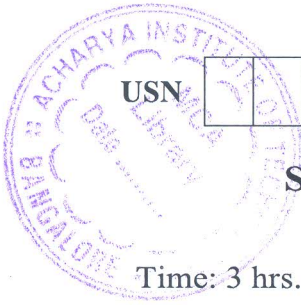18CS645

USN

Sixth Semester B.E. Degree Examination, June/July 2023
System Modelling and Simulation

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a.   What is Simulation? List any four circumstances, when the simulation is the appropriate tool and when it is not. **(10 Marks)**
    b.   With a neat flow diagram, explain the steps in simulation study. **(10 Marks)**

OR

2   a.   Define the following :
        i) System ii) Entity   iii) Activity   iv) Endogenous event   v) Exogenous event   vi) State. Indentify them four any one system. **(10 Marks)**
    b.   The news stand buys the paper for 33 paise each and sells them for 50 paise each. Newspaper not sold at the day are sold as scarp for 5 paise each, Newspaper can be purchased in the bundle of 10, thus newsstand can buy 50, 60 and 70 so on. There are three types of days, Good, Fair and Poor, they have probabilities of 0.35, 0.45 and 0.20, distribution of newspaper demanded on each of the three days is given in the table, simulate the demand for 10 days and record, profit from sales each day, find the optimal number of papers newsstand should purchase. Assume the newsstand buys 70 news papers each day.
        Random digits for types of news days :
        58, 17, 21, 45, 43, 36, 27, 73, 86, 19
        Random digit for types of demand:
        96, 63, 31,19, 91,75, 84, 37, 23, 02.

Demand	Demand distribution probability		
	Good	Fair	Poor
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	
100	0.07		

(10 Marks)

Module-2

3   a.   Explain binomial and Poisson distribution and give probability mass function, mean and variance. **(08 Marks)**
    b.   Explain the following continuous distributions.
        i)   Exponential distribution
        ii) Normal distribution
        iii) Uniform distribution
        iv) Triangular distribution **(12 Marks)**

OR

4   a.   Explain the characteristics of queuing system. **(10 Marks)**
    b.   State and explain the Kendall notation of queuing system. **(05 Marks)**
    c.   List the steady state parameters of M/G/1 queue. **(05 Marks)**

Module-3

5 a. What are Pseudo-random numbers? List out the problems that occur and important considerations during generation of Pseudo – random numbers. **(10 Marks)**

   b. The sequence of the random numbers 0.15, 0.94, 0.05, 0.51 and 0.29 has been generated. Use Kolmogorav – Smirnov test with $\alpha = 0.05$ to determine if the hypothesis that the number are uniformly distributed on the interval [0, 1] can be rejected. Take $D_\alpha = 0.565$. **(10 Marks)**

OR

6 a. Suggest a step by step procedure to generate random variates using acceptance – rejection technique for Poisson distribution and Gamma distribution. **(10 Marks)**

   b. Consider the sequence of random numbers : 0.12, 0.01, 0.23, 0.28, 0.89, 0.31, 0.64, 0.28, 0.83, 0.93, 0.99, 0.15, 0.33, 0.35, 0.91, 0.41, 0.60, 0.27, 0.75, 0.88, 0.68, 0.49, 0.05, 0.43, 0.95, 0.58, 0.19, 0.36, 0.69, 0.87. Test whether 3rd, 8th, 13th and so on numbers in the above sequence are auto correlated. At significance $\alpha = 0.05$, Normal critical table value is given as 1.96. **(10 Marks)**

Module-4

7 a. Explain the selecting input model when data is not available. **(05 Marks)**

   b. Write the suggested estimators for distributions often used in simulation. **(05 Marks)**

   c. Six dump trucks are used to haul coal form the entrance of a small mine to the rail road. Each truck is loaded by one of two loaders. After loading truck immediately moves to the scale to be weighed. Loader and scale have First – Come – First – Serve (FCFS) queue. The travel time from loader to scale in negligible. After being weighed, a truck begins a travel time, afterward unload the coal and returns to the loader queue. It is assumed that five trucks are at loader and one is at the scale at time = 0. Carryout simulation process till the completion of two weighing from the scale. The activities of loading, weighing and travel time are given in the following table

Loading time	10	5	5	10	15	10	10
Weighing time	12	12	12	16	12	16	
Travel time	60	100	40	40	80		

Calculate : i) The busy time of both the loader and scale   ii) Average loader and scale utilization. **(10 Marks)**

OR

8 a. Explain the measures of performance and their estimation. **(10 Marks)**

   b. Apply Chi-square goodness of fit test for Poisson distribution with $\alpha = 3.64$, data size = 100 and observed frequency $O_i = 12, 10, 19, 17, 10, 8, 7, 5, 5, 3, 3, 1$ [$\eta_{0.05, 5} = 11.1$]. **(10 Marks)**

Module-5

9 a. Discuss output analysis for steady state simulation in detail. **(10 Marks)**

   b. Discuss output analysis for terminating simulation in detail. **(10 Marks)**

OR

10 a. Explain with neat diagram, a model building verification and validation. **(10 Marks)**

    b. Describe the three steps approach formulated by Naylor and Finger in the validation process. **(10 Marks)**

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