1920/104
MATHEMATICS
November 2016
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN INFORMATION TECHNOLOGY

MATHEMATICS

3 hours

INSTRUCTIONS TO THE CANDIDATE

This paper consists of **TWO** *sections;* **A** *and* **B**.
Answer **ALL** *the questions in section A and any* **FOUR** *questions in 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.

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SECTION A (40 marks)

Answer all the questions from this section.

1. Define each of the following terms as used in matrices:

   (i)   lower triangular matrix;   (2 marks)

   (ii) diagonal matrix.   (2 marks)

2. Using binomial theorem, expand the expression $(2x^2 - y)^3$ in descending powers of x.   (4 marks)

3. Describe each of the following mathematical functions giving their general form:

   (i)   linear function;   (2 marks)

   (ii) quadratic function.   (2 marks)

4. Given **two** matrices $A = \begin{bmatrix} 1 & 0 \\ -1 & 2 \\ 2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 4 \\ -1 & 2 & 0 \\ 4 & 0 & 0 \end{bmatrix}$, determine $A^T(BA)$.   (5 marks)

5. A bag contains 25 balls labelled 1 to 25. Two balls are drawn from the bag with replacement. Assuming that an even number is considered a success, determine the probability of getting:

   (i)   exactly two successes;   (2 marks)

   (ii) exactly one success.   (2 marks)

6. Define each of the following terms as used in statistics:

   (i)   harmonic mean;   (2 marks)

   (ii) geometric mean.   (2 marks)

7. Convert the decimal number 75_{10} to each of the following equivalents:

   (i)   binary;   (2 marks)

   (ii) gray code.   (2 marks)

8. Explain each of the following terms as used in set theory:

   (i)   intersection of sets;   (2 marks)

   (ii) complement of a set.   (2 marks)

9. Using the substitution method, solve the following set of simultaneous equations;

   $$5x + 3y = 34$$

   $$4x + 5y = 35$$
   (4 marks)

10. Using the binomial expansion, determine the first **three** terms in the expansion of $(1-2y)^7$ in ascending powers of y.   (3 marks)

SECTION B (60 marks)

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

11. (a) (i) Define the term *random experiment* as used in probability theory. (2 marks)

    (ii) Outline **three** properties of a random experiment. (3 marks)

    (b) The following information relates to the qualifications of employees of AZECT company. Sam, John, Willy and Ben have diploma certificates with Sam and Ben also having degrees. Sam, Melvin, Willy, Tom, Morris and Ken are members of the ICTAK certifying body, with Tom and Morris having diploma certificates. Assume set 'A' to be employees' with diploma certificates, set 'B' employees who are ICTAK certified and set 'C' degree holders'.

    (i) Identify the elements of sets *A, B* and *C*; (3 marks)

    (ii) Draw a Venn diagram to represent the sets in (i) showing their respective elements. (4 marks)

    (c) Using the elimination method, solve the following simultaneous equations.

    $$7x - 4y = 37$$
    $$6x + 3y = 51$$

    (3 marks)

12. (a) Differentiate between the terms *qualitative data* and *quantitative data* collection methods. (4 marks)

    (b) Given two matrices $P = \begin{bmatrix} 3 & -1 & 2 \\ 1 & 0 & 3 \\ 3 & -2 & -5 \end{bmatrix}$ and $Q = \begin{bmatrix} 3 & -6 & -3 \\ 7 & -14 & -7 \\ -1 & 2 & 1 \end{bmatrix}$.

    Show that;

    (i) PQ is a null matrix;

    (ii) QP is not a null matrix. (6 marks)

    (c) Table 1 shows the salary distribution in Kenya shillings of 340 employees of a certain firm. Use it to answer the questions that follow.

Salary	3001-4000	4001-5000	5001-6000	6001-7000	7001-8000	8001-9000	9001-10000
No of Employees	30	46	58	76	60	80	20

Table 1

Estimate each of the following measures about the salary of the employees:

    (i) the mean ; (2 marks)

    (ii) the standard deviation. (3 marks)

1920/104
November 2016

3

Turn Over

13. (a) Describe each of the following number systems as used in computer systems.

   (i) Hexadecimal number system; (2 marks)

   (ii) Octal number system. (2 marks)

   (b) A factory keeps the details of ingredients used to produce soaps X and Y as shown in matrix R and the quantity produced on each day of the week as shown in matrices Q.

$$\text{Soaps} \quad \begin{array}{c} X \quad Y \end{array}$$

$$\begin{array}{c} Mon \\ Tue \\ Wed \\ Thu \\ Fi \end{array} \begin{bmatrix} 0 & 1 \\ 2 & 2 \\ 3 & 2 \\ 1 & 1 \\ 1 & 0 \end{bmatrix} = Q$$

$$\text{Ingredients} \quad \begin{array}{ccc} A & B & C \end{array}$$

$$\text{Soap} \quad \begin{array}{c} X \\ Y \end{array} \begin{bmatrix} 3 & 2 & 1 \\ 1 & 4 & 2 \end{bmatrix} = R$$

   Determine the matrix that describes the amount of each ingredient used on each day of the week. (4 marks)

   (c) Table 2 shows the analysis of records of 200 employees of a certain company in terms of age and highest level of education. Use it to answer the questions that follow.

Age (years)	Bachelors degree	Masters Degree
Under 30	90	10
30 - 40	20	30
Over 40	40	10

Table 2

   If an employee is selected at random, determine the probability that his highest level of education is:

   (i) a bachelors degree; (2 marks)

   (ii) a masters degree given that he is over 40 years; (3 marks)

   (iii) a bachelors degree given that he is under 30 years. (2 marks)

14. (a) (i) State the *binomial theorem* where n is a positive integer. (2 marks)

   (ii) Using the Pascal's triangle, expand $(x+2y)^6$ in descending powers of x. (3 marks)

   (b) Using matrix method, solve the following simultaneous equations. (4 marks)

   $$3x - y = 11$$
   $$4x + 3y = 32$$

(c)   John intends to prepare a questionnaire to collect statistical data in a work environment survey for the organization he works for. Explain **three** features of the questionnaire that he should consider.   (6 marks)

15.   (a)   Write the following abbreviations in full as used in computer coding.

     (i)   ASCII;   (1 mark)

     (ii)   EBCDIC.   (1 mark)

   (b)   State **two** characteristics of the binomial distribution.   (1 mark)

   (c)   Table 1 shows the age distribution of 30,100 policy holders in a certain insurance company. Use it to answer the questions that follow.

Age	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	Over 90
Frequency	3016	6894	9229	5714	3575	1492	170	9	1

Table 1

Determine each of the following measures about the age distribution;

     (i)   median;   (3 marks)

     (iii)   quartile deviation.   (3 marks)

   (d)   Given that matrix $A = \begin{bmatrix} 5 & 2 & 1 \\ 0 & -1 & -1 \\ 10 & 3 & 0 \end{bmatrix}$, determine A^{-1} using the cofactor method.

   (6 marks)

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