1920/104
MATHEMATICS
June/July 2023
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN INFORMATION TECHNOLOGY

MODULE I

MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

This paper consists of TWO sections. Section A and section B.
Answer ALL Questions in section A and any FOUR questions from Section B in the answer booklet provided.
Candidate should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

SECTION A (40 marks)
Answer all the questions in this section

1. Define each of the following types of matrices, giving an example in each case:

   (a)   row matrix;   (2 marks)

   (b)   column matrix.   (2 marks)

2. Distinguish between the symbol $\in$ and the symbol $\subset$ as used in set theory.   (4 marks)

3. Distinguish between *one's complement* and *two's complement* operations as used in computers.

                                                                 (4 marks)

4. Explain each of the following types of codes as used in computers:

   (a)   BCD;   (2 marks)

   (b)   excess-3 code.   (2 marks)

5. Use elimination method to solve the following set of simultaneous equation:
$$4x + 3y = 25$$
$$5x + 7y = 41$$
                                                            (4 marks)

6. Use the formula to solve the following quadratic equation:
$$3x^2 + 5x - 2 = 0$$
                                                            (4 marks)

7. Given matrices X and Y such that $X = \begin{bmatrix} 4 & 1 \\ 7 & 2 \end{bmatrix}$ and $XY = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, determine matrix Y.

                                                               (4 marks)

8. Explain each of the following categories of data as used in statistics:

   (a)   discrete;

   (b)   continuous.   (4 marks)

9. Using the inverse matrix method, solve the following set of simultaneous equations:

$$4x + 3y = 32$$
$$2x + y = 10$$
                                                            (4 marks)

10. A group comprises of 7 men and 6 women. Five persons are to be selected to form a committee so that 3 are men. Determine the number of ways this committee can be formed.   (4 marks)

*Answer any **FOUR** questions from this section.*

11. (a) Describe each of the following data collection methods as used in statistics:

    (i) interview;

    (ii) observation. (4 marks)

    (b) Given that sets; $P = \{3, 5, 7, 9, 11\}$, $Q = \{7, 9, 11, 13\}$ and $R = \{11, 13, 15\}$. Evaluate

    (i) $P \cap (Q \cup R)$;

    (ii) $(P \cap Q) \cup (P \cap R)$. (4 marks)

    (c) Given that matrix $U = \begin{bmatrix} 2 & 5 & 7 \\ 2 & -1 & 0 \\ 3 & 4 & 8 \end{bmatrix}$ and matrix $V = \begin{bmatrix} 1 & 4 & 9 \\ 3 & -2 & 4 \\ -5 & 6 & 8 \end{bmatrix}$, determine each of the following matrix operations:

    (i) $U^T + V^T$;

    (ii) UV (3 marks)

    (d) Table 1 shows probability distribution of fish sold per day in a certain market. Use it to answer the questions that follow:

Number of fish	1	2	3	4	5
Probability	0.14	0.25	0.3	0.21	0.1

    Table 1

    Determine each of the following measures for the number of fish sold per day:

    (i) the expected number;

    (ii) the variance. (4 marks)

12. (a) State the meaning of the term *permutation* as used in probability. (1 mark)

    (b) Using the binomial method, expand the expression $(2 + x)^5$ in ascending powers of x. (4 marks)

    (c) Use factorization method to solve the quadratic equation $9x^2 - 24x + 16 = 0$. (4 marks)

    (d) The probability that a boy child is born in a family is 0.5. Given that the family has three children;

    (i) Construct a probability tree diagram for the birth order of the children. (3 marks)

(ii) Determine the probability that:

    I.   all the three children are boys.

    II.   Exactly two of the three children are girls.   (3 marks)

13.   (a)   State the meaning of each of the following terms as used in probability:

    (i)   dependent events;

    (ii)   random experiment.   (2 marks)

    (b)   With the aid of a sketch in each case, describe each of the following types of skewness as used in statistics:

    (i)   positive skewness;

    (ii)   negative skewness.   (4 marks)

    (c)   Convert each of the following to the respective number system indicated:

    (i) 65_{10} to hexadecimal;   (2 marks)

    (ii) 673_8 to decimal;   (2 marks)

    (c)   Given the universal set $U = \{b, g, i, o, r, v, y\}$ and sets $A = \{b, r, y\}$, $B = \{g, r\}$, and $D = \{g, i, o\}$.

    (i)   present this information in Venn diagram;   (3 marks)

    (ii)   determine $(A \cup B)^c \cap D^c$.   (2 marks)

14.   (a)   Define each of the following terms as used in statistics:

    (i)   range;

    (ii)   mode.   (2 marks)

    (b)   State two conditions for a matrix to be a singular matrix.   (2 marks)

    (c)   Using graphical method, with the values of x from 0 to 7, solve the linear equations:

$$9y = 4x - 9$$

$$5y + 2x = 10$$
    (4 marks)

    (d)   Table 1 shows distribution of marks for 30 students who sat for mathematics test. Use it to answer the questions that follow.

Marks	11-20	21-30	31-40	41-50	51-60	61-70	71-80	80-90
Number of Students	1	3	4	4	10	5	2	1

Table 1

Estimate by computing each of the following measures about the students' marks:

    (i)   mean mark;   (2 marks)

    (ii)   median mark;   (2 marks)

    (iii)   standard deviation.   (3 marks)

15.   (a)   State the difference between *primary data* and *secondary data* as used in statistics, giving an example in each case.   (4 marks)

        (b)   With the aid of a Pascal's triangle, expand the binomial expression $(x + y)^6$.

                                                           (5 marks)

        (c)   Solve the following linear inequality:

$$-14 < -7(3x + 2) < 1$$

                                                            (2 marks)

        (d)   Determine the determinant of matrix $W = \begin{bmatrix} 1 & 4 & 9 \\ 3 & -2 & 4 \\ -5 & 6 & 8 \end{bmatrix}$ (4 marks)

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