SUMMER-2019

UNIT-1

Q.1 a) Show that

$(\neg P \wedge(\neg Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ **(7)**

b) Explain with example.

i. Tautology **ii.** Construction **iii.** Equivalent formulas **(7)**

Q.2 a) Obtain principal disjunctive normal form of the following.

$P \vee (\neg P \rightarrow (Q \vee (\neg Q \rightarrow R)))$. **(7)**

b) Given the truth values of P and Q as T, and those of R and S as F. Find the truth value of the following.

$(\neg(P \wedge Q) \vee \neg R) \vee ((Q \leftrightarrow \neg P) \rightarrow (R \vee \neg S))$ **(7)**

UNIT-2

Q.3) Determine whether the conclusion C follows logically from the premises H_1 and H_2. **(13)**

1. $H_1 : P \rightarrow Q$ $H_2 : P$ $C : Q$
2. $H_1 : P \rightarrow Q$ $H_2 : \neg P$ $C : Q$
3. $H_1 : P \rightarrow Q$ $H_2 : \neg(P \wedge Q)$ $C : \neg P$
4. $H_1 : \neg P$ $H_2 : P \rightleftharpoons Q$ $C : \neg(P \wedge Q)$
5. $H_1 : P \rightarrow Q$ $H_2 : Q$ $C : P$
6. $H_1 : P \vee Q$ $H_2 : P \rightarrow R$ $H_2 : Q \rightarrow R$ $C : R$
7. $H_1 : \neg P \vee Q$ $H_2 : \neg(Q \wedge R)$ $H_3 : \neg R$ $C : \neg P$

Q.4 a) Show that $R \vee S$ follows logically from the premise

$C \vee D$, $(C \vee D) \rightarrow \neg H$, $\neg H \rightarrow (A \wedge \neg B)$ and $(A \wedge \neg B) - (R \vee S)$. **(7)**

b) Show that

$(x)\ (P(x) \rightarrow Q(x)) \wedge (x)(Q(x) \rightarrow (R(x)) \Rightarrow (x)\ P(x) \rightarrow R(x))$ **(6)**

UNIT-3

Q.5 a) Let the compatibility relation on a set $\{x_1, x_2, \ldots.x_6\}$ be given by the matrix.

$$\begin{array}{c|ccccc}
x_2 & 1 & & & & \\
x_3 & 1 & 1 & & & \\
x_4 & 0 & 0 & 1 & & \\
x_5 & 0 & 0 & 1 & 1 & \\
x_6 & 1 & 0 & 1 & 0 & 1 \\
\hline
 & x_1 & x_2 & x_3 & x_4 & x_5
\end{array}$$

Draw the graph and find the maximal compatibility blocks of the relation. **(7)**

b) Explain with examples: **(6)**

i. Set **ii.** Subset **iii.** Equality of a set

iv. Proper subset **v.** Empty set

Q.6 a) What is poset? Draw the Hasse diagram for the (3, 9, 27, 54) under the partial ordering relation 'divides'. **(6)**

b) Let X = (1, 2, 3, 4) and R = $\{(x, y)/ x > y\}$. Draw the graph of R and also give its matrix. **(7)**

UNIT-4

Q.7 a) Write down the composition table for $(z_7, +_7)$ where $z_7^* = z_7 - [0]$ **(6)**

b) What is coset? Find the left coset of {[0], [4]} in group $\{z_7, +_7\}$. **(7)**

Q.8 a) Let the language $L(G) = \{a^n b^n c^n / n \geq 1\}$ is generated by the grammar $\{\langle S, B, C\rangle\}, \langle a, b, c\rangle, S, \phi$ where ϕ consists of production

$S \rightarrow aSBC$ $S \rightarrow aBC$, $CB \rightarrow BC$, $aB \rightarrow ab$

$bB \rightarrow bb \rightarrow bcc$ $C \rightarrow cc$ find the derivation for the sentence $a^2b^2c^2$ and $a^3b^3c^3$. **(6)**

b) Show that the inverse element of $(a^{-1})^{-1} = a$ for $a \in G$ where G is a group. **(7)**

UNIT-5

Q.9) Use k-map representation to find minimal sum – of – product expression of each of the following function.

i. $f(a, b, c) = \sum(0, 1, 4, 6)$

ii. $f(a, b, c, d) = \sum(0, 5, 7, 8, 12, 14)$

iii. $f(a, b, c, d) = \sum(2, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15)$

iv. $f(a, b, c) = \sum(0, 2, 4, 6)$

v. $f(a, b, c, d) = \sum(0, 5, 7, 8, 10, 12)$ **(14)**

Q.10 a) What is Boolean algebra? State any four properties of Boolean algebra. **(7)**

b) Draw the diagram of the lattices (S_n, D) for n = 4, 6, 8, 12, 15, 45, 60, 75 and 210. **(7)**

UNIT-6

Q.11 a) Explain the WARSHALL algorithm which produces a path matric P or A^+ from given adjacency matrix A. **(7)**

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 total number of terminal nodes. **(6)**

Q.12 a) Show that the sum of indegrees of all the nodes of a simple diagraph is equal to the sum of outdegrees of all its nodes and that sum is equal to the number of edges of the graph. **(7)**

b) Explain with example

i. Adjacency matrix

ii. Path matrix **(6)**