

Total No. of Questions : 8]

SEAT No. :

P698

[Total No. of Pages : 5

[5869]-361

S.E. (Artificial Intelligence and Data Science)

DISCRETE MATHEMATICS

(2019 Pattern) (Semester - III) (210241)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn whenever necessary.
- 4) Assume suitable data wherever necessary.

**Q1)** a) The company has 10 members on its board of directors. In how many ways can they elect a president, a vice president, a secretary and a treasure. [6]

b) Find eighth term in the expansion of  $(x+y)^{13}$ . [6]

c) A box contains 6 white and 5 black balls. Find number of ways 4 balls can be drawn from the box if [6]

- i) Two must be white
- ii) All of them must have same colour

OR

**Q2)** a) In how many ways can word the 'HOLIDAY' be arranged such that the letter I will always come to left of letter L. [6]

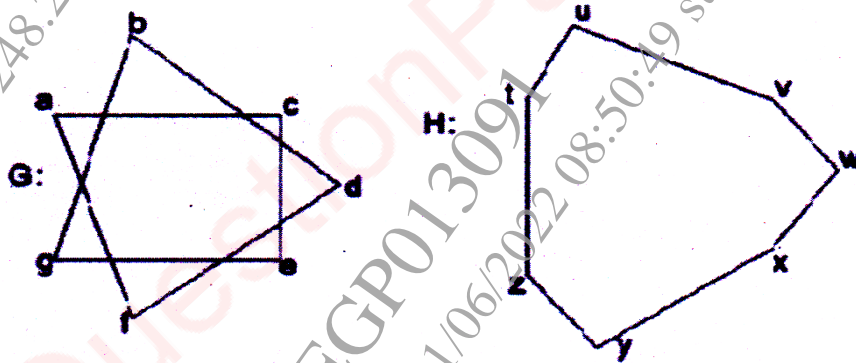
b) In how many ways can one distribute 10 apples among 4 children. [6]

c) Use Binomial theorem to expand  $(x^4 + 2)^3$ . [6]

**Q3)** a) Is it possible to draw a simple graph with 4 vertices and 7 edges. Justify? [7]

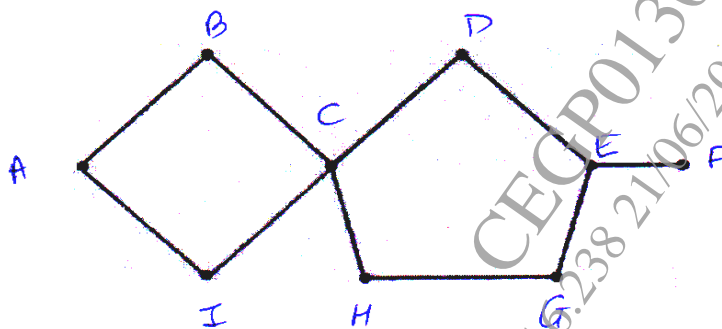
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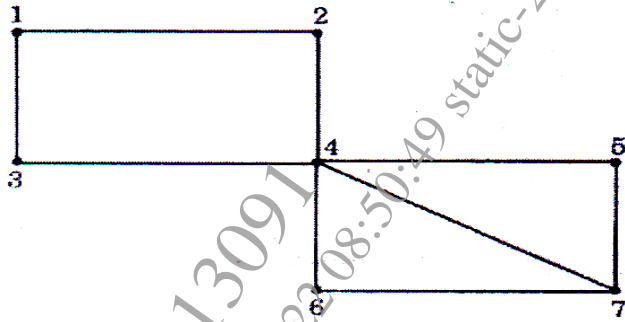
- b) Define following terms with example [5]
- i) Complete graph
  - ii) Regular graph
  - iii) Bipartite graph
  - iv) Complete bipartite graph
  - v) Paths and circuits
- c) The graphs G and H with vertex sets  $V(G)$  and  $V(H)$ , are drawn below. Determine whether or not G and H drawn below are isomorphic. If they are isomorphic, give a function  $g: V(G) \rightarrow V(H)$  that defines the isomorphism. If they are not explain why they are not. [5]



