Eighth Semester B.E. Degree Examination, June 2012

System Modelling and Simulation

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. List any three situations when simulation is the appropriate tool and not appropriate tool.
                                                                         (06 Marks)

  b. Define the following terms used in simulation:
     i) Discrete system   ii) Continuous system   iii) Stochastic system
     iv) Deterministic system   v) Entity   vi) Attribute   **(06 Marks)**

  c. Draw the flowchart of steps involved in simulation study.   **(08 Marks)**

2 a. Consider the grocery store with one checkout counter. Prepare the simulation table for eight customers and find out 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
              ST (min) :   3, 5, 5, 8, 4, 6, 2, 3
    Assume first customer arrives at t = 0.   **(10 Marks)**

  b. Suppose the maximum inventory level M is 11 units and the review period N is 5 days, estimate by simulation, the average ending units in inventory and number of days when a shortage condition occurs. Initial simulation has started with inventory level of 3 units and an order of 8 units scheduled to arrive in two days time. Simulate for three cycles (15 days). The probability for daily demand and lead time is given in table.

Demand	0	1	2	3	4
P	0.1	0.25	0.35	0.2	0.1

Lead time	1	2	3
Probability	0.5	0.3	0.2

    RD for demand: 24, 35, 65, 25, 8, 85, 77, 68, 28, 5, 92, 55, 49, 69, 70.
    RD for lead time: 5, 0, 3.   **(10 Marks)**

3 a. Define the term used in discrete event simulation:
     i) System state   ii) List   iii) Event
     iv) FEL   v) Delay   vi) System.   **(06 Marks)**

  b. Six dump trucks are used to haul coal from the entrance of a small mine to railroad. Each truck is loaded by one of two loaders. After loading truck moves to scale, to be weighed. After weighing a truck begins a travel time and then returns to loader queue. It has been assumed that five of trucks are at loader and one at scale at time 0. By using event scheduling algorithm find out busy time of loader and scale and stopping time E is 64 minutes.

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

                                                                              (14 Marks)

4   a. The number of Hurricanes hitting the coast of India follows Poisson distribution with mean $\alpha = 0.8$ per year. Determine:
        i)   The probability of more than two hurricanes in a year
        ii) The probability of only one hurricane in a year.   (06 Marks)
    b. Explain terms used in queuing notations of the form A/B/C/N/K.   (06 Marks)
    c. List the steady state parameters of M/G/1.   (08 Marks)

PART – B

5   a. Using multiplicative congruential method, generate random numbers to complete cycle. Explain maximum density and maximum period. $A = 11$, $m = 16$, $X_0 = 7$.   (10 Marks)
    b. Using suitable frequency test find out whether the random numbers generated are uniformly distributed on the interval [0, 1] can be rejected. Assume $\alpha = 0.05$ and $D_\alpha = 0.565$. The random numbers are 0.54, 0.73, 0.98, 0.11, 0.68.   (10 Marks)

6   a. Develop a random variate generator for X with pdf given by
$$f(x) = \begin{cases} x, & 0 \le x \le 1 \\ 2 - x, & 1 < x \le 2 \\ 0, & \text{otherwise} \end{cases}$$
                                                                                       (06 Marks)
    b. Explain with an example, importance of data distribution using histogram.   (06 Marks)
    c. The following is set of single digit numbers from a random number generator. Using appropriate test, check whether the numbers are uniformly distributed. $N = 50$, $\alpha = 0.05$ and $X^2_{0.05,9} = 16.9$.

        6, 7, 0, 6, 9, 9, 0, 6, 4, 6, 4, 0, 8, 2, 6, 6, 1, 2, 6, 8, 5, 6, 0, 4, 7
        1, 3, 5, 0, 7, 1, 4, 9, 8, 6, 0, 9, 6, 6, 7, 1, 0, 4, 7, 9, 2, 0, 1, 4, 8   (08 Marks)

7   a. Records pertaining to the monthly number of job related injuries at an underground coalmine were being studied by federal agency. The values of past 100 months are as follows:

Injuries/month	0	1	2	3	4	5	6
Frequency of occurance	35	40	13	6	4	1	1

Apply the chi-square test to these data to test the hypothesis that the distribution is Poisson with mean 1.0 and $\alpha = 0.05$ and $X^2_{0.05,3} = 7.81$.   (10 Marks)

    b. Differentiate between terminating and steady state simulation with respect to output analysis with an example.   (10 Marks)

8   a. Explain with a neat diagram verification of simulation model.   (10 Marks)
    b. Describe with a neat diagram iterative process of calibrating a model. Which are three steps that aid in the validation process?   (10 Marks)

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