CBCS SCHEME

18CS645

Sixth Semester B.E. Degree Examination, June/July 2025
System Modeling and Simulation

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What is Simulation? Explain with flow chart, the steps involved in Simulation study.
                                                                          (10 Marks)
   b. A grocery store has only one checkout counter. Customer arrives at thin checkout counter at random times from 1 to 8 minutes apart. The service times vary from 1 to 6 minutes with probability 0.10, 0.20, 0.30, 0.25, 0.10, 0.05. Develop a simulation table for six customers and find the following :
   i) Average waiting time of customer
   ii) Average service time
   iii) Average time between arrivals
   iv) The probability that server being idle.

Random Digit Arrival	64	112	678	289	871	
Random Digit Service	84	18	87	81	06	91

                                                                          (10 Marks)

OR

2 a. Define a System. List and explain the components of a system with an example. (06 Marks)
   b. Define a model. List and explain the different types of Model.   (04 Marks)
   c. 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 weighted as soon as possible. Both the loaders to scale have first come first serve weighing time for trucks. Travel from loaders to scale in considered negligible. After being weighed, a truck begins travel time and then afterwards returns to loader queue. The activities of loading, weighing and travel time are given in the below 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 weighing from the scale. Depict simulation table and estimate the loader and scale utilization.   (10 Marks)

Module-2

3 a. Explain the Discrete and continuous random variables?   (08 Marks)
   b. Explain the following continuous distributions:
   i) Uniform distribution
   ii) Exponential distribution
   iii) Gamma Distribution
   iv) Triangular distribution   (12 Marks)

OR

4 a. Explain the characteristics of Quening System. List different quening notations? **(12 Marks)**

b. Explain the steady state parameters of M/G/1 queue. **(08 Marks)**

Module-3

5 a. Explain the properties of Random numbers **(04 Marks)**

b. Use the linear congruential method to generate a sequence of random numbers with $X_0 = 27$, $a = 17$, $c = 43$ and $m = 100$. And write the three ways to find the maximal period. **(10 Marks)**

c. The sequence of random numbers 0.44, 0.81, 0.14, 0.05, 0.93 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 $D_\alpha = 0.565$. **(06 Marks)**

OR

6 a. Explain the procedure to generate random variater using inverse transform technique for exponential distribution. **(08 Marks)**

b. 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 and 0.1530. **(12 Marks)**

Module-4

7 a. List and explain the steps involved in development of a useful model of input data? **(06 Marks)**

b. What is the use of histogram? List the steps to construct the histogram? Construct the histogram for the following data:

Arrivals per 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

(10 Marks)

c. Write the parameters and suggested Estimators for the following distributions.
i) Poisson
ii) Exponential
iii) Gamma
iv) Normal **(04 Marks)**

OR

8 a. Explain the types of simulation with respect to output analysis. Give examples. **(08 Marks)**

b. Apply chi-square goodness of fit test for poisson distribution with $\alpha = 3.64$, data size = 100 and observed frequency $O_i = 12, 10, 19, 17, 10, 8, 7, 5, 5, 3, 3, 1$
$[\chi^2_{0.05,5} = 11.1]$ **(12 Marks)**

Module-5

9 a. Discuss output analysis for steady state simulation in detail. **(08 Marks)**

b. Explain the concepts of point estimation and interval estimation. **(12 Marks)**

OR

10 a. With a neat diagram, explain a model building verification and validation. **(10 Marks)**

b. Describe the three steps approach formulated by Naylor and Finger in the validation process. **(10 Marks)**

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