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Unique Paper Code : 2343010034  
Name of the Paper : GRAPH THEORY  
Name of the Course : B.Sc. (Hons.) Computer Science (NEP-UGCF-2022)  
Semester : IV  
Duration : 3 Hours  
Maximum Marks : 90

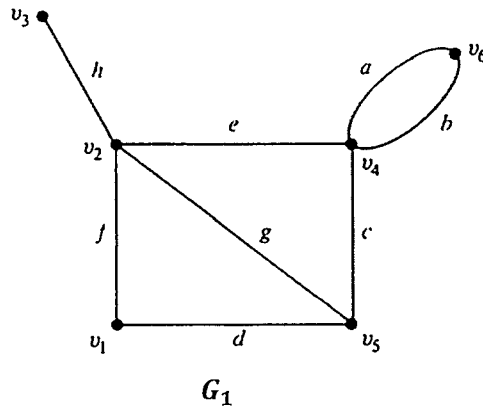
*(For admissions of 2022 onwards)*

**Instructions for Candidates:**

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Question No. 1 (Section-A) is compulsory.
- (c) Attempt any **four** questions from **Section-B**.
- (d) Parts of a question should be attempted together.

## SECTION A

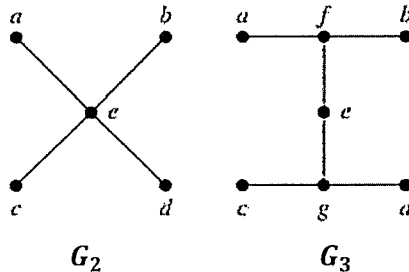
- Q1 a) What is Handshaking theorem? Find the number of edges of graph has 8 vertices with degrees: 2, 3, 4, 2, 5, 3, 1, 4. 5
- b) What is Path matrix? Find the path matrix for the vertex  $v_3$  and  $v_6$  of the graph  $G_1$  5



- c) What is complement of graph? Find the complement of the graph,  $G = (V, E)$ , where,  $V = \{A, B, C, D\}$  and  $E = \{AB, BC, CD, DA, AC\}$  5
- d) Find the number of faces and verify the graph satisfies planar condition or not for a connected planar graph has 12 vertices and 18 edges. 5
- e) How many simple graphs is possible for 4 vertices in the graph? Find the isomorphic class for graph having 4 vertices and draw all of it. 5
- f) Determine whether graph exists or not for the following degree sequence: (i) 4, 3, 3, 2, 2, 2 and (ii) 4, 4, 3, 3, 3, 2. 5

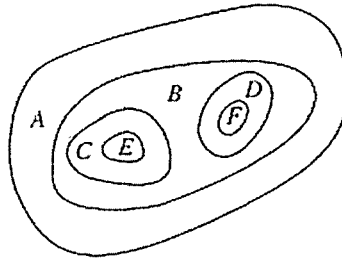
## SECTION B

- Q2 a) Find the union, intersection and ring sum of the graphs  $G_2$  and  $G_3$  7



- b) What is dual graph? Find the dual graph and chromatic number of the graph  $G_4$

8

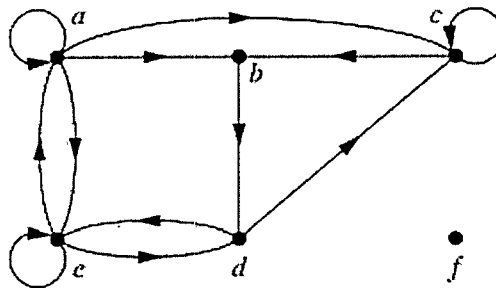


$G_4$

- Q3 a) Find incidence matrix, in-degree, out-degree, in-neighbor and out-neighbor of the graph

7

$G_5$



$G_5$

- b) Suppose that a new company has five employees: Zamora, Agraharam, Smith, Chou, and Macintyre. Each employee will assume one of six responsibilities: planning, publicity, sales, marketing, development, and industry relations. Each employee is capable of doing one or more of these jobs: Zamora could do planning, sales, marketing, or industry relations; Agraharam could do planning or development; Smith could do publicity, sales, or industry relations; Chou could do planning, sales, or industry relations; and Macintyre could do planning, publicity, sales, or industry relations.

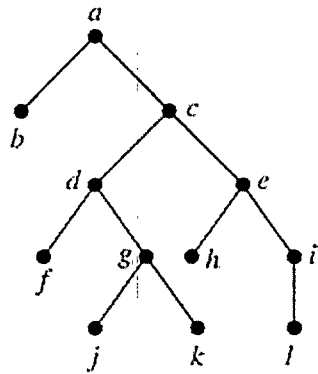
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Give the solution for the following query:

- i) Model the capabilities of these employees using a bipartite graph.
- ii) Find an assignment of responsibilities such that each employee is assigned one responsibility.
- iii) Is it a complete matching?
- iv) Is it a maximum matching?

