=AMW(I,LL)
      DO 92 J=1,21
      IF(MCW-MC(J))92,93,92
   92 CONTINUE
   93 M(J)=M(J)-MNW
   94 L(J)=L(J)+MNW
C  COMPUTE FINISH DATE
```

```
      NDW=ANDW(LL)/10000.
      JF(NIP)=KDAY+NDW
C  PLACE JOB IN PROGRESS
      AIP(NIP)=AIW(LL)
      IW=ANDW(LL)
      IF(IW-199)98,98,97
   97 ANDW(LL)=ANDW(LL)-300.
   98 ANDP(NIP)=ANDW(LL)+100.
      AISP(NIP)=AISW(LL)
      DO999 I=1,4
  999 AMP(I,NIP)=AMW(I,LL)
      GO TO 129
C  MOVE UP WAITING LINE
 7867 NWL=NWL-1
      JW= AIW(LL)
      IIISW=2
      IF(SENSE SWITCH 1)7868,7869
 7868 PRINT 4,KDAY,IW,JW,ND
 7869 IF(SENSE SWITCH 2) 7870,129
 7870 PUNCH 4,KDAY,IW,JW,ND
  129 IF(LL-NWL)130,130,1140
  130 DO 135 I=LL,NWL
      AIW(I)=AIW(I+1)
      ANDW(I)=ANDW(I+1)
      AISW(I)=AISW(I+1)
      DO 1135 J=1,4
 1135 AMW(J,I)=AMW(J,I+1)
  135 CONTINUE
      JAG=LL
      GO TO (140,81),IISW
 1140 GO TO(80,1250),IISW
C  IS A CRITICAL JOB WAITING
  140 LL=1
      IF(NWL)80,80,9993
 9993 DO 145 I=LL,NWL
      IF(AISW(I))9994,9995,9995
 9994 LSW=-AISW(I)
      GO TO9992
 9995 LSW = AISW(I)
 9992 IF(LSW-KDAY)7881,141,145
 7881 IF(IIISW-1)145,145,141
  141 LL=I
C  YES
C  CHECK TO SEE IF JOB CAN LOGICALLY BEGIN
      DO 148 J=1,NWL
      IW=AIW(LL)/10000.
      JW=AIW(J)
      IF(IW-JW)148,145,148
  148 CONTINUE
      IF(NIP)4541,4541,9991
 9991 DO 149 J=1,NIP
      JW=AIP(J)
      IF(IW-JW)149,145,149
  149 CONTINUE
 4541 ND=ANDW(LL)/10000.
      IISW=1
      IF(ND)7867,7867,541
C  CAN THE WAITING CRITICAL JOB START
  541 DO 142 IK=1,4
      MCW=AMW(IK,LL)/10000.
      MNW=AMW(IK,LL)
      DO 143 J=1,21
      IF(MCW-MC(J))143,144,143
  143 CONTINUE
  144 IF(MNW-M(J))142,142,251
  142 CONTINUE
C  YES
      IISW=1
      GO TO 90
C  CAN MEN BE RELEASED FOR CRITICAL JOB BY A JOB IN PROGESS
  251 DO 260 K=1,NIP
C  IS JOB IN PROGRESS MORE CRITICAL THAN JOB IN WAITING
      IF(AISP(K))9996,9997,9997
 9996 LSP=-AISP(K)
      GO TO 9998
 9997 LSP=AISP(K)
 9998 IF(LSP-LSW)260,260,252
C  IS MANPOWER IN PROPER CLASS
  252 DO 255 IAA=1,4
      MCP=AMP(IAA,K)/10000.
