EXPERIMENTAL ANALYSIS OF A GPSS SIMULATION OF A STUDENT HEALTH CENTER

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Summary

Simulation was found to be a useful device in studying the effects of varying service capacity in a medical clinic. The intuitive expectation of an inverse relationship between service capability and waiting time was confirmed. The anticipated main effects were supported while all but one of the interaction effects were negligible. A non-linear relationship between service capacity and waiting time was estimated by regression. This relationship was used to construct a decision table with alternatives and cost effects which can be used for decision-making under many conditions and constraints within the Health Center administration's decision space.

Introduction

Health care on a mass basis is becoming more important as our population increases in size and tends to concentrate in urban centers. Clinic situations arise with increasing frequency as the available supply of medical personnel is asked to perform more services. This suggests that operations research analysis might aid in finding a near optimum allocation of doctors, nurses, technicians and other supportive personnel. Such a situation is reminiscent of the classical economic problem of allocation of scarce resources among competing uses.

The study of waiting lines in front of doctors' offices suggests the application of queuing theory. In the case of one doctor with a nurse or receptionist, analytical analysis of the situation is rather simple, but in the case of a clinical situation there are several doctors of other medical services (lab, x-ray, etc.). The situation soon becomes exceedingly difficult to solve using strictly an analytical approach. Simulation, with sufficient sample size, can adequately duplicate realistic events and give results that parallel those from more rigorous analytical techniques. The simulation approach also permits sensitivity investigation because parameters can be manipulated and the effects studied by experimentation.

Simulation can be used to depict the queuing (waiting and facility utilization) aspects of the system. But simulation also has its limitations. For example, it is exceedingly difficult to incorporate within the model any judgments on the quality of the medical care provided, or how the changes suggested will affect that quality.

Review of the Literature

A review of literature indicates that while the doctor-waiting room situation is used for illustrative purposes in elementary texts on queuing theory (see Wagner [1]), realistic circumstances quickly outstrip the assumptions of elementary queuing models. For purposes of this paper, research involving the stochastic nature of health services may be divided into two broad categories: (1) hospital inpatient studies; and (2) clinic-oriented studies.

The former category subsumes studies on several hospital subsystems including surgery,[2,3,4] maternity care, [5,6,7,8] pharmacy supplies,[9] and ambulance service.[10] Many studies in this area focus upon the daily census [1,2,5,6,13,14,15,16] (number of patients in the hospital) as a variable that is crucial for planning hospital facilities[2,9,10,14] as well as setting admissions policy.[1,2,7,16,17,18,19,20] The behavior of the census depends upon the probabilistic structure of both the arrival process[3,11,12,15,19,21,22] and length of stay.[3,11,18,21,23]

The second category includes hospital outpatient clinics, general practioner clinics, dental and medical specialist clinics, laboratories, and is more closely related to the current research. These settings exhibit a fundamental difference from hospital inpatient studies. While daily census is critical for determining the number of serving facilities (beds) for hospital inpatients, the number of serving physicians in a clinic is not usually a decision variable. Furthermore, clinical patients are served in a fairly strict sequential pattern once admitted to the system, whereas hospital inpatients call for service randomly and intermittently once admitted.

A brief survey of the literature indicates that most research on clinics has focused upon appointment systems as a means of controlling the tradeoff between patient waiting time and doctor's idle time. In 1952 Bailey[24] reported the use of manual simulation to evaluate this tradeoff as a function of the initial number of patients present at the start of a clinic. Jackson[25] demonstrated how the appointment interval relative to mean consultation time could affect this tradeoff. Welch[26] also stressed the effect of initial number present, too-narrow appointment intervals, but especially the lateness of physicians as a cause of patient waiting time. Fry[27] pointed out the necessity of leaving spaces for "walk-in" patients, comprising about 1 of 4 visits in Fry's practice. Blanco-White and Pike[28] demonstrate that in addition to the factors of initial number of patients and physicians' lateness, the mean consultation time, dispersion of consultation time, and the "batch" size of patients scheduled at a time strongly affect waiting time. They found that unpunctuality (where lateness equals earliness) had only a slight effect on patients' waiting. Fetter and Thompson[29] found that if most unpunctuality were due to earliness, then unpunctuality becomes a more potent factor than physician lateness, yet extreme load factors (rate of scheduled appointments) can be even more influential than unpunctuality. In two other studies, Soriano[30] demonstrated analytically, and

William, Covert, and Steele[31] using simulation, that batch arrivals have a negative effect on waiting when patients may be assumed to be punctual. Blanco-White found that unpunctuality diminishes this effect.

