

2920/106
COMPUTATIONAL MATHEMATICS
November 2018
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY
MODULE I

COMPUTATIONAL MATHEMATICS

3 hours

INSTRUCTIONS TO THE CANDIDATE

You should have the following for this examination:

a scientific calculator;

a graph paper.

This paper consists of EIGHT questions.

Answer any FIVE of the EIGHT questions in the answer booklet provided.

All questions carry equal marks.

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.

1.

- (a) Identify each of the following types of matrices:

$$W = \begin{pmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{pmatrix}; \quad X = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}; \quad Y = \begin{pmatrix} 4 & 0 & 0 \\ 0 & 8 & 0 \\ 0 & 0 & 2 \end{pmatrix}; \quad Z = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}.$$

(4 marks)

- (b) A marketing committee that comprises of 6 women and 6 men intends to hold a meeting while seated in a line. Determine the number of ways in which they can be seated if:
- all men are to be seated together and all women are to be seated together;
 - the first seat is preserved for a woman and no two women should be seated next to one another;
 - the outmost positions should be occupied by men. (6 marks)
- (c) Explain **two** advantages of the *interview* as a method of collection of statistical data. (4 marks)
- (d) Convert each of the following numbers to their respective equivalents in the specified number system;
- 364_4 to binary;
 - $4C6F_{16}$ to decimal;
 - 375_8 to hexadecimal. (6 marks)

2.

- (a) State each of the following rules as used in finite sets using mathematical notations:
- union rule;
 - product rule. (4 marks)
- (b) Distinguish between *rounding off* a number and *truncating* a number using the number 45.56789, to 3 decimal places. (4 marks)
- (c) (i) Plot each of the following equations on one graph.
- $2x - 3y = -4$
 - $2x + 3y = 8$
- (ii) Outline **three** interpretations that could be made from the graph in (c) (i). (6 marks)
- (d) (i) State **four** units used during data storage on computer storage media with their respective equivalents in bytes. (2 marks)
- (ii) Differentiate between *BCD* and *ASCII* character coding systems as used in computers data representation. (4 marks)

3.

- (a) Outline **four** properties of the *normal distribution curve*. (4 marks)
- (b) A certain metal manufacturer combines 3 types of metal to produce metal alloys to be used in road construction. The metal alloys are produced in different quantities measured in kg as shown in Table 1. Use it to answer the questions that follow.

Weight of Alloy (Tonnes)	Type of metal (Kg)		
	P	H	V
200	100	3490	0.2150
220	140	3541	0.2340
240	190	3615	0.2453

Table 1

Construct a linear interpolation table showing the amount in kg of metal P, H and V required to produce each of the following tonnes of alloys:

- (i) 210;
- (ii) 225. (8 marks)
- (c) Differentiate between *mutually exclusive events* and *independent events* as applied in probability. (2 marks)
- (d) Table 2 shows frequency distribution of weight in kg of 160 students in a certain college. Use it to answer the questions that follow.

Weight	40 - 45	45 - 50	50 - 55	55 - 60	60 - 65	65 - 70	70 - 75	75 - 80	80 - 85
Frequency	12	15	21	26	37	22	16	5	1

Table 2

Calculate each of the following measures about the weight of the students:

- (i) mean;
- (ii) inter-quartile range. (6 marks)

- ★ (a) Describe each of the following types of charts using a sketch in each case:
- (i) simple bar chart;
- (ii) histogram. (6 marks)
- (b) The actual length of a section of a road is 500 metres. A measuring instrument was used to measure the length and the readings showed the length 510 metres. Using this example, differentiate between *relative error* and *absolute error*. (6 marks)
- (c) Plot the graph of the equation $x^2 - 3x - 10 = 0$, for $-5 \leq x \leq 7$, hence solve the equation $x^2 - 3x - 10 = 8$. (4 marks)
- (d) Differentiate between *categorical data* and *numerical data* as used in statistics. (4 marks)

5.

- (a) Describe each of the following types of binary codes as applied in computers:
- (i) weighted binary codes;
- (ii) reflective codes. (4 marks)

- (b) A certain company processes fruit juice that is sold in packets of 1.5 litres. For a period of 40 weeks, the company's weekly production is shown by the following data in litres. Use it to answer the questions that follow.

354	359	359	360	357	362	364	365	371	365
382	367	364	365	371	370	372	364	355	340
470*	466*	459	454*	460*	4573	452*	4515	4456	4467
361	380	382	394	396	398	398	406	437 ₉	4568

Construct a grouped cumulative frequency distribution with five classes starting at 340. (6 marks)

- (c) (i) Draw the symbol for each of the following logic gates:
 I. NAND gate;
 II. AND gate. (4 marks)
- (ii) Use a truth table with 2 inputs to show that NAND operation is equivalent to AND operation followed by an inverter. (4 marks)

- (d) Convert each of the following numbers to their respective equivalents;
 (i) 110001011_2 to gray code;
 (ii) 643_{10} to excess-3. (2 marks)

6. (a) Define the term *range* as applied in statistics. (1 mark)
- (b) Explain **three** properties of the standard deviation as a statistical measure of dispersion. (6 marks)

- (c) Using row reduction method, solve the following set of simultaneous equations:

$$2x - 3y + 4z = 2$$

$$5x + 4y + z = 33$$

$$3x + 5y + z = 31$$
 (9 marks)

- (d) A certain string of data was binary coded as 11000001 and transmitted. The data was received as 11000011 and the system detected that an error had occurred.
 (i) Explain the method that the system could have used to detect this error. (2marks)
 (ii) Explain one reason as to why this is not the perfect method for error detection in data transmission. (2 marks)

7. (a) (i) Define the term *model* as applied in mathematics. (2 marks)
 (ii) Outline **three** features of a symbolic model. (3 marks)

- (b) A certain casino club uses three different coloured tokens for playing games. For Ksh 2000 one can purchase any of the following combinations of tokens, 14 gold, 20 silver and 24 bronze, or 20 gold, 15 silver or 19 bronze, or 30 gold, 5 silver and 13 bronze.
 (i) Illustrate the narrative as a system of simultaneous equation; (3 marks)
 (ii) Determine the cost of one token for each of the three colours, using Cramer's rule. (8 marks)

- (c) Use a logic diagram to represent the Boolean expression $Q = (\overline{AB}) \cdot (\overline{A+B}) \cdot C$
(4 marks)
- (a) Define each of the following terms as used in statistics:
(i) median;
(ii) mean deviation;
(iii) skewness;
(iv) kurtosis. (4 marks)
- (b) Distinguish between a *finite set* and an *infinite set* as used in set theory, giving an example in each case. (4 marks)
- (c) A certain company has 40 employees. During a routine check-up it was found that 10 employees are healthy and the remaining 30 employees have high blood pressure, a high level of cholesterol or both. If 15 have high blood pressure and 25 have high level of cholesterol, determine each of the following: (*HINT: Use a contingency table*)
(i) the number of employees who have high blood pressure and high level of cholesterol; (2 marks)
(ii) the probability that an employee selected at random has high blood pressure; (2 marks)
(iii) the probability that an employee selected at random has high blood pressure and high level of cholesterol; (2 marks)
(iv) the probability that an employee selected at random has either high blood pressure or high level of cholesterol; (2 marks)
- (d) A straight line passes through the points (5, 12) and (9, 15). Determine the value of y along the line where $x = 7$. (4 marks)

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