



DICT LEVEL I
COMPUTER MATHEMATICS

MONDAY: 27 November 2017.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

- (a) Convert each of the following numbers to binary coded decimal (BCD) form:
- (i) 4321. (2 marks)
 - (ii) 7985. (2 marks)
- (b) The following bit strings represent numbers such that the first four bits 1010 and 1011 represent (+) and (-) signs respectively.
- Required:**
Using the four bit system and the sign given, determine the decimal numbers:
- (i) 1010100100110111. (2 marks)
 - (ii) 10110011011110010100. (2 marks)
- (c) Convert the following numbers to their decimal equivalents:
- (i) 762_8 . (2 marks)
 - (ii) 953_{16} . (2 marks)
- (d) Convert the following to their respective equivalents:
- (i) 0.546875_{10} to binary form. (2 marks)
 - (ii) 10001011001011_2 to hexadecimal form. (2 marks)
- (e) Differentiate between "binary number system" and "hexadecimal number system". (4 marks)
- (Total: 20 marks)**

QUESTION TWO

- (a) Convert each of the following to their respective equivalents:
- (i) BAD_{16} to decimal form. (2 marks)
 - (ii) 4638_{10} to hexadecimal form. (2 marks)
- (b) Use two's complement to subtract the following binary numbers:
 $11010010 - 10110101$. (3 marks)
- (c) Show the infix notations for the following prefixes:
- (i) $x(-45)9$. (1 mark)
 - (ii) $-5x67$. (1 mark)

- (d) (i) Give a reason for adding a 6 to binary coded decimal (BCD) values greater than 9. (2 marks)
- (ii) Explain how to obtain the signed BCD format for the decimal number - 532. (3 marks)
- (iii) Use BCD subtraction to perform the following operation:
 $457_{10} - 532_{10}$. (6 marks)
- (Total: 20 marks)**

QUESTION THREE

- (a) Show the transpose of the following matrix:

$$A = \begin{pmatrix} 3 & 2 & 8 \\ 1 & 5 & 4 \end{pmatrix} \quad (2 \text{ marks})$$

- (b) Define the following types of matrices:

- (i) Diagonal matrix. (1 mark)
- (ii) Scalar matrix. (1 mark)
- (iii) Identity matrix. (1 mark)
- (iv) Symmetric matrix. (1 mark)
- (v) Skew-symmetric matrix. (1 mark)

- (c) Solve the following linear equations using the matrix method:

$$\begin{aligned} 4x - 2y &= 6 \\ 3x + y &= 7 \end{aligned} \quad (4 \text{ marks})$$

- (d) Hanna and Marcella appeared for an interview for two vacancies in the same post. The probability of Hanna being selected is $\frac{3}{7}$ while the probability of Marcella being selected is $\frac{2}{5}$.

Required:

Determine the probability that:

- (i) Both of them will be selected. (2 marks)
- (ii) Only one of them will be selected. (3 marks)
- (iii) None of them will be selected. (2 marks)
- (iv) At least one of them will be selected. (2 marks)

(Total: 20 marks)

QUESTION FOUR

- (a) Josephat Munga sold a machine to Tom Chigiri at a profit of 40%. Tom Chigiri sold the same machine to Jacob Chivuva at a profit of 60%. Jacob Chivuva sold the same machine to Moses Mangwe at a loss of 25%. Moses Mangwe paid Sh.187 more than it cost Josephat Munga.

Required:

Determine the profit made by Josephat Munga.

(3 marks)

- (b) Consider the following singular matrix: $\begin{pmatrix} 3x & x - 1 \\ -4 & x \end{pmatrix}$

Required:

Find the value of x.

(3 marks)

(c) The following data shows the marks obtained in a Mathematics examination in Bidii College:

Marks (x)	Students (f)
0-10	2
10-20	18
20-30	30
30-40	45
40-50	35
50-60	20
60-70	6
70-80	3

Required:

The median of the marks.

(5 marks)

(d) A travel agent in Nairobi surveyed 100 people who had visited the cities of Mombasa and Kisumu. The results were as given below:

- 30 people had visited Mombasa.
- 26 people had visited Kisumu.
- 12 people had visited both Mombasa and Kisumu.

Required:

- (i) Present the above information in a venn diagram. (1 mark)
- (ii) The number of people who had visited Mombasa or Kisumu. (1 mark)
- (iii) The number of people who had visited Kisumu but not Mombasa. (1 mark)
- (iv) The number of people who had visited only one of the two cities. (1 mark)
- (v) The number of people who had visited neither of the two cities. (1 mark)

(e) Bundacho Manufacturers make two products namely; X and Y. The cost of making 15 units of product X and 10 units of product Y is Sh.6,000.
The cost of making 5 units of product X and 8 units of product Y is Sh.3,400.

Required:

The cost of making one unit of product X and one unit of product Y.

(4 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Distinguish between the following terms as used in logic:

- (i) "Conjunction" and "disjunction". (4 marks)
- (ii) "Half-adder" and "full-adder" logic circuits. (4 marks)

(b) State the De Morgan's Theorem. (2 marks)

(c) Construct truth tables for the following propositions:

- (i) $p \wedge q$. (2 marks)
- (ii) $p \wedge q \sim r$. (3 marks)

(d) Highlight two functions of an inverter in logic circuits. (2 marks)

(e) Show that $F = \bar{A}.B.C + A.\bar{B}.C + A.B.\bar{C} + A.B.C$ is equivalent to $B.C. + C.A + A.B$. (3 marks)

(Total: 20 marks)

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