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17CS834

Eighth Semester B.E. Degree Examination, July/August 2021

System Modeling and Simulation

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. What are the advantages and disadvantages of simulating a system? (10 Marks)
 b. A grocery store has one checkout counter. The interarrival time and service times are given in the table below. Prepare a simulation table with a stopping event at time 20 and show the checkout line and FEL. Calculate maximum queue length, average system time and utilization of the server.

Interarrival times	3	5	4	6	2	7
Service time	5	2	7	4	3	5

(10 Marks)

- 2 a. Simulate a single server queueing system for 10 customers and find (i) Average waiting time (ii) Probability that a customer has to wait (iii) Average service time (iv) Server Utilization (v) Average time a customer spends in the system. The probability distributions of inter arrival time and service time are as given below.

Inter arrival time	Probability
1	0.3
3	0.4
5	0.3
Random numbers to be used : 9, 3, 2, 1, 0, 5, 8, 7, 4	

Service time	Probability
1	0.2
2	0.25
3	0.35
4	0.2
Random numbers to be used : 85, 10, 54, 76, 23, 12, 69, 06, 98, 35	

(10 Marks)

- b. Write the event scheduling algorithm and illustrate the execution of arrival event and departure event in event scheduling approach using flowchart. (10 Marks)
- 3 a. 30% of the assembled ink-jet printers are rejected at the inspection station. Find the probability that the first acceptable ink-jet is the third one inspected considering each inspection as a Bernoulli trial. Also find the probability that the fifth printer inspected in the second acceptable printer. (05 Marks)
 b. Explain the concepts of normal distribution. (05 Marks)
 c. Explain the characteristics of queueing system. (10 Marks)
- 4 a. 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 $\alpha = 3$ per hour. Find the (i) Probability of 3 beeps in the next hour (ii) Probability of two or more beeps in a 1-hour period (iii) Probability of number of beeps between 1 and 3. (10 Marks)
 b. Explain the long-run measures of performance of queueing systems with an example. (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.

- 5 a. Explain the linear congruential generator and the rules for selecting the values of the parameters. Generate three random numbers given $X_0 = 37$, $a = 07$, $C = 29$, $m = 100$. **(10 Marks)**
- b. Explain Acceptance-Rejection Technique using Poisson distribution. Generate three Poisson variates with mean $\alpha = 0.6$, Random numbers are 0.8311, 0.6437, 0.9963, 0.8582, 0.4321 and 0.5032. **(10 Marks)**
- 6 a. Test whether 3rd, 7th, 11th and so on numbers are autocorrelated at $\alpha = 0.05$ in the following sequence $Z_{0.025} = -1.96$, 0.594, 0.928, 0.515, 0.055, 0.507, 0.351, 0.262, 0.797, 0.788, 0.442, 0.097, 0.798, 0.227, 0.127, 0.474, 0.825, 0.007, 0.182, 0.929, 0.852 **(10 Marks)**
- b. Explain the procedure for inverse transform technique using exponential distribution. Given the random numbers 0.2414, 0.8210, 0.4756, 0.7354. Compute the exponential variates X_i with value of $\lambda = 2$. **(10 Marks)**
- 7 a. How do you estimate the parameters of the following distributions:
 (i) Poisson distribution (ii) Exponential distribution (iii) Gamma distribution
 (iv) Normal distribution (v) Lognormal distribution **(10 Marks)**
- b. Highlight the features of types of simulations with respect to output analysis with examples for each. **(10 Marks)**
- 8 a. List the properties using physical basis of the distributions for any ten distributions. **(10 Marks)**
- b. Which are the measures of performance of a simulated system? How do you estimate them? **(10 Marks)**
- 9 a. Define verification of simulation model and suggest techniques for verifying a simulation model. **(10 Marks)**
- b. Explain model building verification and validation with respect to simulation models. **(10 Marks)**
- 10 a. Illustrate the calibration technique for simulation model. **(10 Marks)**
- b. Explain Naylor and Finger 3-step approach to aid in the validation process. **(10 Marks)**

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