CBCS SCHEME

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17CS834

Eighth Semester B.E. Degree Examination, Feb./Mar. 2022
System Modelling 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. Define simulation. With a neat flow diagram, explain different steps involved in simulation steady. **(10 Marks)**

b. A grocery shop 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 simulation table for 10 customers and find the following:

(i) Average waiting time of the customer
(ii) Average service time
(iii) Average time between arrivals
(iv) The probability of server being idle.

Random numbers for arrival : 84, 10, 74, 53, 17, 79, 03, 87, 27
Random numbers for service time : 23, 35, 65, 81, 54, 03, 87, 27, 73, 70 **(10 Marks)**

OR

2 a. Briefly explain any four concepts used in discrete event simulation. **(04 Marks)**

b. Generating system snapshot at clock = t and clock = t_1, explain event scheduling algorithm. **(06 Marks)**

c. Six dump trucks are used to haul coal from 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 loader and scale have first-come-first-serve weighing time for trucks. Travel time from loader to scale is considered negligible. After being weighed, truck begins travel time (during which time truck unloads) and then afterwards return to the loader queue. Assume that the first truck directly go to the scale. 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 the 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 characteristics of queuing system. List different queuing notations. **(10 Marks)**

b. Explain uniform and exponential distributions. **(10 Marks)**

OR

4 a. Explain binomial and Poisson distribution. **(10 Marks)**

b. The lifetime of a device used to inspect cracks in aircraft wings given by X, a continuous random variable, assuming all values in the range $x \geq 0$. The pdf of device lifetime in year is given by $f(x) = \begin{cases} \frac{1}{2}e^{-x/2} & x \geq 0 \\ 0 & \text{otherwise} \end{cases}$. What is the probability that life time of the device between 2 to 3 years? **(04 Marks)**

c. Define discrete and continuous random variable. **(06 Marks)**

Module-3

5 a. Write 3 ways of achieving maximal period. With given seed 45, constant multiplier 21, increment 49 and modulus 40 generate sequence of 5 random numbers. **(10 Marks)**

b. Write the steps followed in Kolmogorov-Smirnov frequency test. 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 $D_\alpha = 0.565$. **(10 Marks)**

OR

6 a. What is Acceptance-Rejection technique? Generate 3 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)**

b. What are the properties of random numbers? Briefly discuss. **(06 Marks)**

c. What are pseudo-random numbers? What are problems that occur while generating pseudo-random numbers? **(06 Marks)**

Module-4

7 a. Briefly explain different steps in the development of useful model of input data. **(10 Marks)**

b. The number of vehicles arriving at the north-west corner of intersection in a 5 minutes period between 7.00 am to 7.05 am was monitored for 5 weekdays over a 20 week period. The resulting data are as follows:

Arrivals:	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

Apply Chi-Square goodness-of-fit test to these data to test the hypothesis that the distribution is Poisson with mean = 3.64, $\alpha = 0.05$ and $\chi^2_{0.05,5} = 11.1$. **(10 Marks)**

OR

8 a. Explain how the method of histograms can be used to identify the shape of a distribution. **(10 Marks)**

b. Explain the types of simulation with respect to output analysis. **(10 Marks)**

Module-5

9 a. Explain any two output analysis for steady state simulation. **(10 Marks)**

b. Explain the iterative process of calibrating a model with neat diagrams. **(10 Marks)**

OR

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

b. Discuss three steps approach formulated by Nylor and Finger. **(10 Marks)**

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