The current paper deals with a university student health clinic which differs in several ways from other medical clinics. A student health center has few patients who return on a regular basis. The majority of patients thus become "walk-ins" due to the inconvenience of telephoning for an appointment. Furthermore, student unpunctuality had frustrated previous attempts at appointment systems. Fetter and Thompson[29] report that unpunctuality can transform a supposedly deterministic input to a purely random input. Hence, the introduction of an appointment system was not an attractive decision variable. A different approach was sought for using a constrained university budget in the most effective way possible to limit patient waiting. Physician idleness was not considered since doctors are paid a fixed salary and their practice is limited exclusively to the health of the student community. Thus physician idleness represents neither out-of-pocket cost nor opportunity loss from the viewpoint of the University. Thus the objective of this study pertains to staffing a health clinic to minimize overall waiting for student patients. This approach thus includes the patient waiting times at x-ray, dentist, psychiatrist, and the laboratory with the patient waiting time for a physician. Since the vast majority of patients are non-appointive, it seems unnecessary to net out the "first waiting time" of early appointees as did Fetter and Thompson.[29] Also there appears to be little attention given to fluctuating arrival distribution over time of day, which is a significant factor where university class schedules influence student arrival rates.

Statement of the Problem

The general topic of this study was the effect on patient waiting time of various service capacities. First a study of functional relationships between waiting time and capacity was made. It is fairly obvious that waiting time and capacity are inversely related. But it is not intuitively obvious whether the decrease (in a model that departs from classic queuing assumptions) should be modeled as a linear form or a nonlinear form such as the negative exponential. Therefore the first objective of the study was to determine whether linear or exponential form gives the best fit, using coefficient of determination as the criterion of best fit. The second phase was to determine an effective allocation of funds subject to a constrained budget. Included in the study of both these questions was the auxiliary study as to whether there exist significant interaction effects.

Methodolgy

The model used in the investigation was a General Purpose Simulation System (GPSS) simulation of the Pennsylvania State University's Ritenour Health Center. There are eight general practice doctors at Ritenour. There are also two psychiatrists, one dentist, one laboratory, one x-ray unit and three receptionists. There are three general classes of patients: (1) dental patients, who go directly to the dental waiting room; (2) psychiatric patients, who go directly to the psychiatric waiting room, and (3) general patients who present themselves at the main desk where a receptionist locates their medical record and then assigns them to a doctor who has the least number of people waiting to see him. Figure 1 is a schematic diagram of the physical flow through the health center system. Figure 2 is a logic diagram of the essential decision points in the computer program.

Past records were studied and various personnel were questioned to establish the arrival rates, service rates and relationships between facilities. The distribution of arrival rates for all facilities is given in Table I as well as the distribution of service times. The arrival rates were specified by a mean and deviation and a horizontal distribution. This distribution was selected due to its convenience of use in GPSS and because the available data did not indicate that a uniform distribution was unreasonable. Extreme highs and lows were used to define these ranges. Examination of available records indicated that 42% of the general patients and 30% of the dental patients go to the lab. Seven percent of the general and 20% of the dental patients go to the x-ray facility.

Hypothesis and Experimental Design

The general hypothesis tested was that there are significant main effects and interaction effects between all of the independent variables with respect to the dependent variable. The hypothesis was tested by advancing the null hypothesis that there is no interaction between the variables seeing if analysis of variance[32] warrants rejection of the null hypothesis. The factors varied were (A_1) number of general doctors, (A_2) the number of receptionists and (A_3) the number of laboratory technicians.

Two models were used for the mathematical relationship between the dependent variable waiting time and the independent variables or factors. The equation was conjectured to take one of the two following forms:

$$(1)\quad Y = \sum_{i=1}^{3} \alpha_i A_i + \sum_{i=1}^{3} \sum_{j=1}^{3} \alpha_{ij} A_{ij} + K$$

$$(2)\quad \text{LOG}_e\, Y = \sum_{i=1}^{3} \alpha_i A_i + \sum_{i=1}^{3} \sum_{j=1}^{3} \alpha_{ij} A_i A_j + K$$

where A_1, A_2, A_3 represent the three factors involved and Y is the dependent variable waiting time. A stepwise regression process was used.

