Fifth Semester MCA Degree Examination, December 2012

System Modeling and Simulation

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. What is simulation? When simulation is the appropriate tool? List a few applications of simulation? **(06 Marks)**

   b. What is system, system environment and model? List the components of a system. **(06 Marks)**

   c. Students arrive at a single cashier bookstall at random from 1 to 8 minutes apart. Each possible value of Inter Arrival Time (IAT) has same probability of occurrence. The Service Time (ST) has the following probability distribution:

Service Time (min)	1	2	3	4	5
Probability	0.05	0.15	0.25	0.35	0.20

Simulate the bookstall for 10 students, using the following random numbers for IAT and ST.
IAT = (614, 469, 155, 234, 921, 567, 798, 384, 640)
ST = (11, 95, 73, 56, 34, 27, 62, 79, 45, 16)
Change the service time distribution to be uniform in the interval [1, 5]. Simulate 10 students and find the average of arrival time (AT), waiting time (WT), time spend in system (SST) and idle time. **(08 Marks)**

2 a. Explain the steps used in simulation study, with a neat flow chart. **(10 Marks)**

   b. Explain in detail of concepts in discrete event simulation and event scheduling algorithm. **(10 Marks)**

3 a. Explain the three different types of world views. **(08 Marks)**

   b. The life of a device used to inspect cracks in aircraft wings is given by X, a continuous random variable assuming all values in the range $X \geq 0$. The pdf of the life time, in years is as follows:

$$f(x) = \begin{cases} \frac{1}{2}e^{-x/2}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability that the life of the device is (i) between 2 and 3 years, (ii) less than 2 years. **(06 Marks)**

   c. A computer repair person is "beeped" each time there is a call for service. The number of beeps per hour is known to occur in accordance with a Poisson distribution with a mean of $\alpha = 2$ per hour. Find the probability of (i) exactly three beeps and (ii) two or more beeps. **(06 Marks)**

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

   b. Explain Kolmogrov-Smirnov test for uniformity of random numbers. Hence test for uniformity of the following random numbers:
0.72, 0.82, 0.12, 0.16, 0.73, 0.79, 0.95, 0.57, 0.63 and 0.39.
Given $D_{0.05} = 0.410$. **(10 Marks)**

5 a. Test whether the following sequence of numbers are auto correlated, test at 5% level of significance, where 3rd, 8th, 13th and so on. Given $Z_{0.025} = 1.96$.

    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   **(10 Marks)**

  b. Give a step by step procedure to generate the random variates, using the inverse transforms technique for exponential distribution and uniform distribution. **(10 Marks)**

6 a. Explain briefly the various steps of input modeling. **(08 Marks)**

  b. The vehicle arriving data, given below:

Arrival/period	0	1	2	3	4	5	6	7	8	9	10	11
Frequency	12	10	19	17	10	8	7	5	5	3	3	1

Use χ^2 test, to check whether the data follows Poisson distribution with its parameter $\alpha = 3.64$ at 5% level of significance, given $\chi^2_{(0.05,6)} = 11.1$. **(12 Marks)**

7 a. What is verification of simulation models? List the suggestions given for verification of model. **(10 Marks)**

  b. Explain briefly three-step approach to validation by nayler and finger. **(10 Marks)**

8 a. Explain the type of simulation with respect to output analysis, give an example. **(10 Marks)**

  b. Explain in detail of the concept of point estimation and interval estimation. **(10 Marks)**

* * * * *