



CBCS SCHEME

18CS645

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024 System Modeling 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. Explain with a flowchart the steps involved in simulation study. (10 Marks)
b. A grocery store has one check out counter. Customers arrive at this checkout counter at random 1 to 8 minutes apart and each inter arrival time has the same probability of occurrence. The service time may vary from 1 to 6 minutes with probabilities given below:

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

Simulate the arrival of 6 customers using the following sequence of random numbers.

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

- Estimate : (i) Average waiting time of customer
(ii) Average service time
(iii) Probability of idle server.

(10 Marks)

OR

- 2 a. Explain the various components of discrete event simulation. Write the flowcharts for arrival and departure events. (10 Marks)
b. 6 dump trucks are used to haul coal from the entrance of a small mine to rail road. Each track is loaded by one of 2 loaders. After loading, the truck immediately moves to the scale to be weighed as soon as possible. Both the loaders and the scale have a FCFS waiting line for trucks. Travel time from a loader to the scale is considered negligible. After being weighed, a truck begins travel and then afterward returns to the loader queue. The distribution of loading time, weighing time and travel time are given below. Estimate the loader and scale utilization. Assume 5 trucks are at the loader and one is at the scale, at time '0' stopping time $T_E = 64$ min.

Loading time	10	5	5	10	15	10	10
Weigh time	12	12	12	16	12	16	
Travel time	60	100	40	40	80		

Depict simulation table and estimate the loader and scale utilization.

(10 Marks)

Module-2

- 3 a. Define discrete and continuous random variable. Explain continuous distribution types. (10 Marks)
b. A production process manufactures computer chips on the average at 20% non conforming. Every day, a random sample of size 50 is taken from the process. If the sample contains more than two non conforming chips, the process will be stopped. Compute the probability that the process is stopped by the sampling scheme. (10 Marks)

OR

- 4 a. Explain the characteristics of queueing systems. List different queueing notations. (10 Marks)
 b. Explain steady state parameters of M/M/1 queue and M/G/1 queue. (10 Marks)

Module-3

- 5 a. Explain linear congruential method for generating random number. Using the same technique generate a sequence of random numbers with $X_0 = 27$, $a = 17$, $c = 43$ and $m = 100$. (10 Marks)
 b. Explain the inverse transformation technique for exponential and triangular distribution. (10 Marks)

OR

- 6 a. Explain Kolmogorov-Smirnov test. The sequence of 5 numbers 0.44, 0.81, 0.14, 0.05 and 0.93 were generated. Using KS-test with the level of significance $\alpha = 0.05$, $D_{0.05} = 0.565$. Compare $F(x)$ and $S_n(x)$ on a graph. (10 Marks)
 b. Explain acceptance-rejection technique and generate 3 Poisson variates with mean $\alpha = 0.2$ for the given random number 0.4357, 0.4146, 0.8353, 0.9952, 0.8004. (10 Marks)

Module-4

- 7 a. List and explain the steps involved in development of a useful model of input data. (10 Marks)
 b. Explain Chi-square Goodness of fit test with Poisson assumption. Using the same, test whether random numbers are uniformly distributed with level of significance $\alpha = 0.05$, $\hat{\alpha} = 3.64$, $X_{0.05,5}^2 = 11.1$. Sample data are ;

Interval :	0	1	2	3	4	5	6	7	8	9	10	11
Observed frequency :	12	10	19	17	10	8	7	5	5	3	3	1

(10 Marks)

OR

- 8 a. The time required for 30 different employers to compute and record the number of hours worked during week days given :
 0.34 0.90 1.88 1.90 0.74 2.62 2.67 8.53 4.91 5.50
 1.10 1.03 1.73 1.00 2.03 1.49 2.16 0.80 0.48 5.60
 0.45 0.26 0.24 0.63 0.36 1.28 0.82 2.16 0.05 0.04
 $K = 6$ and Critical value = 9.49 (10 Marks)
 b. Explain histograms with example. Mention its drawbacks and advantages of Q-Q plot. (10 Marks)

Module-5

- 9 a. Why is optimization via simulation difficult? What compromises are made during that process? (10 Marks)
 b. Explain point estimation and interval estimation. (10 Marks)

OR

- 10 a. Explain in detail about the model building, verifying and validation in the model building process with a diagram. (10 Marks)
 b. Explain 3-steps approach to validation of simulation model by Naylor and Finger. (10 Marks)
