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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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