WINTER-2014

UNIT 1

Q1. a) What is statement formula? What are the rules for generating well-formed formula? **(6)**

b) Explain with the example:

i. Conditional and Bi-conditional statements ii. Tautology and contradiction **(6)**

Q2. a) Show the following equivalences without truth table

i. $A \to (P \vee C) \Leftrightarrow (A \wedge \neg P) \to C$ **ii.** $(P \vee Q) \to C \Leftrightarrow (P \to C) \wedge (Q \to C)$ **(8)**

b) Obtained Principle Conjunctive Normal form of $(\neg P \to R) \vee (Q \Leftrightarrow P)$ **(5)**

UNIT 2

Q3. a) Symbolize the following statements

i. All cats are animals

ii. Rosses are red and violets are blue **(6)**

b) Show that $S \vee R$ is tautological implied by $(P \vee Q) \wedge (P \to R) \wedge (Q \to S)$. **(7)**

Q4. a) Show that, **(5)**

$(x)\ (P(x) \to Q(x)) \wedge (x)\ (Q(x) \to R(x)) \Rightarrow (x)\ (P(x) \to R(x))$

b) Determine whether the conclusion C follows logically from the premises H_1 and H_2:

i. H_1: $P \to Q$ H_2: $\neg P$ C: Q

ii. H_1: $P \to Q$ H_2: $\neg(P \wedge Q)$ C: $\neg P$ **(8)**

UNIT 3

Q5. a) Define: i. Intersection ii. Union

iii. Relative Complement iv. Disjoint Sets **(6)**

b) Draw Venn diagram of

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

iii. $A \cap B = A \cap C$ but B is not subset of C. **(7)**

Q6. a) Given the relation matrices M_R and M_S find $M_{R \circ S}$, $M_{\bar{R}}$, $M_{\bar{S}}$, $M_{\overline{R \circ S}}$ Show that $M_{\overline{R \circ S}} = M_{\bar{S} \circ \bar{R}}$ **(7)**

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

b) Let P = {<1, 2>, <2, 4>, <3, 3>} and Q = {<1, 3>, <2, 4>, <4, 2>}. Find $P \cup Q$, $P \cap Q$, D(P), D(Q), R(P), R(Q), $D(P \cup Q)$ and $R(P \cap Q)$.

Show that $D(P \cup Q) = D(P) \cup D(Q)$ and $R(P \cap Q) \subseteq R(P) \cap R(Q)$. **(6)**

UNIT 4

Q7. a) Write down the composition tables for

i. $<Z_6, t_6>$ ii. $<Z_6, X_6>$ **(6)**

b) Define: i. Group ii. Subgroup **(7)**

Q8. a) What is coset? Find coset of {[0], [4]} in the group $<Z_7, +_7>$. **(7)**

b) Convert the following infix expressions to their prefix and postfix form,

i. A * B + C/D ii. A + B * C – D/F **(6)**

UNIT 5

Q9. a) For the following function: f = x + y + z, Give,

i. Circuit diagram representation ii. Truth Table representation

iii. K-map representation. **(8)**

b) Write the following Boolean expressions in an equivalent sum of product canonical form: i. $x_1 * x_2$ ii. $x_1 + (x_2 * x_3')$ **(6)**

Q10. a) Use K-map representation to find minimal sum of product expressions for:

i. f(a, b, c) = Σ(0, 1, 4, 6) ii. f(a, b, c, d) = Σ(0, 5, 7, 8, 12, 14) **(8)**

b) Prove the following Boolean identities,

i. a + (a' * b) = a + b   ii. a * (a' + b) = a * b. **(6)**

UNIT 6

Q11. a) Explain with examples

i. Adjacency matrix   ii. Path matrix   iii. Tree

(6)

b) Show that the sum of indegrees of all the nodes of a simple diagraph is equal to the sum of out degree of all its nodes and that this sum is equal to the number of edges of the graph. **(7)**

Q12. a) Give the directed tree representation of the following formula

$(P \vee (\neg P \wedge Q)) \wedge ((\neg P \vee Q) \wedge \neg R)$ **(6)**

b) Give three different elementary paths from node u_1 to u_3 for the digraph given in the following figure. What is the shortest distance between u_1 and u_3? Is their any cycle in the graph? **(7)**