



PAN AFRICA CHRISTIAN UNIVERSITY

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

END OF SEMESTER EXAMINATION

DEPARTMENT: COMPUTING AND INFORMATION TECHNOLOGY

COURSE CODE: BSIT405

COURSE TITLE: SIMULATION AND MODELLING

CAMPUS: ROYSAMBU

EXAM DATE: TUESDAY, XXXXX/AUGUST,2023

TIME: 8:00AM-11:00AM

INSTRUCTIONS

- This exam script has **TWO (2)** sections.
- Read all questions carefully before attempting.
- Answer All questions in Section **A** and any other Three questions in Section **B**.
- Write only your **student number** on the answer booklet provided.

SECTION A

(Answer ALL questions in this section)

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Question 1:

- a) "Monte Carlo simulation is a special case of stochastic simulation." Justify this statement. [2 Marks]
- b) Explain two applications of simulation and modeling in real life. [2 Marks]
- c) A fair coin is tossed twice. Let X be the number of heads that are observed. Find the probability that at least one head is observed. [2 Marks]
- d) Generate four numbers of a random sequence using multiplicative congruential method with $X_0=2$, $a=13$ and $M=64$, hence generate their corresponding random numbers. [4 Marks]

SECTION B

(Answer any THREE (3) questions in this section)

Question 2:

- a) Find the mean of the discrete random variable X whose probability distribution is

x	-2	1	2	3.5
P(x)	0.21	0.34	0.24	0.21

[3 Marks]

- b) If a coin is tossed 5 times, using binomial distribution find the probability of:
- i. Exactly 2 heads [3 Marks]
- ii. At least 4 heads [4 Marks]

Question 3:

- a) "A sequence of random numbers $R_1, R_2, \dots$ must have two important properties uniformity and independence." Explain these properties. [2 Marks]

b) Suppose six (6) numbers are given 0.64, 0.50, 0.25, 0.58, 0.72, 0.90 . Use [Kolmogorov Smirnov](#) (KS) test with [level of significance \$\alpha = 0.050\$](#) to determine if the hypothesis that they are uniformly distributed on interval $[0,1]$ can be rejected. (Hint: $\alpha = 0.050 \Rightarrow 0.512$) **[8 Marks]**

Question 4:

a) A bag contains green and red balls. Two balls are drawn without replacement. The probability of selecting a green ball and then a red ball is 0.28. The probability of selecting a green ball on the first draw is 0.5. Find the probability of selecting a red ball on the second draw, given that the first ball drawn was green. **[4 Marks]**

b) Dynamic systems have a state that is ever changing as a result of changes in state variables. In your own understanding, describe the terms system, system state, and state variable giving an example from banking system. **[6 Marks]**

Question 5:

a) Discuss the “build model right-build right model” philosophy of model verification and validation. **[4 Marks]**

b) A computer system has a Poisson distribution job arrival stream at an average rate of 2 per minute. Determine the probability that any one-minute interval there will be

i. Exactly 3 jobs **[3 Marks]**

ii. At most 3 job arrivals **[3 Marks]**

Question 6:

XYZ supermarket has a single cashier. During the rush hours, customers arrive at the rate of 10 per hour. The average number of customers that can be processed by the cashier is 12 per hour. On the basis of this information, find the following:

i. Probability that the cashier is idle. **[1 Mark]**

ii. Average number of customers in the queuing system. **[2 Marks]**

iii. Average time a customer spends in the system. **[2 Marks]**

iv. Average number of customers in the queue.

[2 Marks]

v. Average time a customer spends in the queue.

[3 Marks]

