

B.Sc. (Information Technology)-I Second Semester Old
2BIT6 - Discrete Mathematics Paper - VI

P. Pages : 3

Time : Three Hours



GUG/W/18/1434

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 answer related to question.

1. Either

a) i) If $A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$ compute $A \cdot B$. 8

ii) Let $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ & $B = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ compute $A \vee B, A \wedge B$

b) Prove that statement is true by using mathematical induction. 8

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

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

OR

c) i) To show $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ 8

ii) $\sim (p \vee q) \equiv \sim p \wedge \sim q$ and
 $\sim (p \wedge q) \equiv \sim p \vee \sim q$

d) Obtain the principal disjunctive normal form of 8

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

ii) $\neg P \vee Q$

2. Either

a) Determine the value of the following. 8

i) 4P_2 ii) 9P_3 iii) ${}^{20}P_3$ iv) ${}^{52}P_4$

- b) Let $A = \{1, 2, 3, 4\}$ and $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (2, 3), (2, 4), (3, 4), (4, 1)\}$. Draw diagram and M_R of Relation. 8

OR

- c) Explain Warshall's algorithm. Let $A = \{1, 2, 3, 4\}$ and $B = \{(2, 1), (2, 3), (3, 2), (4, 3)\}$ Find the transitive closure of R using Warshall's algorithm. 8

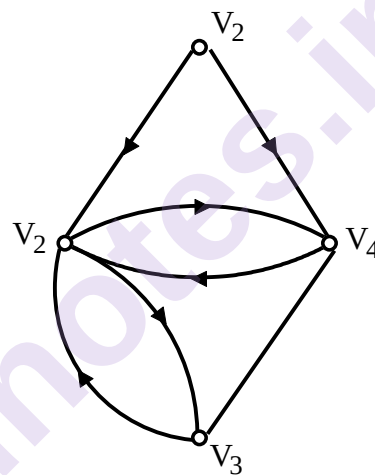
- d) Let f, g, A be function from M to N where N is the set of natural nos so that $f(n) = n+1$, $g(n) = 2n$. 8

$$h(n) = \begin{cases} 0 & \text{where } n \text{ is even} \\ 1 & \text{where } n \text{ is odd} \end{cases}$$

Determine $f \cdot f, f \cdot g, g \cdot f, h \cdot g, (f \cdot g) \cdot h$

3. Either

- a) For the diagram determine $A, A^1, A \cdot A^T, A^T \cdot A$ and $A \wedge A^T$ 8



- b) Define the following. 8

- | | |
|---------------------|------------------------|
| i) Graph | ii) Adjacent node |
| iii) Diagraph | iv) Mixed Graph |
| v) Parallel Edges | vi) Loop |
| vii) Isolated graph | viii) Undirected graph |

OR

- c) Construct the tree 8

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

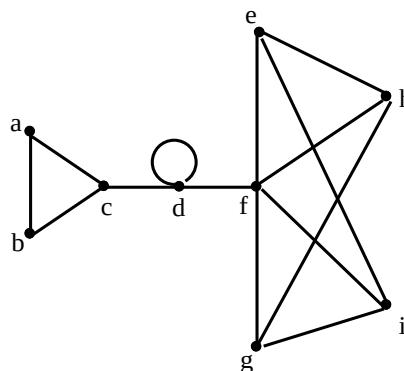
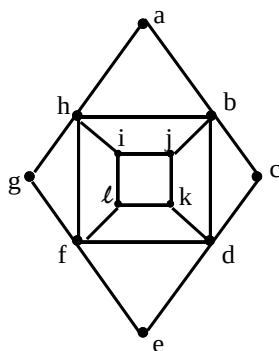
ii) $3 - (x + (6 * (4 \div (2 - 3))))$

iii) $(7 + (6 - 2)) - (x - (y - 4))$

iv) $(x + (y - (x + y))) \times ((3 \div (2 \times 7)) \times 4)$

- d) Find spanning tree for the graph.

8



4. Either

- a) Let T be the set of all even integers. Show that the semigroups $(\mathbb{Z}, +)$ and $(T, +)$ are isomorphic. 8

- b) Let $(S, *)$ and $(T, *')$ be monoid with identities e and e' respectively. Let $f : S \rightarrow T$ be an isomorphism then $f(e) = e'$. 8

OR

- c) If N is a normal subgroup of G if and only if $g \cap g^{-1} = N$ 8

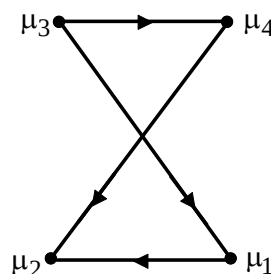
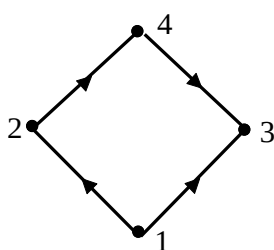
- d) If N is a normal subgroup of G if and only if ${}_g N = N_g$. 8

5. Solve all the questions.

- a) Construct truth table for $\neg(P \vee (Q \wedge R)) \Leftrightarrow ((P \vee Q) \wedge (P \vee R))$ 4

- b) Let $X = \{1, 2, 3, 4\}$ and $R = \{(x, y) \mid x > y\}$. Draw diagram of R and its matrix. 4

- c) Show that graph are isomorphic. 4



- d) A non empty subset H of the group G is a subgroup of G if and only if 4

i) $a, b \in H \Rightarrow a \cdot b \in H$

ii) $a \in H \Rightarrow a^{-1} \in H$

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