A COMPUTER PROGRAM FOR STUDENT ASSIGNMENT

by

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INTRODUCTION

The aim of this project was to develop a suitable program to be used on the IBM 1620 Computer in order to help the faculty, the students, and the University in scheduling class assignments. The primary purpose in suggesting the use of the digital computer is the elimination of the necessity for the present lengthy manual calculations. The student assignment problem deals with assigning the courses to a student that he should take in the next semester.

In the last few years quite a number of universities have done considerable work in this field and in closely related areas.

In the area of Pre-registration Scheduling some work has been done at the University of Pittsburgh.[1] There the system analysis of the Pre-registration Scheduling, by the use of the digital computer was carried out. Pre-registration was considered as a listing of the courses a student should take in the next semester after an analysis of his past academic record had been made.

Work has been done at other universities on certain aspects of the scheduling problem; for example, at Purdue University[2] the computer is used at registration time to determine the time schedule for the student. The student goes to his Counselor at

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[1] Holtzman, A. G., System Analysis of Pre-registration Scheduling.

[2] Loc. cit.

registration time and together they list the courses to be taken. The courses are punched on tabulating cards and fed into the electronic computer. The output card lists the student's courses together with the time schedule for these courses. Consideration is given to a student's outside work schedules.

At Oklahoma State University[3] a program has been developed for the computer to match course schedules and staff availability, because of the fact that staff members may have other conflicting obligations; however, this computer program starts with the time schedule prepared previously, and is not involved with determination of required student courses.

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[3] Loc. cit.

USE OF DIGITAL COMPUTER

High-speed digital computers are today helping many small businesses cut operating expenses and are handling an increased volume of work. These computers are still so costly that only very large organizations can afford to buy or lease them; but the small organization can turn to computer service organizations that sell the time of large computers on an hourly basis. The small organization pays only for the time it takes to solve its particular problem. Because a high-speed computer can perform millions of calculations in an hour, a wide range of problems can be economically solved in a relatively short time and more efficiently than by hand calculation.

Some typical engineering problems that can best be solved by computers include stress analysis, heat and pressure calculations, vibration analysis, and engine design. Digital computers make possible the rapid processing of great amounts of clerical data. They cut down the time and costs spent on functions such as payroll processing, billing, shop-order writing, sales analysis, and a large variety of scheduling problems.

Since the proposed class scheduling system involves the use of a computer, it should be emphasized that this new system is not to imply that the faculty advisor-student relationship now becomes impersonal. On the contrary, more time can be devoted to the professional guidance required because of the assignment of the clerical task to the computer.

The utilization of the digital computer as a help in the

determination of student registration scheduling will now be considered.

The problem is divided into two major phases:

Phase One takes into consideration the following factors:

a. Student's academic performance.

b. Completed courses

c. Prerequisites and concurrency

d. Availability of the course in the forthcoming semester.

Phase One was developed in the Department of Industrial Engineering, Kansas State University, and is shown in Appendix A.

Phase Two follows Phase One and uses Phase One's output as the input and takes into consideration the following factors:

a. Priority

b. Capacity

c. Scheduled times.

Discussion of each of the above-mentioned factors will be found under the heading "Discussion of Problem."

Essentially, the program on the electronic computer determines a student's schedule as is presently done by a faculty member; however, regardless of whether the faculty member or the computer develops the registration schedule, there is still the possibility of conflicts in the student's schedule.

As a by-product of computer scheduling, tabulations can be made to indicate the total number of students assigned to each class. If there is a limit to the number of students for a given course, then the computer can close-out the course and

not permit additional assignments to that class. The tabulation may indicate, too, that some more sections are needed in a particular course. This situation being made known several weeks prior to actual registration will facilitate the cancellation of courses and make possible the offering of additional sections of other courses.

The results of this study indicate that the computer can make a profound impact on facilitating the registration of students.

DISCUSSION OF PROBLEM

One of the most frustrating as well as time-consuming duties imposed on a faculty member is the assignment of class schedules to the students.

The adopted plan for the assignment of a class schedule is as follows:

First the faculty member goes through the courses which the student has had and determines how many of them he has completed.

The same thing could be done by the computer. The computer can go through the past record and transcript of the student, and it can list the courses which the student has had and his grade point average.

From this list of courses and grade point average the computer develops a criterion for the maximum number of hours a student should carry in the next semester.

After setting up the criterion, the computer would go on and check the following items for each course:

1. Whether the course was completed.
2. Whether the course has any prerequisites or concurrences, and if yes, have they been satisfied?
3. Whether the course is available.

At this point a listing will also be made by the computer showing what courses could be taken by the student.

The next step is to find out from the above listing which courses the student should actually take. The procedure is to give priority to certain courses. A faculty member gives priority

to certain courses while assigning the student, because some of the courses are supposed to be taken immediately, and some of the courses have only one class or section; and it is obvious that those courses should be assigned first.