A factorial experimental design was followed by procedures described in a simulation by Bonini[33] and described lucidly by Winer.[32] Assumptions were made of homogeneity of variance, normality of group means and additivity of effects, with tests planned to assess their validity. The "batch mean" method was used to assure normality and to include effects of autocorrelation when estimating sample variance of the mean. Each batch consisted of about 300 patients' waiting times. Although individual waiting times usually exhibit a J shaped distribution, the mean (or sum) of a great many waiting times exhibits normality by the central limit theorem.

The authors investigated the change in waiting time under the following conditions:

Factor	Levels
A_1:	8 through 10 doctors
A_2:	3 or 4 receptionists
A_3:	3 or 4 technicians

These levels were selected on the basis of being within the feasible decision space of Health Center administrators. Thus the design was a 3x2x2 fixed factorial experiment as described in Winer.[32] The sample size was determined by using the methods described in Kirk[34] using the power function for analysis of variance. With a sensitivity of eight percent, the α and β errors for factor A_1 (number of doctors) are given in Table II. It was found that this factor required larger sample sizes than the other two factors. The α and β errors for the other two factors were extremely low under the sample size selected. The sample size was selected on the basis of maintaining a reasonable α and β error plus the consideration of available computer time. The final cell selected was n = 15. Thus under each configuration of the experiment there was fifteen observations. Each observation was the value of total time spent waiting in an entire simulated day. This cell size provided a α of .05 and β of .04. Observations were made statistically independent by using a new string of random numbers for each day.

The simulation with a sample size of 15 under each of the twelve configurationf of the system took a total of 2400 seconds of time and 102,000 records on a I.B.M. 360/67 computer. The analysis of variance was also performed on the computer with the regression analysis performed with the aid of the stepwise regression program BMD02R.[35]

The Program

The simulation program was written to conform to the observed data and to reflect the actual operations of the health center as closely as possible. See Appendix I for an example of the programming. The program had different transaction generators for the doctors, the psychiatrists and the dentist. Furthermore, there were five different generators for the general doctors each of which generated transactions during a specified time of day to conform with the observed distribution of arrivals during the day. This was accomplished by utilizing the various fields of the GPSS GENERATE statement.

Referring to Figure 3 as an illustrative example, we read that a transaction is generated every 10 ± 3 minutes; the generation begins at time 1; the transactions pass from the generation block into the test block which checks to see if one hour has passed (60 minutes); if the hour is up the transactions pass into the TERMINATE block which eliminates the transaction from further consideration. If the hour is not up the transactions are directed into the main program. At T=60 minutes, or one hour, the second generate statement begins creating transactions every 15 ± 2 minutes.

After leaving the generate block the transactions enter a SELECTMIN block which directs the transaction to the receptionist with the shortest line waiting for service. After servicing by the receptionist the transaction is assigned to the doctor's office with the shortest queue. Then a certain percentage of those patients are assigned to the laboratory or x-ray unit after treatment by the doctor. The sequence of events is somewhat similar with the psychiatric and dental transactions generators. At various points in the program data is tabulated on queues, distribution of waiting times and information of facility usage.

Results

As indicated previously the results of the simulation were subjected to an analysis of variance with unweighted means.[32] The data elements were defined as the average waiting time per person multiplied by volume of people flowing through the queues at the doctors office, the receptionists and the laboratory (i.e., total waiting time).

A summary of the means and deviation of total waiting time under each configuration of the model is presented in Table III. Bartlett's test for homogeneity of variance with 11 degrees of freedom was performed and a chi-square of 18.64 was obtained (see Winer [32] p. 98). The probability that the hypothesis of homogeneity of variance or equal distribution of the experimental error is supported. Scheffe's test gives results not supporting the rejection of the hypothesis of additivity of group means. In none of the comparisons of differences between means is Scheffe's constant greater than the critical F ratio (see Kirk,[34] pp. 82-84).

The analysis of variance summary table is shown in Table IV. The data lead us to reject the hypothesis that main effects of the factors doctors, receptionists and technicians are zero. Although the level of significance was $\alpha = .05$, the rejection may be made with a probability of being wrong of p = .001. However, the data do support the hypothesis of zero interaction between all combinations of factors except the factors A_1A_3 (interactions between doctors and technicians) significant at the level p = .02.

