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**Fifth Semester MCA Degree Examination, June/July 2015**  
**System Simulation and Modeling**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions.**

- 1 a. Briefly explain various steps involved in simulation process, with neat diagram. (10 Marks)  
 b. Students arrive at a single cashier book stall at random from 1 to 8 minutes apart. Each possible value of inter arrival time has same probability of occurrence. The service time has the following probability distribution:

Service time (min)	1	2	3	4	5
Probability	0.05	0.10	0.2	0.4	0.25

Simulate the stall for 10 students using the following random numbers for IAT and ST:

IAT: 465, 380, 150, 570, 975, 065, 640, 757, 268  
 ST: 17, 90, 04, 40, 62, 30, 80, 55, 10, 37

Find average waiting time, average time spent by a student in the stall. (10 Marks)

- 2 a. Explain advantages and disadvantages of simulation. (05 Marks)  
 b. One company uses 6 trucks to haul iron ore from mine to industry. There are two loaders to load each truck. After loading, a truck moves to the weighing scale to be weighed. After weighing the truck travels to the industry and returns back to the loader queue. The activity times are given below:

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

Prepare a simulation table using the event scheduling approach until the clock reaches time 40 minutes. Calculate total busy time of both loaders and the scale. Assume two trucks are at loaders, one at scale and three at loader queue at time 0. (10 Marks)

- c. Explain arrival event and departure events in single channel queue using flow charts. (05 Marks)
- 3 a. Write the GPSS block diagram for the single-server queue simulation. (06 Marks)  
 b. The number of hurricanes hitting the coast of Florida annually has a Poisson distribution with a mean of 0.8.  
 i) What is the probability that no hurricane will hit the Florida coast in a year?  
 ii) What is the probability that more than two hurricanes will hit the Florida coast in a year?  
 iii) What is the probability that exactly three hurricanes will hit the Florida coast in a year. (07 Marks)  
 c. Explain the characteristics of queuing systems. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Suppose that the interarrival times and service times in a shop have been shown to be exponentially distributed with averages 1/2 and 20 minutes. Find:
- i) Server utilization
  - ii) Probabilities for 0, 1, 2 or more customers in the shop
  - iii) Average number of customers in the shop
  - iv) Average time spent in the queue. (08 Marks)
- b. Explain the queuing notation A/B/C/N/K with example. (05 Marks)
- c. Mention the important considerations for methods of random number generation. Also explain linear congruential method of generating random number with an example. (07 Marks)
- 5 a. Explain Kolmogorov-Smirnov test to compare the distribution of the set of random numbers generated to the uniform distribution perform the test for uniformity for the numbers 0.44, 0.81, 0.14, 0.05, 0.93 with the level of significance  $\alpha = 0.05$ . (critical value of D for  $\alpha = 0.05$ , N = 5 is 0.565). (10 Marks)
- b. Generate Poisson variates with  $\alpha = 0.25$ . The random numbers to be used are 0.4737, 0.8225, 0.5614, 0.4107, 0.0731, 0.6179, 0.9669, 0.1285, 0.8745, 0.7810, 0.0230. (10 Marks)
- 6 a. Explain the four steps in the development of a useful model of input data. (06 Marks)
- b. The number of vehicles arriving at a circle in a 5-minute period is as shown in the following table. (monitored for 100 days):

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

- Apply Chi-square Goodness-of-fit test to test the hypothesis that the random variable (number of vehicles) is Poisson distributed ( $\chi_{0.05}^2$  value = 11.1). (10 Marks)
- c. How to select input models without data? (04 Marks)
- 7 a. Explain point estimation and confidence interval estimation with example. (08 Marks)
- b. Explain the output analysis for steady state simulation. (08 Marks)
- c. From 25 replications of a manufacturing simulation, a 90% confidence interval for the daily average WIP is  $218 \pm 32$ . What is the 85<sup>th</sup> percentile of daily average WIP? (Use  $t_{0.05} = 1.71$ ,  $Z_{0.85} = 1.04$ ). (04 Marks)
- 8 a. Explain the three-step approach formulated by Naylor and Finger that has been widely followed as an aid in the validation process. (10 Marks)
- b. Why is optimization via simulation difficult? (04 Marks)
- c. What is the purpose of model verification? Explain how verification of models is done? (06 Marks)

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