

Name: _____ Index No: _____

2920/106

COMPUTATIONAL MATHEMATICS

November 2015

Time: 3 hours

Candidate's Signature: _____

Date of Examination: _____



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE I

COMPUTATIONAL MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.

Sign and write the date of examination in the spaces provided above.

You should have a scientific calculator for this examination.

*Answer any **FIVE** of the following **EIGHT** questions in the spaces provided in this question paper.*

Candidates should answer the questions in English.

For Examiner's Use Only

Question	1	2	3	4	5	6	7	8	Total Score
Candidate's Score									

This paper consists of 16 printed pages

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

- _____

- $$2x^2 + 9x - 5 = 0 \quad (4 \text{ marks})$$

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- (i) pictogram; (2 marks)

- [illegible]

- (The following information was obtained from the company's website.)*

(c) (i) Evaluate each of the following expressions:

I. 6P_3 ;

(1 mark)

II. 8C_5

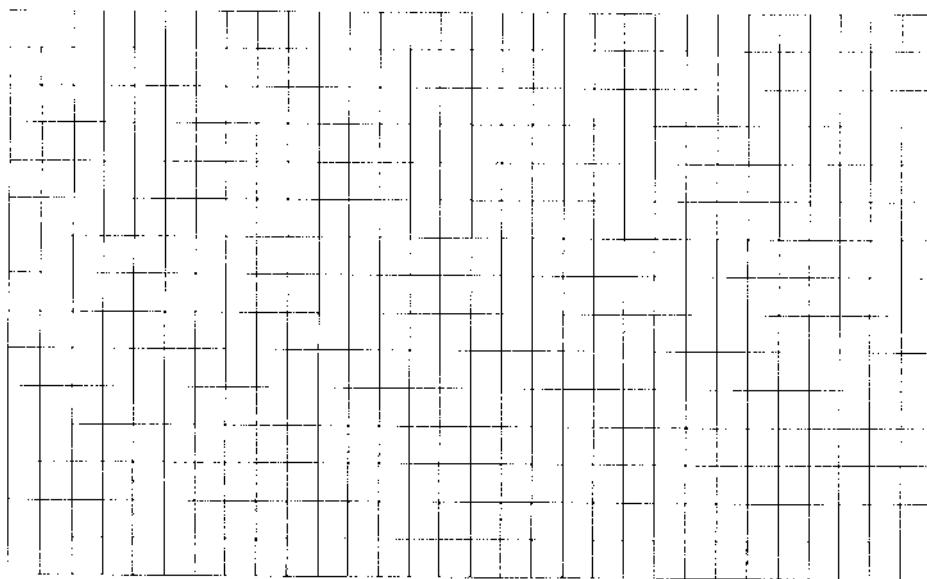
(1 mark)

- (ii) A golf club consists of 26 members of whom 12 are female. Determine the number of ways in which a 3-member committee comprising 1 male and 2 female can be formed. (4 marks)

(d) Using the graphical method, solve for x in the quadratic equation:

$y = 3x^2 - 2x + 4$, for $-3 \leq x \leq 4$.

(4 marks)



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

I. linear interpolation;

(2 marks)

II. linear extrapolation.

(2 marks)

(ii) State **two** assumptions in (i).

(2 marks)

(b) Differentiate between *permutation* and *combination* as used in mathematics.

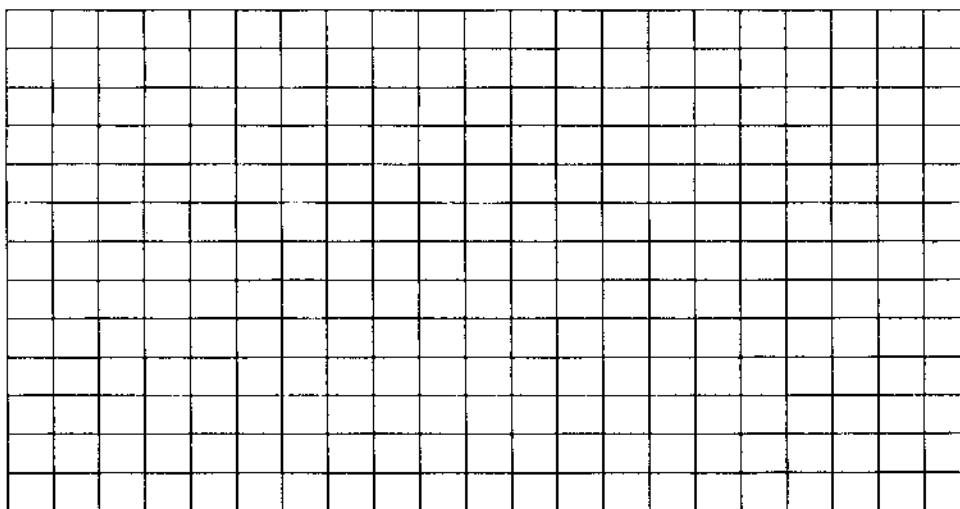
(4 marks)

(c) Using the graphical method, solve the following system of simultaneous equations:

(4 marks)

$$2y + 3x = 22$$

$$3y + 2x = 23$$



- (d) Table 1 shows values extracted from an equation that is a function of x . Use it to answer the question that follows.

x	1	2	3	4	5	6
$f(x)$	20	39	90	209	432	795

Table 1

Using Newton Raphson forward difference formula, evaluate $f(3.5)$.

(6 marks)

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3. (a) (i) Define the term *range* as used in statistics.

