CBCS SCHEME

Sahyadri College of Engineering & Management
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15CS834

Eighth Semester B.E. Degree Examination, Aug./Sept.2020
System Modeling and Simulation

Time: 3 hrs. Max. Marks: 80

Note: i) For Regular Students: Answer any FIVE full questions irrespective of modules.
ii) For Arrear Students : Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What is simulation? Explain with flowchart, the steps involved in simulation study. **(08 Marks)**

b. A grocery store has only one checkout counter. Customer arrives at this checkout counter at random from 1 to 5 minutes apart with equal probability. The service time varies from 1 to 6 minutes with probability 0.30, 0.25, 0.05, 0.10, 0.10 and 0.20. Develop a simulation table for 10 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.
Use the following set of random numbers for arrivals 84, 10, 74, 53, 17, 79, 03, 87, 27. Random digit for service time 23, 35, 65, 81, 54, 03, 87, 27, 73, 70. **(08 Marks)**

2 a. Explain the major concepts in discrete event simulation. Write the flowchart for arrival and departure events. **(08 Marks)**

b. Six dump trucks are used to have coal form 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 and scale have first come first serve weighing time for trucks. Travel 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 weighing from the scale. Depict simulation table and estimate the loader and scale utilizations. **(08 Marks)**

Module-2

3 a. Explain the characteristics of queueing systems. List different queuing notations. **(08 Marks)**

b. Define discrete and continuous random variable. Explain the binomial and Poisson distribution. **(08 Marks)**

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

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

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Module-3

5 a. What is the role of maximum density and maximum period in generating random numbers? With given seed 45, constant multiplier 21, increment 49 and modulus 40, generate a sequence of fire random numbers. **(08 Marks)**

b. The sequence of numbers 0.54, 0.73, 0.98, 0.11, 0.08 has been generated. Use Kolmogorov Simirnov test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. Compare F(X) and $S_N(X)$ on a graph. $D_{0.05} = 0.565$. **(08 Marks)**

OR

6 a. Explain the inverse transformation technique for exponential distribution. Show the corresponding graphical interpretation. Explain the acceptance rejection technique. **(08 Marks)**

b. Use the Chi-Square test with $\alpha = 0.05$ to test for whether the data shown are uniformly distributed. The test uses n = 10 intervals of equal length. $\chi^2_{0.05,9} = 16.9$.

0.41	0.52	0.73	0.99	0.02	0.47	0.30	0.17	0.82	0.56
0.05	0.45	0.31	0.78	0.05	0.79	0.71	0.23	0.19	0.82
0.93	0.65	0.37	0.39	0.42	0.99	0.90	0.25	0.89	0.87
0.44	0.12	0.21	0.46	0.67	0.83	0.76	0.79	0.64	0.70
0.81	0.94	0.74	0.22	0.74	0.96	0.99	0.77	0.67	0.56

(08 Marks)

Module-4

7 a. List the steps involved in development of a useful model of input data and explain. **(08 Marks)**

b. Explain how the method of histograms can be used to identify the shape of a distribution. With an example, also mention drawbacks of histogram and advantages of Q-Q plot. **(08 Marks)**

OR

8 a. Customers arriving at a busy bank counter in a 5 minutes period between 10 to 2 pm was recorded for days given below:

Arrival/period	0	1	2	3	4	5	6	7	8	9	10
Frequency	15	12	10	10	8	7	5	4	3	2	4

Use Chi-Square test to check whether the data follows Poisson distribution at 5% level of significance. $\chi^2_{0.05,4} = 9.49$. **(08 Marks)**

b. The time required for 30 different employs to compute and record the number of hours worked during week days given:

1.88	2.62	1.49	0.35	0.82	2.03	1.54	0.21	0.39	2.03	2.16	0.90	1.90
0.63	0.17	0.03	0.45	0.31	0.15	2.03	4.29	0.04	1.73	0.92	2.81	0.05
5.5	2.16	0.48	0.18									

Use the Chi-Square to test the hypothesis that these service times are exponentially distributed at 5% of level of significance. Let the number of intervals be K = 6 and critical value 9.49. **(08 Marks)**

Module-5

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

b. Explain the concepts of point estimation and interval estimation. **(08 Marks)**

OR

10 a. Explain in detail about the model building, verifying and validation in the model building process through a diagram. **(08 Marks)**

b. Explain 3-steps approach to validation of simulation models by Naylor and Finger. **(08 Marks)**

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