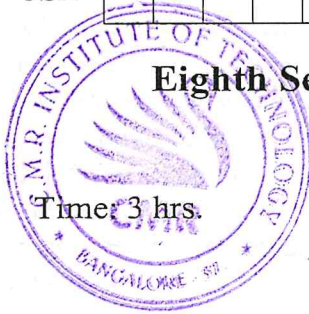


USN

10CS82



Eighth Semester B.E. Degree Examination, July/August 2021
System Modeling and Simulation

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. What is Simulation? List any four circumstances when the simulation is appropriate tool and when it is not. (10 Marks)
- b. Suppose the maximum inventory level M is 11 units and the review period N is 5 days. Estimate by simulation, the average ending units in inventory and number of days when a shortage condition occurs. Initial simulation started with inventory level of 3 units and an order of 8 units scheduled to arrive in two days of time. Simulate for 3 cycles (15 days). The probability of daily demand and lead time is given in table: (10 Marks)

| | | | | | |
|--------------|------|------|------|------|------|
| Daily demand | 0 | 1 | 2 | 3 | 4 |
| Probability | 0.10 | 0.25 | 0.35 | 0.20 | 0.10 |

| | | | |
|------------------|-----|-----|-----|
| Lead time (days) | 1 | 2 | 3 |
| Probability | 0.5 | 0.3 | 0.2 |

| | | | | | | | | | | | | | | | |
|----------------------------|----|----|----|----|---|----|----|----|----|---|----|----|----|----|----|
| Random digit for demand | 24 | 35 | 65 | 25 | 8 | 85 | 77 | 68 | 28 | 5 | 92 | 55 | 49 | 69 | 70 |
| Random digit for lead time | 5 | 0 | 3 | | | | | | | | | | | | |

- 2 a. Explain the major concepts of discrete event simulation with an example. (10 Marks)
- b. Prepare a simulation table for a single channel queuing system using event scheduling/time advance algorithm, until the clock reaches 21, using the Inter-Arrival Time (IAT) and Service Time (ST) given below in the order shown.

| | | | | | | |
|------|---|---|---|---|---|---|
| IAT | 8 | 6 | 1 | 8 | 3 | 8 |
| S.T. | 4 | 1 | 4 | 3 | 2 | 4 |

- Compute: i) Total busy time of server ii) Maximum queue length. (07 Marks)
- c. Explain three phases of activity scanning approach. (03 Marks)
- 3 a. Explain: i) Binomial distribution ii) Exponential distribution. (08 Marks)
- b. A bus arrives every 20 minutes at a specified stop beginning at 6:40 A.M., and continuing until 8:40A.M. A certain passenger does not know the schedule, but arrives randomly (uniformly distributed) between 7.00A.M. and 7:30A.M. every morning. What is the probability that the passenger waits more than 5 minutes for a bus? (06 Marks)
- c. Briefly explain the properties of Poisson process with example. (06 Marks)
- 4 a. Explain the characteristics of queuing system. List the different queuing notations for parallel server systems. (12 Marks)
- b. What is network of queue? Mention the general assumption for a stable system with infinite calling population. (08 Marks)

- 5 a. What are pseudo random numbers? Use linear congruential method to generate a sequence of 5 two digit random numbers with given seed 45, constant multiplier 21, increment 49 and modulus 40. (06 Marks)
- b. The sequence of random numbers 0.44, 0.81, 0.14, 0.05 and 0.93 has been generated. Use Kolomogorov – Simrnov test with 5% significance level, to determine if the hypothesis that the numbers are uniformly distributed on the interval (0, 1) can be rejected. [N = 5, $D_{0.05,5} = 0.565$] (06 Marks)
- c. Explain inverse transform technique of producing random variates for i) Exponential distribution ii) Triangular distribution. (08 Marks)

- 6 a. Records pertaining to the monthly number of job related injuries at an underground coal mine were being studied by a federal agency. The values for the past 100 months were as follows:

| | | | | | | | |
|-------------------------|----|----|----|---|---|---|---|
| Injuries per month | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Frequency of occurrence | 35 | 40 | 13 | 6 | 4 | 1 | 1 |

Apply chi-square goodness of fit test to these data to test the hypothesis that the underlying distribution is Poisson. Use the level of significance $\alpha = 0.05$, Take $\chi_{0.05,2}^2 = 5.99$. (08 Marks)

- b. Explain data collection in input modeling. (06 Marks)
- c. List the different families of probability distribution used with specific physical process in order to select for simulation. (06 Marks)
- 7 a. What is output analysis? Explain terminating and steady state simulation with example. (10 Marks)
- b. Briefly explain point estimation and confidence-interval estimation with example. (10 Marks)
- 8 a. What is verification? Explain the suggestions given for use in verification process. (10 Marks)
- b. Describe the three step approach to validation by Naylor and Finger. (10 Marks)

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