

M.Sc. - I (Computer Science) (NEP Pattern) Semester-I
NEP-24-2 / 01MSCCS04.2 - Paper-IV - Elective-II - Discrete Mathematics

P. Pages : 3

Time : Three Hours



GUG/S/25/15082

Max. Marks : 80

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

Either :

1. a) Show that 8

i) $A \cap A = A$

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

iii) $A \cup \phi = A$

iv) $A \cap (B - C) = (A \cap B) - C$

- b) Construct the truth table for the following formulas. 8

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

OR

- c) Prove that the statement is true by using mathematical induction. 8

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

- d) If $\begin{bmatrix} a+2b & 2a-b \\ 2c+d & c-d \end{bmatrix} = \begin{bmatrix} 4 & -2 \\ 4 & -3 \end{bmatrix}$ 8
find a, b, c and d.

Either :

2. a) Consider f, g and h all functions on the integers by $f(n) = n^2$, $g(n) = n+1$ and $h(n) = n-1$ 8
find i) $h \circ f \circ g$ ii) $g \circ f \circ h$

- b) Explain and prove the Pigeonhole principle and extended pigeon hole principle. 8

OR

- c) To prove 8
 $P(n, r) = P(n-1, r) + r \cdot P(n-1, r-1)$

- d) Let $A = \{1, 2, 3\}$ and $B = \{1, 2, 3, 4\}$. Let R and S be the relation from A to B whose matrices are given below.

8

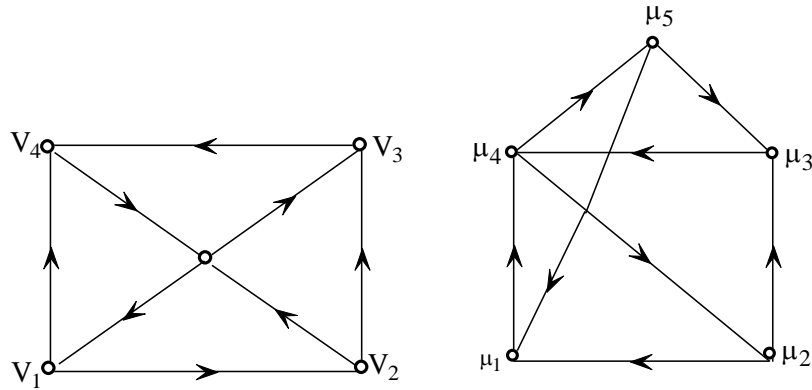
Compute \bar{S} , $R \cap S$, $R \cup S$ and R^{-1}

$$M(R) = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \quad M(S) = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix}$$

Either :

3. a) Show following graphs are Isomorphic.

8



- b) Define the following

8

- Partially order set
- Lattice
- Hasse Diagram
- Hamiltonian Path

OR

- c) Prove that “Every chain is distributive Lattice”

8

- d) In a Lattice prove that

8

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

Either :

4. a) Find the left linear grammar and right linear grammar for the following

8

- $0^* (1(0+1))^*$
- $(0+1)^* 00(0+1)^*$

- b) Show that 8
- i) $(ab)^{-1} = b^{-1}a^{-1}$ for all $a, b \in G$.
- ii) $G_1, \cap G_2$ is also a subgroup of G .

OR

- c) Let G be the grammar as follows 8
- $S \rightarrow aB \mid bA$
- $A \rightarrow a \mid aS \mid bAA$
- $B \rightarrow b \mid bS \mid aBB$
- for the string "aaabbabbba"
- find
- i) Leftmost derivation
- ii) Rightmost Derivation
- d) Define the following 8
- i) Semi group
- ii) Abelian group
- iii) Normal group
- iv) Subgroup

5. Solve all the questions.
- a) What is set? Explain different operations on set. 4
- b) How many distinguishable permutations of the letter in the word 4
- i) MISSISSIPPI
- ii) BOOLEAN
- c) Define the following 4
- i) Graph
- ii) Weighted Graph
- iii) Null graph
- iv) Mixed Graph
- d) Explain Moore machine in detail. 4