After assigning the single section classes, multiple section classes are considered, and this procedure is the most cumbersome part of the problem. The advisor has to take into consideration the timing and capacities of the classes already assigned. In fact, this part is just a trial and error procedure. This work can be very well done with the help of a computer. The computer goes back and forth and selects classes which do not involve or produce any conflicts.

The following factors were considered while developing the program:

1. Priority. The priority is given to the single section classes. The single section classes are designated by the minus sign in front of the line number. So, they are assigned first by the computer and then multiple section classes are assigned.
2. Capacity. This factor is only considered for the multiple section classes. The course which has more than one section is considered as a multiple section. In this case the section which has the highest capacity is given the first preference if it does not involve a conflict.
3. Timing. This factor is considered to avoid time conflicts among the classes assigned. This factor requires quite a bit of transformation of data. A numbering

system is developed for every hour of each day in a week; that is, if a class is scheduled at 8:00 o'clock on Monday, it is given a number 1, and a similar pattern is followed for other hours of the week. A list for other times is given in Appendix E.

DISCUSSION OF PROGRAM

The program of Phase One is shown in Appendix A. The discussion of that program will be found elsewhere.[4]

Program of Phase Two is shown in Appendix B. The symbols used with this problem are defined as follows:

SYMBOLS AND THEIR DEFINITIONS

Symbol	Meaning	Definition
LINE	Line No.	A Line No. is given to a course or a section of a course. All the courses and their sections are given different Line Nos. This is the line number found in the university schedule of classes.
DESC	Description	This is a number whose first three digits designate the Department and next three digits represent the catalog No. All courses as well as Departments are given different numbers. The last digit is used to distinguish laboratory, lecture and recitation sections of the same course. Codes will be found in Appendix F.[5]
MAN	MA, MB, MC, MD, to -----MN	This two digit number is a code to designate day and hour. See Appendix E.
MO	MO	Same as above.
KAP	Capacity	This represents the class capacity.
TAKE		This number has the same format as DESC and indicates the courses to which a student should be assigned.
ISKD		A table of numbers 1 through 72 to be used to prevent course conflicts.

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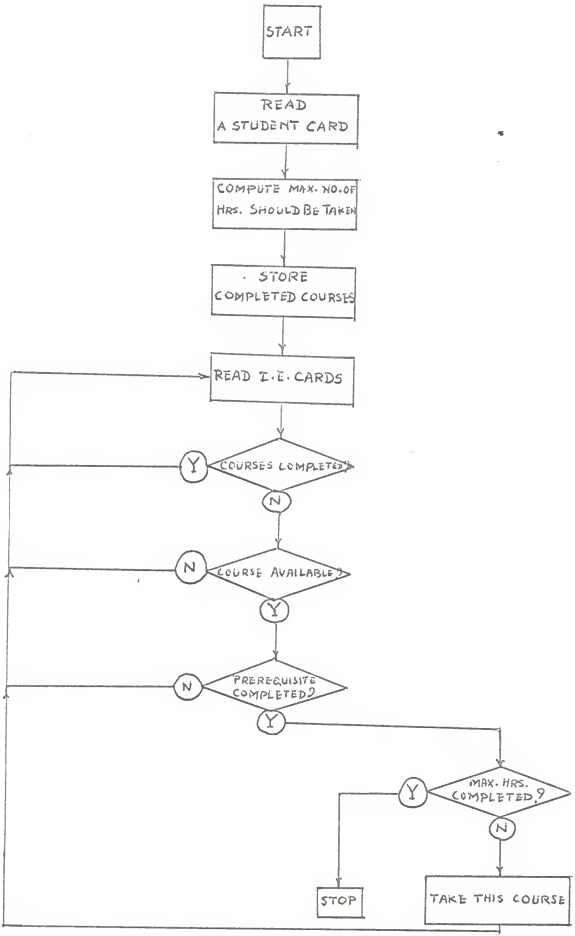
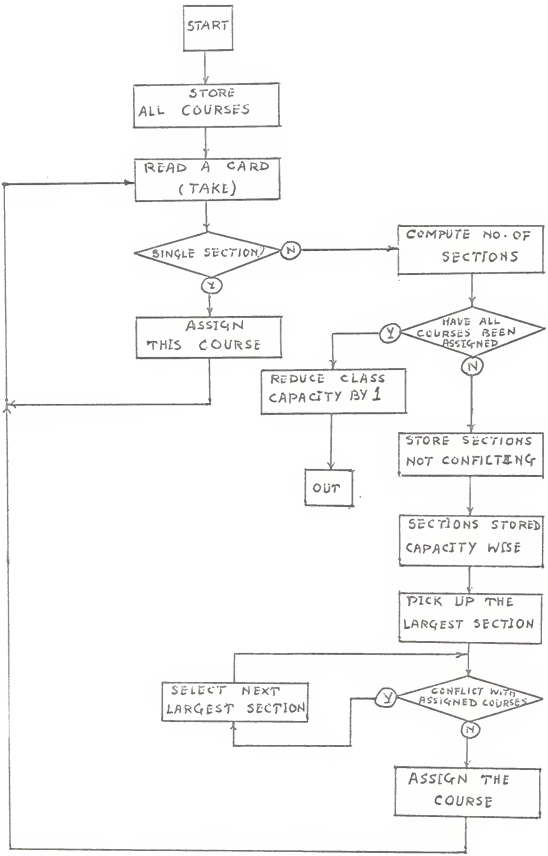
[4] SMALVARMEHTA, STUDENT ASSIGNMENT PROBLEM.
[5] Kansas State University, Chart of Accounts.