After considering the results of an evaluation of nonlinearity of trend, there were two likely possibilities to investigate as far as a regression line was concerned:

$$(3) \quad Y = K_1 - \alpha_1 A_1 - \alpha_2 A_2 - \alpha_3 A_3 - \alpha_4 A_1^2 - \alpha_5 A_1 A_3$$

$$(4) \quad \text{LOG } Y = K_2 - \phi_1 A_1 - \phi_2 A_2 - \phi_3 A_3 - \phi_4 A_1^2 - \phi_5 A_1 A_3$$

The A_1A_3 term was included because of the AOV results which indicate interaction between the doctors and the technicians. The effect of an additional technician depends upon the addition of an extra doctor, and vice-versa. See Table V for an interpretation of variables.

The two resulting regression lines obtained were as follows:

$$(5) \quad Y = 1512.66 - 267A_1 - 117.4A_2 + 38.24A_1^2 - 64.04A_1A_3$$

$$(6) \quad \text{Log}_e\ Y = 7.42 - .135A_1 - .160A_2 - .0963A_1A_3$$

Table VI gives standard errors and the F ratio for each coefficient in both equations. The R^2 for linear equation (5) is .7797 while the R^2 for the natural log equation (6) is .7826. Thus the logarithmic equation gives better fit. As we expected both functions exhibit an inverse relation between waiting time and capacity, but the linear model does not exhibit diminishing returns for the factor A_2, receptionist, so that the non-linear model was preferred.

Cost Analysis

Conversations with Health Center personnel revealed the following salary structure: doctors receive $17,000 a year, a receptionist about $4,800 and a lab technician $6,200. Table VII presents the twelve possible configurations of the system (including the present one) and associated daily savings in student waiting time; annual added cost for this configuration; and a measure of efficiency (the annual cost per hour of reduction of daily student waiting time). The lower the cost per hour the more efficient the particular configuration is in a relative sense.

The table can be used in the selection of added personnel and the selection of economical additions to the Health Center staff. For example if the administration were constrained by an incremental budget of $25,000 then an examination of the total annual cost column reveals that the largest reduction in waiting time can be achieved by hiring a doctor and a lab technician (configuration 101) at a cost of $23,200 and a daily savings of 42.5 student hours. If the administration wanted to add one employee then the cost per hour column would be examined and a receptionist would be added (configuration 010).

This table covers all possibilities within the administration decision space and can be used by a person without a mathematical background to select a near-optimal combination of added personnel. Optimal results could be achieved by use of integer programming where the decision variables are number of personnel to hire, although it is more practical to simply enumerate all solutions in the current case.

Conclusion

Simulation was found to be a useful device in studying the effects of varying service capacity in a medical clinic. The intuitive expectation of an inverse relationship between service capability and waiting time was confirmed. The anticiapted main effects were supported while all but one of the interaction effects were negligible. A non-linear relationship between service capacity and waiting time was estimated by regression. This relationship was used to construct a decision table with alternatives and cost effects (see Table XI) which can be used for decision-making under many conditions and constraints within the Health Center administration's decision space.

This paper has attempted to demonstrate how the output of computer simulations may be analyzed rigourously using analysis of variance to assess main and interaction terms, followed by stepwise regression analysis to estimate coefficients for an intrinsically linear model. It is also possible that the current research is innovative in treating staffing configuration as a decision variable in contrast to the type of appointment system in previous health clinic waiting-time studies.

However, certain disclaims must also be made concerning the limitations of this research. It should be made clear that the findings reported herein may be sensitive to several inadequacies of the model. First the reliability of the arrival and service patterns would be greatly enhanced by a larger scale study. However, we would not expect the results to be extremely sensitive to errors in the arrival or servicing patterns. However, lateness, emergency calls and physician's breaks have previously been found highly influential. Finally the appointment systems could be included in the model to assess the effect of its expansion.

It appears that simulation and statistical analysis can be utilized in clinical situations and hospital situations to great advantage. The number of elements in modern health care systems is increasing as is the complexity of relationships between them and operations research can provide valuable aids in administrative decision making.

