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GF—12—2023

FACULTY OF SCIENCE

B.Sc. (Third Semester) EXAMINATION

APRIL/MAY, 2023

(CBCS/Revised Course)

COMPUTER SCIENCE

Paper AF-13

(Elective-A)

(Discrete Mathematics)

(Friday, 21-4-2023)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—Three Hours   *Maximum Marks*—75

N.B. :—   (*i*)   *All* questions are compulsory.

       (*ii*)   Figures to the right indicate full marks.

1.   Solve any *five* of the following (**3** marks each) :   15

    (*a*)   If set A = {1, 3, 5}, B = {2, 4, 6} and C = {0, 2, 4, 6, 8}.

       Then :

       (*i*)   Find universal set

       (*ii*) $(A \cup B) \cap C$

       (*iii*) $(A \cap B) \cup (B \cap C)$

    (*b*)   Define any *three* types of set with the appropriate example.

    (*c*)   The equation of a line given by the $2x - 6y + 3 = 0$. Find the slope and both the intercepts.

                                                    P.T.O.

(d) Find the truth table for the following compound statement and also comment whether it is tautology, contradiction or contigency :

(i) $p \wedge (q \wedge \sim p)$

(ii) $\sim (p \vee q) \vee [(\sim p) \wedge q] \vee p$

(e) Find x, y, z, t if :

$$\begin{bmatrix} x & 2y \\ z & 4t \end{bmatrix} + \begin{bmatrix} 3 & z \\ -1 & -6 \end{bmatrix} = \begin{bmatrix} 0 & -7 \\ 3 & 26 \end{bmatrix}.$$

(f) Find cartesian product of the set :

A = {1, 2, 3} and B = {3, 4, 5}.

(g) Construct Binary tree for the following expression :

$(a + b) * (d/c)$.

2. Attempt/Solve any *three* of the following (**5** marks each) :   15

(a) Prove that :

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

$$A = \{4, 5, 7, 8, 10\}, \; B = \{4, 5, 9\}, \; C = \{1, 4, 6, 9\}$$

(b) Explain any *two* properties of set using suitable example.

(c) Verify given equivalence using properties only :

$$(p \Rightarrow \sim q) \wedge (p \Rightarrow \sim r) \equiv \sim [p \wedge (q \vee r)].$$

(d) In a survey among 140 students, 60 likes to play video games, 70 likes to play indoor games, 75 likes to play outdoor games, 30 plays indoor and outdoor both, 18 plays outdoor and video games, 42 plays video

games and indoor games and 8 likes to play all three. Use Venn diagram to find :

(*i*)   Students who plays only outdoor games

(*ii*)   Students who plays exactly one game

(*iii*)   Students who plays at most two games.

(e)   Prove that, $p \Rightarrow q \equiv \sim p \vee q$, using truth table.

3.   Attempt any *three* of the following (**5** marks each) :   15

(a)   Prove that the given compound preposition is tautology using the truth table :

$$[(p \to q) \vee (q \leftrightarrow r)] \wedge (p \vee q).$$

(b)   Find adjoint of A,

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{bmatrix}.$$

(c)   Find inverse of matrix :

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{bmatrix}.$$

(d)   If

$$A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & x & 1 \end{bmatrix} \text{ and } A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & y \\ 5/2 & -3/2 & 1/2 \end{bmatrix},$$

find x and y.

(e)   Find equation of line passing through (7, 5) and (–9, 5).

P.T.O.

4. Attempt any *three* of the following (**5** marks each) : 15

   (a) Equation of circle is $x^2 + y^2 - 12x - 16y + 19 = 0$. Find centre and radius of circle.

   (b) Find the equation of line that passes through point (–2, 3) and is parallel to the line $4x + 4y = 8$.

   (c) Explain all the properties of Relation in brief.

   (d) The relation R on the set A = {1, 2, 3, 4, 5} defined by a rule $(x, y) \in$ R if $x + y \leq 6$. Find :

      (i) The element of R

      (ii) The element of R^{-1}

      (iii) The domain R

      (iv) The range of R

      (v) The domain R^{-1}

      (vi) The range R^{-1}

   (e) Let $F : A \to B$ and $g : B \to C$ are defined by formula :

$$F(x) = x + 9$$

$$g(x) = x^2 + 3.$$

   Then find :

      (i) goF(x)

      (ii) FoF(x)

    (*iii*)   Fog(x)

    (*iv*)   gog(x)

    (*v*)   goF(b)

    (*vi*)   Fog(a)

    (*vii*)   goF(3)

    (*viii*)   Fog(3)

5.   Attempt any *three* of the following (**5** marks each) :   15

    (*a*)   Explain in brief Isomorphic Graph with proper diagram.

    (*b*)   Explain Center of Tree and Binary Tree briefly.

    (*c*)   Show that, the matrix :

$$A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix} \text{ as } A^3 - 4A^2 + A = 0$$

    (*d*)   Describe each of the following in Roster form :

    (*i*) $A = \{x \mid x \text{ is an even prime}\}$

    (*ii*) $B = \{x \mid x \in R, \ x^2 - 1 = 0\}$
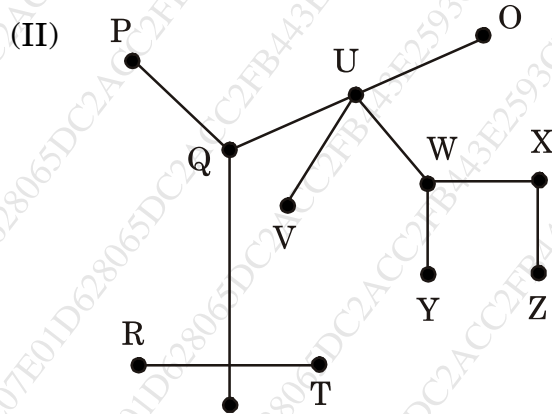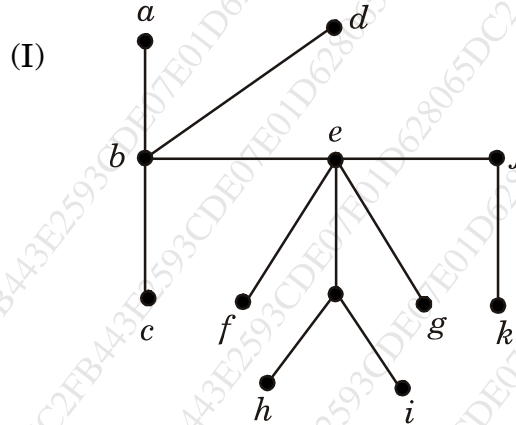
    (*iii*) $B = \{x \mid x \text{ is a prime number, } 11 < x < 20\}$

    (*iv*) $E = \{x \mid x \text{ is a perfect square } x < 30\}$

    (*v*) $E = \{x \mid x \text{ is an integer; } -3 < x < 3\}$

P.T.O.

(*e*) (*i*) Find the center of tree for given 2 graph :

(I)

(II)

(*ii*) Write down the left child and right child of each vertex or node of tree.