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06CS82

Eighth Semester B.E. Degree Examination, December 2012
System Modeling and Simulation

Time: 3 hrs.

Max. Marks:100

**Note: 1. Answer FIVE full questions
 atleast TWO questions from each part.
 2. Use statistical tables are permitted.**

PART – A

- 1 a. List the circumstances under which simulation is the appropriate tool and circumstances under which simulate is not the appropriate tool. **(10 Marks)**
- b. Explain in brief, with a neat figure the steps involved in simulation study. **(10 Marks)**
- 2 a. With the help of a flow diagram, explain the simulation of single channel queuing system. **(10 Marks)**
- b. One company uses 6 tracks to haul manganese are from Kolar to its industry. There are two loaders to load each truck. After loading, a track movers to the weighing scale to be weighted. The queue discipline is FIFO. When it is weighted a truck travels to the industry and returns to the loader queue. The distribution of loading time, weighing time and travel time are as follows :

Loading times :	10	5	5	10	15	10	10
Weigh times	12	12	12	16	12	16	
Travel times	60	100	40	40	80		

Calculate the total busy time of both loaders, of the scale average loader and scale utilization. Assume 5 trucks are at the loaders and one is at the scale at time '0' stopping time $T_E = 64$ min. **(10 Marks)**

- 3 a. Explain discrete random variables and continuous random variables, with examples and explain any two discrete distributions. **(10 Marks)**
- b. A production process manufactures alternators for outboard engines used in recreational boating. On the average, 1% of the alternators will not perform up to the required standards. When tested at the engine assembling plant. When shipment of 100 alternators is received at plant, they are tested, and if more than two are non confirming, the shipment is returned to the alternators manufacture. What is the probability of returning a shipment? **(10 Marks)**
- 4 a. Explain the characteristics of queuing system. List the different queuing notations. **(10 Marks)**
- b. For the following sequence can the hypothesis that the numbers are uniformly distributed, on the basis of length using chi-square test. $X^2_{0.05,9} = 16.9$

0.34	0.90	0.25	0.89	0.87	0.44	0.12	0.21	0.46	0.67
0.83	0.76	0.79	0.64	0.70	0.81	0.94	0.74	0.22	0.74
0.96	0.99	0.77	0.67	0.56	0.41	0.52	0.73	0.99	0.02
0.47	0.30	0.17	0.82	0.56	0.05	0.45	0.31	0.78	0.05
0.79	0.71	0.23	0.19	0.82	0.93	0.65	0.37	0.39	0.42

(10 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.

PART – B

- 5 a. Explain the different techniques used for generating random numbers, with examples. (10 Marks)
- b. The sequence of numbers 0.44, 0.81, 0.14, 0.05, 0.93 has been generated use the Kolmogorov – Smirnov test with $\alpha = 0.05$ to determine if the hypothesis that the numbers are uniformly distributed on the interval $[0, 1]$ can be rejected. Compare $F(x)$ and $S_N(x)$. [where $D_{0.05,5} = 0.565$]. (10 Marks)
- 6 a. Explain the types of simulation, with respect to output analysis give at least two examples. (10 Marks)
- b. Consider the 30 two digit numbers in the sequence given below. Test whether the 3rd, 8th, 13th and so on, numbers in the sequence are auto correlated. Where $\alpha = 0.05$ and $[Z_{0.025} = 1.96]$

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)

- 7 a. What do you mean by verification and validation of simulation model? Explain calibration and validation of models, with the help of diagram. (10 Marks)
- b. Explain Chi – square goodness of fit test. Apply it to Poisson assumption with $\alpha = 3.64$, data size = 100 and observed frequency. [where $X_{0.05}^2 = 11.1$]
- O_i : 12 10 19 17 10 8 7 5 5 3 3 1. (10 Marks)
- 8 a. Explain with neat diagram, model building, verification and validation. (10 Marks)
- b. Write short notes on :
- Optimization via simulation
 - Time advance algorithm. (10 Marks)

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06CS82

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		Lead time	1	2	3
P	0.1	0.25	0.35	0.2	0.1		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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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- 4 a. The number of Hurricanes hitting the coast of India follows Poisson distribution with mean $\alpha = 0.8$ per year. Determine:
- The probability of more than two hurricanes in a year
 - 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

$$f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2 - x, & 1 < x \leq 2 \\ 0, & \text{otherwise} \end{cases}$$

(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 $X_{0.05,9}^2 = 16.9$.

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 occurrence	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 $X_{0.05,3}^2 = 7.81$. (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)
