2920/106
COMPUTATIONAL MATHEMATICS
July 2011
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE I

COMPUTATIONAL MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

  Answer booklet;

  Scientific calculator.

*Answer any **FIVE** of the following EIGHT questions.*

All questions carry equal marks.

This paper consists of 7 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

1. (a) (i) Define the term *byte* as used in computers. (2 marks)

    (ii) Convert each of the following numbers to its binary equivalent:

        I. 24.625_8;

        II. $163D.125_{16}$.

        (4 marks)

    (iii) Divide 1000110_2 by 111_2. (2 marks)

    (b) Using a truth table, prove that $A.(A+B) = A+A.B = A$ (2 marks)

    (c) Distinguish between *permutation* and *combination* as used in discrete counting. (4 marks)

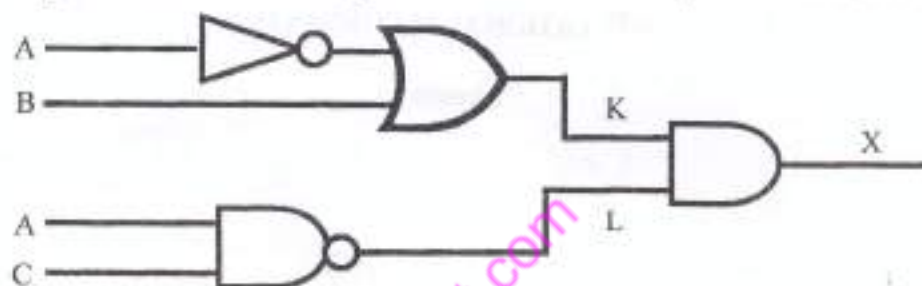   (d) Figure 1 shows a circuit diagram. Use it to answer the questions that follow.

Figure 1

    (i) Write a *boolean expression* that represents the circuit in figure 1 (2 marks)

    (ii) Using a *truth table*, find the output X. (4 marks)

2. (a) State **two** reasons for using *binary codes* in digital systems. (2 marks)

    (b) Convert 14_{10} to its gray code equivalent. (2 marks)

    (c) (i) Define the term *parity bit* as used in computers. (2 marks)

    (ii) Describe each of the following alphanumeric codes:

        I. ASCII;

        II. EBCDIC.

        (4 marks)

    (d) (i) Distinguish between *relative* and *absolute* measures as used in statistics. (4 marks)

(ii) Table 1 shows the heights of students in ICT module I class. Use it to answer the question that follows.

Height	f
52.7 - 52.9	2
52.9 - 53.1	10
53.1 - 53.3	4
53.3 - 53.5	5
53.5 - 53.7	7
53.7 - 53.9	3
53.9 - 54.1	0
54.1 - 54.3	3
54.3 - 54.4	1
	35

Table 1

Compute Pearson's coefficient of skewness for the distribution.

(6 marks)

3. (a) (i) Explain the term *exhaustive event* as used in probability. (2 marks)

(ii) In a pack of 15 mangoes, 3 are always bad. If 5 mangoes are chosen at random, find the probability that none of them will be bad? (4 marks)

(b) (i) Outline **four** factors that should be considered when selecting a *data collection method*. (4 marks)

(ii) Table 2 shows the expenditure incurred by Stapan Company Ltd. in the financial year 2010.

Description	Kshs in '000'
Employees	91.152
Transport	5520
Raw materials used	6670
Premises payment	4200
Advertising	3600

Table 2

Construct a pie chart to represent the data. (4 marks)

(c) Distinguish between *rational* and *irrational* numbers as used in algebra.

(4 marks)

(d) Using factorization method, solve $9x^2 + 6x + 1 = 0$ (2 marks)

4. (a) (i) Define the term *geometric mean* as used in statistics. (2 marks)

(ii) Table 3 shows results for computer application examination at a particular college. Use it to answer the question that follows.

