WINTER-2017

UNIT 1

Q.1 a) Obtain principle disjunctive normal form of **(7)**

$(P \wedge R) \vee (\neg P \wedge \neg Q) \vee (Q \wedge R)$

b) Explain with example: **(6)**

i) Tautology **ii)** Contradiction **iii)** Equivalent formulas.

Q.2 a) Show the following equivalences: **(6)**

i) $P \rightarrow (Q \cup R) \Leftrightarrow (P \wedge \neg Q) \rightarrow R$

ii) $(A \cup B) \rightarrow C \Leftrightarrow (A \rightarrow C) \wedge (B \rightarrow C)$

b) Obtain Principle Conjunctive Normal form of $(\neg P \rightarrow R) \wedge (Q \leftrightarrows P)$ **(7)**

UNIT 2

Q.3 a) Show that R V S is tautological implied by **(7)**

$(P \vee Q)$, $(P \rightarrow R)$ and $(Q \rightarrow S)$.

b) Symbolize the following statements: **(6)**

i) Every apple is red **ii)** All Indians are brave

iii) Some Cats are black.

Q.4 a) $x(A(x) \rightarrow B(x)) \wedge (x)\ (B(x) \rightarrow C(x)) \Rightarrow (x)\ (A(x) \rightarrow C(x))$. **(7)**

b) Show that $(G \vee H)$ is a valid conclusion for **(6)**

$(B \wedge C)$, $(B \Leftrightarrow C) \rightarrow (H \vee G)$.

UNIT 3

Q.5 a) Let $P = \{\langle 1, 2\rangle, \langle 2, 4\rangle, \langle 3, 3\rangle\}$ and $Q = \{\langle 1, 3\rangle, \langle 2, 4\rangle, \langle 4, 2\rangle\}$. **(7)**

Find $P \cup Q$, $P \cap Q$, $D(P)$, $D(Q)$, $R(P)$, $R(Q)$, $D(P \cup Q)$ and $R(P \cap Q)$.

Also show that,

$D(P \cup Q) = D(P) \cup D(Q)$ and $R(p \cap Q) \subseteq R(P) \cap R(Q)$.

b) Let $X = \{1, 2, 3, 4, \ldots .10\}$ and $R = \{\langle x, y\rangle / x + y = 10\}$ **(7)**

Draw graph of R and give its Matrix representation.

Q.6 a) Draw Venn Diagrams of **(7)**

i) $A \cup B = A \cup C$ but $B \neq C$ **ii)** $A \cap B = A \cap C$ but $B \neq C$

iii) $A \cup B \subset A \cup C$ but $B \not\subseteq C$.

b) Given the relation Matrices M_R and M_S find $M_{R\circ S}$, $M_{\overline{R}}$, $M_{\overline{S}}$, $M_{R\,\bar{\circ}\,S}$. Show that $M_{R\,\bar{\circ}\,S} = M_{\overline{S}\circ\overline{R}}$

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix} \qquad M_S = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$ **(7)**

UNIT 4

Q.7 a) Write composition table for

i) $\langle Z_7, +_7\rangle$ **ii)** $\langle Z_7, *_7\rangle$ **(7)**

b) Find out left coset of H in $\langle Z_6, +_6\rangle$ where $H = \{[0], [3]\}$. **(6)**

Q.8 a) Explain: **i)** Monoid **ii)** Group **iii)** Semigroup. **(6)**

b) Convert the following infix expressions to Prefix and Postfix: **(7)**

i) $(A * B) - (C * (D / F))$ **ii)** $(A + B) * (C - D)$

UNIT 5

Q.9 a) Expand the following functions into their Sum of product form: **(7)**

i) $f(x, y, z) = xy' + y'z'$ **ii)** $f(w, x, y, z) = xy + w'yz$.

b) Draw the lattice diagram of $<S_n, D>$ where n = 12, 15, 30, 75 **(7)**

Q.10 a) Use K–Map representation to find Minimal Sum of product expressions for: **(7)**

i) $f(x, y, z) = \sum(0, 1, 4, 6)$

ii) $f(w, x, y, z) = \sum(0, 5, 7, 8, 12, 14)$

b) Find the complement of every element of the lattice $<S_n, D>$ for n = 75 **(6)**

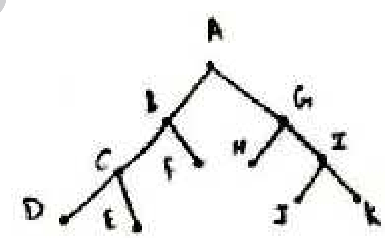
UNIT 6

Q.11 a) Prove that in a simple directed graph the sum of degrees of all the nodes is twice the number of edges of the graph. **(6)**

b) Give the directed tree representation of following: **(7)**

$(\neg P \wedge (P \vee \neg Q)) \wedge ((\neg P \vee Q) \vee \neg R)$

Q.12 a) Traverse the following tree with three techniques: Inorder, Preorder, Postorder. **(7)**



b) Obtain adjacency Matrix and Path Matrix of the digraph given below. **(6)**