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**J-3412[S-1268]**

**[2037]**

**MCA (Semester - 5<sup>th</sup>)**

**SYSTEM SIMULATION AND MODELING (MCA - 504 A)**

**Time : 03 Hours**

**Maximum Marks : 75**

**Instruction to Candidates:**

- 1) Section - A is **compulsory**.
- 2) Attempt any **Nine** questions from Section - B.

**Section - A.**

**Q1)**

**(15 x 2 = 30)**

- a) What are various measures of performance for queueing systems?
- b) Write a note on deterministic vs stochastic simulation models.
- c) Mention various components of a discrete event system simulation model.
- d) List and explain various types of models with examples in each category.
- e) Mention various advantages, disadvantages and pitfalls of simulation.
- f) What are two approaches for storing lists of records in a computer?
- g) What are stochastic variables? Mention their properties.
- h) Explain joint probability mass function with the help of an example.
- i) How covariance is computed for two jointly continuous random variables?
- j) What is significance of confidence interval?
- k) Describe object oriented simulation.
- l) Give a layout for simulation of a telephone system.
- m) List desirable features when selecting simulation software.
- n) What are simulation requirements of a single server queue?
- o) Explain network model.

**P.T.O.**

## Section - B

(9 x 5 = 45)

**Q2)** List and explain various measures of performance for queueing systems.

**Q3)** How deterministic problem can be approached by Monte-carlo simulation?  
Evaluate the integral.

$$I = \int_a^b g(x) dx .$$

Where  $g(x)$  is a real valued function.

**Q4)** Describe the events required in the simulation of an inventory model. Give flow charts for order arrival and demand routing for an inventory model.

**Q5)** Propose a manufacturing system model. Estimate the expected overall average job time for three job types using the probabilities of occurrence of job types as the weights.

**Q6)** Suppose that X and Y are jointly discrete random variables with

$$p(x, y) = \begin{cases} \frac{x+y}{30} & \text{for } x = 0,1,2 \text{ and } y = 0,1,2,3 \\ 0 & \text{otherwise.} \end{cases}$$

Compute and plot  $p_x(x)$  and  $p_y(y)$ .

**Q7)** A geometric distribution with parameter  $p$  ( $0 < p < 1$ ) has probability mass function.

$$p(x) = p(1 - p)^x \text{ for } x = 0,1,2,\dots$$

Show that this distribution has the memoryless property.

**Q8)** Mention various features needed in programming discrete event simulation models. Give a detailed comparison of simulation packages with programming languages.

**Q9)** Discuss the following as concerning the hardware and software requirements of a simulation software.

- (a) Customer support and documentation.
- (b) Output report and graphics.

**Q10)** Write technical notes on the following.

- (a) Monte Carlo computation vs. stochastic simulation.
- (b) Fixed time step vs. event to event model.

**Q11)** Discuss in detail, why validating a model of a computer system might be easier than validating a military combat model. Assume that the computer system of interest is similar to an existing one.

**Q12)** Explain LCG in detail with suitable example.

**Q13)** What are major simulation software in manufacturing applications? Also discuss modeling system randomness.