Symbol	Meaning	Definition
NLINE		Storage space to list multiple section courses.
KSKD		Storage area corresponding to final proof ticket showing which line numbers occur when.
ITHIS		Storage area corresponding to the final proof ticket but used to print final assignment by eliminating duplicates.
NKAP		Temporary storage for class capacities corresponding to N Line. May be reduced to zero to select next largest section.
MLINE		Lists multiple sections that do not conflict with single section classes.
KLINE		Storage area to store M Line sections of same subjects in ascending order of capacity.
LLINE		Storage area to store M Line sections of different subjects in descending order of number of sections.

Flow Chart For Phase One



Flow Chart For Phase Two



INPUT-OUTPUT DATA

Input data are shown in Appendix C.

The output of this program for Phase II is shown in Appendix D.

The output is in the form of Line Nos. These Line Nos. or the courses which are represented by these Line Nos. should be assigned to the student. In the output some lines are preceded by a negative sign which is the same as the positive Line No. with the exception that the course with a negative Line No. was considered first and assigned first; in short, this line was given priority because it is of single section.

From this output the student slip can be made out with the use of a class schedule. The timing corresponding to the above Line Nos. in the schedule will be the class schedule for the student. If any course is not assigned or any class is closed, or if any conflict between lines occurs, then that information is also printed out by the computer. A more detailed discussion will be found in the sample problem.

SAMPLE PROBLEM

All the symbols used in this problem are defined in the Symbol Table under the heading of "Discussion of Program."

The following are TAKE, the Input Data II, which are shown in Appendix C:

3333200	01
3335100	02
4084190	03
4097431	04
4096470	05
0000000000	06

Consider the above Nos. as the output of the Phase I program and as the input for the Phase II program which is shown in Appendix A and Appendix B, respectively.

After Input Data I are read, the computer will read the first Input Data II card. Then the computer will go through the Input Data I as shown in Appendix C. Now this Input Data I will be referred to as Line Numbers. So, the computer will go through the line numbers and when this TAKE card matches the DESC of Line No., the computer will check whether the Line No. is negative or positive; if it is negative, the computer will go ahead and write the Line Nos. in the KSKD if there is no conflict. If it is positive, the computer will write all the sections in NLINE and KAP in NKAP.

Illustrative Example--Step I

Card No.	Desc.	Checked through the Line Nos.
1	3333200	Positive Line Nos.
2	3335100	Negative Line No.
3	4084190	Positive Line Nos.
4	4097431	Negative Line No.
5	4096470	Negative Line No.

Step II

Negative Line Nos. are assigned in KSKD and positive Line Nos. in NLINE, as explained.

ISKD	NLINE	NKAP	KSKD
1	-9999	-9999	
2	2231	48	
3	2232	48	
4	2233	48	
5	2234	48	
6	2235	48	
7	2236	48	
8	2237	48	
9	-9999	-9999	
10	2853	14	
11	2855	10	
12	2856	18	
13	-9999	-9999	
14			-2238
15			
16			-2238
17			
18			-2238
19			
20			
21			
22			
23			
24			
25			
26			
27			

ISKD	NLINE	NKAP	KSKD
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			-3005
38			
39			-3005
40			
41			-3005
42			
43			
44			
45			
46			
47			
48			
49			
50			
51			-3016
52			
53			
54			
55			
56			
57			-3016
58			
59			
60			
61			
62			
63			-3016
64			
65			
66			

Step III

The class time of each line written in NLINE will now be checked with the column KSKD, and the section which has no conflict will be written in MLINE as follows:

Example: NLINE 2232 has class times 14, 16, 18, as shown in the line schedule. This conflicts with the line -2238 which is already assigned in KSKD. Therefore, line 2232 is not written in MLINE. Only the sections which do not conflict are written in MLINE.

MLINE 1	MLINE 1 CAP	MLINE 2	MLINE 2 CAP
2853	14	2231	48
2855	10	2233	48
		2234	48
		2236	48

Step IV

The above sections written in MLINE are next transferred to KLINE in such a manner that the class which has the smallest capacity is listed first.