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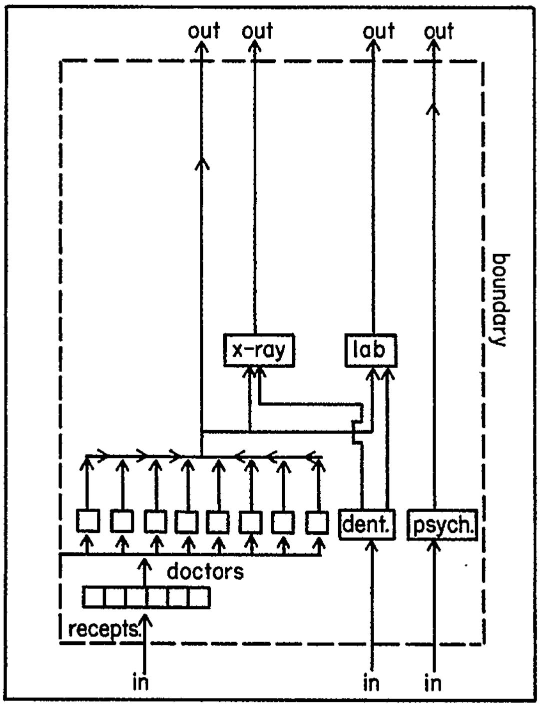

FIGURE 1

PHYSICAL FLOW THROUGH HEALTH CENTER

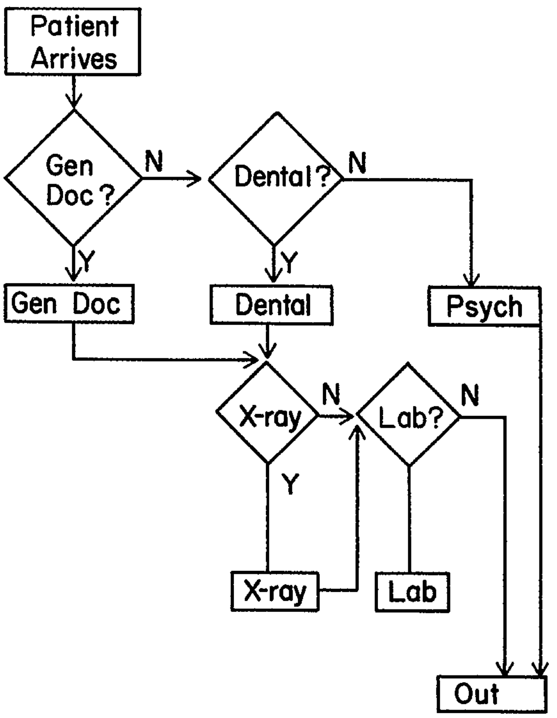

FIGURE 2

LOGIC DIAGRAM OF COMPUTER PROGRAM

TABLE I - DISTRIBUTION OF ARRIVAL AND SERVICE TIMES IN SECONDS[a]

	AVERAGE INTER-ARRIVAL TIME	DEVIATION FROM MEAN	AVERAGE TREATMENT TIME	DEVIATION FROM MEAN
GENERAL DOCTOR[b]				
8-9 a.m.	130	40	840	540
9-10 a.m.	95	30	"	"
10-12 a.m.	80	15	"	"
1-3:30 p.m.	95	30	"	"
3:30-4:30 p.m.	115	40	"	"
RECEPTIONIST	(same as general doc)		240	80
DENTIST	1100	350	900	420
PSYCHIATRIST	2400	330	2000	500
X-RAY			1020	240
LAB			240	60

[a]Parameters of arrival and service time as estimated from records and conversations.

[b]Time dependent relation of arrivals fluctuating with time of day.

TABLE II - VALUES OF α AND β USED IN SELECTION OF CELL SIZE

FACTOR A N	ϕ	$\alpha = .05$ β	$\alpha = .01$ β
5	1.52	.45	.80
10	1.87	.17	.25
15	2.30	.04	.10
20	2.64	.01	.04
25	2.95	.00	.01

N - cell size
α - probability of error of type 1
β - probability of error of type 2
ϕ - power function

$$\phi = \sqrt{((A_i)*B*C*N)/e^2*K)}$$

A_i - mean of ith level of factor A
k - number of levels
B - number of levels within factor B
C - number of levels within factor C
e^2 - variance

TABLE III - CELL MEANS OF TOTAL WAITING TIME

(Avg. waiting time over all configurations - take results in table times 10^2 to get actual time in seconds)

