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Fourth Semester M.Tech. Degree Examination, June/July 2016
Modeling, Simulation & Analysis of Manufacturing
Systems

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions.
2. Use of Distribution table is permitted.

- 1 a. Discuss the circumstances under which simulation is the appropriate tool to use. (10 Marks)
 b. What is simulation? Explain Monte Carlo method of simulation with an example. (10 Marks)
- 2 a. A computer technical support centre is staffed by two people Able and Baker, who take calls and try to answer questions and solve computer problem. The time between calls range from 1 to 4 minutes with distribution as shown below.

Inter arrival Distribution of calls for technical supports

Inter Arrival Distribution of Calls	
Inter arrival time	Probability
1	0.25
2	0.40
3	0.20
4	0.15

Able is more experienced and can provide service faster than Baker. The distribution of their service time are as shown below.

Able's Service distribution

Service time (in minutes)	Probability
2	0.30
3	0.28
4	0.25
5	0.17

Baker's Service time distribution

Service time (in minutes)	Probability
3	0.35
4	0.25
5	0.20
6	0.20

When both are idle, Able takes the call. If both are busy the call goes on hold, assume first call arrives at time 0 (zero) perform simulation for 10 callers, use the following sequence of random numbers.

Random digit for arrival	15	22	74	45	60	20	35	90	18
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Random digits for service time	60	40	45	30	85	70	90	55	28	32
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(14 Marks)

(06 Marks)

- b. What is a model? Briefly explain the types of models.
- 3 a. What are the desirable features of simulation software? Briefly explain any two of them. (10 Marks)
 b. List the six classes of techniques for increasing model validity and credibility of a simulation model, and explain the technique-collect high quality information and data on the system. (10 Marks)

(10 Marks)

- 4 a. Generate five random numbers using linear congruential method, given that $x_0 = 27$, $a = 17$, $C = 43$, $M = 100$. (05 Marks)
- b. The sequence of numbers 0.44, 0.81, 0.14, 0.05 and 0.93 has been generated, use Kolmogorov – Smirnov test determine the hypothesis that the numbers are uniformly distributed in the interval $[0, 1]$ can be rejected at 5% level of significance. Given the critical value of $D = 0.565$. (10 Marks)
- c. Give the procedure for the inverse transform technique for the Weibull distribution. (05 Marks)
- 5 a. Buses arrive at bus stop according to a Poisson’s process with a mean of 1 bus per 15 minutes, generate the random variate ‘N’ which represents the number of arriving bus during a 1hour time slot. Given $R_1 = 0.4357$, $R_2 = 0.4146$, $R_3=0.8353$, $R_4 = 0.9952$, $R_5 = 0.8004$, $R_6 = 0.7945$, $R_7 = 0.1530$. (08 Marks)
- b. Explain the inverse transform technique of producing random variates for exponential distribution. And generate exponential variates x_i with mean 1, given random numbers $R_i = 0.1306, 0.0422, 0.6597, 0.7965, 0.7696$. (12 Marks)
- 6 a. Discuss the following variance reduction techniques :
i) Indirect estimation ii) Conditioning (12 Marks)
- b. With the help of an example demonstrate the danger inherent in making decisions based on the output from a single run of each alternative system. (08 Marks)
- 7 a. Explain the various steps used in Time-advanced algorithm. (04 Marks)
- b. Six trucks are used to haul coal from the entrance of small mine to the rail road. Each truck is loaded by one of two loaders. After loading, a truck immediately moves to the scale to be weighed. Both the loaders and the scale have FCFS waiting line for trucks. After being weighed, a truck begins a travel time and then afterwards returns to the loader que. It is assumed that 5 of the trucks are at the loaders and one is at the scale at time θ . The activity times are given in the following table.
- | | | | | | |
|---------------------|----|----|----|----|----|
| Loading time (min) | 10 | 5 | 15 | 5 | 10 |
| Weighing Time (min) | 12 | 16 | 12 | 12 | 12 |
| Travel Time (min) | 40 | 60 | 80 | 80 | 40 |
- Simulate the system for 25 minutes estimate the loader and scale utilization. (16 Marks)
- 8 a. Give reasons why simulation is more widely applied to manufacturing systems. (05 Marks)
- b. List the specific potential benefits from using simulation for manufacturing analysis. (08 Marks)
- c. Explain the concept in Discrete event simulation. (07 Marks)
