

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 8143

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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 Choose the correct answer for the following question.

- (a) Define Simulation. What are the different types of simulation?
- (b) What is a random number generator (RNG)?
- (c) What is system modelling?
- (d) State two advantages of simulation.
- (e) Compare between deterministic and stochastic simulation models giving examples.
- (f) Explain the following concepts with example.
 - i. Discrete-event simulation
 - ii. Continuous simulation.

(5×3=15)

SECTION -II

2. (a) Describe the application of Simulation in diverse areas of real-world.
 - (b) What are the essential components of a simulation model? Discuss the general principles of designing a simulation model? (7, 8)
3. (a) Explain the difference between true random numbers and pseudo-random numbers. What are the properties of a good pseudo-random number generator (PRNG)?

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- (b) Derive the theoretical basis of the Inverse Transform method. Explain how it is applied to generate random variates from Uniform $U(a,b)$ and Exponential distributions with parameter λ . (8, 7)

4. (a) Explain the steps involved in Monte Carlo simulation. What role does random number generation play a role in Monte Carlo methods?

- (b) A retail store sells product X daily with the following demand distribution:

Daily Demand	Probability
10	0.2
20	0.3
30	0.25
40	0.15
50	0.10

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: 0.12, 0.45, 0.78, 0.91, 0.33 and estimate the ending inventory. (7, 8)

5. (a) Discuss the scope and limitations of simulation in Artificial Intelligence and Machine Learning.
- (b) What are simulation languages, and why are they important? Also explain its role in simulation modelling. (8, 7)
6. (a) Discuss the basic structure of queuing model and explain the difference between poisson arrival and exponential service time in queuing theory.
- (b) A call center with one operator has an incoming call rate of three calls per hour. On the average, the operator spends 15 minutes for each call. Answer the following questions:
- (i) How busy is the operator?
- (ii) How likely is it that a customer will have to wait on hold? (7, 8)
7. (a) Discuss the generation of random sample size n from Normal and Poisson

distributions using simulation methods.

- (b) A call center receives calls at an average rate of 5 calls per hour. Assuming that the number of calls follows an exponential distribution, generate 5 random interarrival times using the Inverse Transformation Method with a given set of uniform random numbers from uniform (0,1) as: 0.13, 0.46, 0.79, 0.92, 0.34. (7, 8)