SUMMER-2015

UNIT 1

Q1. a) Explain with example,

i. Tautology ii. Contradiction iii.Equivalent formulas **(8)**

b) Obtain the principle disjunctive normal form of

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

Q2. a) Show the following equivalences,

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

b) Obtain the principal conjunctive normal form of $\neg(P \vee Q) \Leftrightarrow (P \wedge Q)$. **(6)**

UNIT 2

Q3. a) Determine whether the conclusion C follows logically from the premises H_1 and H_2:

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

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

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

Q4. a) Show that $S \vee R$ is tautological implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$. **(7)**

b) Symbolize the following statements

i. Some cats are black. ii. All Indians are brave **(6)**

UNIT 3

Q5. a) Explain with example:

i. Set ii. Subset iii. Equality of set
iv. Empty set **(6)**

b) Show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ **(7)**

By i. Formal proof. ii. Venn diagram

Q6. a) 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)**

b) Let X = {1, 2, 3} and f, g, h and s be the functions from X to X given by,

f = {<1, 2>, <2, 3>, <3, 1>} g = {<1, 2>, <2, 1>, <3, 3>}

h = {<1, 1>, <2, 2>, <3, 3>} s = {<1, 1>, <2, 2>, <3, 3>}

find f,g g.f, f.h.g, g.s f.s and s.s. **(7)**

UNIT 4

Q7. a) Explain: i. Group ii. Subgroup **(7)**

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

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

Q8. a) What is coset? Find the coset of {[0], [3]} in the group $<z_6, +_6>$ **(7)**

b) Write down the composition table for

i. $<z_7, +_7>$ ii. $<z_7, *_7>$ **(6)**

UNIT 5

Q9. a) Expand the following functions into their sum-of-product form:

i. f(x, y, z) = xy' + y'z' ii. f(w, x, y, z) = xy + w'yz **(8)**

b) In any Boolean algebra, show that

i. a = b ⇔ ab' + a'b = 0 ii. a = 0 ⇔ ab' + a'b = b **(6)**

Q10. a) Draw the diagram of the lattice $<S_n, D>$ for n = 4, 12, 15, 60. **(5)**

b) Use the K-map representation to find a minimal sum-of-products expression for the following functions:

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

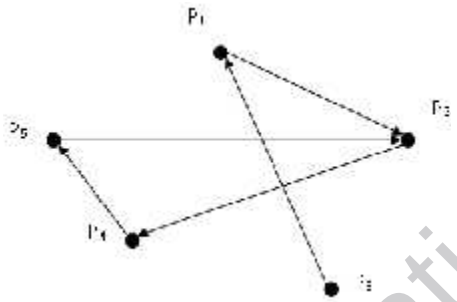
UNIT 6

Q11. a) Explain with example,

i. Graph ii. Indegree and outdegree iii. Tree. **(6)**

b) Show that in a complete binary tree the total number of edges is given by $2(n_t - 1)$, where n_t is the number of terminal nodes. **(7)**

Q12. a) Obtain adjacency matrix and path matrix of the digraph given below, **(7)**



b) Give the directed tree representation of the following formula $(P \vee (\neg P \wedge Q)) \wedge (\neg P \wedge Q) \wedge \neg R)$ **(6)**