1920/104
MATHEMATICS
July 2018
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN INFORMATION TECHNOLOGY

MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

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. Explain each of the following terms as used in probability:

   (i) mutually exclusive events;

   (ii) random variable. (4 marks)

2. Convert each of the following number systems to their respective equivalent, showing your workings:

   (i) 475_8 to binary;

   (ii) $7B2D_{16}$ to decimal. (4 marks)

3. With the aid of an example in each case, distinguish between *lower triangular* matrix and *identity* matrix. - diagonal matrix whose principal diagonal is one. (4 marks)

4. With the aid of an illustration in each case, describe the following coding systems:

   (i) ASCII; - 8 bits

   (ii) EBCDIC. (4 marks)

5. State whether each of the following matrix statements are either true or false:

   (i) In order for matrix **A** to be inverse of **B**, both $\mathbf{AB} = \boldsymbol{I}$ and $\mathbf{BA} = \boldsymbol{I}$;

   (ii) If **X** and **Y** are n × n and inveruble, then $\mathbf{X}^{-1}\,\mathbf{Y}^{-1}$ is the inverse of **XY**;

   (iii) If $\mathbf{A} = \begin{bmatrix} x & y \\ p & q \end{bmatrix}$ and $xq - yp \neq 0$, then $\mathbf{A}^{-1}$ does not exist. true 1, 4, 6, 4, 1 (3 marks)

6. Using the graphical method, solve the quadratic equation $y = 2x^2 - 12x + 16$, for $0 \leq x \leq 5$. (4 marks)

7. (i) Using binomial theorem, expand the expression $(2 + x)^4$ in ascending powers of x, simplifying the result. (2 marks)

   (ii) Using Pascal's triangle, determine the coefficients of the expression $(a + b)^4$. (3 marks)

8. (a) Determine the equation of a line that passes through the point (18, 6) and has a gradient of -12. (2 marks)

   (b) The size of matrix $\boldsymbol{X}$ is a 5 × 3 matrix and the product of $\boldsymbol{XY}$ is a matrix of size 5 × 7 matrix. Determine the size of matrix $\boldsymbol{Y}$. (3 marks)

$6 = 12m + c$

$6 = 12 + c$

$c = -6$

$y = 12x - 6$

$y = mx + c$

$y = -12m + c$

9. Table 1 shows data relating to renting out of cars by a certain car hire company. The company has 38 cars which were rented out for different duration in days within the month Use it to answer the question that follows.

Number of days (x)	10	11	12	13	14
Number of cars (f)	5	8	10	9	6

Table 1

Determine by calculation the *harmonic mean* of the number of cars rented out. (3 marks)

10. Distinguish between *dependent events* and *independent events* as applied in probability. (4 marks)

one events must happen for another ? happen

it stand on its own

dependent - have no conditions

Independent - one event must happen 4 another 2 happen

SECTION B (60 marks)

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

11. (a) Let ; $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{3, 4, 5, 6\}$, $B = \{6, 7, 8\}$ and $C = \{7, 8, 9\}$

Determine each of the following:

(i) $(A \cup B) \cap C$; (3, 4 5 6 6 7 8) ∩ C

(ii) $B' \cap C'$; 3 4 5 6 7 8 7 8 9

(iii) $A \cup C'$. (6 marks)

3, 4, 5 6, 1 8 9

(b) Given the following matrices $\mathbf{A} = \begin{bmatrix} 5 & 1 \\ 3 & -3 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 2 & 0 \\ 4 & 3 \end{bmatrix}$:

Show that $\mathbf{AB} \neq \mathbf{BA}$. (4 marks)

(c) The captain of Crystal football team is required to choose a committee of 4 members from a team comprising 3 men and 4 women. Determine each of the following:

(i) the number of ways the committee could be chosen; (1 mark)

random rule

(ii) the number of ways in which the committee could be chosen if it must comprise 2 men and 2 women; (2 marks)

(iii) the probability of choosing the committee which consists of 2 men and 2 women. (2 marks)

12. (a) Estimate the *geometric mean* of the following distribution:

Class	5-15	15-25	25-35	35-45	45-55
Frequency	10	22	25	20	8

(4 marks)

(b) From past experience, it was found out that in a certain factory, there is an average of two accidents per month. Assuming a Poisson distribution, determine the probability that in a certain month selected at random there would be:

(i) no accident; (2 marks)

(ii) exactly two accidents; (2 marks)

(ii) less than four accidents. (3 marks)

(c) Patrick collected raw data for a research he was undertaking. Outline **four** ways in which he could classify this data. (4 marks)

13. (a) Given the following sets, $Q = \{a, b, c, d, e, f\}$ and $P = \{a, b, c\}$ describe each of the following :

P

abcdef abc

abcef

(i) $P \subseteq Q$, using a Venn diagram; (3 marks)

(ii) the power set of set P (P_P). (2 marks)

(b) A factory produces blankets and duvets. The cost of producing 15 blankets and 10 duvets is Ksh 6,000 while the cost of producing 5 blankets and 8 duvets is Ksh 3,400.

(i) formulate a model for the cost of producing blankets and duvets as a set of simultaneous equation; (2 marks)

$15b + 10d = 6000$
$5b + 8d = 3400$

(ii) using the model, determine the cost of producing one blanket and one duvet. (3 marks)

(c) Table 2 shows the number of defective spare parts produced in a day per batch and the corresponding probabilities. Use it to answer the question that follows.

No of defectives	8	9	10	11	12	13	14	15
Probability of defective	0.10	0.15	0.15	0.25	0.20	0.10	0.00	0.05

Table 2

Determine each of the following about the spare parts produced for a given day:

(i) the expected number of defective parts;

(ii) the standard deviation. (5 marks)

14. (a) Convert the number 698_{10} to each of the following equivalents:

(i) BCD ;

(ii) Binary. (4 marks)

(b) Using the *Cramers'* method, solve the following set of simultaneous equations. (11 marks)

$$x - 2y + z = 3$$
$$2x + y + 3z = 12$$
$$x + y + z = 6$$

15. (a) Outline **four** properties of the *normal probability distribution*. (4 marks)

(b) Using a graph in each case, present each of the following linear inequalities:

(i) $y > 2x + 3$;

(ii) $y \leq 2x + 3$. (6 marks)

(c) In a certain factory, the probability of workers suffering from an occupational disease is 20%. Determine the probability that out of six workers randomly selected from the factory, 4 or more will suffer from the disease. (5 marks)

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$15b + 3500 = 6000$
$5b + 2800 = 3400$
$50 + 8d = 3400$
200.25