KLINE 1	KLINE 2
2855	2231
2853	2233
	2234
	2236

Step V

In this step the KLINES are transferred to LLINE so that the line with the larger number of section is listed first.

LLINE 1	LLINE 2
2231	2855
2233	2853
2234	
2236	

Step VI

In Step VI from the LLINE, the LLINE which has the fewest sections is the first one checked. The class which has largest capacity which is indicated by the last line No. of the LLINE selected will be assigned to KSKD if checking shows there is no conflict. If that line No. is assigned, then the computer will go to another LLINE; but if it is not assigned, then the computer takes the next line which follows in descending order.

So, the line No. 2853 which has classes 20, 21, 22, 23, and the line No. 2236 which has classes 43, 45, 47, will be assigned in KSKD.

Step VII

Now from the KSKD column after assigning the above LLINE classes, each line number will be selected without repeating the same line No.

Example: Line No. -2238 appears three times in KSKD line in column 14, 16, and 18, but it will be written only once in ITHIS column, which is shown below:

ITHIS
-2238
2853
-3005
2236
-3016

These are the final line numbers to which a student should be assigned and which are the same as the computer results as shown in Appendix D.

CONCLUSION

From the preliminary work on this problem it is concluded that it would be feasible to apply this technique to the University assignment procedure. Thus, a very big saving in time as well as a smooth pattern of registration could be made. The present program of Phase I is restricted to students enrolled in Industrial Engineering. To make this program workable for all other departments it would be necessary to transform curriculum data; but once established in the specified format, data can be fed directly into the computer and results can be obtained.

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APPENDIX A

PROGRAM FOR PHASE 1

```
*1405
C  SMALVARMEHTA 4 FOR I. E. ASSIGNMENTS APRIL 63
C DONT FORGET *1405 SOURCE PROGRAM CONTROL CARD
C   INSERT COURSF 099 IN IHAD DECK IF NOHR = 61 OR MORE
C DATA DECK-IHAD CARDS, ZERO CARDS, MINUS CARD, NEXT CARDS, TOTAL 85
    1 READ2,STUNO,SUR,GIVN,OTHR,MAX,KSEM,NOHR,SEM,NYR,IGP
    2 FORMAT(F6.0,A7,A6,A6,I2,I15,I11,A6,I2,I10)
    5 IF(IGP-1500)100,100,10
   10 IF(IGP-2000)120,120,20
   20 IF(IGP-2500)140,140,30
   30 IF(IGP-3000)160,160,40
   40 IF(IGP-3500)180,180,200
  100 MAX=14
      GO TO 3
  120 MAX=16
      GO TO 3
  140 MAX=18
      GO TO 3
  160 MAX=19
      GO TO 3
  180 MAX=20
      GO TO 3
  200 MAX=21
    3 NOHR=NOHR+MAX
      PRINT4,STUNO,SUR,GIVN,OTHR,MAX,NOHR,IGP,SEM,NYR
    4 FORMAT(F8.0,A7,A6,A6,I7,I6,I9,2X,A6,2X,I2)
      J=000
      N=001
      NUF=000
      DIMENSION IHAD(80),ISHD(25),ICAN(70),LATR(80)
      DO 62 K=1,70
   62 .CAN(K) = 0
      K=000
      DO 63 L = 1,80
   63 LATR(L) = 0
   21 FORMAT(I3)
      L=000
   24 I=N
      READ21,IHAD(I)
      N=N+1
      IF (IHAD(I)) 272,23,23
   23 GO TO 24
  272 PRINT 271
  271 FORMAT(37H THESE COURSES SHOULD BE ASSIGNED NOW)
    7 FORMAT(I3,I7,I2,I2,I2,I2,I2,I2,I2,I2,A5,A6,A6)
      LE = 85-N
```

```
    DO 134 M=1,LE
  6 READ7,NEXT,KAT,KR,ISEM,NID1,NID2,NID3,KON1,KON2,DEPT,SUBJ,TITL
 26 GO TO(101,102,103),KSEM
101 GO TO(106,105,105,106,106,106,105),ISEM
102 GO TO(105,106,105,106,106,105,106),ISEM
103 GO TO(105,105,106,105,106,106,106),ISEM
105 L=L+1
    LA=L
    LATR(L)=NEXT
    GO TO 134
 14 STOP
106 DO 112 I=1,N
    IF(NID1-IHAD(I)) 112,107,112
112 CONTINUE
135 IF(NID1-KON1)136,107,136
136 IF(NID1-KON2)105,107,105
107 DO 116 I=1,N
    IF(NID2-IHAD(I))116,113,116
116 CONTINUE
137 IF(NID2-KON1)138,113,138
138 IF(NID2-KON2)105,113,105
113 DO 121 I=1,N
    IF(NID3-IHAD(I))121,125,121
121 CONTINUE
141 IF(NID3-KON1)142,117,142
142 IF(NID3-KON2)105,117,105
117 IF(KON1)14,122,123
122 IF(KON2)14,125,127
123 DO 124 J=1,JA
    IF(KON1-ISHD(J))124,122,124
124 CONTINUE
    GO TO 105
127 DO 128 J=1,JA
    IF(KON2-ISHD(J))128,125,128
128 CONTINUE
    GO TO 105
125 NUF=NUF+KR
131 IF(MAX-NUF)236,133,133
133 J=J+1
    JA=J
    ISHD(J)=NEXT
 42 FORMAT(I4,2X,A5,I4,2X,A6,A6,I5)
    PRINT42,NEXT,DEPT,KAT,SUBJ,TITL,KR
 41 FORMAT(I4,A5,I4,A6,A6,I5,F10.0,I8,A6,I3)
    PUNCH41,NEXT,DEPT,KAT,SUBJ,TITL,KR,STUNO,IGP,SEM,NYR
    GO TO 134
236 NUF=NUF-KR
    K=K+1
    KA=K
    ICAN(K)=NEXT
134 CONTINUE
500 PRINT 204
204 FORMAT(33H THESE COURSES COULD BE TAKEN NOW)
```

```
    DO 210 K=1,KA
    IF(ICAN(K))14,210,211
211 PRINT 21, ICAN(K)
210 CONTINUE
    PRINT 202
202 FORMAT(25H TAKE THESE COURSES LATER)
    DO 220 L=1,LA
    IF(LATR(L))14,220,221
221 PRINT 21, LATR(L)
220 CONTINUE
    PRINT 499
499 FORMAT(9HGOOD LUCK)
    PAUSE
    GO TO 1
    END
```

