



Eighth Semester B.E. Degree Examination, June/July 2024
System Modeling and Simulation

Time: 3 hrs

Max. Marks:100

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

PART – A

- 1 a. What is simulation? List and explain the steps in simulation study. (10 Marks)
 b. Define the following :
 (i) System (ii) Entity (iii) Activity (iv) Endogenous event (v) Exogenous event
 (vi) State. Identify them for any one system. (10 Marks)

- 2 a. Explain the major concepts in discrete event simulation? Write flowcharts for arrival and departure events. (10 Marks)
 b. Six dump trucks are used to have coal from the entrance of a mine to a rail road. Each truck is loaded by one of the two loaders. After loading, a truck immediately moves to the scale to be weighed as soon as possible. Both the loaders and scale have first come first serve weighting line for trucks. Travel time from loaders to scale is considered negligible. After being weighed, a truck begins travel time (during which time truck unloads) and then afterwards returns to loader queue. The activities of loading weighing and travel time are given in the table.

Loading time	10	5	5	10	15	10	10
Weighing time	12	12	12	16	12	16	
Travel time	60	100	40	40	80		

End of simulation is completion of two weighings from the scale. Depict simulation table and estimate the loader and scale utilizations. Assume that five of the trucks are at the loaders and one is at scale at the time 0. (10 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. List and explain characteristics of queuing system. Briefly explain queuing notations. (14 Marks)
 b. Explain the steady-state behavior of $M | G | 1$ queue. (06 Marks)

PART – B

- 5 a. Explain linear congruential method. Write three ways of achieving maximal period. (05 Marks)
 b. The sequence of random number 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use Kolmogorov – Smirnov 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 $D_\alpha = 0.565$. (05 Marks)
 c. What is acceptance rejection technique? Generate three Poisson variates with mean $\alpha = 0.2$. The random numbers are 0.4357, 0.4146, 0.8353, 0.9952, 0.8004, 0.7945, 0.1530. (10 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. Discuss output analysis for steady state simulation in detail. (10 Marks)
- b. Discuss output analysis for terminating simulation in detail. (10 Marks)
- 8 a. Explain the 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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