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06CS82

Eighth Semester B.E. Degree Examination, June/July 2014
System Modeling and Simulation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define simulation, simulation model, entities, event, activities and delay. **(06 Marks)**

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

c. Explain with flow chart, the steps involved in simulation study. **(08 Marks)**

2 a. Dr. XYZ is a dentist who schedules all patients for 30 minute appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following table shows the various categories of work, their probabilities and time actually needed to complete the work. **(10 Marks)**

Categories	Filling	Crown	Cleaning	Extraction	Checkup
Time required (min)	45	60	15	45	15
Probability of category	0.40	0.15	0.15	0.10	0.20

Simulate the dentist's clinic for 3 hours and determine the average waiting time for patients and total idle time for doctor. Assume that patients show up at the clinic at exactly their scheduled arrival time starting at 8 : 00 a.m. Use the following random digits for handling the above problem.

Random digits	40	82	11	34	25	66

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

c. Define the terms system state and Future Event List (FEL) used in discrete event simulation. **(02 Marks)**

3 a. Six dump trucks are used to haul coal from the entrance of a mine to a railroad. Each truck is loaded by one of the two loaders. After loading, a truck immediately moves to the scale, to be weighted as soon as possible. Both the loader and the scale have first – come – first – served waiting line for trucks. Travel time from a loader to scale is considered negligible. After being weighed, a truck begins travel time (during which time truck unloads) and then afterwards return to loader queue. The activities of loading, weighings and travel time are given in the following table :

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

It has been assumed that "five" of the trucks are at loader side and "one" at scale at time "0". By using event scheduling algorithm, find out average loader utilization and scale utilization. End of simulation is completion of "two" weighing from the scale. Depict the simulation table. **(10 Marks)**

b. 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 ii) two or more beeps. **(06 Marks)**

c. Define discrete random variable. Explain the binomial distribution. **(04 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. What do you mean by "Long run measures of performance" of queuing system? List steady – state parameters of the M|G|1 queue. **(10 Marks)**

PART – B

5 a. Mention the important considerations for the selection of routines to generate random numbers. **(05 Marks)**

b. Use multiplicative congruential method to generate sequence of four 3 digit random numbers with $X_0 = 117$, $a = 43$ and $m = 1000$. **(05 Marks)**

c. Explain Kolmogorov – Smirnov test for uniformity of random numbers. Hence test for uniformity of the following random numbers at 5% level of significance.
0.72, 0.82, 0.12, 0.16, 0.73, 0.79, 0.95, 0.57, 0.63, 0.39. Given $D_{(0.05, 10)} = 0.410$. **(10 Marks)**

6 a. List the steps involved in development of a useful model of input data. **(04 Marks)**

b. Suggest a step by step procedure to generate random variates using inverse transform technique for exponential distribution. **(06 Marks)**

c. The number of vehicles arriving at a junction in a five minute period was observed for 100 days. The resulting data is as follows :

Number of arrivals	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

It is assumed that the arrivals follow a Poisson distribution with parameter $\alpha = 3.64$. Using chi – square goodness of fit test, determine whether the assumption that arrivals follow Poisson distribution can be accepted at 0.05 level of significance, given

$\chi^2_{(0.05,5)} = 11.10$

(Note : Expected values used should be ≥ 5 for calculation). **(10 Marks)**

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

b. Briefly explain the measure of performance of a simulation system. **(10 Marks)**

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

b. Describe the three steps approach to validation by Naylor and Finger. **(10 Marks)**

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