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| Name of the Course | **: B.Sc. (H) Mathematics (CBCS)** |
| Unique Paper Code | **: 32357505_OC** |
| Name of the Paper | **: DSE- Discrete Mathematics** |
| Semester | **: V Semester** |
| Duration | **: 3 hours** |
| Maximum Marks | **: 75 Marks** |

**Instructions for Candidates:**

*Attempt any four questions. All questions carry equal marks.*

**1**. Let $(P_1, \leq)$ be ordered set of all divisors of 5 and $(P_2, \leq)$ be ordered set of all divisors of 9, both ordered with divisibility. Draw the diagram of direct product $P_1 \times P_2$ . Is it same as the diagram of the lattice of factors of 20 , justify ,also Prove or Disprove $P_1 \times P_2$ is a lattice. Further, prove the result that a lattice $(L, \leq)$ is a chain if and only if every nonempty subset of $L$ is a sublattice of $L$.

**2.** Use the Karnaugh map method to simplify the polynomial $p$ given by

$$p = (x' + y)(x' + z) + xyz$$

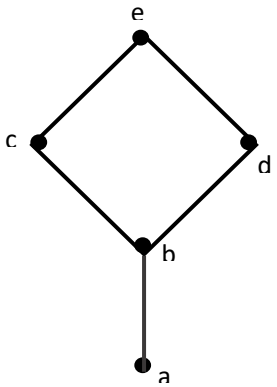
Does the expression $x'y'$ imply the expression $xy'z' + x'y'z + x'y'z'$. Give reason for your answer

Give the symbolic representation of the circuit $q$ given by

$$q = xy'z((x' + z) + (y + z'))$$

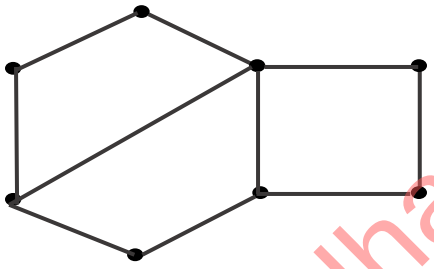
Also, draw the contact diagram of above circuit $q$.

**3.** Let $A = \{a, b, c, d, e\}$ be a partial ordered set with the given Hasse diagram

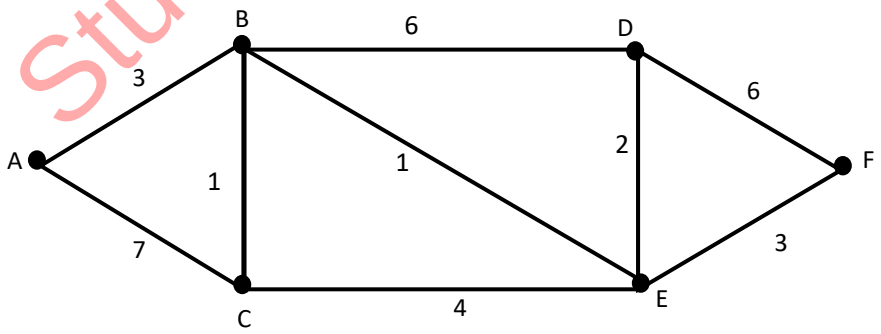


Find the meet (∧) and join (∨) of subsets of {a,c} and {b,e}. Let $B = \{1, 2, 3, 4, 5\}$ be order isomorphic to *A* under the following order isomorphism: *f(a)* = 1, *f(b)* = 3, *f(c)* = 5, *f(d)* = 2, *f(e)* = 4. Draw the Hasse diagram of poset *B*. Also prove that in a lattice every non empty subset has a supremum and infimium.

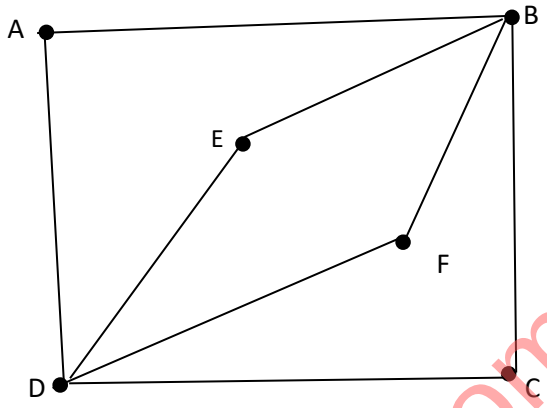
**4**. Draw the graph $K_{4,4}$. How many edges does this graph has? Also, find the adjacency matrix of this graph. Does there exist a graph with 32 edges and 12 vertices, each of degree 4 or 6? Justify your answer. For the graph given below, Either give the bipartition sets or explain why the graph is not bipartite.



**5**. Use the original form of Dijkstra's Algorithm to find shortest path from A to F in the graph given below. Label all vertices. Explain algorithm.



Consider the following Graph.Check whether the graph is Eulerian. Explain your Answer.

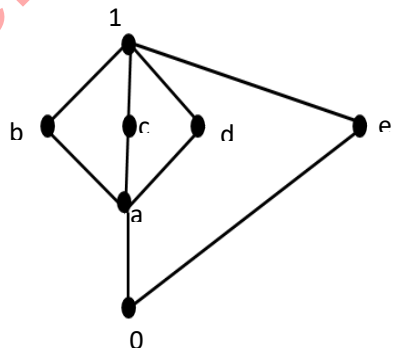



**6**. Find elements a, b, c in $N_5$ which do not satisfy the following law:

$(a \vee b = c \vee b \text{ and } a \wedge b = c \wedge b) \Rightarrow a = c$

Deduce that a lattice L is distributive if and only if the above law holds for all a,b,c ∈ L. Verify whether the lattice L in the figure given below is modular and /or distributive, by using $M_3$-$N_5$ theorem.



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