B.Sc. (IT) - I (C.B.C.S. Pattern) Sem-II

UBITT204-Paper-IV : Discrete Mathematics

P. Pages : 3 **GUG/S/19/10923**

Time : Three Hours * 2 8 9 7 * Max. Marks : 80

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

1. Either:-

a) What is sets? Explain different operations on sets. **8**

b) Prove that: **8**

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

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

OR

c) If A and B are matrices then prove that **8**

i) $(A + B)^T = A^T + B^T$

ii) $\left(A^T\right)^T = A$

d) Prove the statements. **8**

i) $(p \to q) \leftrightarrow (\sim q \to \sim p)$ is a tautology.

ii) $p \vee (p \wedge r) \equiv (p \vee q) \wedge (p \vee r)$

2. Either:-

a) Determine the value of 'n' if **8**

i) $4X\ {}^{n}P_3 = {}^{n+1}P_3$

ii) ${}^{n}C_4 = {}^{n}C_3$

b) Let $A = \{a, c, e\}$ and $u = \{a, b, c, d, e, f, g\}$ compute the following function value. **8**

i) $f_A(a)$ ii) $f_A(g)$

iii) $f_A(e)$ iv) $f_A(t)$

OR

c) The number of combination of 'n' different things taken 'r' at a time is given by. **8**

$${}^{n}C_{r} = \frac{n!}{r!(n-r)!},\ n \geq r \geq 1$$

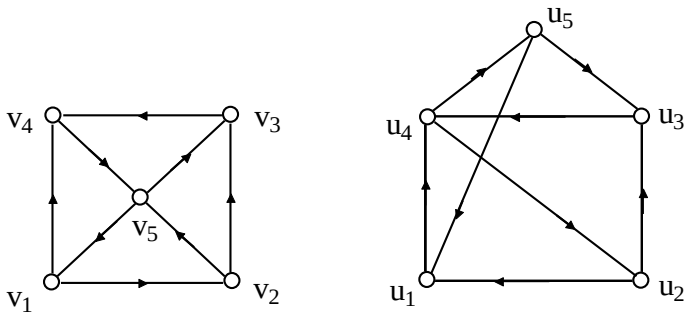
d) Consider A = B = C = R and Let $f : A \to B$ and $g : B \to C$ be defined by f (x) = x + g and **8**
$g(y) = y^2 + 3$ find following composition functions

i) $(f \circ f)(a)$ ii) $(g \circ f)(u)$

iii) $(f \circ g)(b)$ iv) $(g \circ g)(a)$

3. Either:-

a) Show that following graph are isomorphic. **8**



b) Construct the tree. **8**

i) $\big(7+(6-2)\big)-\big(x-(y-4)\big)$

ii) $\big((2+x)-(2\times x)\big)-(x-2)$

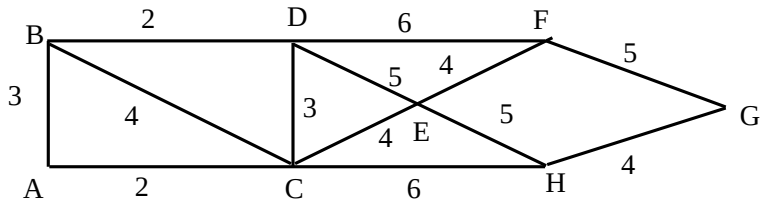
OR

c) Define the following terms with example. **8**

i) Graph ii) Tree

iii) Null Graph iv) Complete binary tree

d) What is Hamiltonian path and circuit? Find a Hamiltonian circuit for the graph given. **8**



4. Either:-

a) If $(S_1, *)$ and $(S_2, *)$ are semigroup then $(S_1 \times S_2, *)$ is a semigroup, where * is defined by **8**
$(S_1', S_2') * (S_1'', S_2'') = (S_1' * S_1'', S_2' * S_2'')$

b) Prove the left cancellation law. **8**
i.e. $ab = ac \Rightarrow b = c \forall a, b, c, \in G.$

OR

c) Consider the binary operation * on Q, the set of rational number defined by **8**
$a * b = \frac{ab}{2} \forall a, b \in Q$. Determine whether * is

i) Associative ii) Commutative

d) Prove that $e_1' = e_1''$ where e_1' is a right identity and e_1'' is a left identity of a binary operation. **8**

5. Solve all the questions.

a) If $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ **4**

Compute $A \vee B$

b) Define following **4**
i) One – to – one function
ii) Many one into function

c) Explain minimum spanning tree with an example. **4**

d) Show that $(a\,b)^{-1} = b^{-1}a^{-1}$ for all $a, b \in G$. **4**

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