CBCS SCHEME

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18AI821

# Eighth Semester B.E. Degree Examination, June/July. 2023
# 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. What is Simulation? Explain the steps in Simulation study with a neat diagram? **(08 Marks)**

b. A small shop has one checkout counter. Customers arrive at this 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. The service time may vary from 1 to 6 minutes with probability given below.

| ST | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Probability | 0.05 | 0.10 | 0.20 | 0.30 | 0.25 | 0.10 |

Develop a simulation table for 10 customers. Find :

i) average waiting time
ii) average service time
iii) average time customer spends in the system.

Use the random digits as (sequentially) :

For arrival : 91, 72, 15, 94, 30, 92, 75, 23, 30

For service times : 84, 10, 74, 53, 17, 79, 91, 67, 89, 38

**(12 Marks)**

**OR**

**2** a. Explain system and system environment. Also list the components of a system. **(08 Marks)**

b. Prepare a table using event scheduling/time advance algorithm for a checkout counter. Stop the simulation when the $5^{th}$ customer departs. Estimate mean response time and proportion of customers who spent 5 or more minutes in the system. Event notice must have event type, time and customer number. Consider the time as

IAT : 1 1 6 3 7 5 2 4 1 . . . . . .

ST : 4 2 5 4 1 5 4 1 4 . . . . . .

**(12 Marks)**

## Module-2

**3** a. Explain the various probability terminology and concepts. **(12 Marks)**

b. Explain the Poisson process in detail and also mention it properties. **(08 Marks)**

**OR**

**4** a. Explain the various steady state parameters of M/G/1 queue. **(10 Marks)**

b. Explain networks of queue, service times and server mechanics used in queuing system with an example. **(10 Marks)**

## Module-3

5 a. Explain combined linear congreuential method for random number generation. Generate 6 three digit random numbers using multiplicative congruential method with $X_0 = 117$, a = 43 and m = 1000. **(10 Marks)**

b. Explain Acceptance and rejection technique. Generate 3 Poisson variates with a mean $\alpha = 0.2$. Use the Random number: 0.4357, 0.4146, 0.8353, 0.9952, 0.8004. **(10 Marks)**

**OR**

6 a. The sequence of numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use the Kolmogorov – Smirnov test with $\alpha = 0.05$ to learn whether the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. [$D_\alpha = 0.565$] **(10 Marks)**

b. Explain the step by step procedure to generate random variates using inverse transform technique for exponential distribution. **(10 Marks)**

## Module-4

7 a. Test the following sequence of numbers for uniformity using Chi-square Test. Level of significance/critical value of $\alpha$ = 0.05, 0.594, 0.928, 0.515, 0.055, 0.507, 0.351, 0.262, 0.797, 0.788, 0.442, 0.097, 0.798, 0.227, 0.127, 0.474, 0.825, 0.007, 0.182, 0.929, 0.852 [$\chi_\alpha = 16.9$]. **(10 Marks)**

b. Explain the modeling of a non-stationary Poisson process. **(10 Marks)**

**OR**

8 a. Explain the transient and point and interval estimation. **(10 Marks)**

b. Explain the transient and steady state simulation parameters with respect to output analysis. **(10 Marks)**

## Module-5

9 a. Explain in detail model building, verification and validation process with a diagram. **(10 Marks)**

b. Describe the three step approach to validation by Naylor and Finger. **(10 Marks)**

**OR**

10 a. Explain the iterative process of calibrating a model. **(10 Marks)**

b. Explain the confidence – interval estimation method. **(10 Marks)**

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