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**Eighth Semester B.E. Degree Examination, Jan./Feb. 2023**  
**System Modeling and Simulation**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting at least TWO questions from each part.**

**PART - A**

- 1 a. Define Simulation. Explain when simulation is an appropriate tool and not an appropriate tool. (10 Marks)
- b. With a neat flow diagram, explain the steps in simulation study. (10 Marks)

- 2 a. A small grocery store has one check out counter. Customer arrives at this counter at random from 1 to 10 mins apart. Each possible value of inter arrival time has the same probability of occurrence equal to 0.10. Service time vary from 1 to 6 mins with probability shown below.

Service time	1	2	3	4	5	6
Probability	0.05	0.10	0.20	0.30	0.25	0.10

Develop a simulation table for 10 customers. Find

- (i) Average waiting time.  
 (ii) Average service time.  
 (iii) Average time customer spends in system.

Random digits for arrivals are 91, 72, 15, 94, 30, 92, 75, 23, 30

Service time are 84, 10, 74, 53, 17, 79, 91, 67, 89, 38

- b. Explain event scheduling algorithm with example. (10 Marks)

- 3 a. Six dump trucks are used to haul coal from entrance of a small mine to the rail road. Each truck is loaded by one of the two loaders. After loading truck immediately moves to the scale to be weigh as soon as possible. Both Loaders and scale has FCFS for trucks. Travel time from loader to scale is negligible. After being weigh a truck begins to travel and then return to loader queue. Simulate for clock  $t_E = 64$ . Find the average loader utilization and average scale utilization. Use the following data. It has assumed that five of the trucks are at loader and one is at scale at time 0.

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

(12 Marks)

- b. A production process manufactures computer chips on the average at 2% non conforming. Every day a random sample of size 50 is taken from the process. If the sample contains more than two non conforming chips, the process will be stopped. Determine the probability that the process is stopped by the sampling scheme. (08 Marks)

- 4 a. Explain the characteristics of queueing system. List the different Queueing notations. (10 Marks)

- b. The interarrival times as well as the service time at a single chair unisex barbershop is exponentially distributed. The values of  $\lambda$  and  $\mu$  are 2/hour and 3/hour respectively. The time between arrivals averages  $\frac{1}{2}$  hour; exponentially distributed and the service time average 20 minutes also exponentially distributed. Find

- (i) Average time an arrival spends in system  
 (ii) Average time customer spends in Queue.  
 (iii) Time-avg number in the Queue.

(10 Marks)



**PART - B**

- 5 a. Using multiplicative linear congruential method, generate random numbers to complete cycle for  $a = 19$ ,  $X_0 = 63$ ,  $m = 100$ . (07 Marks)
- b. The sequence of numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use 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 for,  $D_\alpha = 0.565$ . (07 Marks)
- c. Generate three Poisson variate with mean  $\alpha = 0.2$  (06 Marks)
- 6 a. Explain the steps involved in the development of a useful model of input data. (10 Marks)
- b. Briefly explain the different ways to obtain information about process if data are not available. (10 Marks)
- 7 a. Explain types of simulation with respect to output analysis. Give example. (10 Marks)
- b. Explain the output analysis for terminating simulation. (10 Marks)
- 8 a. Explain with neat diagram, model building verification and validation. (10 Marks)
- b. Explain the three step approach for validation process as formulated by Naylor and Finger. (10 Marks)

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