DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
UNIVERSITY OF BARISAL
Final Examination - 2022
Course Title: Simulation and Modeling
Course Code: CSE-3209
3rd year 2nd Semester
Session: 2021-22 (Admission: 2019-20)

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: [8]

i) Weibull Distribution   ii) Gamma Distribution

iii) Geometric Distribution   iv) Bernoulli Distribution

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

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

     $= 0$ 0, therwise

Are x and y independent?

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

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

     $= 0,$ 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

4.
a) Briefly explain the differences between discrete system and continuous system with suitable figures. [4]

b) Discuss the concept of "Time Advance Mechanism" with an example. [4]

c) What are different components of a Discrete-event simulation models? Explain. [4]

5.
a) Define Chi – Square Test. [2]

b) Generate three Poisson variants with mean $\alpha = 0.2$ using acceptance rejection techniques. Given random numbers are 0.4357, 0.4146, 0.8353, 0.9952 and 0.8004. [4]

c) The life of a device used to inspect cracks in aircraft wings is given by X, a continuous [6]
    random variable assuming all values in the range $x \geq 0$. The cdf of the device's lifetime, in
    years, is as follows-

$$F(x) - \frac{1}{2}\int_0^x e^{-t/2}\,dt$$

    a.   Find the probability that the device will last for <2 years.

    b.   Find the probability that the device will last between 2 and 3 years.

6. a) What is the Kendall notation of Queuing System? [3]

    b) Define a Markov chains and its application. [4]

    c) Use the mixed congruential method to generate a sequence of three two-digit random [5]
    numbers with $X0 = 37$, $\alpha = 7$, $c = 29$ and $m = 100$.

7. a) For the following multiplicative generator, compute Z_i for enough values of $i \geq 1$ to cover [6]
    an entire cycle

    i) $Z_o = 1$, $a = 11$, $m = 16$

    ii) $Z_o = 2$, $a = 11$, $m = 16$

    iii) $Z_o = 1$, $a = 2$, $m = 13$

    iv) $Z_o = 2$, $a = 3$, $m = 13$

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

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

8. At a grocery store with one counter, customers arrive at random from 1 to 8 minutes apart [12]
    (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]