USN | | | | | | | | | | **15CS834**

Eighth Semester B.E. Degree Examination, July/August 2022
System Modeling and Simulation

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. What is Simulation? Explain with neat flow diagram the step involved in simulation study.
(08 Marks)

   b. Develop a simulation table for eight (8) customers in a grocery system with one check – out counter. Find the average waiting time of customer in Queue, idle time of server, and average service time. The Inter – Arrival Time (IAT) and Service Time (ST) are given in minutes :

IAT	3	2	6	4	4	5	8	
S.T	3	5	5	8	4	6	2	3

Assume first customer arrives at time t = 0.   **(08 Marks)**

OR

2 a. What is system and system environment? Explain the major concept of Discrete Event simulation with example.   **(08 Marks)**

   b. Develop a simulation table for Dump truck system where six dump trucks are used to carry coal from 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 is negligible. After being weighed, a truck begins a travel time, afterwards unloads the coal and returns to the loader queue. It is assumed that five trucks are at the loader and one is at the scale at time t = 0. Carryout simulation process till the computation 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	19
Weighing time	12	12	12	16	12	16	
Travel time	60	100	40	40	80		

Calculate the i) Busy time of both the loaders and the scale
            ii) Average loader and scale utilization.   **(08 Marks)**

Module-2

3 a. Explain Poisson process and its properties with example. List out the assumption which are needed to fulfill the counting process {N(t), t ≥ 0}, is said to be Poisson process with mean rate λ.   **(10 Marks)**

   b. Forty percent of the assembled ink-jet printers are rejected at the inspection station.
      i) Find the probability that the first acceptable ink-jet printer is the third one inspected
      ii) Find the probability that the third printer inspected is the second acceptable printer.
(06 Marks)

OR

4 a. Explain with an example the characteristics of Queuing system? What does the format A/B/C/N/K represent?   **(10 Marks)**

   b. Suppose that the life of an industrial lamp is in thousands of hours, is exponentially distributed with failure rate $\lambda = 1/3$ (one failure every 3000hours, on the average). Find the probability that the lamp will last longer than its mean time o life. Also find the probability that the industrial lamp will last between 2000 and 3000hours.   **(06 Marks)**

Module-3

5 a. What are pseudo random Numbers? Explain the important consideration for the selection of routines to generate random numbers. **(08 Marks)**

   b. What are 3 ways of achieving maximum periods in random number generation? Generate a sequence of 5 random numbers with given seed 45, constant multiplier 21, increment 49 and modulus 40. **(08 Marks)**

OR

6 a. The sequence of random numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use Kolmgorov – 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$D_{0.05,5} = 0.565$. **(08 Marks)**

   b. What are Acceptances – Rejection technique? Generate three Poisson random variants with mean $\alpha = 0.2$ and take random numbers as : $R_1 = 0.4357$, $R_2 = 0.4146$, $R_3 = 0.8353$, $R_4 = 0.9952$ and $R_5 = 0.8004$. **(08 Marks)**

Module-4

7 a. List and explain the steps involved in the development of a useful model for a given set of input data. **(08 Marks)**

   b. Records pertaining to the monthly number of job relted injuries at an underground coal mine were being studied by a federal agency. The values for the past 100 months were as follows:

Injuries per months	Frequency of occurrences
0	35
1	40
2	13
3	6
4	4
5	1
6	1

   Apply the chi-square test these data to test the hypothesis that the underlying distribution is Poisson. Use the level of significance $\alpha = 0.05$ and $\chi^2_{0.05,2} = 5.99$. **(08 Marks)**

OR

8 a. List and explain the steps involved in selection of input models without data. **(08 Marks)**

   b. Let X_1 represent the average lead time (in month) to deliver the industrial robots and X_2 represent the annual demand for industrial robots. The following data are available on demand and lead for last 10 years.

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

   Find the dependency between lead time and demand. **(08 Marks)**

Module-5

9 a. What are the different suggestions given in verification process? **(08 Marks)**

   b. Explain in detail model building, verification and validation process through a diagram. **(08 Marks)**

OR

10 a. What is output analysis? Explain the types of simulation with respect to output analysis. **(08 Marks)**

   b. Describe the three step approach by Naylor and Finger in the validation process. **(08 Marks)**

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