WINTER-2019

UNIT-1

Q.1 a) Show the following equivalences **(7)**

1. $A \rightarrow (P \vee C) \Leftrightarrow (A \wedge \neg P) \rightarrow C$

2. $(P \rightarrow C) \wedge (Q \rightarrow C) \Leftrightarrow (P \vee Q) \rightarrow C$

b) Show that the following implication without constructing truth table. **(7)**

1. $(P \rightarrow Q) \Rightarrow (P \rightarrow (P \wedge Q))$

2. $((P \rightarrow Q) \rightarrow Q) \Rightarrow (P \vee Q)$

Q.2 a) Obtain principle disjunctive normal form **(7)**

1. $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$

2. $\dot{E}(P \vee Q) \Leftrightarrow (P \wedge Q)$

b) Obtain principle conjunctive normal form. **(7)**

1. $(\dot{E}P \rightarrow R) \wedge (Q \Leftrightarrow P)$

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

UNIT-2

Q.3 a) Determine whether he conclusion C follows logically from premises given.

1. $H_1 : \neg Q,\ H_2 : P \rightarrow Q,\ C : \neg P.$

2. $H_1 : \neg P,\ H_2 : P \vee Q,\ C : Q$

3. $H_1 : P \rightarrow Q,\ H_2 : P,\ C : Q$ **(7)**

b) Show that $R \wedge (P \vee Q)$ is a valid conclusion from the premises $P \vee Q$, $Q \rightarrow R$, $P \rightarrow M$, & $\neg M$. **(6)**

Q.4) Show that following set of premises are inconsistent.

1. $P \rightarrow Q,\ P \rightarrow R,\ Q \rightarrow \neg R,\ P$

2. $A \rightarrow (B \rightarrow C),\ D \rightarrow (B \wedge \neg C),\ A \wedge D$ **(7)**

b) Use indirect proof method to show $\neg (P \wedge Q)$ follows from $\neg P \wedge \neg Q$. **(6)**

UNIT-3

Q.5 a) Given the relation matrices M_R & M_S **(7)**

Find $M_{R\circ S}$, $M_{\overline{R}}$, $M_{\overline{S}}$, $M_{\overline{R\circ S}}$ $M_{\overline{S\circ R}}$

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix} \quad M_S = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$

b) Let the compatibility relation onset $\{x_1, x_2, \text{-----} x_6\}$ be given by the matrix **(6)**

x_2	1				
x_3	1	1			
x_4	0	0	1		
x_5	0	0	1	1	
x_6	1	0	1	0	1
	x_1	x_2	x_3	x_4	x_5

Draw the graph and find maximal compatibility blocks of the relation.

Q.6 a) Let $R = \{\langle 1,2\rangle\ \langle 3,4\rangle\ \langle 2,2\rangle\}$ and $s = \{\langle 4,2\rangle\ \langle 2,5\rangle\ \langle 3,1\rangle\ \langle 1,3\rangle\}$

Find $R°S$, $S°R$,$R°(S°R)$,$((R°S)°R)$ $R°R°R$, $S°S$. **(6)**

b) Given $S = \{S, a, \{3\}, 4\}$ $\quad R = \{\{a\}, 3, 4, 1\}$

Indicate whether following are true or false.

1. $\{a\} \in S$

2. $\{a\} \in R$

3. $\{a, 4\ \{3\}, 4\} \subseteq S$

4. $\{\{a\}, 1, 3, 4\} \subset R$

5. $R = S$

6. $\{a\} \subseteq S$

7. $\{a\} \subseteq R$

8. $\phi \in R$ **(7)**

UNIT-4

Q.7 a) Define the following terms. **(6)**

1) Sub Algebra **2)** Semigroup

3) Monoid **4)** Group.

b) Let $\langle G, *\rangle$ be a group in which G = {e, a} and $\langle(G, *\rangle$ is defined as. **(7)**

*	e	a
e	e	a
a	a	e

Find out $\langle G \times G, 0\rangle$ direct product of G with itself.

Q.8 a) Write down the composition table for $\langle Z_6^*, +_6\rangle$ and $\langle Z_6, *_6\rangle$ ⟩ where, $Z_6^* = Z_6 - [0]$. **(7)**

b) Show that every element in a group is its own inverse then the group must be abelian group. **(6)**

UNIT-5

Q.9 a) Obtain the sum of product expression of each of the following using k map

1. f(a, b ,c, d) = Σ 2, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15.

2. f(a, b, c, d) = Σ 0, 5, 7 ,8, 10, 12. **(7)**

b) Simplify following Boolean expression. **(7)**

1. (a * b)' = (a + b)'

2. (a' * b *c) + (a * b' * c) + (a * b' * c')

3. (a + b') * (b + c') * (c + a')

Q.10 a) prove the following Boolean identities. **(7)**

1. a + (a' * b) = a + b.

2. a* (a' + b) = a * b.

3. (a * b) + (a * b') = a

4. (a * b * c) + (a * b) = (a * b)

b) Let X = {2, 3, 6, 12, 24, 36} then relation $\leq$ i.e., $x < y$ if x divides y draw Hasse diagram. $\langle x, \leq \rangle$ and Determine it is lattice or not. **(7)**

UNIT-6

Q.11 a) Define the terms.

1) Strongly connected graph

2) Weakly connected graph.

3) Null graph **4)** Simple graph. **(7)**

b) Give the Warshall's Algorithm for path matrix with example. **(6)**

Q.12 a) Show that in a complete binary tree, the total number of edges is given by $2(n_t - 1)$ where n_t is total number of terminal nodes. **(6)**

b) Traverse the following tree with in-order, pre-order. **(7)**