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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FOURTH YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF BUSINESS & INFORMATION TECHNOLOGY
KBI 2312 – SIMULATION AND MODELLING

Date: 08TH April 2024
Time: 11:30AM – 1:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Draw the simulation for the table given below:

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

(6 Marks)

b) Define the following terms in relation with simulation
   i) Stochastic Model (2 Marks)
   ii) Simulation (2 Marks)

c) Discuss Monte Carlo simulation as used in modeling. (6 Marks)

d) There is commonly used notation principle in most seen queueing models, i.e.: A/B/C. What do the letters A, B and C indicate in this notation? (6 Marks)

e) 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)

f) Explain the term system environment explaining the types of system environments in simulation and modeling. (4 Marks)

QUESTION TWO (20 MARKS)

a) Discuss the three important characteristics of Monte-Carlo method. (6 Marks)

b) A social media influencer decides to open a new page and her target is to reach 10k followers in 10 weeks. Given her past experience, she assumes that each week she will get 1.5k new followers that had never followed the page and of her current followers she believes 10% will stop following the page each week. However, 20% of those that the left the page in the past will join again each week. Showing your simulation workings, determine whether she will reach her target? (10 Marks)

c) Discuss the core elements of an Arithmetic Modelling Language (4 Marks)

QUESTION THREE (20 MARKS)

a) Simulate the workings of a little health center where Patients arrive at the health center and are first visited by a nurse. Once they are visited by the nurse, they have an actual consultation with a doctor. Once they are finished with the doctor, they meet the administrative staff to schedule a follow-up appointment.
   i) Explain the simulation using the components of a simulation model (10 Marks)
   ii) Discuss the three assumptions made during the simulation process (6 Marks)

b) Differentiate between a deterministic and stochastic model giving an example of each. (4 Marks)

QUESTION FOUR (20 MARKS)

a) Direct experimentation and mathematical model are other alternatives of representing the system, discuss five reasons that puts simulation as the best option of representing the system as opposed to the alternatives. (10 Marks)

b) Bernoulli random variables represent binary experiments with a probability of success equal to θ. Demonstrate a simple simulation algorithm to simulate one Bernoulli observation. (6 Marks)

c) Summarize 4 reasons when Simulation is the Appropriate Tool (4 Marks)

QUESTION FIVE (20 MARKS)

a) Simple queueing systems are defined by specifying three important steps, describe them. (6 Marks)

b) Consider a random variable X which takes on values 1 and 2 with probability 0.25 and 0.75, respectively (i.e.,25.0]1Pr[==x and 75.0]2Pr[==x). With illustration, Determine
   i) The mean (3 Marks)
   ii) Variance of X. (3 Marks)

c) A computer support staff 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. Showing your workings:
   i) What is the support staff's expected idle time each day? (4 Marks)
   ii) How many jobs are ahead of the average set just brought in? (4 Marks)