M.Sc.- I (Computer Science) CBCS Pattern Semester-I

PSCSCT02 - Paper-II : Discrete Mathematics

P. Pages : 3 **GUG/W/23/11143**

Time : Three Hours * 6 1 7 0 * Max. Marks : 80

Notes : 1. All questions are compulsory and carry equal marks.
2. Draw neat and labelled diagram and use supporting data wherever necessary.
3. Avid vague answer and write specific answer related to question.

Either:

1. a) Show that **8**

i) $A \times (B \cup C) = (A \times B) \cup (A \times C)$

ii) $A \times (B \cap C) = (A \times B) \cap (A \times C)$

b) Prove following **8**

$$1^3 + 2^3 + 3^3 + ----+ n^3 = \left[\frac{n(n+1)}{2}\right]^2$$

by using mathematical induction.

OR

c) Construct truth table for **8**

$(P \leftrightarrow Q) \leftrightarrow (R \leftrightarrow S)$

d) Obtain the principal disjunctive normal form of **8**

$P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$

Either:

2. a) Prove the extended pigeonhole principle. **8**

b) Determine the value of n if **8**

i) ${}^nC_4 = {}^nC_3$

ii) ${}^nC_{n-2} = 10$

iii) ${}^{20}C_{n+2} = {}^{20}C_{2n-1}$

OR

c) Prove that if $f : X \rightarrow Y$ and $g : Y \rightarrow Z$ are one to one function, then $g \cdot f$ is one to one. **8**

d) Let $\alpha = \{1,2,3,4\}$ and $R = \{(1,1),(1,4),(4,1),(4,4),(2,2),(2,3),(3,2),(3,3)\}$ write matrix of R and also it diagram. **8**

Either:

3. a) Let $A = \{1, 2, 3, 4, 6, 8, 9, 12, 18, 24\}$ be ordered by divisibility. Draw the Hasse diagram of A. **8**

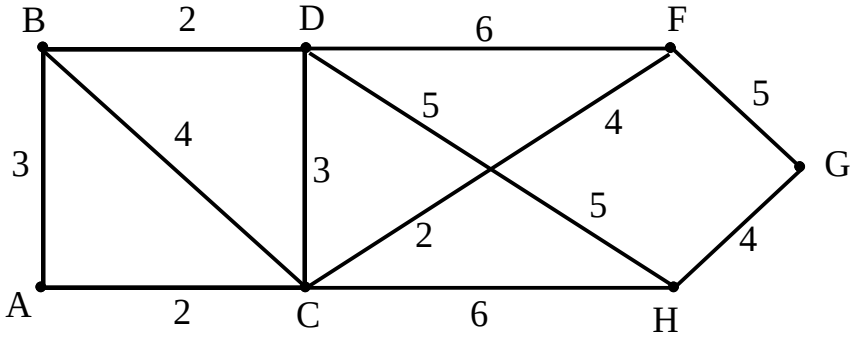
b) In a lattice prove that **8**

i) $(a * b) \oplus (a * c) \leq a * [b \oplus (a * c)]$

ii) $(a + b) * (a \oplus c) \geq a \oplus [b * (a \oplus c)]$

OR

c) Find a Hamiltonian circuit for the graph given. **8**



d) Simplify the following expression. **8**

i) $(1 * a), \oplus (0 * a')$

ii) $(a * b)' \oplus (a \oplus b)'$

iii) $(a' * b' * c) \oplus (a * b' * c) \oplus (a * b' * c')$

Either:

4. a) Consider the machine m whose table is shown below. **8**

	a	b	c
S_0	S_0	S_0	S_0
S_1	S_2	S_3	S_2
S_2	S_1	S_0	S_3
S_3	S_3	S_2	S_3

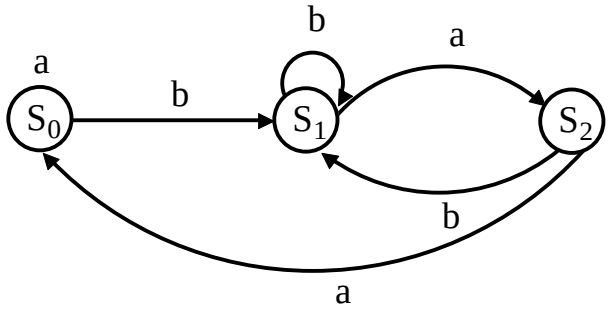
Draw digraph of the machine and also find finite state machine and also find transition function.

b) If $(S_1, *)$ and $(S_2, *)$ are semigroups then $(S_1 \times S_2, *)$ is a semigroup, when $*$ is defined by **8**

$(S_1', S_2') * (S_1'', S_2'') = (S_1' * S_1'', S_2'' * S_2'')$

OR

c) Construct the state transition table of the finite state machine, where diagraph is shown below. **8**



d) Let G be the group each element a in G has only one inverse in G. **8**

5. a) Attempt all the questions. **4**

a) Construct the truth table for

i) $(A \oplus B) \oplus C$

ii) $(A \uparrow B) \uparrow C$

b) How many distinguishable permutation of the letter is the word BANANA. **4**

c) Construct the tree. **4**

$((3*(1-x)) \div ((4+7-(y+2))) * (7+(z \div y))$

d) Define: **4**

i) Language

ii) Grammar

iii) Regular Grammar

iv) Derivation.

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