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Eighth Semester B.E. Degree Examination, July/August 2022
System Modeling and Simulation

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART – A

- 1 a. What is Simulation? Write the advantages and disadvantages of Simulation. (10 Marks)
- b. With a neat flowchart, explain the steps involved in Simulation study. (10 Marks)
- 2 a. Describe a queuing system with respect to arrival and Service mechanisms, System capacity Queue discipline , flow diagrams of arrival and service events. (08 Marks)
- b. A small grocery shop has one checkout counter. Customer arrive at this checkout counter at random from 1 to 10 minutes apart. Each possible value of inter – arrival time has the same probability of occurrence , equal to 0.10. Service times vary from 1 to 6 minutes with probability shown in Table Q2(b).

Service Time Distribution Table Q2(b).

Service Time	1	2	3	4	5	6
Probability	0.05	0.10	0.20	0.30	0.25	0.10

Develop Simulation table for 10 customers. Find i) Average waiting time
 ii) Average service time iii) Average time customer spends in the system.

Take the random digits for arrivals as 91, 72, 15, 94, 30, 92, 75, 23, 30 and for service times are 84, 10, 74, 53, 17, 79, 91, 67, 89, 38 sequentially. (12 Marks)

- 3 a. Explain Event scheduling algorithm by generating system snapshots at clock – t and clock = t₁. (06 Marks)
- b. Six trucks are used to haul coal from the entrance of a 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 afterward returns to the loader queue. It is assumed that 5 of the trucks are at the loaders and one is at the scale at time 0. The activity times are given in the following table : Table Q3(b).

Loading time (min)	10	5	15	5	10
Weighing time (min)	12	16	12	12	12
Travel time (min)	40	60	80	60	40

Simulate the system for 25 minutes. Estimate the loader and scale utilization. (14 Marks)

- 4 a. What is Poisson Process? With an example, explain the properties of Poisson process. (06 Marks)
- b. Explain the characteristics of a Queuing system. (08 Marks)
- c. Briefly explain the various steady state parameters of M/G/U Queue. (06 Marks)

PART – B

- 5 a. What are Pseudo Random Numbers? What are the problems that occur while generating Pseudo Random numbers? (06 Marks)
- b. The sequence of random numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use the Kolmogorov – Sminrov test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. (08 Marks)

- c. Suggest a step by step procedure to generate random variates using the inverse transform technique for exponential distribution. (06 Marks)
- 6 a. What is Acceptance – Rejection Technique? Generate 3 Poisson variates with mean $\alpha = 0.2$. Use the following random numbers 0.4357 , 0.4146 , 0.8353 , 0.9952 , 0.8004. (08 Marks)
- b. Explain the steps involved in the development of a useful model for a given set of input data. (06 Marks)
- c. What is Histogram? Explain how a histogram is constructed. (06 Marks)
- 7 a. Briefly explain the measure of performance of a Simulation System. (10 Marks)
- b. Explain Terminating State Simulation and Steady State Simulation. (10 Marks)
- 8 a. Explain with a neat diagram, Model building , Verification and Validation process. (10 Marks)
- b. Describe the three steps approach to Validation by Naylor and Finger. (10 Marks)