(2 marks)

- (ii) Table 2 shows the duration taken by patients to respond to a certain drug. Use it to answer the question that follows.

Duration (days)	10.0	10.5	11.0	11.5	12.0	12.5	13.0
No. of Patients	4	8	14	22	19	10	3

Table 2

Determine each of the following measures about the distribution.

- I. mean absolute deviation; (2 marks)

- II. standard deviation. (4 marks)

- (b) (i) Given that $x, y \in \mathfrak{F}$; use the truth tables to show that:

$$\overline{(x + y)} = \overline{x} \cdot \overline{y} \quad (2 \text{ marks})$$

- (ii) Using elimination method, solve the following system of simultaneous equations. (5 marks)

$$13a + 9b - 2c = 25$$

$$5a + 3b - c = 8$$

$$13a - 5b + 2c = 9$$

- (c) Table 3 shows the production of sugar in thousand tonnes by a certain company over a period of eight years. Use it to answer the questions that follow.

Year	2001	2002	2003	2004	2005	2006	2007	2008
Production	25	40	60	45	65	50	75	80

Table 3

- (i) Construct a *simple bar chart* to represent this information. (3 marks)

(ii) Determine the percentage change in production of sugar from 2003 to 2004.

(2 marks)

4. (a) (i) Define the term *pseudocode* as used in modeling.

(2 marks)

(ii) A company *manufactures* two products A and B, which have to go through two processes X and Y. The maximum capacity of both processes is 1750 and 4000 hours respectively. Each unit of product A requires 3 hours in process X and 2 hours in process Y while each unit of product B requires 1 hour in process X and 4 hours in process Y.

I. Express this information in algebraic form;

(2 marks)

II. Assume the maximum capacity of both processes available were to be utilized, determine the number of units of product A and B that would be produced.

(4 marks)

- (b) Kibs College presented two teams for the national games; the men's hockey team and ladies' handball team. The probability of men's hockey team winning is $\frac{3}{5}$ while that of ladies team winning is $\frac{4}{7}$. Using a probability tree, determine the probability that:

(i) at least one team wins; (4 marks)

(ii) both teams lose. (2 marks)

- (c) Using binomial theorem, expand the expression $\sqrt{(4+x)}$ in ascending powers of x up to the fourth term. (6 marks)

5. (a) (i) State **four** properties of the arithmetic mean. (4 marks)

- (ii) Distinguish between the terms *bit* and *word* as used in computer number systems. (4 marks)

- (b) Using de Morgans' laws, simplify the expression: $XY + X(Y + Z) + B(B + Z)$. (4 marks)

- (c) (i) Explain the term *singular* matrix as used in Mathematics. (2 marks)

(ii) Given three matrices, $P = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 0 & -1 \\ 4 & 6 & 5 \end{bmatrix}$, $Q = \begin{bmatrix} 0 & 3 \\ -2 & 4 \\ 1 & -4 \end{bmatrix}$ and $R = \begin{bmatrix} 0 & 6 & 2 \\ 3 & -4 & -3 \end{bmatrix}$

Show that $(PQ)R = P(QR)$. (6 marks)

6. (a) Outline **four** conditions that must be satisfied by a *binomial probability distribution*. (4 marks)

- (b) Explain each of the following mathematical models.

(i) logical;

(2 marks)

(ii) spatial;

(2 marks)

(iii) statistical.

(2 marks)

- (c) Determine the mean of the probability density function given by

$$f(x) = x^2 + x + 1, \text{ for } 2 \leq x \leq 6.$$

(4 marks)

(d) (i) Differentiate between *truncating* and *rounding off* as used in Mathematics. (4 marks)

(ii) Given the decimal number 34.4562, perform the following operations:

I. truncate to 2 decimal places; (1 mark)

II. round off to 2 decimal places. (1 mark)

7. (a) (i) Define the term *sample space* as used in probability. (2 marks)

(ii) Determine the *sample space* for the experiment of tossing a coin three times. (2 marks)

(b) Explain each of the following terms as used in binary codes:

(i) weighted binary code; (2 marks)

(ii) reflective code; (2 marks)

(iii) sequential code. (2 marks)

- (c) Differentiate between *qualitative data* and *quantitative data* as used in statistics giving an example in each case. (6 marks)

- (d) The length of a table is $90\text{cm} \pm 3\text{cm}$ while the weight of the same table is $24\text{kg} \pm 3\text{kg}$.

- (i) Determine the percentage error in each case. (2 marks)

- (ii) Using the results in (i), justify the most precise measurement. (2 marks)

8. (a) (i) Define the term *independent events* as used in probability. (2 marks)

- (ii) Rita came across the following list of events when revising for her Mathematics examination. Use it to answer the question that follows.

- The occurrence of head or tail when a coin is tossed;
- Where a bag contains blue and black balls that are drawn at random, the probability of drawing a blue ball in a second draw having drawn a black ball in the first draw;
- Taking out a marble from a bag containing some marbles and not replacing it, and then taking out a second marble;
- Turning left and turning right before crossing a road.

Classify each of the events as *dependent*, *mutually exclusive* or *conditional*. (4 marks)

(b) (i) Draw the *logic circuit* equivalent to the Boolean expression $W = (X + YZ)$. (4 marks)

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(ii) With the aid of a truth table, determine the output of $A + B'C$ (2 marks)

[illegible]

(c) Convert the hexadecimal number $4B3.12F_{16}$ to its decimal equivalent. (4 marks)

- (d) Using binomial theorem, expand the expression $(x + y)^8$ in ascending powers of y up to the fifth term. (4 marks)

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