APPENDIX B

PROGRAM FOR PHASE 2

```
*1005
C SHAGI.RISALTZ  1  AUGUST 27 1963
   20 FORMAT(I5,F9.0,15I3,I4)
      N=75
      DIMENSION LINE(75),DESC(75),MAN(75,14),MC(75),KAP(75),TAKE(25),
     1ISKD(72),NLINE(60),KSKD(72),ITHIS(75),NKAP(60),MLINE(10,60),
     2KLINE(10,60),LLINE(10,60)
  100 DO 1 I=1,75
    1 READ 20,LINE(I),DESC(I),(MAN(I,J),J=1,14),MC(I),KAP(I)
   61 M=0
      KOUNT=0
      ITHIS(1)=-9999
   21 FORMAT(F10.0)
      NLINE(1)=-9999
      NKAP(1)=-9999
      DO 220 NX=2,60
      NLINE(NX)=0
  220 CONTINUE
      DO 256 NJ=2,60
      NKAP(NJ)=0
  256 CONTINUE
      DO 221 NY=1,25
      TAKE(NY)=0
  221 CONTINUE
      DO 222 NZ=1,72
      KSKD(NZ)=0
  222 CONTINUE
      DO 237 NA=1,60
          ITHIS(NA)=0
  237     CONTINUE
      DO 238 I=1,10
      DO 239 J=1,60
      MLINE (I,J)=0
  239 CONTINUE
  238 CONTINUE
      DO 279 IH=1,10
      DO 280 JU=1,60
      KLINE(IH,JU)=0
  280 CONTINUE
  279 CONTINUE
      DO 275 IC=1,10
      DO 276 JC=1,60
      LLINE(IC,JC)=0
  276 CONTINUE
  275 CONTINUE
```

```
C  THE  FOLLOWING  PUT  1,72  IN  ISKD
      NS=1
      DO 201 IS=1,72
      ISKD(IS)=NS
      NS=NS+1
  201 CONTINUE
      IA=2
   60 M=M+1
    2 READ21,TAKE(M)
      IF(TAKE(M))  41,320,101
   41 STOP
  600 FORMAT(32HTHERE IS A CONFLICT BETWEEN LINE)
   10 IF(LINE(I))14,41,67
   14 PRINT 600
   11 PRINT 22,KSKD(K)
   22 FORMAT (I5)
   23 FORMAT (8HAND LINE)
      PRINT 23
      PRINT 22,LINE(I)
   24 FORMAT (54HTHESE ARE SINGLE SECTION COURSES.BETTER LUCK NEXT TIME)
      GO TO 61
  101 DO 202 K=1,75
      IF(TAKE(M)-DESC(K)) 202,62,202
   62 I=K
  300 IF(KAP(I)) 41,202,301
  301 IF(LINE(I)) 102,41,400
  400 NLINE(IA)=LINE(I)
      NKAP(IA)=KAP(I)
      IA=IA+1
  202 CONTINUE
      NLINE(IA)=-9999
      IF(NLINE(IA)-NLINE(IA-1)) 65,602,41
   65 NKAP(IA)=-9999
      IA=IA+1
      KOUNT=KOUNT+1
      IM=KOUNT+1
      JB=KOUNT+1
      GO TO 60
  602 PRINT 27
   27 FORMAT (42HTHERE AINT NO CARD LIKE THIS HERE LINE NO.)
      PRINT 22,TAKE(M)
      PRINT 28
   28 FORMAT(71HEITHER THIS CLASS HAS BEEN DROPPED, IT IS CLOSED, OR THE
     1RE IS AN ERROR./24HTELL IT TO YOUR ADVISER.)
      PAUSE
      GO TO 61
  102 DO 104 J=1,14
      IF(MAN(I,J))41,415,103
  415 IF(LINE(I))104,41,541
  103 DO 203K=1,72
  302 IF(MAN(I,J)-ISKD(K))203,321,203
  203 CONTINUE
  321 IF(KSKD(K))10,500,700
```

```
  500 IF(LINE(I))520,41,541
  450 IF(MAN(I,J))41,104,520
  520 KSKD(K)=LINE(I)
  104 CONTINUE
  130 IF (MO(I))41,429,131
  429 IF (LINE(I))200,41,541
  131 DO 217 K=1,72
  316 IF(MO(I)-ISKD(K))217,336,217
  217 CONTINUE
  336 IF(KSKD(K))10,514,700
  514 IF (LINE(I))534,41,540
  464 IF(MO(I))41,465,534
  465 IF(JLINE)42,200,268
  534 KSKD(K) = LINE(I)
  200 GO TO 60
  601 IF(LINE(I))12,602,132
   12 PRINT 25
   25 FORMAT (8HLINE NO.)
      PRINT 22, LINE(I)
      PRINT 26
   26 FORMAT(87HIS A SINGLE SECTION COURSE. THE CLASS HAS BEEN CLOSED OR
     1WE ARE JUST FRESH OUT OF CARDS./40HSEE YOUR SECTION ADJUSTER OR ST
     2ART AGAIN)
      PAUSE
      GO TO 61
  320 IF(KOUNT)41,132,330
  330 IK=2
      IL = 1
      IN=1
  340 IC=102
      NX=0
      GO TO 337
   69 KOUNT=KOUNT-1
      IF(KOUNT)41,229,70
   70 IN=1
