CBCS SCHEME

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15CS834

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is Simulation? When is simulation an appropriate tool? **(08 Marks)**

b. A grocery store has one checkout counter. Customer arrive at the checkout counter at random from 1 to 8 minutes apart and each inter-arrival time has the same probability of occurance. The service times vary from 1 to 6 minutes. With probability given below :

Service (min)	1	2	3	4	5	6
Probability	0.01	0.20	0.30	0.25	0.10	0.05

Simulate the arrival of 6 customers and calculate

- Average waiting time of customer.
- Probability that a customer has to wait.
- Average service time.

Use the following sequence of random numbers.

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

Assume that the first customer arrives at time 0. Depict the simulation in a tabular form. **(08 Marks)**

OR

2 a. Explain event scheduling algorithm by generating system snapshots at clock = t and clock = t_1. **(08 Marks)**

b. Consider a single server queuing system with inter arrival and service time details as shown below :

IAT	1	1	6	3	7	5	2	4	1
ST	4	2	5	4	1	5	4	1	4

Stop simulation when simulation clock reaches 23. Find the Busy time of the server and maximum queue length. **(08 Marks)**

Module-2

3 a. Explain Binomial and Poisson distribution and give probability mass function, mean and variance. **(08 Marks)**

b. Explain the following continuous distributions:
(i) Uniform distribution
(ii) Exponential distribution **(08 Marks)**

OR

4 a. Explain the characteristics of queuing system. **(08 Marks)**

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

Module-3

5 a. What are the pseudo random numbers? What are the problems that occur while generating pseudo random numbers? **(08 Marks)**

b. What are the techniques for generating random numbers. Consider the following sequence of 5 numbers 0.44, 0.81, 0.14, 0.05, 0.93 are generated. Use Kolmogorov-Smirnov test with $\alpha = 0.05$ to test the uniformity property of random number generated. Take $D_\alpha = 0.565$. **(08 Marks)**

OR

6 a. Suggest a step by step procedure to generate random variates using inverse-transform technique for exponential distribution. **(08 Marks)**

b. What is acceptance and rejection techniques? Explain generation of Poisson variates. 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 **(08 Marks)**

Module-4

7 a. Explain the steps involved in the development of useful model of input data. **(04 Marks)**

b. Explain Quantile-Quantile plot. **(04 Marks)**

c. Test whether the following data follows Poisson distribution using Chi-Square test of goodness of fit. With mean $\alpha = 0.05$. Take $\lambda^2_{0.05,5} = 11.1$

Arrival/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

(08 Marks)

OR

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

b. Explain the different ways of selecting input models when data is not available. **(04 Marks)**

c. Explain the types of simulation with respect to output analysis. **(04 Marks)**

Module-5

9 a. Briefly explain the measures of performance of a simulation systems. **(08 Marks)**

b. Discuss output analysis for terminating simulation in details. **(08 Marks)**

OR

10 a. Explain with a neat diagram, model building verification and validation process. **(08 Marks)**

b. Describe the 3 steps approach to validation by Naylor and Finger. **(08 Marks)**

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