BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MCA **SEMESTER : V**
BRANCH: MCA **SESSION : MO/19**

SUBJECT: MCA5003 SYSTEM SIMULATION AND MODELING

TIME: 3 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What do you mean by model of a system? Explain the different types of models with example. [6]
Q.1(b) Describe the simulation of (M,N) inventory system. [6]

Q.2(a) Discuss the steps involved in simulation study with the help of flowchart. [6]
Q.2(b) For the single server and number of customers N=8. The following interarrival time and service time for each customers are provided as follows: [6]
AT_i=(0,10,15,35,30,10,5,5) ST_i =(20,15,10,5,15,15,10,10)
Find the following:
(1) Cumulative departure time of each customer CDT_i
(2) Queue length immediately after each arrival, QL_i
(3) Idle time of server for each customer, IDT_i

Q.3(a) Illustrate the different method to implement list processing and operations performed on it. [6]
Q.3(b) Generate a FEL, LQ(t) , LS(t) ,B and MQ for a grocery store having single checkout counterupto clock time=21. [6]

Interarrival time	8	6	1	8	3	8
Service time	4	1	4	3	2	4

A simulation stopping time set to 60 mins. There is already one customer in system when simulation was started at clock time t=0.

Q.4(a) A random variable X has the following probability distribution: [6]
x : 0 1 2 3 4 5 6 7
p(x): 0 k 2k 2k 3k k^2 $2k^2$ $7k^2$ +k.
(i) find the value of k. (ii) find the smallest value of x for which $P(X \le x) > 1/2$.
Q.4(b) [6]
High temperature in Biloxi, denoted by random variable x, has the following pdf where x is in degree F.

$$f(x) = \begin{cases} \dfrac{2(x-85)}{119}, & 85 \le x \le 92 \\ \dfrac{2(102-x)}{170}, & 92 \le x \le 102 \\ 0, otherwise \end{cases}$$

(1) Find the median temperature (2) What is the variance of the temperature? (3) What is the modal temperature?

Q.5(a) Describe the all steady state parameters of M/M/1/∞/∞ queuing model. [6]
Q.5(b) For the M/M/1/∞/∞ queuing model with service rate μ = 10 customers per hour and λ increases from 5 to 8.64 by increments of 20% and then to$\lambda = 10$. for each value of λ find server utilization (rho) , Ls , Lq , Ws , Wq. compare results with M/G/1 queuing model. [6]

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Q.6(a) Describe the linear congruential method. discuss the cases for generating the maximum period for random numbers. [6]

Q.6(b) Develop a generator for a triangular distribution with range(1,10) and mean of 4. [6]

Q.7(a) The given table represent the average lead time to deliver(in months), and the annual demand , for industrial robots for the last ten years. [6]

Lead time	Demand
6.5	103
4.3	83
6.9	116
6.0	97
6.9	112
6.9	104
5.8	106
7.3	109
4.5	92
6.3	96

Determine whether the lead time and demand are dependent or not.

Q.7(b) Illustrate the calibration and validation of models. [6]

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