THE CO-OPERATIVE UNIVERSITY OF KENYA

UNIT CODE: BCSC 4126 UNIT NAME: SIMULATION AND MODELING

ASSIGNMENT ONE (1) **NOVEMBER, 2022**

INSTRUCTION:

- Attempt ALL the Questions
- 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 24th NOVEMBER, 2022**

Question 1

a) Briefly explain the Queuing System as applied in simulation and modeling (5 marks)

b) Consider a simple server queuing system that starts at time t=0. The arrivals occur at times 1.2, 1.8, 2.6, 3.8, 6.0, 6.2, 7.0, 7.5, 8.6, and 0.2. Departures occur at times 3.0, 4.2, 4.9, 5.6 and 10. Time is in minutes. Simulate this system until when the sixth client enters service and estimate: (10 marks)

i. The average delay in the waiting line
ii. The average number of clients in the waiting line at any time
iii. The server utilization rate

Question 2

a) Describe how the MIDDLE SQUARE METHOD as Generator of Random Numbers, explaining its two short comings (7 marks)

b) Use the Linear Congruential Generator (LCG) with a=67, m=31, c=17 and seed $Z_0 = 117$ to generate the first FIVE random variates on [0, 1]. (8 marks)

Question 3

a) The table below shows the probability distribution of a barges arriver per day at a port.

No. of Arrivals	Probability
0	0.10
1	0.17
2	0.15
3	0.25
4	0.23
5	0.10

The uploading rate per day follows the probability distribution given below. NB: uploading is done on first come first serviced (FCFS) basis

Unloading rate	Probability
1	0.05
2	0.15
3	0.45
4	0.25
5	0.10

Suppose the following are the random numbers of arrivals and random numbers of uploading.

Arrival Random No.: 53, 07, 51, 82, 50, 35, 12, 57, 99, 27, 56, 93, 35, 34, 00, 22, 31

Upload Random No.: 35, 66, 38, 12, 54, 75, 34, 05, 19, 70, 64, 85, 90, 73, 59, 61, 43

Required: Simulate a <u>seventeen</u> day analysis and determine: (10 marks)

(i) The average number of barges delayed
(ii) The average number of arrivals per day
(iii) The average number of barges offloaded each day