2920/106
COMPUTATIONAL MATHEMATICS
November 2017
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE I

COMPUTATIONAL MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

*This paper consists of **EIGHT** questions.*
*Answer any **FIVE** of the **EIGHT** questions in the answer booklet provided.*
***ALL** questions carry equal marks.*
*You should have a **scientific calculator** for this examination.*
Candidates should answer the questions in English.

This paper consists 6 printed pages.

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

1. (a) Define each of the following terms as used in probability theory:

(i) sample space;

(ii) independent events;

(iii) equally likely events. (3 ma

(b) A vehicle assembly firm purchased its vehicle parts from 4 different suppliers. Parte Ltd supplies 20%, Quinty Ltd 30%, Rikert Ltd 25% and Santer Ltd 25%. Partel Ltd tends to have the best quality as only 3.0% of their supplies are defective. Quinty Ltd supplies are 4.0% defective, Rikert Ltd 7.0% and Santer Ltd 6.5% defective.

(i) If a vehicle part is selected at random from the store, determine the probability that it is defective; (4 marks

(ii) A defective vehicle part was picked at random from the store, determine the probability that it was supplied by Partel Ltd ; (3 marks

(c) Table 1 is a truth table in a Boolean algebra. Use it to answer the questions that follow:

Input			Output
X	Y	Z	Q
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Table 1

(i) Translate the truth table as Boolean algebra in its minimized form; (2 marks

(ii) Represent the Boolean algebra as a circuit of logic gates. (4 marks

(d) Explain each of the following terms as used in computer modelling.

(i) pseudocode;

(ii) algorithm. (4 marks

2. (a) Use the binomial theorem to expand each of the following expressions in an descendin powers of y:

(i) $(a + 2y)^4$; (3 marks

(ii) $\left(2x + \frac{2}{y}\right)^5$. (4 marks

(b) Table 2 shows the amount of money in thousands of Kenya shillings, paid as benefits to retrenched employees in a certain company .Use it to answer the questions that follow.

Benefits '000'	20-29	30-39	40-49	50-59	60-69	70-79	80-89
No of employees	50	60	70	90	52	40	11

Table 2

Determine each of the following about the benefits the employees received:

(i) inter-quartile range ; (3 marks)

(ii) maximum amount for the lower 40% of the employees. (2 marks)

(iii) minimum amount for the top 10% of the employees; (3 marks)

(c) Given that matrix $S = \begin{bmatrix} 1 & 0 \\ -1 & 2 \\ 2 & 0 \end{bmatrix}$ and $T = \begin{bmatrix} 3 & -1 & 4 \\ -1 & 2 & 0 \\ 4 & 0 & 0 \end{bmatrix}$, determine $S^T(TS)$. (5 marks)

3. (a) Define each of the following terms as used in mathematics:

(i) Linear interpolation;

(i) Linear extrapolation. (4 marks)

(b) Distinguish between *combination* and *permutation* as used in counting theory. (4 marks)

(c) Describe **three** properties of *arithmetic mean* as a measure of central tendency. (6 marks)

(d) The entry fee to a trade fair is Ksh. 2,100 for a group comprising 12 children and 3 adults and Ksh. 2000 for a group comprising of 8 children and 3 adults.

(i) Translate the problem into a system of simultaneous equations; (3 marks)

(ii) Determine the entry fee per child and per adult. (3 marks)

4. (a) Define each of the following units as used in collection of statistical data, stating an example of each:

(i) physical units;

(ii) arbitrary units. (4 marks)

(b) Describe each of the following logic gates:

(i) XOR;

(ii) NAND. (4 marks)

(c) (i) With the aid of a diagram in each case, distinguish between a *positively skewed* distribution and a *negatively skewed* distribution. (4 marks)

(ii) State the relation between the mean, mode and median in each distribution in (i). (2 marks)

(d) Plot the graph of $y = 3x^2 + 4x - 2$ for $-3 \leq x \geq 4$ in the grid provided and hence solve the equation $3x^2 + 4x - 2=0$. (6 marks)

5. (a) Describe **three** survey methods of collecting primary data. (6 marks)

(b) Distinguish between *weighted* and *sequential* binary codes as used in computing. (4 marks)

(c) There are 10 digits, 0 to 9, which could be used to generate a code of four digits to be used to identify an item of clothing. The digits can be in any order but repetition of digits in any code is not permitted. Determine the number of different groups of code that can be generated. (3 marks)

(d) Table 3 shows wage distribution in Kenya shillings for110 employees in a certain company. Use it to answer the questions that follow.

Wages in '000	No of employees
0 - 30	20
30 - 60	35
60 - 90	30
90 - 120	15
120 - 150	10

Table 3

Present this information using each of the following charts:

(i) Histogram;

(ii) Frequency polygon;

(iii) Ogive curve. (7 marks)

6. (a) Distinguish between *rounding off* and *truncating* number as used in mathematics. (4 marks)

(b) John estimated the population of a certain town to be 1,424,800 but after the census it was established that the actual population was 1,678,620. Determine each of the following errors about the population.

(i) absolute error;

(ii) percentage error. (3 marks)

(c) Given matrix $\mathbf{A} = \begin{bmatrix} 3 & -1 & 2 \\ 1 & 0 & 3 \\ 3 & -2 & -5 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 3 & -6 & -3 \\ 7 & -14 & -7 \\ -1 & 2 & 1 \end{bmatrix}$, show that;

(i) **AB** is a null matrix;

(ii) **BA** is not a null matrix. (6 marks)

(d) The marketing department of a certain company has been tasked to design 42 colour codes for 42 different parts of a certain product. A colour code should consist of 3 colours and if 3 colours are used for one part, the same cannot be used for a different part.

(i) Evaluate if 7 different colours would be adequate to generate the 42 parts colour codes. (3 marks)

(ii) As an alternative to the use of three colour combination it has been suggested that only two colours be used for one colour code. Evaluate if 10 colours would be adequate to colour code the 42 different parts. (4 marks)

7. (a) Define each of the following terms as used in matrices:

(i) lower triangular matrix;

(ii) diagonal matrix. (4 marks)

(b) Explain **two** reasons for using binary codes in digital systems. (4 marks)

(c) An electricity company has found that the weekly number of occurrences of lightning striking the transformers has a Poisson distribution with mean 0.4. Determine the probability that:

(i) no transformer will be struck in a week; (2 marks)

(ii) at most two transformers will be struck in a week. (4 marks)

(d) Use the extrapolation method to determine the value of y given the value of x and two points on a straight line as follows:

(i) value of x = 23 and the points are (3,8) and (18,27);

(ii) value of x= 4.5 and the points are (0,7) and (3,10); (6 marks)

8. (a) Outline **two** characteristics of a probability distribution in general. (2 marks)

(b) Given that $U=\{m,o,p,w,k,a,t\}$; If $A=\{m,o,p,w,k\}$ and $B=\{k,a,t\}$

Determine each of the following:

(i) $A^c \cup B$;

(ii) $A \cap B^c$

(iii) $A \cup B \cap A \cap B$. (6 marks)

(c) Table 4 shows data relating to a certain function. Use it to answer the questions that follow.

x	0.1	0.2	0.3	0.4	0.5
f(x)	0.09983	0.19867	0.29552	0.38942	0.47943

Table 4

(i) Construct the *Newton's backward difference* table using the data. (4 marks)

(ii) Determine $f(0.15)$ using the values in the table constructed in (i). (6 marks)

(d) Convert the hexadecimal number FEB_{16} to its binary equivalent. (2 marks)

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