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	0	1	4	5	10	17	22	16	2	3

Table 3

Determine the *median* mark. (3 marks)

(b) Makenan Insurance Company has insured 1800 motorcycle drivers, 3000 car drivers and 7000 bus drivers. From experience, the probability that an insured driver will be involved in an accident is 0.01, 0.04 and 0.17 respectively. Find the probability that an insured bus driver will be involved in an accident. (5 marks)

(c) Using quadratic formula, solve the equation $x^2 + 5x - 8 = 0$ (3 marks)

(d) (i) Figure 2 shows a line drawn by a module I student during computational mathematics lesson. Use it to answer the questions that follow.

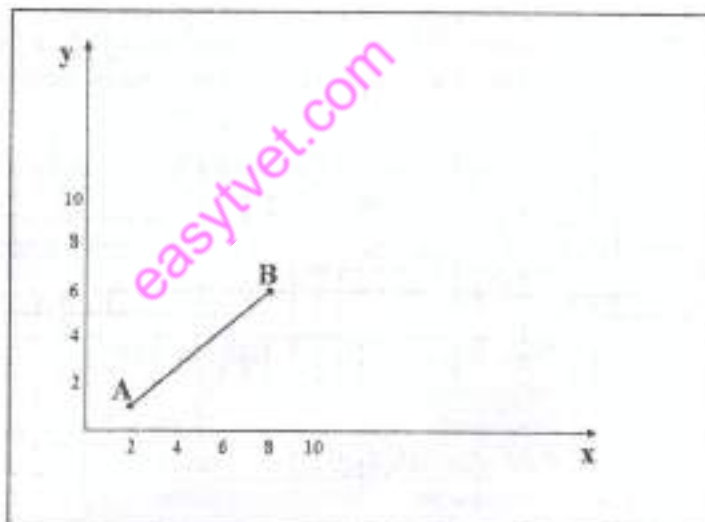

Figure 3

I. Determine the gradient of the line.

II. Find the equation of the line.

(3 marks)

(ii) Sketch the graph of the equation $y = x^2 - 6x + 13$. (4 marks)

5. (a) (i) Define the term *error* as used in mathematical computations.

(2 marks)

(ii) Outline **three** causes of errors in mathematical computations.

(3 marks)

(b) Using the graphical method, solve the following simultaneous equations.

$y - x^2 + 9 = 0$
$y + 3x - 9 = 0$

(5 marks)

(c) Table 4 shows the x values with their corresponding f(x) values. Use it to answer the question that follows.

x	2	4	6	8	10
fx	9.68	10.96	12.32	13.76	15.28

Table 4

Using Newton-Gregory forward interpolation method, find f(2.4) (6 marks)

(d) Assume that matrix $A = \begin{pmatrix} 4 & 6 & 2 \\ 1 & 7 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 6 & 3 & 6 \\ 4 & 3 & 5 \end{pmatrix}$ and $C = \begin{pmatrix} 4 & 2 \\ 1 & 3 \\ 7 & 2 \end{pmatrix}$

Find:
(i) $A + B$;

(ii) CA.

(4 marks)

6. (a) State **three** properties of binomial expansion. (3 marks)

(b) Describe each of the following terms as used in modeling:

(i) histogram;

(ii) frequency polygon. (4 marks)

(c) (i) A lecturer cited the following situations during a computational mathematics class.

- Tom planned to buy two chickens from a poultry shop.
- Joyce, a teacher, was to pick 21 students from a school of 850 students.
- Three balls were to be picked from 10 balls.
- Position one, two and three were to be identified from a list of athletes' who participated in KETISO games.

State whether each situation is either *permutation* or *combination* justifying your answer. (2 marks)

(ii) A group of students in ICT class is to be picked to represent the institution in a charity walk. The group should contain 5 male students and 6 female students. This group should be chosen from 7 male and 9 female students. Find the number of ways of picking the group.

