

1920/104
MATHEMATICS
July 2019
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
CRAFT CERTIFICATE IN INFORMATION TECHNOLOGY
MATHEMATICS

3 hours

INSTRUCTIONS TO THE CANDIDATE

You should have the following for this examination:

- Scientific calculator
- Statistical tables
- Geometrical set
- Graph paper

This paper consists of TWO sections; A and B.

Answer ALL the questions in section A and any FOUR questions from section B in the answer booklet provided.

Candidates 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.

SECTION A (40 marks)

Answer **ALL** the questions from this section.

1. Convert each of the decimal numbers to an 8-bit two's complement binary number:
 - (i) 47_{10} ; (2 marks)
 - (ii) -72_{10} . (3 marks)
2. Differentiate between *BCD* and *EBCDIC* computer coding systems. (4 marks)
3. Describe each of the following types of statistical data:
 - (i) discrete data;
 - (ii) continuous data. (4 marks)
4. Use the binomial theorem to expand the expression $(5x + 2b)^3$ in the descending powers of x . (3 marks)
5. Given that matrix $W = \begin{bmatrix} 3 & -4 \\ -2 & 5 \end{bmatrix}$, determine $(2W)^{-1}$. (4 marks)
6. Use the matrix method to solve the following pair of simultaneous equations:

$$\begin{aligned} x + 2y &= -1 \\ 3x - 5y &= 19 \end{aligned}$$
 (5 marks)
7. Determine the value of x in each of the following inequalities:
 - (i) $-2(x + 3) < 10$;
 - (ii) $-4x(x - 3) \leq 16$. (4 marks)
8. Outline **three** methods of collecting statistical data. (3 marks)
9. Describe **two** ways in which statistical data can be classified. (4 marks)
10. Explain **two** assumptions in Poisson probability distribution. (4 marks)

SECTION B (60 marks)

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

11. (a) Describe each of the following types of matrices:
- column matrix;
 - scalar matrix.
- (4 marks)

(b) Given the following matrices, $X = \begin{bmatrix} 2 & -1 \\ 3 & 0 \\ -5 & 2 \end{bmatrix}$, $Y = \begin{bmatrix} 4 & 4 & -3 \\ 0 & -1 & -2 \end{bmatrix}$ and $Z = \begin{bmatrix} 1 & 6 \\ 1 & -2 \\ 0 & -3 \end{bmatrix}$

Determine each of the following matrix operations:

- $(XY)Z$; (3 marks)
- $X^T Z$. (3 marks)

- (c) Convert each of the following numbers to their equivalent number systems indicated:

- 63150_8 to binary;
 - 153_8 to hexadecimal.
- (5 marks)

12. (a) Table 1 shows the probability of selling a specified number of cars by a certain car dealer in a certain month. Use it to answer the question that follows.

Table 1

Number of cars	8	9	10	11	12	13	14	15
Probability (x)	0.10	0.15	0.15	0.25	0.20	0.10	0.0	0.05

Determine the number of cars the car dealer expects to sell during the period. (2 marks)

- (b) Use the substitution method to solve the following pair of simultaneous equations:

$$3x - y = 11$$

$$3x - 2y = 4$$

(4 marks)

- (c) Using graphical method, solve the following pair of simultaneous equations:
(Use the range $-4 \leq x \leq 3$)

$$y = 2x^2 + x - 5$$

$$y = 2x + 1$$

(6 marks)

- (d) A team comprising of 7 men and 6 women and a committee of 5 persons is to be formed from a group. Determine the number of ways in which a committee of 3 men and 2 women could be formed. (3 marks)

13. (a) Outline **three** properties of a *binomial probability distribution*. (3 marks)

- (b) Using Pascal's triangle, expand the expression $(x - 3y)^4$ in ascending powers of y . (6 marks)

- (c) Table 2 shows distribution of overtime hours worked by 100 employees of a company. Use it to answer the questions that follow.

Table 2

Overtime hours	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40
Number of employees	11	20	35	20	8	6

Calculate each of the following measures about the overtime hours:

- (i) the median;
- (ii) the standard deviation. (6 marks)

14. (a) The Principal of Stargat College is required to choose the environmental committee of 4 members from a staff comprising 3 women and 4 men.

Determine the number of ways of choosing the committee if:

- (i) 2 men and 2 women should be chosen; (2 marks)
- (ii) The probability that the committee consists of 2 men and 2 women. (3 marks)

- (b) Given the sets $U = \{11, 12, 13, 14, 15, 16, 19\}$, $X = \{11, 12, 13, 14\}$ and $Y = \{12, 14, 16\}$, use *Venn diagram* to represent each of the following set operations:

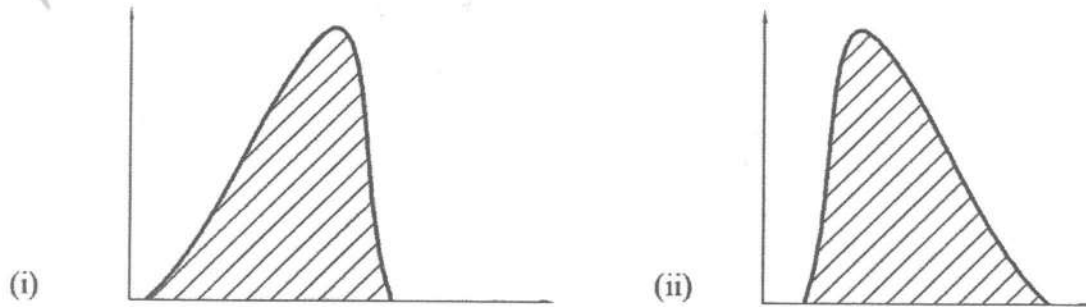
- (i) $X \cup Y'$;
- (ii) $X \cap U$;
- (iii) $X - Y$. (7 marks)

- (c) Given that matrix $L = \begin{bmatrix} 3 & -1 & 2 \\ -3 & 1 & 5 \\ 0 & 3 & 7 \end{bmatrix}$, show that $L^{-1} = \begin{bmatrix} 8/63 & -13/63 & 1/9 \\ -1/3 & -1/3 & 1/3 \\ 1/7 & 1/7 & 0 \end{bmatrix}$. (3 marks)

15. (a) State the meaning of each of the following set properties:

- (i) $A \subset B$;
- (ii) \emptyset ;
- (iii) $x \in T$;
- (iv) \bar{A} . (4 marks)

- (b) State **two** differences between data sets that were used to draw the graphs labelled (i) and (ii) with respect to skewness: (4 marks)



- (c) A box *R* contains 2 green and 8 white similar balls. A box *S* contains 4 green and 8 white similar balls. A ball is drawn at random from box *R* and placed in box *S*. Then a ball is drawn at random from box *S*.

- (i) Represent this information using a probability tree diagram. (2 marks)
- (ii) Determine the probability of each of the following events:
- I. drawing a green ball from box *R* and a white ball from box *S*; (2 marks)
- II. drawing a green ball from box *S*. (3 marks)

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