WINTER-2015

UNIT 1

Q.1 a) Show that the following equivalence:

$(((Q \wedge A) \rightarrow C) \wedge (A \rightarrow (P \vee C))) \Leftrightarrow ((A \wedge (P \rightarrow Q)) \rightarrow C$ **(7)**

b) What is well formed formula? What are the rules for well formed formula? Explain with suitable example. **(6)**

Q.2 a) Obtain disjunctive normal form of:

i. $\sim(P \vee Q) \leftrightarrow (P \wedge Q)$ **ii.** $P \wedge (P \rightarrow Q)$ **(7)**

b) Obtain principal conjunctive normal form of the given formula: $(\sim P \rightarrow R) \wedge (Q \leftrightarrow P)$ **(6)**

UNIT 2

Q.3 a) Show that: $(x)\ (P(x) \rightarrow Q(x)) \wedge (x)\ (Q(x) \rightarrow R(x)) \Rightarrow (x)\ (P(x) \rightarrow R(x))$. **(7)**

b) Show that $R \vee S$ follows logically from the premises:

$C \vee D$, $(C \vee D) \rightarrow \sim H$, $\sim H \rightarrow (A \wedge \sim B)$ and $(A \wedge \sim B) \rightarrow (R \vee S)$. **(6)**

Q.4 a) Symbolize the following statement:

i) All cats are animal ii) Some cats are black

iii) Some real no. are rational

iv) Any integer is either positive or negative. **(8)**

b) Show that, R is a valid inference from the premise $P \rightarrow Q$, $Q \rightarrow R$ and P. **(5)**

UNIT 3

Q.5 a) Let, R and S be the relation given by:

R: {<1, 2> <3, 4> <2, 2>} S: {<4, 2> <2, 5> <3, 1> <1, 3>}

Find R·S, S·R, R·R, S·S, R·(S·R), (R·S)·R, R·R·R. **(7)**

b) Given S = {1, 2, 3, ….. 10} and the relation R on S where

$R = \{< x, y > \mid x + y = 10\}$ what are the properties of relation? **(6)**

Q.6 a) Let the compatibility relation on a set $\{X_1, X_2, X_3, \ldots X_6\}$ be given by matrix: **(6)**

$$\begin{array}{c|ccccc} X_2 & 1 & & & & \\ X_3 & 1 & 1 & & & \\ X_4 & 1 & 1 & 1 & & \\ X_5 & 0 & 1 & 0 & 0 & \\ X_6 & 0 & 0 & 1 & 0 & 1 \\ \hline & X_1 & X_2 & X_3 & X_4 & X_5 \end{array}$$

b) Given the relation matrix M_R and M_S. Find $M_{R \cdot S}$, $M_{\overline{R}}, M_{\overline{S}}$ and $M_{\overline{R \cdot S}}$ show that:

$M_{\overline{R \cdot S}} = M_{\overline{S} \cdot \overline{R}}$ $\quad M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ $M_S = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$ **(7)**

UNIT 4

Q.7 a) Show that with every element in group is its own inverse then group must be abelian group. **(6)**

b) Design composition table for algebraic system $< z_m, +_m >$ and $< z_{m_1}, *_m >$ when m = 5. **(7)**

Q.8 a) Design composition table for algebraic system $< z_6, +_6 >$ and $< z_6, *_6 >$. **(7)**

b) Find out left cosets of H in: $< z_4, +_4 > = \{[0], [2]\}$. **(6)**

UNIT 5

Q.9 a) Obtain sum of product canonical form of the Boolean expression:

i) $x_1 \oplus (x_2 * x'_3)$ ii) $(x_1 \oplus x_2)' \oplus (x'_1 * x_3)$ **(7)**

b) Find the complement of every element of lattice $< S_a, D >$ for n = 75, n = 24 and n = 10. Let n be positive integer and S_n be the set of division of n. **(6)**

Q.10 a) For the following function given: $F = \overline{W} + y(\overline{x} + \overline{z})$

1. Circuit diagram representation
2. Truth table representation
3. K-map representation. **(7)**

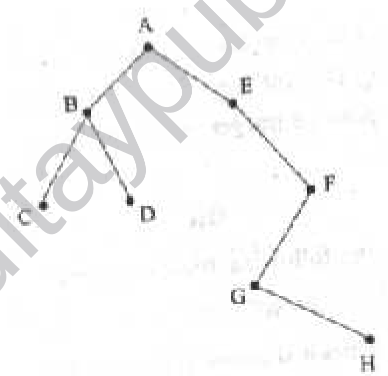
b) Find minimum sum of product expression of following function using K-map:

1. F(a, b, c) = Σ(0, 1, 4, 6)
2. F(a, b, c, d) = Σ(0, 5, 7, 8, 12, 14)
3. F(a, b, c, d) = Σ(0, 1, 2, 3, 13, 15) **(6)**

UNIT 6

Q.11 a) Give a directed tree representation of the formula (P ∨ (~P ∧ Q)) ∧ ((~P ∨ Q) ∧ ~R). From this representation obtain the corresponding prefix formula. **(6)**

b) Transverse the following tree with preorder, postorder and in order: **(6)**



Q.12 a) Define the following term:

i) Indegree ii) Outdegree iii) Complete binary tree **(6)**

b) Find all indegree and outdegree of the node of the graph given below. Give all elementary cycle of graph: **(7)**