      GO TO 67
   67 IK = IK + 1
      GO TO 340
  337 DO224 IM = 1,75
      IF (MLINE(IK)-LINE(IM))224,223,224
  223 I=IM
      GO TO 102
  224 CONTINUE
      GO TO 69
  540 IF(MLINE(KOUNT,IN)-LINE(I))542,41,542
C  LISTS  COURSES  THAT  DO  NOT  CONFLICT  WITH  SINGLE  SECTION  COURS
  542 MLINE(KOUNT,IN) = LINE(I)
  543 IN = IN+1
      IK = IK+1
      GO TO 340
  541 IF (IC-130)225,540,234
  225 IC = IC+2
      NX=NX+1
      GO TO (102,102,102,102,102,102,102,102,102,102,102,102,130)NX
```

```
229 JB=JB-1
    IF(JB)41,262,240
240 JLINE=0
    JKAP=0

    JC=1
    J=1
250 DO 226 JA=J,IK
    IF(MLINE(JB,JC))41,271,230
230 IF(MLINE(JA))228,1000,228
228 IF(MLINE(JB,JC)-NLINE(JA))226,227,226
227 J=JA
    IF(NKAP(J)-JKAP)235,68,68
 68 JLINE=NLINE(J)
    JKAP=NKAP(J)
235 JC=JC+1
    JH=JC
226 CONTINUE
271 IH=JB
    JH=JH-1
    IF(JH)41,229,212
212 JU=JH
    IF(KLINE(IH,JU))41,273,211
211 GO TO 271
273 KLINE(IH,JU)=JLINE
213 DO 274 JE=1,60
    IF(JLINE-NLINE(JE))274,277,274
274 CONTINUE
277 I=JE
    NKAP(I)=0
    JLINE=0
    JKAP=0
    JC=1
    J=1
    GO TO 250
262 ICWA=1
    JAS=60
264 DO 260 IAS=1,10
    IF(KLINE(IAS,JAS))41,260,261
261 DO 263 JC=1,JAS
    LLINE(ICWA,JC)=KLINE(IAS,JC)
    KLINE(IAS,JC)=0
263 CONTINUE
    ICWA=ICWA+1
260 CONTINUE
    JAS=JAS-1
    IF(JAS)41,299,264
299 IM=ICWA
268 IM=IM-1
    IF(IM)41,1000,265
265 IP=449
    NXT=0
    JLINE=0
```

```
 298 DO 266 JZ=1,60
     IF(LLINE(IM,JZ))41,269,266
 269 JZ=JZ-1
     JLINE=LLINE(IM,JZ)
     GO TO 231
 266 CONTINUE
 231 DO 232 L = 1,75
     IF(JLINE-LINE(L))232,233,232
 233 I = L
     IC = 150
     GO TO 102
 232 CONTINUE
 234 IP = IP+1
     NXT=NXT+1
     GO TO (450,450,450,450,450,450,450,450,450,450,450,450,450,464
    1),NXT
 700 DO 702 JJ=1,72
     IF(JLINE-KSKD(JJ))702,703,702
 703 IT=JJ
     KSKD(IT)=0
 702 CONTINUE
     JLINE=0
     JZ=JZ-1
     IF(JZ)41,281,701
 701 JLINE=LLINE(IM,JZ)
     IF(JLINE)41,41,231
 281 IF(LLINE(IM+1,1))41,284,283
 284 DO 285 K=1,60
     LLINE(IM,K)=0
 285 CONTINUE
     GO TO 1001
1001 PRINT 30
  30 FORMAT(33HBE HAPPY YOU HAVE ONE COURSE LESS)
     GO TO 268
 283 IP=449
     NXT=0
     IM=IM+1
     JLINE=0
     DO 286 K=1,60
     DO 287 JD=1,72
     IF(LLINE(IM,K)-KSKD(JD))287,288,287
 288 IV=K
     GO TO 290
 287 CONTINUE
 286 CONTINUE
 290 DO 291 JD=1,72
     IF (LLINE(IM,IV)-KSKD(JD))291,292,291
 292 IW=JD
     KSKD(IW)=0
 291 CONTINUE
     IV=IV-1
     IF(IV)41,281,289
 289 JZ=IV
     JLINE=LLINE(IM,JZ)
```

```
 1000 PRINT 29
   29 FORMAT(54HHOW LUCKY CAN YOU GET..THE FOLLOWING LINE NUMBERS WORK)
C  THE  FOLLOWING PUTS KSKD  IN  THIS
  132 II=2
      DO 218 I=1,75
      DO 219 K=1,72
      IF(LINE(I)-KSKD(K))219,63,219
   63 ITHIS(II)=LINE(I)
      II=II+1
  219 CONTINUE
  218 CONTINUE
  255 DO 251 I=2,75
      DO 252 J=1,75
      K=I
      IF(ITHIS(K)-ITHIS(K+1))254,251,254
  254 IF(LINE(J)-ITHIS(K))252,253,252
  253 KAP(J)=KAP(J)-1
      GO TO 251
  252 CONTINUE
  251 CONTINUE
C  THE FOLLOWING PRINTS  OUT  ITHIS ELIMINATING DUPLICATES
      IJ=2
  317 IF(ITHIS(IJ))318,42,318
   42 PAUSE
      GO TO 61
  318 IF(ITHIS(IJ)-ITHIS(IJ+1))13,64,13
   13 PRINT 22,ITHIS(IJ)
   64 IJ=IJ+1
      GO TO 317
      END
```

