



MACHAKOS UNIVERSITY

University Examination for 2022/2023 Academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS

FIRST YEAR SECOND SEMESTER EXAMINATION FOR
DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY

2920/104 CM-COMPUTATIONAL MATHEMATICS

DATE: 27/3/2023

TIME: 11:30 – 2:30 PM

Instruction: This paper contains only 5 questions. Answer all questions

1. (a) Using a 3 by 3 matrix, give an example of each of the following:
- (i) Zero matrix
 - (ii) Lower triangular matrix
 - (iii) Diagonal matrix
 - (iv) Identity matrix
- (4 marks)

- (b) Perform the following matrix operations

(i) $-5 \begin{bmatrix} 5 & -6 \\ 4 & 9 \end{bmatrix}^T$ (2 marks)

(ii) $2 \begin{bmatrix} x & x+y & 6 \\ -2 & -x & 1 \end{bmatrix} - 3 \begin{bmatrix} -x & -2y & 0 \\ 3x & x & -1 \end{bmatrix}$ (4 marks)

- (c) The table below shows frequency distribution of the favorite sport among 120 students in a school. Use it to answer questions that follow.

Sport	Frequency
Football	26
Cricket	22
Swimming	22
Basketball	30
Athletics	20

- (i) Represent the information using a pie chart (3 marks)
- (ii) Outline four uses of charts in data representation (4 marks)
- (d) Kihoto self-help group comprises of 58 members. They intend to choose 3 officials from the group to represent them in a conference. Determine the number of ways the 3 members can be chosen (3 marks)
- 2 . (a) (i) Explain two ways in which parity bit is used for error detection in computer systems (4 marks)
- (ii) State four categories of binary codes used in computer systems (2 marks)
- (b) Peter, John and Mary intend to buy 15, 16, 18 books and 9, 11, 15 pens each respectively. In shop A, a book costs Kshs 250 and a pen costs Kshs 175 while in shop B, a book costs kshs 225 while a pen costs kshs 190
- (i) Represent this information in matrix form (2 marks)
- (ii) Using matrix method, determine the total cost the three students would spend to acquire the items from shop A and from shop B (4 marks)
- (c) Given the matrix $C = \begin{bmatrix} -1 & 0 & 3 \\ 3 & 2 & 2 \\ 0 & 0 & 1 \end{bmatrix}$ determine inverse of matrix C using the cofactor method (8 marks)
3. (a) Explain the following terms as used in probability:
- (i) Independent events
- (ii) Mutually exclusive events
- (iii) Exhaustive events (6 marks)
- (b) The table below shows the amount of water in liters (x) and respective heights(y) attained by 5 plants after being watered for a period of time. Use it to answer questions that follow.

Amount of water(x)	0	10	20	30	40
Height of plant in cm(y)	7	18	32	51	87

- (i) Construct a forward difference table (3 marks)
- (ii) Determine the Newton's interpolating polynomial (5 marks)

(c) Solve each of the following equations using the method indicated

(i) $2x^2 - 8x - 7 = 0$: using formula method (3 marks)

(ii) $x^2 + 5x = 14$: using factorization method (3 marks)

- 4 (a) (i) Outline the meaning of the term sample space as used in probability (1 mark)
- (ii) A student tossed a coin four times. Outline possible outcomes from this experiment (4 marks)
- (iii) Determine the probability of getting exactly two heads from the experiment in (ii) (3 marks)

(b) With aid of a logic circuit, describe the component of Boolean variable A (4 marks)

(c) A researcher conducted a survey on drinks consumed by students in a college over a period of time and obtained the following results;

- 51 drunk Coca-Cola, 49 drunk Fanta and 60 drunk Sprite;
- 34 drunk both Coca-Cola and Fanta
- 32 drunk both Fanta and Sprite
- 26 drunk both Coca-cola and Sprite
- 24 drunk the three drinks
- 1 drunk none

(i) Represent this information using Venn diagram (3 marks)

- (ii) Determine the number of students who;
- (I) where surveyed
- (II) drunk sprite, but not Fanta nor Coca-Cola
- (III) drunk Fanta or sprite
- (IV) drunk exactly two types of drinks
- (V) drunk exactly one drink (5 marks)

5. (a) Using the graphical method, solve the following simultaneous equation for
- $$-3 \leq x \leq 4;$$
- $$2x + 3y = 1$$
- $$y = 2x^2 - 2x - 5$$
- (6 marks)
- (b) State four types of measurement scales used in statistics (4 marks)

- (c) Derive the truth table of each of the following logic gates having 2 inputs;
- (i) NOR gate
 - (ii) NAND gate
 - (iii) XNOR gate (6 marks)
- (d) In a series of successive measurements in an experiment, the readings of the period in seconds(s) of oscillation of a simple pendulum were found to be 2.63s, 2.56s, 2.42s, 2.71s and 2.80s.
- Calculate each of the following'
- (i) mean value of the period of oscillation
 - (ii) absolute error in reading (4 marks)