CBCS SCHEME

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15CS834

Eighth Semester B.E. Degree Examination, Dec.2019/Jan.2020
System Modelling 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. With a neat diagram, explain the steps in simulation study. **(08 Marks)**

b. A small grocery shop has one checkout counter. Customers arrive at this checkout counter at random from 1 to 10 minutes apart. Each possible value of inter-arrival time has the same probability of occurrence equal to 0.10. Service times vary from 1 to 6 minutes with probability shown below:

Service time	1	2	3	4	5	6
Probability	0.05	0.10	0.20	0.30	0.25	0.10

Develop simulation table for 10 customers. Find: (i) Average waiting time (ii) Average service time (iii) Average time customer spends in system. Take the random digits for arrivals as 91, 72, 15, 94, 30, 92, 75, 23, 30 and for service times are 84, 10, 74, 53, 17, 79, 91, 67, 89, 38 sequentially. **(08 Marks)**

OR

2 a. A company uses 6 trucks to haul manganese from the entrance of a mine to a railroad. Each truck is loaded by one of two loaders. After loading, a truck moves to the weighting scale to be weighted. Both loaders and scale have first-come first served queue. After being weighted a truck begins a travel time afterward returns to loader queue. The activity of loading, weighing and travel time are given in the following 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	-	-

Calculate the total busy time of both loaders, the scale, average loader and scale utilization. Assume 5 trucks are at the loader and one is at the scale, at time '0'. Stopping event time TE = 24 min. **(08 Marks)**

b. Explain the terms used in discrete event simulation with an example:
i) Event ii) Event notice iii) FEL iv) Delay
v) Clock vi) System state vii) Activity viii) System **(08 Marks)**

Module-2

3 a. Discuss different types of discrete distribution. **(10 Marks)**

b. Explain the different characteristics of queuing systems. **(06 Marks)**

OR

4 a. Explain the different types of continuous distribution. **(10 Marks)**

b. Explain Kendall's notation for parallel server queuing system A|B|C|N|K and also interpret meaning of M|M|2|∞|∞. **(06 Marks)**

Module-3

5 a. 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. **(06 Marks)**

b. Explain linear congruential method. Write three ways of achieving maximal period. **(05 Marks)**

c. The sequence of random numbers 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 $D_{\alpha_N} = 0.565$. **(05 Marks)**

OR

6 a. What is inverse transform technique? Generate five exponential random variates with $\lambda = 1$ and random numbers 0.1306, 0.0422, 0.6597, 0.7965, 0.7696. **(06 Marks)**

b. Explain the properties of random numbers and pseudo-random numbers. **(05 Marks)**

c. Use the Chi-square test with $\alpha = 0.05$ to test whether the data shown below are uniformly distributed or not. [Note: $\chi^2_{2,n-1} = 16.9$].

0.594	0.351	0.422	0.127	0.182
0.928	0.262	0.797	0.788	0.929
0.515	0.097	0.798	0.825	0.852
0.507	0.474	0.227	0.07	0.05

(05 Marks)

Module-4

7 a. Explain different steps in the development of useful model of input data with example. **(08 Marks)**

b. Explain Chi-Square goodness of fit test. Apply it to Poisson assumption with parameter $\alpha = 3.64$, the number of vehicles arriving at a junction in a five minute period was observed for 100 days. The resulting data is as follows:

No. of 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

Determine whether the assumption that arrivals follows Poisson distribution can be accepted at 0.05 level of significance, given $\chi^2_{0.05,5} = 11.1$ **(08 Marks)**

OR

8 a. Explain the type of simulation with respect to output analysis, give an example. **(08 Marks)**

b. Briefly explain the confidence-interval estimation method. **(08 Marks)**

Module-5

9 a. Explain three step approach for validation process as formulated by Nayler and Finger. **(08 Marks)**

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

OR

10 a. Explain output analysis for termination simulation. **(08 Marks)**

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

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