SUMMER-2013

UNIT 1

Q.1 a) Show the following equivalence: (7)

i.
$$P \rightarrow (Q \lor R) (P \rightarrow Q) \lor (P \rightarrow R)$$

ii.
$$(\neg(P \land Q) \rightarrow (\neg P \lor (\neg P \lor Q)) \Rightarrow (\neg P \land Q)$$

b) Define the following terms:-

ii. Tautological Implication

(6)

(6)

- **i.** Statement iii. Well formed formula iv. Normal Forms.
- following implications without Show the **Q.2** a) constructing truth tables: (6)

i.
$$P \rightarrow (P \rightarrow R) \Rightarrow (P (P \land Q))$$

ii.
$$(((P \lor \neg P) \to Q) \to ((P \lor \neg P) \to R)) \Rightarrow (Q \to R)$$

btain PCNF
i. $(\neg P \to R) \lor (Q \leftrightarrow P)$
ii. $(P \land Q) \lor (\neg P \land R)$.

b) Obtain PCNF

ii.
$$(P \wedge O) \vee (\neg P \wedge R)$$
.

Q.3 a) Show that the conclusion C follows from premises $H_1, H_2,...$ in following cases using truth table: **(7)**

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

ii.
$$H_1: (P \vee Q), H_2: P \to R, H_3: Q \to R, C: R$$

- **b)** Show that $R \wedge (P \vee Q)$ is valid conclusion of premises $P \vee Q$ $Q, Q \rightarrow R, P \rightarrow M$ and $\neg M$ using rules of inference. (6)
- **Q.4 a)** Show that $R \to S$ can be derived from premises

$$P \rightarrow (Q \rightarrow S_{*}) \neg R \lor P \text{ and } Q.$$
 (13)

- Show that $\neg(P \land Q)$ follows from $\neg P \land \neg Q$, using indirect proof method.
- **ii.** Show that following premises are inconsistent:

$$E \rightarrow S, S \rightarrow H, A \rightarrow \neg H, E \wedge A.$$

UNIT 3

Q.5 a) Draw the Benn diagram showing: (7)

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

b) Let R and S be given relations as:

 $R = \{<1,2>,<3,4><2,32>\}$

 $S = \{<4,2>,<2,5>,<3,1><1,3>\}$

Find R_oS, S_oR, R_o(S_oR), (R_oS)_oR,

 $R_{\circ}S$, $S_{\circ}S$.

Q.6 a) Given the relation matrices M_R and M_s , find

$$M_{\overline{(R.S)}}.M_{\overline{R}}.M_{\overline{S}}.M_{\overline{S.R}}.M_{\overline{R.S}}.$$
 (7)

$$\mathbf{M}_{R} = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix} \mathbf{M}_{S} = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}$$
 (7)

b) Define the following terms:

(6)

(6)

i. Equal Sets

ii. Power Set

iii. Relative Complement **iv.** Absolute Complement.

UNIT 4

Q.7 a) Define the algebraic system:

i.
$$\langle Z_4, +4, *4 \rangle$$

ii.
$$\langle Z_6*+6 \rangle$$
 where $Z_6*=Z_6-\{[0]\}$. (7)

b) Explain the following terms with example:

i. Group

ii. Semigroup

iii. Monoid

iv. Direct Product of Groups.

Q.8 a) Show that with every element in a group is its own inverse then the group must be abelian. **(7)**

b) Let $\langle G, * \rangle$ is group where, $G = \langle \alpha, \beta, \gamma, \delta \rangle$ and * is given by composition table:

*	α	β	γ	δ
α	α	β	γ	δ
α β	β	α	δ	γ
γ	γ	δ	β	α
δ	δ	γ	α	β

Find out the identity element and inverse of each element of group with justification. **(7)**

UNIT 5

Q.9 a) Let is integer and S_R contains all divisors of n which are less than or equal to n Let D denote relation of division such that a, b ε S_n and a \leq b if a divides b. Draw the lattice < S_n D> for various values of n = 5, 15, 45, 75. **(7)**

b) Prove the following Boolean identities: **(7)**

i.
$$a \oplus (a^*b) = a \oplus b$$
 ii. $a^*(a^*b) = a^*b$

iii.
$$(a * b) \oplus (a * b') = a$$
 iv. $(a * b * c) \oplus (a * b) = a * b$

Q.10 a) Simplify following Boolean Expression: (7)

i.
$$(a * b)' \oplus (a \oplus b)'$$
 ii. $(a'*b'*c) \oplus (a * b'*c) \oplus (a * b'*c)$

b) Obtain the sum of product canonical form of following using three variables x_1 , x_2 , and x_3 : **(7)**

i.
$$x_1 + x_2$$
 ii. $(x_1 + x_2)' + (x'_1 * x_3)$
UNIT 6

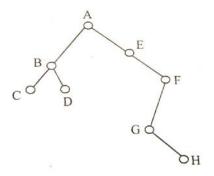
Q.11 a) Define the terms:

(6)

- **i.** Isomorphic Graphs **ii.** Strongly Connected Graph
- **iii.** Simple Graph **iv.** Parallel Edges.

b) Give the Warshall's algorithm for path matrix with example. **(7)**

Q.12 a) Show that in a complete binary tree the total number of edges is given by 2(n_t-1) where n_t is the total number of terminal nodes. (6) **b)** Traverse the following tree with Preorder Postorder and Inorder: (7)



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