KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
END SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE
KCS 406 – SIMULATION AND MODELING

Date: 15TH AUGUST 2023
Time: 8:30AM – 10:30AM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS
QUESTION ONE (30 MARKS)

1. Define the term Simulation   (2 Marks)
2. 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 $\Pr[x == 2] = 0.75$). With illustration, Determine
    a)   the mean   (3 Marks)
    b)   variance of X.   (5 Marks)

3. Draw the simulation table, given: (8 Marks)

Customer	Service Time	Interarrival Time
1	2	-
2	1	2
3	3	4
4	2	1
5	1	2
6	4	6

4. Assume you have a group of birds and rabbits. There are 5 more rabbits than there are birds. Use the variable b to represent the number of birds in the group, and use the variable r to represent the number of rabbits in the group. Create an algebraic model representing this scenario.   (4 Marks)

5. Explain the following queuing system characteristics: (6 Marks)
    a)   calling population
    b)   system capacity
    c)   Arrival process
    d)   Queue behavior and discipline

QUESTION TWO (20 MARKS)

1. Discuss the Components of a Basic Queuing Process   (9 Marks)
2. Monte Carlo methods vary a lot but tend to follow a particular pattern, discuss the steps of Monte Carlo Simulation.   (8 Marks)

3.   Differentiate between System and System Environment?   (3 Marks)

QUESTION THREE (20 MARKS)

1.   A television repairman finds that the time spent on his jobs has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution approximately with an average rate of 10 per 8-hour day:
   a)   what is the repairman's expected idle time each day?   (4 Marks)
   b)   How many jobs are ahead of the average set just brought in?   (4 Marks)

2.   Using a diagram, illustrate and explain the elements of a single queue queuing system   (12 Marks)

QUESTION FOUR (20 MARKS)

1.   Universal Bank is considering opening a drive-in window for customer service. Management estimates that customers will arrive at the rate of 15 per hour. The teller whom it is considering to staff the window can service customers at the rate of one every three minutes.
Assuming Poisson arrivals and exponential service find
   i)   Average number in the waiting line.   (2 Marks)
   ii)   Average number in the system.   (2 Marks)
   iii)   Average waiting time in line.   (2 Marks)
   iv)   Average waiting time in the system.   (2 Marks)
2.   Discuss 5 reasons when Simulation is the Appropriate Tool   (10 Marks)

QUESTION FIVE (20 MARKS)
1.   Highlight five components of a system   (10 Marks)
2.   What are the techniques for verification of simulation model?   (8 Marks)
3.   Define the term Algebraic Model: (2 Marks)