kasneb

DICT LEVEL I

COMPUTER MATHEMATICS

TUESDAY: 26 November 2019.   **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)   Outline two functions of complements in computer arithmetic.   (2 marks)

(b)   Calculate the special characters that could be accommodated by:

     (i)   6 – bit code.   (1 mark)

     (ii)   7 – bit code.   (1 mark)

     (iii)   8 – bit code.   (1 mark)

(c)   Compare BCD and ASCII number systems based on each of the following criteria:

     (i)   Number of bits.   (2 marks)

     (ii)   Type of data represented.   (2 marks)

     (iii)   Application areas.   (2 marks)

(d)   Write $F2DA_{16}$ in expanded notation form.   (1 mark)

(e)   (i)   Given that $16_{10} = 100_x$, find the value of x.   (2 marks)

     (ii)   Convert 4433_5 to decimal and then change the result you will get to binary.   (2 marks)

(f)   Perform the following binary operations:

     (i) $1010.01_2 - 111.111_2$ (2 marks)

     (ii) $1111_2 + 111_2 + 1101_2$ (2 marks)

(Total: 20 marks)

QUESTION TWO

(a)   Convert 0111   0011   0000   1001   BCD 8421 code to its decimal equivalent.   (2 marks)

(b)   Given that 0110   0011   1001   1011 is the XS – 3 code for the decimal number X, find the XS – 3 code for the 10s complement of X without decoding X.   (3 marks)

(c)   Using zoned decimal format, write the EBCDIC codes for:

     (i)   +3759.   (1 mark)

     (ii)   – 3759.   (1 mark)

     (iii)   3759.   (1 mark)

(d)   Construct truth tables to illustrate the following logic operators:

(i)   "exclusive or" operator. (2 marks)

(ii)   "if and only if" operator. (2 marks)

(iii)   Double negation law. (2 marks)

(e)   (i)   Prove the following argument is valid:

$p, p \rightarrow q \vdash q$. (2 marks)

(ii)   Prove the following argument is a fallacy:

$p \rightarrow q$, $q \vdash p$. (2 marks)

(f)   Find:
(i)   Contrapositive of $\sim p \rightarrow q$. (1 mark)

(ii)   Contrapositive of the converse of $p \rightarrow \sim q$. (1 mark)
(Total: 20 marks)

QUESTION THREE
(a)   Describe the following measures of statistics:

(i)   Arithmetic mean. (2 marks)

(ii)   Geometric mean. (2 marks)

(iii)   Standard deviation. (2 marks)

(iv)   Coefficient of variation. (2 marks)

(b)   The table below shows the distribution of weekly commissions payable to certain employees based on their weekly sales targets:

Weekly commission (Sh."000")	Number of employees
1 – 5	4
6 – 10	6
11 – 15	8
16 – 20	6
21 – 25	4
26 – 30	3
31 – 35	4

Required:
(i)   The mean weekly commission. (4 marks)

(ii)   The modal commission. (4 marks)

(iii)   The median commission. (4 marks)
(Total: 20 marks)

QUESTION FOUR

(a) If a coin and a die are tossed, the sample space, S, consist of the following 12 elements:

$$S = \{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6\}$$

Note: A = {Heads and an even number appears}
 B = {A prime number appears}
 C = {Tails and an odd number appears}

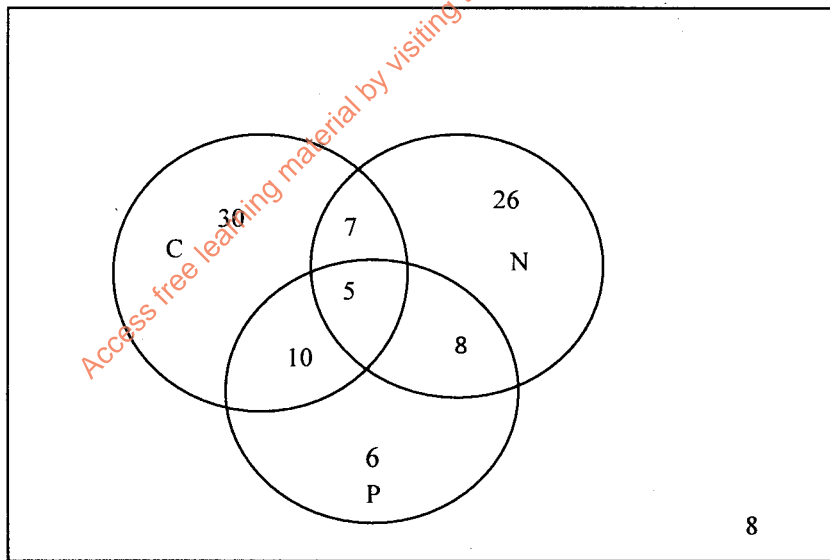**Required:**
Express explicitly the event that:

(i) A or B occurs. (2 marks)

(ii) B and C occur. (2 marks)

(iii) Only B occurs. (2 marks)

(iv) Which pair of the events A, B and C are mutually exclusive. (2 marks)

(b) Solve the following system of linear equations:

(i) $2x + ½ = \dfrac{1}{3}x + 5.$ (3 marks)

(ii)
$$
\begin{aligned}
r - 2s + t &= 2 \\
3s - 4t &= 9 \\
2t &= 6
\end{aligned}
$$

(4 marks)

(c) In a survey of 100 DICT students, the number of students taking computing (C), Networking (N) and Programming (P) are shown in the figure below:

Required:
(i) The number of students taking computing or networking, but not both. (1 mark)

(ii) The number of students taking computing or networking but not programming. (1 mark)

(iii) The number of students taking one or two of these courses but not all the three. (1 mark)

(iv) The number of students taking at least two of these courses. (1 mark)

(v) The number of students taking at least one of these courses. (1 mark)

(Total: 20 marks)

QUESTION FIVE

(a) Define the following terms as used in matrices:

    (i) Null matrix.   (2 marks)

    (ii) Transpose of a matrix.   (2 marks)

(b) (i) Given the following matrix equation:

$$\begin{pmatrix} 3 & 1 \\ -\frac{1}{2} & 0 \\ 2 & -1 \end{pmatrix} + \begin{pmatrix} x+y & 4 \\ \frac{1}{2} & 9 \\ -2 & 6 \end{pmatrix} = \begin{pmatrix} 6 & 5 \\ 0 & 2x-y \\ 0 & 5 \end{pmatrix}$$

        Solve for x and y.   (4 marks)

    (ii) Determine the inverse of the following matrix:

$$\begin{pmatrix} a-b & a \\ a & a+b \end{pmatrix}$$

                                                    (4 marks)

(c) Explain the following set theory terms:

    (i) Superset.   (2 marks)

    (ii) Cardinality.   (2 marks)

(d) Given that U = {1, 2.................8, 9}

        A = {4, 5, 6, 7}   B = {5, 6, 7, 8, 9}   C = {2, 5, 6, 8} and D = {1, 5, 9}

    Determine: {A ∩D} ∩ {B∩C}.   (4 marks)

                                                 (Total: 20 marks)

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