WINTER-2013

UNIT 1

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

b) Show the following equivalences **(7)**

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

Q2. a) Explain

i. Tautological Implication. ii. Normal form. iii. Polish Notation **(6)**

b) Obtained the principle disjunctive normal form of $(\neg P \to R) \wedge (Q \leftrightarrows P)$ **(7)**

UNIT 2

Q3. a) Show that $R \to S$ can be derived from the premises $P \to (Q \to S)$, $\neg R \vee P$, and Q. **(7)**

b) Show that $(\exists x)M(x)$ follows logically from the premises $(x)(H(x) \to M(x))$ and $(\exists x)H(x)$. **(7)**

Q4. a) Symbolize the following statements, **(8)**

i. all cats are animals ii. Some cats are black

iii. Some real numbers are rational

iv. Any integer is either positive or negative.

b) Explain: i. Predicate calculus. ii. Rules for inferences. **(6)**

UNIT 3

Q5. a) Show that: $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

By i. Formal proof. ii. Venn diagram **(6)**

b) Let R and S be the given relations as **(7)**

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

Find $R \circ S, S \circ R, R \circ R, R \circ (S \circ R), (R \circ S) \circ R, R \circ R\ S \circ S$

Q6. a) Explain with example: i. Set, ii. Subset

iii. Proper subset, iv. Universal set **(6)**

b) Let X = {1, 2, 3, 4, 5, 6, 7} and R = (<x, y> | x – y is divisible by 3}. Show that R is an equivalent relation. Draw the graph of R. **(7)**

UNIT 4

Q7. a) Explain: i. Group ii. Subgroup
iii. Monoids iv. Sub Monoids. **(8)**

b) Write down the composition table for: i. $<z_7, +_7>$
ii. $<z_7, \times_7>$ **(6)**

Q8. a) Show that if every element in a group is its own inverse, then the group must be Abelian. **(7)**

b) What is coset? Find the left coset of {[0], [3]} in a group $<z_6, +_6>$. **(7)**

UNIT 5

Q9. a) Obtained the sum of product canonical form of the following using three variables x_1, x_2 and x_3 : i. $x_1 + x_2$
ii. $(x_1 + x_2)' + (x_1 * x_3)$ **(7)**

b) Let n is integer and Sn contains all divisors of n which are less than or equal to n. Let D denote relation of division such that a, b ε Sn and a ≤ b if a divides b. draw the lattice <Sn, D> for n = 6, 8, 24, 30 and 75. **(6)**

Q10. a) For the function f = w' + y (x' + z') give **(7)**

1. The circuit diagram representation.
2. The truth table representation.
3. The Karnaugh map representation.

b) Prove the Boolean identities **(6)**

i. a * (a' ⊕ b) = a * b **ii.** (a * b) ⊕ (a * b') = a

UNIT 6

Q11. a) Prove that let G = {V, E} be a graph the sum of the degrees of all the nodes in V is twice the number of edges in E. **(7)**

b) Give the directed tree representation of the formula, **(6)**

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

Q12. a) Explain: i. Graph ii. Tree iii. Binary tree & complete binary tree iv. Adjacency matrix **(7)**

b) Give the Warshall's algorithm for path matrix with example, **(6)**