      MNP=AMP(IAA,K)
      IF(MCP)2255,255,2255
2255  IF(MCW-MCP)255,254,255
  255 CONTINUE
      GO TO 260
C  CAN JOB BE DELAYED
  254 IW=ANDP(K)
      IF(IW-99)262,262,261
  261 IW=IW-100
  262 IF(IW-30)253,260,253
  253 IF(IW-31)8255,260,8255
C  YES
 8255 KK=K
      GO TO 270
C  JOB IN PROGRESS WILL NOT BE DELAYED
  260 CONTINUE
C  CRITICAL JOB CAN NOT START
  145 CONTINUE
      GO TO 80
C  RELEASE MANPOWER
  270 DO 870 I=1,4
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      DO 272 J=1,21
      IF(MCP-MC(J))272,271,272
  272 CONTINUE
  271 M(J)=M(J)+MNP
  870 L(J)=L(J)-MNP
C  STORE DELAYED JOB IN WAITING QUEUE
C  ENLARGE WAITING QUEUE
      IIISW=2
      NWL=NWL+1
```

```
      IF(NWL-180)277,277,1902
  277 IW=NWL-1
      DO 39 I=1,IW
      IJK=(NWL-I+1)
      IJKL=(NWL-I)
      AIW(IJK)=AIW(IJKL)
      ANDW(IJK)=ANDW(IJKL)
      AISW(IJK)=AISW(IJKL)
      DO 41 J=1,4
   41 AMW(J,IJK)=AMW(J,IJKL)
   39 CONTINUE
      AIW(1)=AIP(KK)
      IW=ANDP(KK)/10000.
      AIWS=IW
      AND=JF(KK)-KDAY
      IF(AISP(KK))2731,2732,2732
 2731 AISW(1)=-AISP(KK)-AND+AIWS
      GO TO 278
 2732 AISW(1)=AISP(KK)-AND+AIWS
  278 IW=ANDP(KK)
      IF(IW-99)274,274,273
  273 AIWS=IW-100
      GOTO 275
  274 AIWS=IW+200
  275 ANDW(1)=AND*10000.+AIWS
      DO 276 I=1,4
  276 AMW(I,1)=AMP(I,KK)
      LL=LL+1
C  SET SW1=2
      ISW1=2
C  MOVE UP JOBS IN PROGRESS
  300 JJJ=1
  301 NIP=NIP-1
      IF(KK-NIP)302,302,312
  302 DO 310 K=KK,NIP
      AIP(K)=AIP(K+1)
      ANDP(K)=ANDP(K+1)
      AISP(K)=AISP(K+1)
      JF(K)=JF(K+1)
      DO 303 I=1,4
  303 AMP(I,K)=AMP(I,K+1)
  310 CONTINUE
  312 GO TO (9991,200),JJJ
C  HAS A JOB-ENDED ON CURRENT DATE
  200 IF(NIP)208,208,212
  212 DO 210 K=1,NIP
      IF(KDAY-JF(K))210,205,205
  210 CONTINUE
  208 IF(LC-30)5208,5208,140
 5208 IF(KDAY-IS1)140,20,20
C  YES
  205 KK=K
C  RELEASE MANPOWER
```

```
      DO 224I=1,4
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      DO 223 J=1,21
      IF(MCP-MC(J))223,221,223
  223 CONTINUE
  221 M(J)=M(J)+MNP
      L(J)=L(J)-MNP
  224 CONTINUE
C  PRINT/PUNCH FINISHED JOB
  230 IP=AIP(KK)/10000.
      IIISW=2
      IIIIS=2
      JP=AIP(KK)
      ND=ANDP(KK)/10000.
 6858 IF(SENSE SWITCH 1)241,242
  241 PRINT 4 ,KDAY,IP,JP,ND
    4 FORMAT(/I4,12X,6HFINISH,I6,I6,I6)
      DO 247 I=1,4
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      IF(MCP)242,242,247
  247 PRINT 105,MCP,MNP
  242 IF(SENSE SWITCH 2)243,244
  243 PUNCH 4, KDAY,IP,JP,ND
      DO 245 I=1,4
      MCP=AMP(I,KK)/10000.