(4 marks)

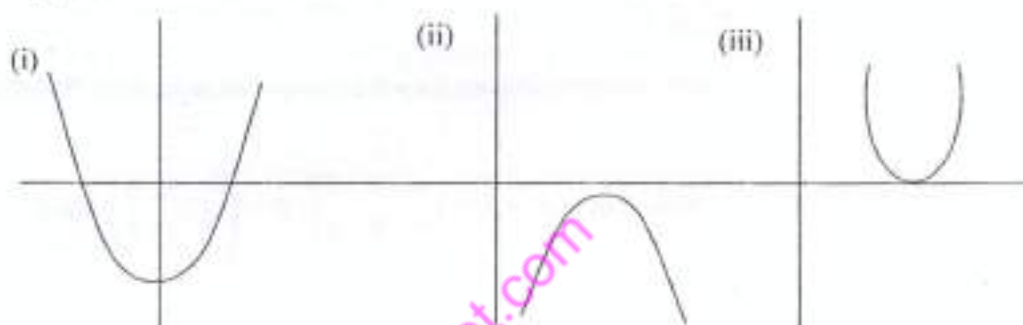(d) Using Cramer's rule, solve the following set of equations.

$x - 4y - 2z = 21$

$2x + y + 2z = 3$

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

(7 marks)

7. (a) Determine the number of real roots represented by each of the following graphs.

(3 marks)

(b) (i) Describe the term *confidence interval* as used in probability.

(2 marks)

(ii) A plastic container contains five blue balls, three white balls and two red balls. Given that two balls are drawn from the container without replacement.

I. draw a *probability tree* to represent the scenario.

II. find the probability that both balls are of different colours.

(6 marks)

(c) Calculate the relative error of a measurement whose true value is 6.24×10^6 and whose computed value is 6.17×10^6. (2 marks)

(d) Using binomial theorem:

(i) expand $(2x+3)^4$; (3 marks)

(ii) find the coefficient of x^5 in the expansion of $(5-2x)^8$. (4 marks)

8. (a) (i) Define the term *parameter* as used in mathematical modeling.

(2 marks)

(ii) Explain **three** uses of statistical models. (6 marks)

(b) State **four** benefits of mathematical modeling. (4 marks)

(c) Distinguish between *discretization* and *cancellation* errors as used in computation. (4 marks)

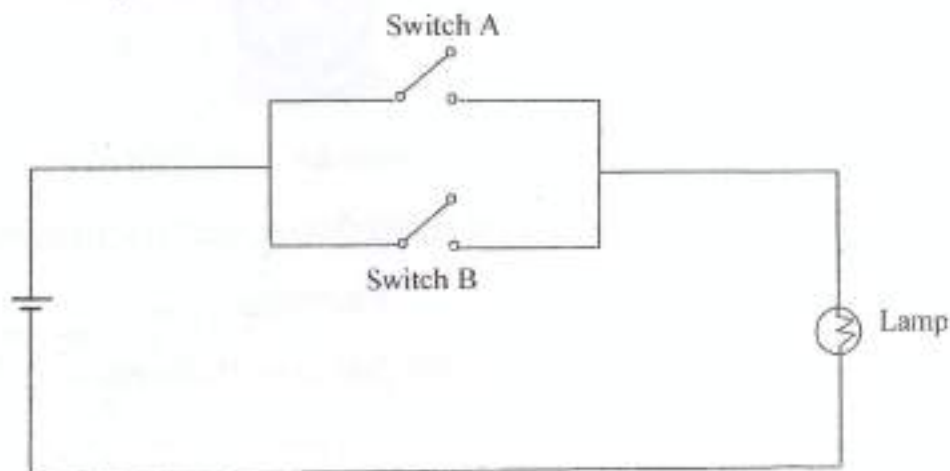(d) Figure 3 shows a circuit drawn during practical lesson in electronics. Use it to answer the question that follows.

Figure 3

The switch conditions in the figure are as shown in table 5.

Switch A	Switch B
ON	ON
ON	OFF
OFF	ON
OFF	OFF

Table 5

Find the condition of the lamp when $A \cup B$ is applied. (4 marks)