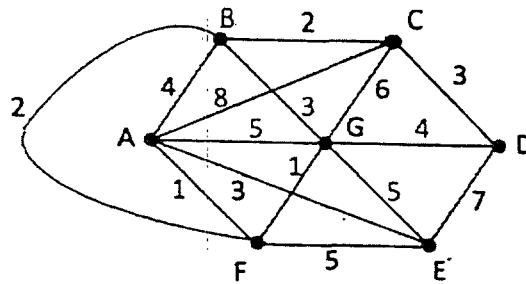
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- Q4 a) What is distance, eccentricity, radius, diameter and center of connected graph? Find distance, eccentricity, radius, diameter and center of the graph  $G_6$  7



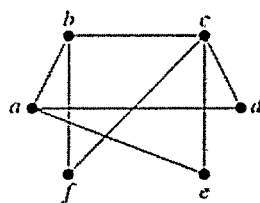
$G_6$

- b) Find the shortest path from vertex A to all vertex in a graph  $G_7$  using Dijkstra's algorithm and calculate the length of shortest path from vertex A to vertex D. 8

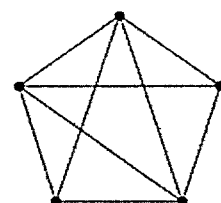


$G_7$

- Q5 a) Justify the graph  $G_8$  and  $G_9$  is planar or not? 7



$G_8$

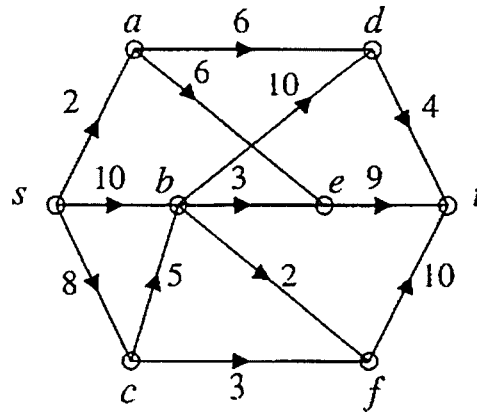


$G_9$

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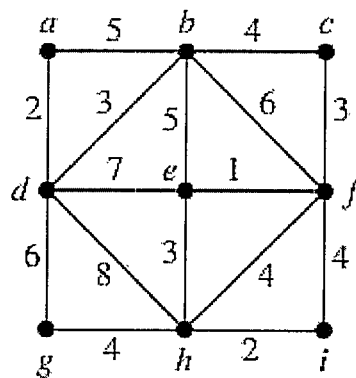
- b) Find the maximum flow of the graph  $G_{10}$  from vertex  $s$  to vertex  $t$ .

8



$G_{10}$

- Q6 a) What is independent set and dominating set? Compute the maximum size of independent set for  $K_4$  and  $C_4$ . 7
- b) What is spanning tree and minimum spanning tree of a graph? Find the minimum spanning tree for the graph  $G_{11}$  where, starting vertex  $c$  using Kruskal's algorithm. 8



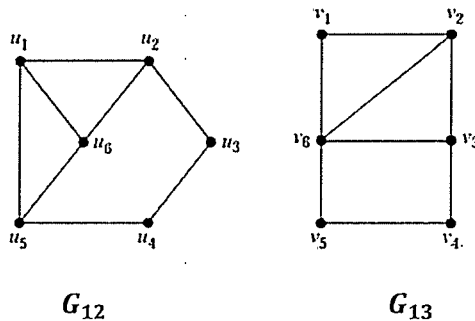
$G_{11}$

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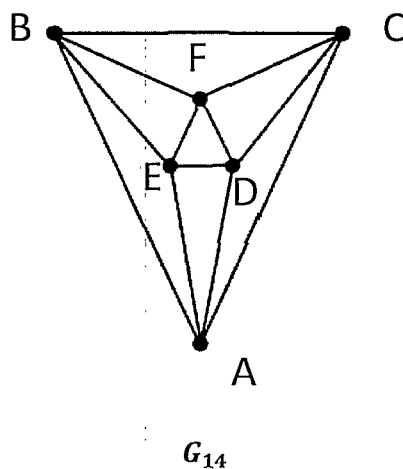
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Q7 a) What is isomorphic graph? Prove the graphs  $G_{12}$  and  $G_{13}$  are isomorphic or not? 7



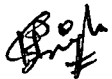
b) Find out graph  $G_{14}$  have Euler Path, Euler Circuit, Hamiltonian Path, Hamiltonian Circuit or not with proper reasoning. 8



Set-A

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