APPENDIX C

INPUT DATA 1

```
2231 3333200. 07 09 11                                                  048
2232 3333200. 14 16 18 00 00 00 0                                        48
2233 3333200. 19 21 23 00 00 00 0-                                       48
2234 3333200. 20 22 24 00 00 00 0-                                       48
2235 3333200. 39 37 41 00 00 00 0-                                       48
2236 3333200. 43 45 47 00 00 00 00                                       48
2237 3333200. 49 51 53 00 00 00 00                                       48
2238 3335100. 14 16 18 00 00 00 00                                       48
2239 3336100. 13 15 17                                                   75
2240 3336200. 13 15 17 00 00 00 0-                                       48
2241 3336200. 26 28 30 00 00 00 0                                        48
2242 3336200. 19 21 23 00 00 00 00                                       48
2243 3336210. 14 16 18 00 00 00 00                                       48
2244 3337200. 26 28 30 00 00 00 0                                        48
2245 3337300. 43 45 47 00 00 00 00                                       48
2246 3337700. 25 27 29 00 00 00 00                                       48
2247 3337990. 00 00 00 -                                                 48
2248 3338100. 58 00 00 0                                                 48
2249 3339990. 00 00 00 -                                                 48
2999 4094480. 19 21 23 00 00 00 00                                       20
2853 4084190. 20 21 22 23 00 00 00 0                                     14
2854 4084190. 20 21 22 23 00 00 00 0
2855 4084190. 26 27 28 29 00 00 00 0                                     10
2856 4084190. 38 39 40 41 00 00 00 0                                     18
2857 4084200. 12 18 24 30 00 00 00 -                                     10
2858 4084200. 12 18 24 30 00 00 00 -
2859 4084200. 44 50 56 62 00 00 00 0                                     10
2860 4084200. 44 50 56 62 00 00 00 0
2861 4084200. 47 53 59 65 00 00 00 0                                     10
2862 4084200. 47 53 59 65 00 00 00 0
2863 4084230. 19 21 23 65 00 00 00 0                                     10
2864 4084230. 14 16 18 65 00 00 00 0                                     10
2865 4084240. 43 49 55 61 00 00 00 0*                                    10
2866 4084240. 43 49 55 61 00 00 00 0*
2867 4084240. 45 51 57 63 00 00 00 0-                                    10
2868 4084240. 45 51 57 63 00 00 00 0*
2981 4091150. 58 00 00 0                                                 200
2982 4093180. 07 09 11 13 15 17 00 00 00 00                              40
2983 4093180. 37 39 41 43 45 47 00 00 00 00                              16
2984 4093180. 49 51 53 55 57 59 00 00 00 00                              22
2985 4093180. 44 46 50 52 56 58 00 00 00 00                              38
2986 4093390. 08 10 00 00 0
2987 4093390. 14 16 00 00 0-                                             20
2988 4093390. 26 28 00 00 00                                             19
2989 4093390. 38 40 00 00 0                                              50
2990 4093390. 44 46 00 00 00                                             42
```

```
2991 4093390. 21 23 00 00 0-                                        22
2992 4093990. 00 00 00 -                                             1
2993 4094060. 08 10 00 00 0                                         92
2994 4094180. 38 00 00 0                                             6
2995 4094181. 44 50 56                                               6
2996 4094360. 19 21 23  0 00 00 00                                  23