OR

- Q4) a) Determine which if the graph below represents Eulerian circuit, Eulerian path, Hamiltonian circuit and Hamiltonian path. Justify your answer [7]





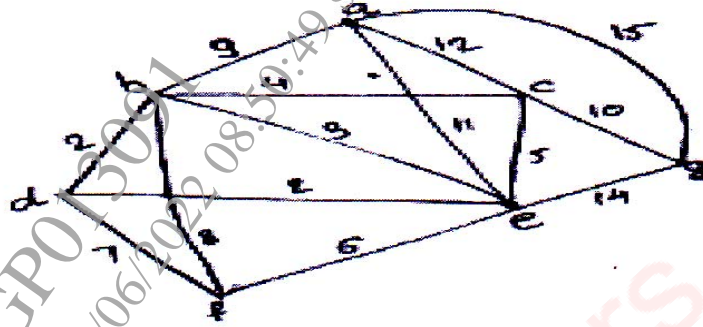
- b) A connected planar graph has nine vertices with degree 2, 2, 2, 3, 3, 3, 4, 4, 5  
Find. [5]
- number of edges
  - number of faces
  - construct two such graphs
- c) Explain the following statement with example. [5]  
“Every graph with chromatic number 2 is bipartite graph”

Q5) a) Construct Huffman tree. [6]

|   |    |
|---|----|
| A | 5  |
| B | 6  |
| C | 6  |
| D | 11 |
| E | 20 |

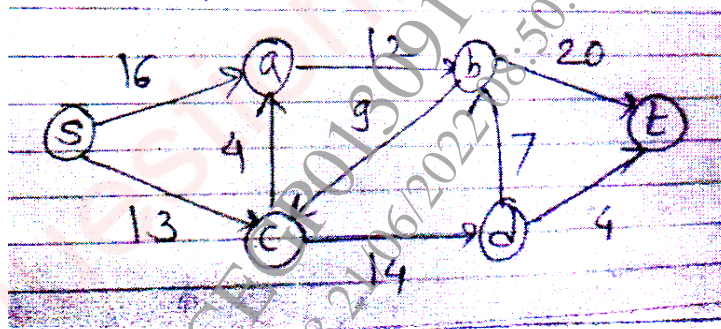
- b) Explain [6]
- Cutset
  - Tree properties
  - Prefix code

- c) Give the stepwise construction of minimum spanning tree using Prim's algorithm for the following graph. Obtain the total cost of minimum spanning tree. [6]



OR

- Q6) a) Using the labelling procedure to find maximum flow in the transport network in the following figure. Determine the corresponding minimum cut. [6]



- b) Define with example. [6]
- Level and height of a tree.
  - Binary search tree.
  - Spanning tree
- c) Construct binary search tree by inserting integers in order 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24. [6]

Find

- No. of internal nodes
- Leaf nodes

**Q7) a)** Let  $R = \{0, 60, 120, 180, 240, 300\}$  and  $*$  binary operation so that for  $a$  and  $b$  in  $R$ ,  $a * b$  is overall angular rotation corresponding to successive rotations by  $a$  and by  $b$ . Show that  $(R, *)$  is a group. [6]

**b)** Following is the incomplete operation table of 4-element group. Complete the last two rows. [6]

|   |   |   |   |   |
|---|---|---|---|---|
| * | e | a | b | c |
| e | e | a | b | c |
| a | a | b | c | e |
| b |   |   |   |   |
| c |   |   |   |   |

**c)** Explain Algebraic system and properties of binary operations. [5]

OR

**Q8) a) i)** Explain the following terms with examples. [6]

ii) Ring with unity

iii) Integral domain

iv) Field

**b)** Consider the set  $Q$  of rational numbers and let  $a * b$  be the operation defined by  $a * b = a + b - ab$ . [6]

i) Find  $3 * 4$ ,

ii)  $2 * (-5)$ ,

iii)  $7 * (1/2)$

Is  $(Q, *)$  a semigroup? Is it commutative?

**c)** Show that  $(\mathbb{Z}_n, \oplus)$  is Abelian group. [5]

