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Eighth Semester B.E. Degree Examination, June/July 2016
System Modeling and Simulation

Time: 3 hrs.

Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. With a neat flow chart, explain various steps in a simulation study. **(10 Marks)**
   b. Briefly explain the advantages and disadvantages of simulation. **(10 Marks)**

2 a. A computer technical support center is staffed by two people, Able and Baker, who take calls and try to answer questions and solve computer problems. The time between calls ranges from 1 to 4 minutes with the distribution as shown in Table 1.1. Able is more experienced and can provide service faster than Baker, which means that, when both are idle, Able takes the call. The distribution of their service times are shown in Table 1.2 and Table 1.3 respectively.

Table 1.1: Inter arrival time (IAT) distribution

IAT (mins)	1	2	3	4
Probability	0.25	0.40	0.20	0.15

Table 1.2: Service time distribution of Able

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

Table 1.3: Service time distribution of Baker

Service time (mins)	3	4	5	6
Probability	0.35	0.25	0.20	0.2

Random digits for inter-arrival times are : 26, 98, 90, 26, 42, 74, 80, 68, 22, 48, 34, 45, 24, 34.
Random digits for service time are : 95, 21, 51, 92, 89, 38, 13, 61, 50, 49, 39, 53, 88, 01, 81.
Simulate this system for 10 customers, by finding

  i) Average waiting time for a customer
  ii) Average Inter Arrival time
  iii) Average service time of Able
  iv) Average service time of Baker
  v) Average waiting time of those who wait. **(12 Marks)**

   b. Explain the various concepts used in discrete-event simulation with an example. **(08 Marks)**

3 a. Explain simulation in Java. **(06 Marks)**
   b. A company used 6 trucks to haul manganese from Kolar to industry. There are two loaders, to load each truck. After loading, a truck moves to the weighing scale to be weighed. The queue discipline is FIFO. When it is weighed, a truck travels to the industry and returns to the loader queue. The distribution of loading time, weighing time and travel time are as follows :

Loading Time (mins)	10	5	5	10	15	10	10	15
Weighing Time (mins)	8	12	8	16	12	8		
Travel Time (mins)	30	60	80	40	50	70		

End of simulation is completion of four weighing from the scale. Calculate the total busy time of both loaders, scale, average loader and scale utilization. Assume that four trucks are at the loaders and Two are at the scale, at time "0". The shopping of simulation is after 10 iterations. **(14 Marks)**

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4   a. What is Poisson process? With example explain the properties of Poisson process. **(06 Marks)**
    b. Explain the characteristics of a queuing system. **(08 Marks)**
    c. Explain the various steady state parameters of M/G/1 Queue. **(06 Marks)**

PART – B

5   a. Use linear congruential method to generate a sequence of 5 random numbers, with given seed 27, increment 43, and constant multiplier 17, modulus 100. **(04 Marks)**
    b. The sequence of random numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use K – S test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. Take $D\alpha = 0.565$. **(08 Marks)**
    c. Test whether the 2nd, 9th, 16th …….. Numbers in the following sequence are auto correlated by taking $\alpha = 0.05$. Take $Z_{\alpha/2} = 1.96$.
       0.38, 0.48, 0.36, 0.01, 0.54, 0.34, 0.96, 0.06, 0.61, 0.85, 0.48, 0.86, 0.14, 0.86, 0.89, 0.37, 0.49, 0.60, 0.04, 0.83, 0.42, 0.83, 0.37, 0.21, 0.90, 0.89, 0.91, 0.79, 0.77, 0.99, 0.95, 0.27, 0.41, 0.81, 0.96, 0.31, 0.09, 0.06, 0.23, 0.77, 0.73, 0.47, 0.13, 0.55, 0.11, 0.75, 0.36, 0.25, 0.23, 0.72, 0.60, 0.84, 0.70, 0.30, 0.26, 0.38, 0.05, 0.19, 0.73, 0.44. **(08 Marks)**

6   a. Explain acceptance – rejection technique for Poisson distribution. Generate 5 Poisson variates with mean $\alpha = 0.25$. Random numbers are: 0.073, 0.693, 0.945, 0.739, 0.014, 0.342. **(10 Marks)**
    b. Test whether the following data follows Poisson distribution using the chi-square test of goodness of fit. With mean $\alpha = 0.05$. Take $\lambda^2_{0.05,5} = 11.1$ **(10 Marks)**

Arrivals /period	0	1	2	3	4	5	6	7	8	9	10	11
Frequency	12	10	19	17	10	8	7	5	5	3	3	1

7   a. Explain the replication method for steady – state simulations. **(10 Marks)**
    b. Differentiate between point estimation and interval estimation. **(05 Marks)**
    c. Differentiate between terminating and steady state simulations by giving one example each. **(05 Marks)**

8   a. Explain components of verification and validation process. Explain with neat diagram, model building, verification and validation process. **(12 Marks)**
    b. With neat diagram, explain the iterative process of calibrating a model. **(08 Marks)**

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