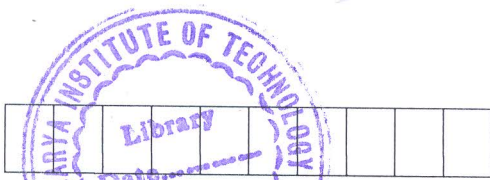# Fifth Semester MCA Degree Examination, Dec.2019/Jan.2020
System Simulation and Modeling

Time: 3 hrs.　　　　　　　　　　　　　　　　　　　　　　　Max. Marks:100

Note: *1. Answer any FIVE full questions.*
2. Statistical tables can be provided.

1　a. Define Simulation. What are the advantages of simulation? **(06 Marks)**
　　b. Name the entities, attributes, activities, events and events for the following system:
　　　i)　　Small appliance repair shop　　ii) Grocery store. **(06 Marks)**
　　c. With the help of flow chart, explain the steps in simulation study. **(08 Marks)**

2　a. Explain one discrete distribution and one continuous distribution and calculate mean and variance of the same. **(08 Marks)**
　　b. Hurricane hitting the eastern coast of India follows Poisson distribution with mean 0.8 per year. Determine:
　　　i)　　Probability of not hitting the eastern coast in a year.
　　　ii)　　The probability of more than two hurricanes hitting the eastern coast in a year.
　　　　　　　　　　　　　　　　　　　　　　　　　　(06 Marks)
　　c. Lifetime of a bulb following pdf
$$f(x) = \begin{cases} 0.4e^{-0.4x} & x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$
　　　i)　　What is the probability it is still alive after 5 years?
　　　ii)　　What is the probability it dies between 3 and 6 years? **(06 Marks)**

3　a. Briefly explain linear congruential method and generate five random numbers using multiplicative congruential method with $x_0 = 5$, $a = 10$ and $m = 64$. **(08 Marks)**
　　b. Explain Kolmogorov-Smirnov test to test the generated random numbers are uniformly distributed or not. **(06 Marks)**
　　c. Develop a random variate generator for x with pdf $f(x) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0 \\ 0 & \text{otherwise} \end{cases}$ **(06 Marks)**

4　a. Define Queue and explain the characteristics of queuing system. **(10 Marks)**
　　b. Dr. Raman is a dentist who schedules all his patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time actually needed to complete the work.

Category	Time required	Probability of category
Filling	45 minutes	0.40
Crown	60 minutes	0.15
Cleaning	15 minutes	0.15
Extraction	45 minutes	0.10
Check up	15 minutes	0.20

　　Simulate the dentist's clinic for 4 hours and determine average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8am. Use the following random numbers for handling the above problem: 40, 82, 11, 34, 25, 66, 17, 79. **(10 Marks)**

5   a.   Explain Event scheduling algorithm.   (06 Marks)
     b.   Write a note on list processing and operational.   (06 Marks)
     c.   With the help of flow chart, explain simulation in Java for single server queue.   (08 Marks)

6   a.   Briefly explain the steps involved in developing input model.   (06 Marks)
     b.   Write a note on quantile-quantile plot.   (06 Marks)
     c.   Records pertaining to the monthly number of job related injuries at an underground coalmine were being studied by a federal agency. The values for the past 100 months were as follows:

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

Apply the Chi-square test to these data to test the hypothesis that the underlying distribution is Poisson. Use the level of significance $\alpha = 0.05$, $\chi^2_{0.05(4)} = 9.49$, $\chi^2_{0.05(3)} = 7.81$, $\chi^2_{0.05(2)} = 5.99$ (08 Marks)

7   a.   What is verification of a simulation model? List the suggestions for verification of a model.   (10 Marks)
     b.   Describe 3 steps approach to validation by Naylor and Finger.   (10 Marks)

8   a.   Explain terminating or transient simulation with respect to output analysis.   (07 Marks)
     b.   Explain point estimation and interval estimation to estimate parameters.   (08 Marks)
     c.   Explain the methods of reducing initialization bias in steady state simulation.   (05 Marks)

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