2997 4094380. 25 29 00 00 0-                                        17
2998 4094381. 40 46 52 00 00 00                                     17
3000 4095060. 25 27 23 00 00 00 0-                                  15
3001 4095380. 45 00 00 00 00 00 0-                                  10
3002 4095381. 47 53 59 00 00 00 0-                                  10
3003 4096370. 13 15 17 00 00 00 00                                  15
3004 4096460. 19 21 23 00 00 00 00                                   1
3005 4096470. 37 39 41 00 00 00 00                                  17
3006 4096490. 08 39 41 00 00 00 0-                                   5
3007 4096491. 14 20 26 00 00 00 00                                   5
3008 4096530. 38 40 26 00 00 00 00                                   7
3009 4096531. 44 50 56 00 00 00 00                                   7
3010 4096550. 08 50 56 00 00 00 00                                   3
3011 4096551. 14 16 20 22 26 28 00 00 00 00                          3
3012 4096860. 07 09 20 22 26 28 00 00 00 00                          9
3013 4097130. 42 45 47 22 26 28 00 00 00 00                          9
3014 4097160. 00 00 00 *                                            25
3015 4097430. 49 53 00 00 0-                                        10
3016 4097431. 51 57 63 00 00 00 0-                                  10
3017 4098860. 25 27 29 00 00 00 00                                  10
3018 4098960. 00 00 00 *                                            10
3019 4092030. 47 53 59 00 00 00 00                                  10
3020 4092120. 07 13 9 17 11 17                                      10
```

INPUT DATA 2

```
3333200.
3335100.
4084190.
4097431.
4096470.
000000000.
```

APPENDIX D

RESULTS

```
HOW LUCKY CAN YOU GET..THE FOLLOWING LINE NUMBERS WORK
 2238
 2853
 3005
 2236
 3016
```

APPENDIX E

Time Chart

Hour	A.M.						P.M.								
Day	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO
M	1	7	13	19	25	31	37	43	49	55	61	67	73	79	85
T	2	8	14	20	26	32	38	44	50	56	62	68	74	80	86
W	3	9	15	21	27	33	39	45	51	57	63	69	75	81	87
T	4	10	16	22	28	34	40	46	52	58	64	70	76	82	88
F	5	11	17	23	29	35	41	47	53	59	65	71	77	83	89
S	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90

APPENDIX F

PARTIAL LIST OF DEPARTMENTAL CODE NUMBERS

401 Dean of Engineering and Architecture
402 Agricultural Engineering
403 Agricultural Engineering--SBVE
404 Applied Mechanics
405 Architecture and Allied Arts
406 Chemical Engineering
407 Civil Engineering
408 Electrical Engineering
409 Industrial Engineering
410 Mechanical Engineering
411 Mechanical Engineering--Lab. Equipment
412 Nuclear Engineering

A COMPUTER PROGRAM FOR STUDENT ASSIGNMENT

by

JAYANT P. SHAH

B. S. (Engineering) Mechanical, Tri-State College,
Angola, Indiana, 1962

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Industrial Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1964

The object of this report was to develop a computer algorithm to be used in scheduling student's class assignments.

There are two phases of the program. In phase I, the computer checks the courses which a student has had and goes through his academic record. As the result of phase I, courses are listed which should be taken by a student in the next semester.

In phase II, the computer determines the class schedule for the courses by giving priority to single section classes and taking into consideration the class capacity of multiple section classes. The computer prints the results in the form of line numbers. The line numbers are the same as line numbers of the class schedule of Kansas State University for a given semester.

The program was written in Fortran II for the IBM 1620 Digital Computer with 60 K Storage.