DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
UNIVERSITY OF BARISAL

Final EXAMINATION 2020

Course Title: Simulation and Modeling
Course Code: CSE-3209
3rd year 2nd Semester
Session: 2019-20 (Admission: 2017-18)

Time: 3 hour **Marks:** 60

Answer any five Questions from the followings.

1. a) What is computer simulation? [2]
   b) Briefly describe the steps of simulation study. [3]
   c) Briefly explain the differences between discrete system and continuous system with suitable figure. [3]
   d) Write down the name of several entities, attributes, activities, events, and state variables for the following system i) A small appliance repair shop ii) A hospital emergency room [4]

2. a) Write short notes on the followings including their scope of implementation in simulation process: [8]
   i) Exponential Distribution ii) Triangular Distribution
   iii) Lognormal Distribution iy) Poisson Process
   b) A Hurricane is to hit in the country, and expected to follow poisson distribution with a mean of 0.8 per year. Find the possibility of occurring more than two hurricanes in a year. Also find the possibility of exactly one hurricane in a year. [4]

3. a) Define the following queuing system characteristics: [2]
   (i) calling population (ii) Arrival process
   b) A classical inventory problem concerns the purchase and sale of newspapers. The paper seller buys the papers for 33 cents each and sells them for 50 cents each. (The lost profit from excess demand is 17 cents for each paper demanded that could not be provided.) Newspapers not sold at the end of the day are sold as scrap for 5 cents each. (the salvage value of scrap papers). There are three types of Newsday's, "good, "fair," and "poor," with probabilities of 0.35, 0.45, and 0.20, Respectively. The problem is to determine the optimal number of papers the newspaper seller should purchase. This will be accomplished by simulating demands for 20 days and recording profits from sales each day. The demand table and distribution of type of Newsday are given below. [10]

Demand Table

Demand	Demand probabilities			Cumulative probabilities			Range of Random Numbers		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
40	0.03	0.10	0.44	0.03	0.10	0.44	0 – 3	0 – 10	0 – 44
50	0.05	0.18	0.22	0.08	0.28	0.66	4 – 8	11 – 28	45 – 66
60	0.15	0.40	0.16	0.23	0.68	0.82	9 – 23	29 – 68	67 – 82
70	0.20	0.20	0.12	0.43	0.88	0.94	24 – 43	69 – 88	83 – 94
80	0.35	0.08	0.06	0.78	0.96	1.00	44 – 78	89 – 96	95 – 00
90	0.15	0.04	0.00	0.93	1.00	1.00	79 – 93	97 - 00	
100	0.07	0.00	0.00	1.00	1.00	1.00	94 - 00		

Distribution of Type of Newsday

Type	Probability	Cumulative Probability	Range of Random Numbers
Good	0.35	0.35	01 – 35
Fair	0.45	0.80	36 – 80
Poor	0.20	1.00	81 – 00

Simulate for the purchase of 70 newspapers per day for 20 days and compute the profit of news dealer. Random numbers for Type of News day: 94, 77, 49, 45, 43, 32, 49, 00, 16, 24, 31, 14, 41, 61, 85, 08, 15, 97, 52, 78
Random numbers for Demand: 80, 20, 15, 88, 98, 65, 86, 73, 24, 60, 60, 29, 18, 90, 93, 73, 21, 45, 76, 96

4. a) What are the problems may occur during the generation of random numbers? [3]

b) Define linear congruential method for generating random number. Use the linear congruential method to generate a sequence of four (4) random numbers with X0 = 27, a = 17, c = 43, and m = 100. [4]

c) What are the methods are used for testing a random number? Suppose, five numbers 0.44, 0.81, 0.14, 0.05, 0.93 are generated. Test the uniformity of the generated numbers using the Kolmogorov–Smirnov test with the level of significance $\alpha = 0.05$. [Critical value $D\alpha$=0.565] [5]

5. a) For the following multiplicative generator, compute Zi for enough values of i>=1 to cover an entire cycle [6]

i) Zo = 1, a=11, m=16

ii) Zo = 2, a=11, m=16

iii) Zo = 1, a=2, m=13

iv) Zo = 2, a=3, m=13

b) Find first three random variables in [0,1] using Xo = 27, a = 8, c = 47, m = 100. [2]

c) The sequence of numbers 0.54, 0.73, 0.98, 0.11 and 0.68 has been generated. Use the Kolmogorov-Smirnov test with a = 0.05 to check uniformity. [4]

6. a) Suppose that x and y are jointly discrete random variables with [3]

$P(x,y)=(x+y)/30 \quad for\ x=0,1,2\ and\ y=0,1,2,3$

$= 0 \quad 0,\ therwise$

Are x and y independent?

b) Suppose that x and y are jointly continuous random variables with [6]

$f(x,y)= y-x \quad$ for $0<x<1$ and $1<y<2$

$= 0, \quad otherwise$

Compute E(x), Var(x), E(y), Var(y), Cov(x, y), Cor(x,y)

c) Test for whether the 3rd, 8th, 13th, and so on, numbers in the following sequence at the beginning of this section are autocorrelated using $\alpha = 0.05$. [3]

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

7. a) Explain how simulation and modelling can play an important role in Manufacturing and Material Handling System. [3]

b) Briefly describe probable simulation processes in a Manufacturing System [Use an appropriate example]. [6]

c) Define verification in simulation process? Describe techniques to perform verification on simulation model. [3]

8. At a grocery store with one counter, customers arrive at random from 1 to 8 minutes apart (each of inter-arrival time has the same probability of occurrence). The service times vary from 1 to 6 minutes with the probabilities as 0.10, 0.20, 0.30, 0.25, 0.10 and 0.05 respectively. Analyze the system by simulating the arrival and service of 15 customers. [Justifying your situation and requirements, you can choose your required random values] [12]