

SECTION A - (5 X 2 = 10)Answer All the Questions:

1. Define conjunction.

[OR]

2. Express in English the statement
- $P \rightarrow Q$
- where

P: The sun is shining today.

Q: $2 + 7 > 4$

3. Define Elementary product.

[OR]

4. Obtain a conjunctive normal form of
- $P \wedge (P \rightarrow Q)$
- .

5. Define Equivalence relation.

[OR]

6. Define Idempotent element.

7. Define Lattice.

[OR]

8. Define Direct product of lattice.

9. Define Regular graph.

[OR]

10. Define Length of the path.

SECTION B - (5 X 4 = 20)Answer All the Questions:

11. Construct the truth table for
- $P \vee \neg Q$
- .

[OR]

12. Write the duals of a)
- $(P \vee Q) \wedge R$

b) $(P \wedge Q) \vee T$

c) $\neg(P \vee Q) \wedge (P \vee \neg(Q \wedge \neg S))$.

13. Obtain a disjunctive normal form of
- $\neg(P \vee Q) \Leftrightarrow (P \wedge Q)$
- .

[OR]

14. Obtain a conjunctive normal form of
- $Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$
- .

15. Let
- $R = \{(1,2), (3,4), (2,2)\}$
- and
- $S = \{(4,2), (2,5), (3,1), (1,3)\}$
- . Find

$R \circ S, S \circ R, R \circ (S \circ R), (R \circ S) \circ R, R \circ R, S \circ S$ and $R \circ R \circ R$.

[OR]

16. Let A and B be sets. Using characteristic function, prove that
- $\overline{A \cup B} = \bar{A} \cap \bar{B}$
- .

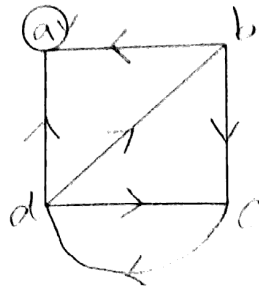
17. Let
- (L, \leq)
- be a lattice. For any
- $a, b \in L$
- , prove that
- $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$
- .

[OR]

18. Prove that any lattice homomorphism is order preserving.

...2...

19. Find the degree of each vertices of the given digraph.



[OR]

20. How many edges are there in a graph with ten vertices each of degree six.

SECTION C – (5 X 9 = 45)

Answer All the Questions:

21. Show that $(\neg P \wedge (\neg Q \wedge R)) \vee ((Q \wedge R) \vee P \wedge R) \Leftrightarrow R$.

[OR]

22. Show that $\neg(P \wedge Q) \rightarrow (\neg P \vee (\neg P \vee Q)) \Leftrightarrow (\neg P \vee Q)$.

23. Obtain the principal disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$.

[OR]

24. Obtain the principal conjunctive normal form of $P \rightarrow (\neg P \wedge (Q \rightarrow P))$.

25. Prove that composition of functions is associative.

[OR]

26. If A and B are any two subsets of E, then prove that

$$\psi_{A \cup B}(x) = \psi_A(x) + \psi_B(x) - \psi_{A \cap B}(x), \text{ for all } x \in E.$$

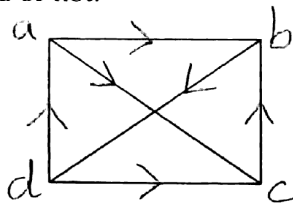
27. State and prove distributive inequality of lattice.

[OR]

28. In a lattice if $a \leq b \leq c$, then show that a) $a \oplus b = b * c$

$$\text{b) } (a * b) \oplus (b * c) = (a \oplus b) * (a \oplus c) = b$$

29. Check the given digraph is strongly connected, weakly connected and unilaterally connected or not.



[OR]

30. Find the adjacency matrix for the digraph given below.