DOCTOR	RECEPT	LAB TECH.	OBSERVATIONS	MEAN OF TOTAL WAIT-TIMES	STANDARD DEVIATION
8	3	3	15	11282	1270
8	3	4	15	10195	1050
8	4	3	15	9703	1200
8	4	4	15	9250	970
9	3	3	15	9015	1100
9	3	4	15	7530	930
9	4	3	15	7554	1270
9	4	4	15	6378	945
10	3	3	15	7224	999
10	3	4	15	5509	185
10	4	3	15	6400	1480
10	4	4	15	4433	202

TABLE IV - AOV TABLE

(Analysis of Variance Summary Table)

SOURCE	SUMS OF SQUARES	DF	MEAN SQUARES	F RATIO	PROB.
A_1	539034438.	2	269517219.	237.665	.000
A_2	62112851.	1	62112851.	54.772	.000
A_3	77816440.	1	77816440.	68.620	.000
A_1A_2	1155339.	2	577669.	0.509	.602
A_1A_3	8616476	2	4308238.	3.799	.024
A_2A_3	580610.	1	580610.	0.512	.475
$A_1A_2A_3$	1503100.	2	751550.	0.663	.517
ERROR	190515234.	168	1134019.		

Corrected total sum of squares 881334000.
Uncorrected total sum of squares 120365000.

A - DOCTORS

B - RECEPTIONIST

C - LAB TECH.

TABLE V - RELATIONSHIP BETWEEN FACTOR LEVEL AND NUMBER OF PERSONNEL[a]

FACTOR	DESCRIPTION	NUMBER OF PERSONNEL	LEVEL
A_1	DOCTOR	8	1
A_1	DOCTOR	9	2
A_1	DOCTOR	10	3
A_2	RECEPTIONIST	3	1
A_2	RECEPTIONIST	4	2
A_3	LAB TECHNICIAN	3	1
A_3	LAB TECHNICIAN	4	2

[a]Thus if A = 1, B = 2, and C = 2 there are 8 doctors, 4 receptionists and 4 technicians.

TABLE VI - STANDARD ERRORS AND R^2 FOR BOTH EQUATIONS[a]

EQUATION 2

Dependent variable: $\log_e Y$

VARIABLE	COEFFICIENT	STANDARD ERROR	F TO REMOVE
CONSTANT	7.42618	0.01938	48.7713
A_1	-0.13526	0.02093	58.6594
A_2	-0.16033	0.02093	58.6594
A_1A_3	-0.09633	0.00969	98.8139

MULTIPLE R^2 = .7826

EQUATION 1

Dependent variable: Y

VARIABLE	COEFFICIENT	STANDARD ERROR	F TO REMOVE
CONSTANT	1512.66		
A_1	-267.72	68.17	15.42
A_2	-117.49	15.70	55.96
A_1^2	38.24	16.65	5.27
A_1A_3	-64.04	7.26	77.60

MULTIPLE R^2 = .7797

[a](Tolerance F ratio: 2.5)

TABLE VII - EFFECTS ON WAITING TIME AND COST OF ALL POSSIBLE PERSONNEL CHANGES WITHIN ADMINISTRATIVE DECISION SPACE

ADDED PERSONNEL			REDUCTION WAITING TIME (HOURS)	TOTAL ADDED COST (DOLLARS)	COST[a] PER HOUR
DOC	RECP	LAB			
0	0	0	(original configuration)		
0	0	1	30.4	6200	20.40
0	1	0	32.5	4800	14.80
0	1	1	36.0	11000	30.60
1	0	0	35.0	17000	48.50
1	0	1	42.5	23200	54.50
1	1	0	40.8	21800	53.50
1	1	1	50.0	28000	56.60
2	0	0	44.0	34000	77.00
2	0	1	59.0	40200	68.00
2	1	0	46.8	38000	83.00
2	1	1	69.0	45060	65.00

[a](annual cost/daily hrs. saved)

