(3 hours) **Marks: 80**

Note:

1. **Question No.1 is compulsory**
2. **Attempt any three questions from question 2 to 6**
3. **Figures to the right indicate marks**
4. **Use of scientific calculator is allowed**

Q1.

a) Discuss simulation application in any one of the following system
   i) Cash counter Analysis in Bank
   ii) Customer flow analysis in supermarket
   iii) Check out counter at airport (10)

b) A sequence of numbers 0.54,0.73,0.98,0.11 and 0.68 has been generated . Use Kolmogrove- Smrinov test with α=0.05 to determine if the hypothesis that the numbers are uniformly distributed on the interval[0.1] can be rejected. (Given critical value of Dα=0.565) (10)

Q2.

a) Write short notes on
   i) Properties of Random numbers
   ii) Steps of Simulation study (10)

b) A set of 100 numbers are tested for uniformity. The observed frequencies in 10 intervals are given below. Use Chi-square test to test the hypothesis whether the numbers are uniformly distributed(Given value of $\chi^2_{0.05,9}$ is 16.9) (10)

Interval	1	2	3	4	5	6	7	8	9	10
Observed Frequency	8	8	10	9	12	8	10	14	10	11

Q3.

a)
i) Mention the important points while collecting the data
ii) Explain different types of simulation models (10)

b) Consider a single server system. Arrival is uniformly distributed between 1 and 8 minutes.Service distribution and random digits for inter arrival and service time are as follows

Service time	1	2	3	4	5	6
Probability	0.17	0.15	0.32	0.20	0.06	0.10

Develop a simulation table and analyze the system by simulating the arrival and service of 10 customers. The first customer arrives to the system at 0th time. Calculate the average waiting time,

Customer No	1	2	3	4	5	6	7	8	9	10
RD for inter arrival time	---	751	303	106	94	606	747	339	877	454
R D for Service Time	74	52	16	82	94	61	87	35	29	99

service time and average time spend by the customer in the system. (10)

Q4.

a) What are the steps for the development of a useful model for input data (10)

b) Use mixed congruential method to generate a sequence of three two digit random numbers with X0=37, a=7,c=29 and m=100. (10)

Q5

a) Explain verification and validation of simulation models. (10)

b) Use inverse transformation method to generate random variates for exponential distribution with mean 1. Use the random numbers:0.30,0.48,0.36,0.01,0.54,0.34. (10)

Q6.

a) Discuss types of simulation with respect to output analysis with examples. (10)

b) The number of customers arriving at a bank between10.00Am to 1.00Pm is Poisson distributed with mean 3. Use Acceptance- Rejection technique to generate Poisson random variate using the random numbers:- 0.5294,0.3578,0.1574 (5)

c.) Perform the simulation of the following inventory system, given daily demand is represented by the random numbers 4,3,8,2,5 and the demand probability is given as below

Demand	1	2	3
probability	0.2	0.5	0.3

If the initial inventory is 4 units, determine on which day the shortage condition occurs. The review period is of 5 days. (5)

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