THE CO-OPERATIVE UNIVERSITY OF KENYA

UNIT CODE: BCSC 4126   UNIT NAME: SIMULATION AND MODELING

ASSIGNMENT TWO (2)   **NOVEMBER, 2022**

INSTRUCTION:

- Attempt ALL the Questions - IN GROUPS OF 3-5 STUDENTS
- Use illustrations where applicable
- Submit your solutions as one document through emasomo (**no emailing or hard copy will be accepted)**
- Submit your solution file in PDF format ONLY
- **DEADLINE is 2ND DECEMBER, 2022**

Question 1

a) The purpose for modeling can also have a functional level. With effective illustrations, describe any FIVE functional levels to which simulation modeling has been applied (10 marks)

b) Suppose that the number of major earthquakes occurring per month in a particular Mt. Kilimanjaro area is collected for 100 months and summarized in the table below:

Number of earthquakes per month	0	1	2	3	4
Number of months	57	31	8	3	1

Test at 5% level of significance whether the earthquakes occur randomly. Assume a Poisson distribution.   (10 marks)

Question 2

a) Most simulation programming system include a report generator to print out statistics gathered during the run. Describe any FIVE common required statistics, which are usually included in the output.   (10 marks)

b) Explain the multiplicative Linear Congruential Random Number Generator, using illustration on how it works   (4 marks)

c) Use a multiplicative linear congruential random number generator with

$$a = 16807 \qquad c = 0, \quad x_0 = 12345, \qquad m = 2^{31} - 1$$

to generate the first five random variates on the interval (0, 1)   (6 marks)

Question 3

a) Consider a random variable X which takes on values 1 and 2 with probability 0.25 and 0.75, respectively (i.e., $Pr[x = 1] = 0.25$ and $Pr[x = 2] = 0.75$). Determine the mean and variance of X. Plot the probability density function (pdf) and probability distribution function (PDF) of X.   (10 marks)

Question 4

This is the program for the SMPL Simulation Model. What does this program model do? Give and explain the output from the execution of the program.

```c
#include <stdio.h>
#include "smpl.h"
void main(void)
    {
        real Ta = 1;
        real Ts = 1.2;
        real te = 3.5;
        int customer = 1;
        int event;
        int server;
        smpl(0, "Mystery program");
```

```c
            server=facility("server", 1);
            schedule(1, 0.0, customer);

while (time() < te)
{
        cause(&event,&customer);

        switch(event)
        {
        case 1:

                printf("(1) at %f ", time());
                schedule(2, 0.0, customer);
                schedule(1, Ta, customer);
                break;

        case 2:

                printf("(2) at %f ", time());
                if (request(server, customer, 0) == 0)
                printf("(2a) at %f ", time());
                schedule(3, Ts, customer);

        }
        break;

        case 3:

                printf("(3) at %f ", time());
                release(server, customer);
                break;
                }
        }
}
```