      MNP=AMP(I,KK)
      IF(MCP)244,244,245
   245 PUNCH 105,MCP,MNP
C  MOVE UP JOBS IN PROGRESS
  244 JJJ=2
      GO TO 301
C  HAVE ALL JOBS FINISHED
 1250 IIISW=1
 1258 IF(LC-30)1270,1270,1251
 1251 IF(NWL)1252,1252,1270
 1252 IF(NIP)1253,1253,1270
C  UPDATE CLOCK
 1270 IF(LC-30)1500,1500,1502
C  DOES TIME=START TIME OF JOB READ IN
 1500 IF(KDAY-IS1)1502,20,20
 1502 IF(NIP)295,295,96
C  PRINT/PUNCH JOB START
   96 DO 113 LL=1,NIP
      LSP=ANDP(LL)
      IF(LSP-99)113,113,99
   99 ANDP(LL)= ANDP(LL)-100.
      IF(AISP(LL))123,124,124
  123 LSW=-AISP(LL)
      GO TO 125
  124 LSW=AISP(LL)
  125 IF(LSW-KDAY)121,121,122
  121 LSW=-LSW
  122 IW=AIP(LL)/10000.
      JW=AIP(LL)
      ND=ANDP(LL)/10000.
      ISP=AISP(LL)/10000.
      IIIIS=2
```

```
      DO 101 J=1,4
      I=J*2-1
      N(I)=AMP(J,LL)/10000.
  101 N(I+1)=AMP(J,LL)
      IF(SENSE SWITCH 1)115,117
  115 PRINT 1,KDAY,IW,JW,ND,ISP,LSW
    1 FORMAT(/I4,7H  START11X,I6,I6,I6,I6,I6)
      DO 104 I=1,8,2
      IF(N(I))117,117,104
  104 PRINT 105,N(I),N(I+1)
  105 FORMAT(6X,I6,I6,I6)
  117 IF(SENSE SWITCH 2)119,113
  119 PUNCH 1,KDAY,IW,JW,ND,ISP,LSW
      DO 106 I=1,8,2
      IF(N(I))113,113,106
  106 PUNCH 105,N(I),N(I+1)
  113 CONTINUE
C  PRINT/PUNCH JOB DELAY
  295 IF(NWL)1501,1501,296
  296 DO 294K=1,NWL
      IW=ANDW(K)
      IF(IW-199)294,294,297
  297 IW=AIW(K)/10000.
      ANDW(K)=ANDW(K)-200.
      JW=AIW(K)
      DO 298 J=1,4
      I=J*2-1
      N(I)=AMW(J,K)/10000.
  298 N(I+1)=AMW(J,K)
      IIISW=2
      IIIIS=2
      IF(SENSE SWITCH 1)291,292
  291 PRINT 3,KDAY,IW,JW
    3 FORMAT(/I4,7X,5HDELAY,6X,I6,I6)
      DO 107 I=1,8,2
      IF(N(I))292,292,107
  107 PRINT 105,N(I),N(I+1)
  292 IF(SENSE SWITCH 2)293,294
  293 PUNCH 3,KDAY,IW,JW
      DO 108 I=1,8,2
      IF(N(I))294,294,108
  108 PUNCH 105,N(I),N(I+1)
  294 CONTINUE
 1501 GO TO(3334,3335),IIIIS
 3335 IIIIS=1
      IF(SENSE SWITCH 1)299,400
  299 PRINT 3333,KDAY
 3333 FORMAT(//,I4,15H  LABOR SUMMARY)
      J=MT-1
      DO 109 I=2,J
  109 PRINT 105 ,MC(I),L(I),M(I)
      PRINT 3333
  400 IF(SENSE SWITCH 2)401,3334
  401 PUNCH 3333,KDAY
      DO 402 I=2,MT
  402 PUNCH 105,MC(I),L(I),M(I)
      PUNCH 3333
 3334 KDAY=KDAY+KDN
      GO TO 200
C  YES-PROJECT COMPLETE
 1253 PRINT 7
    7 FORMAT(16HPROJECT COMPLETE)
      IF(SENSE SWITCH 2)1255,1260
 1255 PUNCH 7
 1260 PAUSE
      KDN =1
      GO TO 1998
  800 PRINT 803
  803 FORMAT(20HCARD OUT OF SEQUENCE)
 1900 PAUSE
      IF(SENSE SWITCH 3)1998,20
 1901 FORMAT(19HQUEUE CAP. EXCEEDED)
 1902 PRINT 1901
      PAUSE
      GO TO 1998
 1903 FORMAT(25HIN PROCESS QUEUE EXCEEDED)
  904 PRINT 1903
      PAUSE
      GO TO 1998
      END
```