

B.C.A. - I Sem-I (Old)
1BCA6 - Paper-VI : Discrete Mathematics

P. Pages : 2

Time : Three Hours



* 0 7 9 4 *

GUG/S/19/1095

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. Avoid vague answers and write specific points/answers related to questions.

1. Either

- a) Prove following by using properties on sets. 8
 i) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ ii) $(A \cup B) \cup C = A \cup (B \cup C)$
 b) i) If $A = \begin{bmatrix} 3 & 4 & -1 \\ 5 & 0 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 5 & 3 \\ 0 & -3 & 2 \end{bmatrix}$ then find $A+B$. 8
 ii) If A and B are matrices, then prove that $(A + B)^T = A^T + B^T$

OR

- c) Show that 8
 i) $p \vee (q \vee r) \equiv (p \vee q) \vee r$ ii) $\sim(p \leftrightarrow q) \equiv ((p \wedge \sim q) \vee (q \wedge \sim p))$
 d) Prove by using mathematical induction 8

$$1+2+3+4+\dots+n = \frac{n(n+1)}{2}$$

2. Either

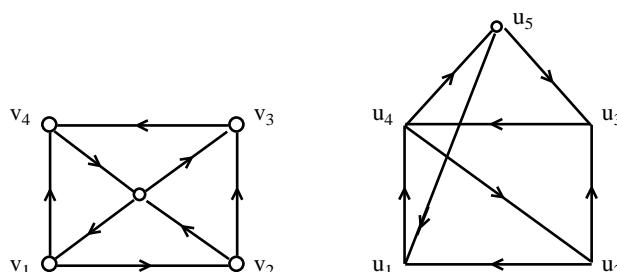
- a) Determine the value of the following 8
 i) 4P_2 ii) ${}^{20}P_3$
 iii) ${}^{15}P_3$ iv) 9P_3
 b) Find the value of n if. 8
 i) ${}^nC_4 = {}^nC_3$ ii) ${}^nC_{n-2} = 10$

OR

- c) If $A = \{1, 2, 3\}$ and $B = \{a, b\}$ then, find: 8
 i) $A \times B$ ii) $B \times A$
 iii) $A \times A$ iv) $B \times B$
 d) Consider $A = \{a, c, e\}$ and $U = \{a, b, c, d, e, f, g\}$ compute the following function values. 8
 i) $f_A(a)$ ii) $f_A(g)$
 iii) $f_A(e)$ iv) $f_A(d)$

3. Either

- a) Show that following graphs are Isomorphic. 8



- b) Define following Terms: 8
- i) Graph ii) Diagraph
 - iii) Parallel edges iv) Null graph
- OR**
- c) Find all the spanning trees of graph G and find which is minimal spanning Tree of G shown in Fig. 8
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- d) Construct the tree for. 8
- i) $3 - (x + (6 * (4 \div (2 - 3))))$ ii) $(7 + (6 - 2)) - (x - (y - 4))$.
4. Either 8
- a) Show that $(ab)^{-1} = b^{-1}a^{-1}$ for all $a, b \in G$, where G is a group. 8
- b) Let G be the grammar 8
- $$S \rightarrow aB/bA$$
- $$A \rightarrow a/aS/bAA$$
- $$B \rightarrow b/bS/aBB$$
- for the string 'aaabbabbba'
find:
- i) Leftmost derivation ii) Parse Tree
- OR**
- c) Show that $(a^{-1})^{-1} = a$ for all $a \in G$ where G is a group and a^{-1} is an inverse of a. 8
- d) Let $(A, *)$ be semigroup show that for a, b, c in A, 8
- if $a * c = c * a$ and $b * c = c * b$ then $(a * b) * c = c * (a * b)$.
- 5.
- a) Define characteristics function and prove following Theorem. 4
- i) $f_{A \cap B} = f_A \cdot f_B$ i.e $f_{A \cap B}(x) = f_A(x) \cdot f_B(x)$ for all x .
- b) Define following. 4
- i) One-to-one function ii) Onto function
- c) Define following. 4
- i) Directed Tree ii) Binary Tree
- d) Prove the left cancellation law 4
- $i.e ab = ac \Rightarrow b = c \forall a, b, c \in G$.
