

WINTER 2011**UNIT 1**

Q. 1 a) Obtain principal disjunctive normal form (7)

$$\uparrow(\neg PR) \wedge (Q \leftrightarrow P)$$

b) Show that following is the equivalent formula (6)

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

Q. 2 a) Obtain principal disjunctive normal form (7)

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

b) Write equivalent forms of- (6)

$$\text{i. } \neg (P \vee Q) \quad \text{ii. } \neg (P \wedge Q) \quad \text{iii. } \neg (P \rightarrow Q)$$

UNIT 2

Q. 3 a) Show That (7)

$$(\forall x) (P(x) \rightarrow (Q(x) \wedge (x) (Q(x) \rightarrow R(x)))$$

$$\Rightarrow (\forall x) (P(x) \rightarrow R(x))$$

b) Explain terms statement function variables, quantifier, predicate and predicate formula with example. (6)

Q. 4 a) Show that $(\exists x) M(x)$ follows logically from the premises.

$$(\forall x) (H(x) \rightarrow M(x)) \text{ and } (\exists x) H(x) \quad (7)$$

b) i. Which of the following are statements (6)

$$(1) (\forall x) (P(x) \vee Q(x)) \wedge R$$

$$(2) (\forall x) (P(x) \wedge Q(x)) \wedge (\exists x) S(x)$$

$$(3) (\forall x) (P(x) \wedge Q(x)) \wedge S(x)$$

ii. What do you mean by quantifiers, free and bound variables?

UNIT 3

Q. 5 a) Explain different properties of binary relation. Any three properties with example. (7)

b) Let $X = \{1, 2, 3, 4, 5, 6\}$ and $R = \{(x, y) / (x > y)\}$

Draw graph of R and give Matrix (6)

Q. 6 a) Show whether following reactions are transitive and symmetric.

i. $R = \{<1,2>, <2,2>\}$

ii. $R = \{<1,2>, <2,3>, <1,3>, <2,1>\}$

iii. $S \{1,2,3,4\}$

iv. $R = \{<1,2>, <4,3>, <2,2>, <3,1>\}$ (6)

b) What do you mean by primitive recursive function?

Show that $f(x,y) = x + y$ is primitive recursive (7)

UNIT 4

Q. 7 a) Define terms :-

i. Subgroup ii. Subgroup

iii. Monoid iv. Semigroup Homomorphism. (8)

b) Design composition table fir algebraic system $(Z_{-}, +_{-})$ and $(Z_{-}, *_{-})$ (6)

Q. 8 a) Find left coset of $\{[0],[3]\}$ in the group $(Z_6, +_6)$ (6)

b) Find all sub-groups of

i. $(Z_9, +_9)$ ii. (Z^*_{-}, X_{-}) (8)

UNIT 5

Q.9 a) Find different properties of Lattices. (6)

Find minimum sum of products expression using k maps.

i. $f(a,b,c,d) = \Sigma (0,1,2,3,13,15)$

ii. $f(a,b,c,d,e) = \Sigma (0,1,3,8,9,13,14,15,16, 17,19,14,25,27,31)$ (8)

Q. 10 a) Define terms:- (6)

i. Isotonicity. ii. Sub Lattice iii. lattice Homomorphism.

b) Obtain minimal expression using k map

i. $f(a,b,c,d) = \Sigma (0,1,2,3,13,15)$

ii. $f(a,b,c,d,e) = \Sigma (9,20,21,29,30,31)$ (8)

UNIT 6

Q. 11 a) Explain with example paths, Reachability, Connectedness. **(6)**

b) Find adjacency matrix for the graph given below. **(7)**

Q. 12 a) Define terms strong component and weak component of digraph. Find strong components of following digraph. **(8)**

b) Find reachable sets of $\{v_1, v_4\}$, $\{v_4, v_5\}$ and $\{v_3\}$ for the digraph in above Question. **(5)**