

CBCS SCHEME

15CS834

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Eighth Semester B.E. Degree Examination, June/July 2023

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. What are the advantages and disadvantages of simulating a system? (08 Marks)
b. Explain the steps in a simulation study with the flow chart. (08 Marks)

OR

- 2 a. Name the entities, attributes, activities, events and state variables for the system shown below:
(i) Library
(ii) Bank
(iii) Airport
(iv) Grocery store (06 Marks)
- b. Six dump trucks are used to haul coal from entrance of a small mine to the rail road. Each truck is loaded by one of the two loaders. After loading truck immediately moves to the scale to be weighed as soon as possible. Both loaders and scale have FCFS for trucks. Travel time from loader to scale is negligible. After being weighed, a truck begins a travel time and then returns to loader queue. Simulate for clock = 20. Find average loader utilization and average scale utilization. The activity times are given in the following table:

Loading Time:	10	5	5	10	15	10	10
Weighing Time:	12	12	12	16	12	16	
Travelling Time:	60	100	40	40	80		

(10 Marks)

Module-2

- 3 a. Find mean and variance of the die tossing experiment. Assume the die is loaded so that the probability that given face land up in proportional to the number of spots showing. (08 Marks)
b. The time to failure of a light bulb is weibull distributed with $v = 1.8 \times 10^3$ hours, $\beta = \frac{1}{2}$ and $\alpha = \frac{1}{3} \times 10^3$ hours.
(i) What fraction of bulbs are expected to last longer than mean lifetime?
(ii) What is the median lifetime of a light bulb? (08 Marks)

OR

- 4 a. Explain the characteristics of queuing system. Also explain the queuing notation in general. (08 Marks)
b. Explain the steady state parameters of M/G/I queue. (08 Marks)

Module-3

- 5 a. Explain generation of pseudo random numbers with examples. Mention the important considerations in selecting a method for generating random numbers. (08 Marks)

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.

- b. Use Chi-Square test with $\alpha = 0.05$ to test whether data shown below is uniformly distributed or not. Assume critical value $\chi_{0.05,9}^2 = 16.9$.

0.34	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	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	0.17	0.99	0.46	0.05	0.66	0.10	0.42	0.18	0.49
0.37	0.51	0.54	0.01	0.81	0.28	0.69	0.34	0.75	0.49
0.72	0.43	0.56	0.97	0.30	0.94	0.96	0.58	0.73	0.05
0.06	0.39	0.84	0.24	0.40	0.64	0.40	0.19	0.79	0.62
0.18	0.26	0.97	0.88	0.64	0.47	0.60	0.11	0.29	0.78

(08 Marks)

OR

- 6 a. Generate four digit random numbers using multiplicative congruential method with $X_0 = 117$, $a = 43$, $m = 1000$. (04 Marks)
- b. The sequence of numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use Kolmogorov-Smimov test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval $[0, 1]$ can be rejected. [$D_\alpha = 0.565$] (06 Marks)
- c. Suggest a step by step procedure to generate random variates using inverse transform technique for exponential distribution. (06 Marks)

Module-4

- 7 a. Explain four methods of selecting input models without data. (04 Marks)
- b. The number of vehicles arriving at a junction in a five minute period is observed for 100 days. The resulting data is as follows:

Number 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

It is presumed that the arrivals follows a Poisson distribution with parameters $\alpha = 3.64$. Using Chi-Square test, determine whether the assumptions that arrivals follow Poisson distribution can be accepted at a 0.05 level of significance. (06 Marks)

- c. Explain types of time series input models. (06 Marks)

OR

- 8 a. Explain types of simulations with respect to output analysis with suitable examples. (08 Marks)
- b. Explain output analysis for steady state simulations. (08 Marks)

Module-5

- 9 a. With a neat flow diagram, explain the concept of model building, verification and validation of simulation models. (08 Marks)
- b. Describe the three step approach of Naylor and finger in the validation process. (08 Marks)

OR

- 10 a. Explain the calibration and validation of models. (08 Marks)
- b. Explain the suggestions given for use in verification process. (08 Marks)