BLOCK NUMBER	*LOC	OPERATION	A,B,C,D,E,F,G
		SIMULATE	
	DCWT	EQU	1,S
	LBWT	EQU	2,S
	XRWT	EQU	3,S
	DNWT	EQU	4,S
	RECC	EQU	5,S
	TRAY	EQU	6,T
	TLAB	EQU	5,T
	TDOC	EQU	3,T
	TDEN	EQU	11,T
	TREC	EQU	20,T
	DOC1	EQU	1,F,Q,C
	DOC2	EQU	2,F,Q,C
	DOC3	EQU	3,F,Q,C
	DOC4	EQU	4,F,Q,C
	DOC5	EQU	5,F,Q,C
	DOC6	EQU	6,F,Q,C
	DOC7	EQU	7,F,Q,C
	DOC8	EQU	8,F,Q,C
	DOC9	EQU	9,F,Q,C
	DOC10	EQU	10,F,Q,C
	LAB	EQU	11,F,Q,C
	XRAY	EQU	12,F,Q,C
	DEN	EQU	13,F,Q,C
	REC1	EQU	16,F,Q,C
	REC2	EQU	17,F,Q,C
	REC3	EQU	18,F,Q,C
	3	TABLE	M1,C,30,120
	5	TABLE	MP7,0,30,100
	6	TABLE	MP8,0,30,150
	11	TABLE	MP3,0,60,90
	20	TABLE	M1,0,15,100
	1	STORAGE	200
	2	STORAGE	200
	3	STORAGE	200
	4	STORAGE	200
	5	STORAGE	200
1		GENERATE	130,40,1,,,,F
2		TEST GE	C1,3600,TTT
3		TERMINATE	0
4		GENERATE	95,30,3601,,,,F
5		TEST GE	C1,7200,TTT
6		TERMINATE	0
7		GENERATE	80,15,7201,,,,F
8		TEST GE	C1,14400,TTT
9		TERMINATE	0
10		GENERATE	95,30,14401,,,,F
11		TEST GE	C1,23400,TTT
12		TERMINATE	0
13		GENERATE	115,40,23401,,,,F
14		TEST GE	C1,27000,TTT
15		TERMINATE	0
16	TTT	SELECTMIN	3,16,18,,FR
17		ENTER	5
18		LINK	P3,FIFO,RECP
19	RECP	SEIZE	P3
20		LEAVE	5
21		TABULATE	20
22		ADVANCE	240,80
23		RELEASE	P3
24		UNLINK	P3,RECP,1
25	STT	TRANSFER	.500,BACK,FRNT
26	FRNT	SELECTMIN	1,1,5,,CH
27		TRANSFER	,KKK
28	BACK	SELECTMIN	1,6,10,,CH
29	KKK	ENTER	1
30		LINK	P1,FIFO,WDOC
31	WDOC	SEIZE	P1
32		LEAVE	1
33		TABULATE	3
34		ADVANCE	840,540
35		RELEASE	P1
36		UNLINK	P1,WDOC,1
37		TRANSFER	.42,BBB,ALAB
38	BBB	TRANSFER	.07,KILL,ARAY
39	ALAB	MARK	7
40		ENTER	2
41		LINK	11,FIFO,NEXT
42	NEXT	SEIZE	11
43		LEAVE	2
44		TABULATE	5
45		ADVANCE	240,60
46		RELEASE	11
47		UNLINK	11,NEXT,1,,,BBB
48		TRANSFER	,BBB
49	ARAY	MARK	8
50		ENTER	3
51		LINK	12,FIFO,NEX
52	NEX	SEIZE	12
53		LEAVE	3
54		TABULATE	6
55		ADVANCE	1020,240
56		RELEASE	12
57		UNLINK	12,NEX,1
58		TRANSFER	,KILL
59		GENERATE	1100,350,1,,,,F
60		TEST GE	C1,K27000,GGG
61		TERMINATE	0
62	GGG	MARK	3
63		ENTER	4
64		LINK	13,FIFO,GOON
65	GOON	SEIZE	13
66		LEAVE	4
67		TABULATE	11
68		ADVANCE	900,420
69		RELEASE	13
70		UNLINK	13,GOON,1
71		TRANSFER	.200,DDD,ARAY
72	DDD	TRANSFER	.300,KILL,ALAB
73		TRANSFER	,KILL
74	KILL	TERMINATE	0
75		GENERATE	27000,,,,,,F
76		ASSIGN	2,K13
77	BAC	GATE NU	P2
78		LOOP	2,BAC
79		ASSIGN	8,K5
80	STOR	GATE SE	P8
81		LOOP	8,STOR
82		ASSIGN	2,K13
83	BAC1	GATE NU	P2
84		LOOP	2,BAC1
85		ASSIGN	2,K11
86	BAC2	GATE NU	P2
87		LOOP	2,BAC2
88		TERMINATE	1
		START	1
		CLEAR	
		RESET	
		START	1