B.E. Computer Science & Engineering (MODEL CURRICULUM) Sem-IV

SE201CS : Discrete Mathematics

P. Pages : 3 **GUG/W/22/13806**

Time : Three Hours * 3 0 3 5 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Use of non programmable calculator is permitted.

1. a) Prove that $A \times (B \cap C) = (A \times B) \cap (A \times C)$. **4**

b) If $A = \{4,5,7,8,10\}$ **4**

$B = \{4,5,9\}$

$C = \{1,4,6,9\}$

then verify that

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

c) Let R & S be the following relation on : **8**

$A = \{1,2,3\}$

$R = \{(1,1)(1,2)(2,3)(3,1)(3,3)\}$

$S = \{(1,2)(1,3)(2,1)(3,3)\}$

find a) $R \cap S,\ R \cup S,\ R^C$

b) $R \cdot S$

c) $S^2 = S \cdot S$

d) $R \cap S^C$

OR

2. a) Let f, g, h be function from N to N where N is set of natural numbers so that **8**

$f(n) = n+1,\quad g(n) = 2n$ &

$h(n) = 0$, if n is even &

$h(n) = 1$, if n is odd

Determine :

a) $f \cdot f$ b) $f \cdot g$

c) $g \cdot f$ d) $g \cdot h$

e) $(f \cdot g) \cdot h$

b) Give $A = \{1,2\},\ B = \{x,y,z\}$ & $C = \{3,4\}$ find $A \times B \times C$. **2**

c) Given $A = \{1,2,3,4\}$ & $B = \{x,y,z\}$ Let R be the following relation from A to B. **6**

$R = \{(1,y)(1,z)(3,y)(4,x)(4,z)\}$

i) Determine the matrix of the relation

ii) Find the inverse relation R^{-1} of R.

iii) Determine the domain & range of R.

3. a) Construct the table for **4**

$(a \vee b) \longleftrightarrow [((\sim a) \wedge c) \longrightarrow (b \wedge c)]$

b) Show that **8**

$\{((p \vee q) \wedge \sim (\sim p \wedge (\sim q \vee \sim r)))\} \vee \{(\sim p \wedge \sim q) \vee (\sim p \wedge \sim r)\}$ is tautology.

c) Find the truth value of **4**

$[p \rightarrow ((q) \wedge (\sim r)) \vee s] \wedge [(\sim t) \leftrightarrow (s \wedge r)]$

where t is false and p,q,r & s are true.

OR

4. a) Determine the validity of the following argument "If my brother stands first in class then I will give him a watch. He stood first or I was out of station I did not give him a watch" **8**

$\therefore$ I was out of station.

b) Write converse, inverse, contrapositive of conditional **8**

$p \rightarrow \sim q$ State which one of them is equivalent to

$p \rightarrow \sim q$ Using truth tables

5. a) Show that the set of matrices **8**

$$A\alpha = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}, \alpha \in R$$

Forms a Monoid.

b) If G is an abelian group then for all $a, b \in G$ and for all integers prove that **8**

$(a \cdot b)^n = a^n \cdot b^n$

OR

6. a) Let $(R, t, \cdot)$ be any ring with zero then for every $a, b \in A$ show that **8**

i) $0 \cdot a = a \cdot 0 = 0$

ii) $a \cdot (-b) = (-a) \cdot b = -(a \cdot b)$

iii) $(-a) \cdot (-b) = a \cdot b$

iv) $a \cdot (b - c) = a \cdot b - a \cdot c$

b) Show that the set $\{0, 1, 2, 3, 4, 5, 6\}$ is a commutative ring w.r.t to addition modulus 7 and multiplication modulus 7 as the composition. **8**

7. a) Construct the switching circuit for the following Boolean expression simplify & draw equivalent circuit verify the equivalence by truth table. **8**

$(A \cdot B) + (A \cdot B') + (A' \cdot B')$

b) Define distributive lattice show that the lattice (S_{45}, D) is complemented lattice. **8**

OR

8. a) Draw Hasse diagram of the lattice D_{20} & D_{30}. Write complements of every element. **8**

b) Let $(B, \wedge, \vee, ', 0, 1)$ be a Boolean algebra. Define the operator $(+, \cdot)$ on the element of B by $a + b = a \wedge b$ for all $a, b \in B$ **8**

Show that

i) $a + b + b = a$

ii) $a + 0 = a$

iii) $a + 1 = a$

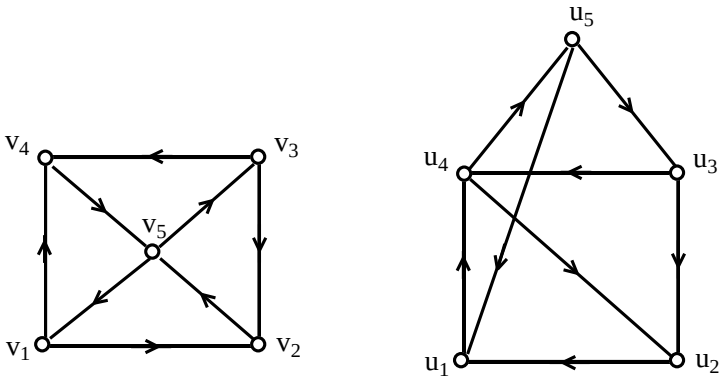
iv) $a \cdot (b + c) = a \cdot b + a \cdot c$

9. a) Construct a tree for the algebra expression **8**

i) $[3-(2x)]+[(x-2)-(3+x)]$

ii) $[3(1-x)] \div [\{4+(7-(y+2)\} \times \{7+(x \div y)\}]$

b) Check whether the diagraph given below are isomorphic. Find correspondence between there nodes. **8**



OR

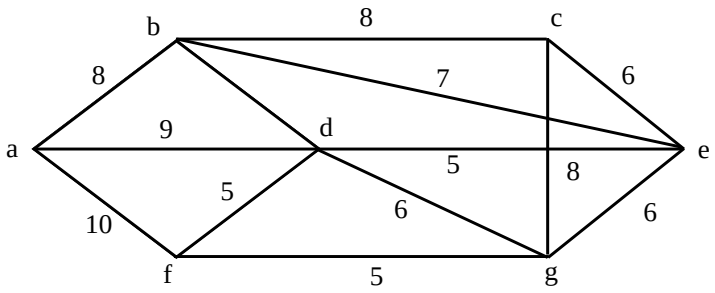
10. a) Draw the diagraph corresponding to adjacency matrices A, B, A^T, B^T **8**

Where,

$$A = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 \end{bmatrix}$$

Show that the diagraph corresponding to A^T & B^T are isomorphic.

b) Apply prims algorithm to construct a minimal spanning tree for the weighted graph given below. **8**



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