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Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024

System Modeling and Simulation

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1 a. What is simulation? Explain when simulation is the appropriate and not appropriate tool. (08 Marks)
- b. With a neat flow diagram, explain the steps in a simulation study. (12 Marks)
- 2 a. Explain the various concepts in discrete-event simulation. (08 Marks)
- b. A grocery store has one checkout counter. Customers arrive at this checkout counter at random from 1 to 8 minutes apart and each interval time has the same probability of occurrence. The service times vary from 1 to 6 minutes with probability given below:

Service (minutes)	1	2	3	4	5	6
Probability	0.10	0.20	0.30	0.25	0.10	0.05

Simulate the arrival of 6 customers and calculate the following:

- Average waiting time for a customer.
- Probability that a customer has to wait.
- Probability of a server being idle.
- Average service time, and
- Average time between arrival.

Use the following sequence of random numbers:

Random digits for arrival	913	727	015	948	309	922
Random digits for service time	84	10	74	53	17	79

Assume that the first customer arrives at time 0. Depict the simulation in tabular form.

- 3 a. Explain useful statistical models in case of limited data. (05 Marks)
- b. Explain Event Scheduling/Time Advance algorithm. (05 Marks)
- c. Six dump trucks are used to carry manganese ore from Ballari to JSW industry. Each dump truck is loaded by one of two loaders. After loading, a dump 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 dump truck begins a travel time and then afterward returns to the loader queue. It is assumed that 5 of the trucks are at the loader and one is at the scale at time 0. The activity times are given in the following table:

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

Simulate the system for 20 minutes, estimate the loader and scale utilization. (10 Marks)

- 4 a. Explain the characteristics of queuing system. Also explain the queuing notation in general. (10 Marks)
- b. Explain the steady state parameters of M/G/1. (06 Marks)
- c. What is network queue? Mention the general assumption for a stable system with infinite calling population and no limit on system capacity. (04 Marks)

PART – B

- 5 a. What are pseudo random numbers? What are the problems that occur while generating pseudo random numbers? (06 Marks)
- b. Explain linear congruential method for generating random numbers. (06 Marks)
- c. What is acceptance-rejection technique? Generate 3 Poisson variates with mean Alpha (α) = 0.2. Use the following random numbers 0.4357, 0.4146, 0.8353, 0.9952, 0.8004. (08 Marks)
- 6 a. Explain different steps in the development of a useful model of input data. (08 Marks)
- b. Discuss the ways to obtain information about a process if data are not available. (04 Marks)
- c. What is Chi-Square goodness test? Apply it to Poisson assumption with alpha (α) = 3.64. Data size = 100. Observed frequency 12, 10, 19, 17, 10, 8, 7, 5, 5, 3, 3, 1. Take level of significance = 0.05. (08 Marks)
- 7 a. Explain replication method for steady-state simulation. (08 Marks)
- b. Explain output analysis for terminating simulation. (06 Marks)
- c. Differentiate between point estimation and interval estimation. (06 Marks)
- 8 a. Explain with a neat diagram, model building, verification and validation process. (10 Marks)
- b. Explain calibration and validation of simulation models. (10 Marks)

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