

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7465

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Unique Paper Code : 2373570011

Name of the Paper : DSE: Statistical Simulation (NEP)

Name of the Course : **B.A. (P) / B. Sc. (P)**

Semester : VIII

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all. **Section-I** is compulsory and attempt any **five** questions from **Section-II**.
3. Use of a non-programmable scientific calculator is allowed.

Section-I

1. Answer any five questions.

- (a) Explain different types of simulation models with suitable example.
- (b) Distinguish between the simulation technique and analytical method.
- (c) Discuss the properties of a good random number generator.
- (d) Write the algorithm of mid-square method
- (e) Describe the simulation of a simple queueing system
- (f) Discuss how simulation helps in decision-making.

(5×3=15)

Section-II

2. (a) Explain the phases of simulation study. Also describe the verification and validation in simulation with examples.
(b) Explain the Monte-Carlo simulation technique in detail with algorithm and applications.
(8, 7)
3. (a) Describe the concept of event scheduling. Explain event-based simulation with example.
(b) Why is simulation considered a powerful tool for experimentation. Discuss the challenges faced during simulation modelling.
(8, 7)

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4. (a) Define random numbers and pseudo random numbers. Explain how do they differ from each other.
- (b) Describe the Mid-Square method of generating pseudo-random numbers. Why is it considered less reliable compared to other methods like the Linear Congruential Generator? (8, 7)
5. (a) Describe the theoretical framework for simulating a single-server queue. Define all components and explain how the simulation clock, event list, and state variables interact?
- (b) Explain the scope and applications of simulation in at least four distinct fields such as manufacturing, healthcare, finance, and logistics. Elaborate on one field in detail. (8,7)
6. (a) Let X be the random variable with p.m.f.

$$\begin{array}{c}
 x : 1 \quad 2 \quad 3 \quad 4 \quad 5 \\
 P(X = x): 0.2 \quad 0.3 \quad 0.1 \quad 0.1 \quad 0.3
 \end{array}$$

Use the random sample 0.381, 0.46, 0.89, 0.97, 0.35 to generate 5 values of X .

- (b) Describe the role of simulation languages in modelling complex systems. Discuss different simulation languages and their features. (8, 7)
7. (a) A retail store sells product X daily with the following demand distribution:

Daily Demand	Probability
10	0.15
20	0.25
30	0.35
40	0.10
50	0.15

The store replenishes stock every 5 days with a fixed reorder quantity of 100 units. Simulate 5 days of demand using the given random numbers: 0.42, 0.75, 0.78, 0.93, 0.52 and estimate the ending inventory.

- (b) What is the role of a simulation clock in discrete event simulation? Explain the two approaches next event time advance and fixed time increment, in detail. (8, 7)