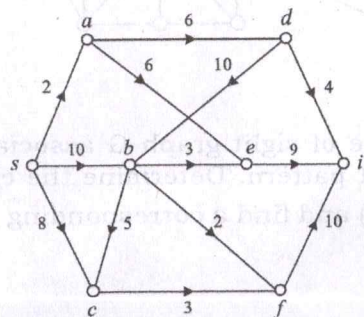
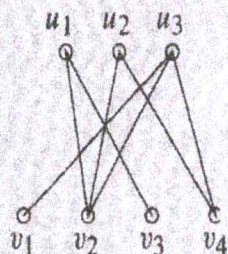
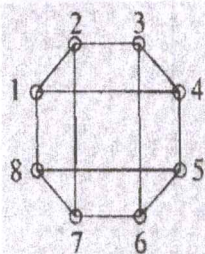


6. (a) Show that in any directed network, the value of an (s, t) -flow never exceeds the capacity of any (s, t) -cut.
- (b) Find a maximum flow in the directed network shown in the figure below and prove that it is a maximum.



- (c) Define perfect matching in a graph. Determine whether the following graphs have a perfect matching.



This question paper contains 8 printed pages]

Your Roll No. :
 Sl. No. of Q. Paper : 10203 I
 Unique Paper Code : 2352202402
 Name of the Paper : Introduction to Graph Theory
 Name of the Course : Bachelor of Arts (Programme) with Mathematics as Major (DSC-2)
 Semester : IV

Time : 3 Hours

Maximum Marks : 90

Instructions for Candidates :

- Write your Roll No. on the top immediately on receipt of this question paper.
- Attempt all the given **six** questions, selecting any two parts out of the three **parts (a), (b) and (c)** for each of the six questions.
- All** the questions carry equal marks.
- Use of Calculator is not allowed.

- Define a complete bipartite graph. If a graph has five vertices of degree 4 and four vertices of degree 3, how many edges does it have? Explain your answer.
 - Determine whether the following graph with the given vertex set, V and the set of edges, ε has an Eulerian circuit:

$$V = \{A, B, C, D\};$$

$$\varepsilon = \{AB, BC, CD, DA, AC, BD\}$$

- (c) Draw the corresponding pseudograph for the given adjacency matrices:

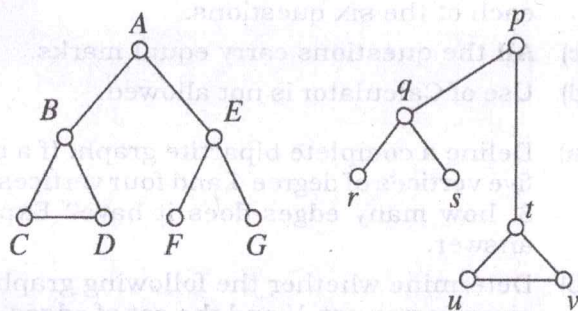
(i)

	A	B	C
A	0	0	2
B	0	0	1
C	2	1	0

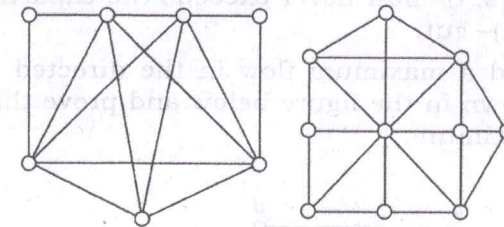
(ii)

	A	B	C	D
A	0	0	1	1
B	0	1	1	0
C	1	1	0	1
D	1	0	1	0

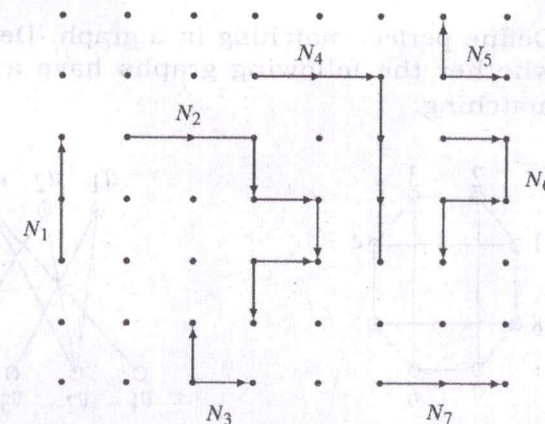
2. (a) When do we say two graphs G_1 and G_2 be isomorphic. Are the given pair of graphs isomorphic?



- (b) Explain why the graph is Eulerian and find an Eulerian circuit.

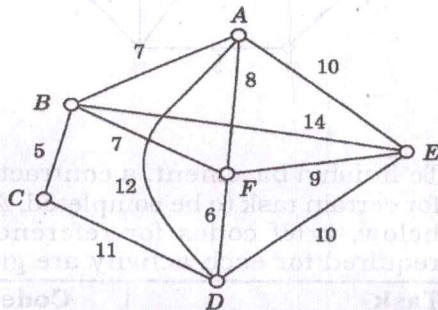


- (c) Draw the line of sight graph G associated with the given net pattern. Determine the chromatic number $\chi(G)$ and find a corresponding partition of nets.

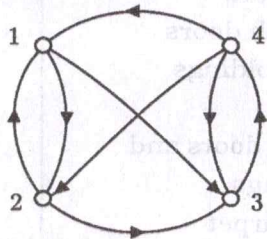


Referring to the above graph, find the minimum time to complete the task.

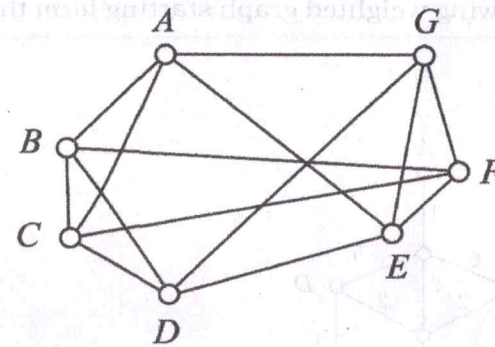
- (b) Find a minimum spanning tree using Kruskal's algorithm for the following graph.



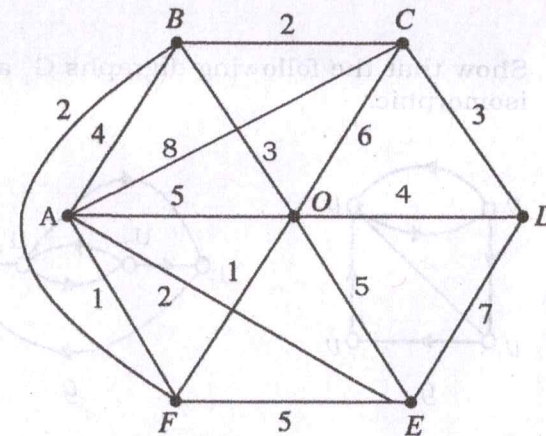
- (c) Find the adjacency matrix A of the following digraph. Is the digraph Eulerian? Explain.



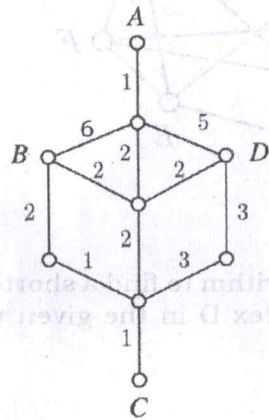
5. (a) Define a planar graph. Show that $K_{3,3}$ is not planar.
(b) Define the chromatic number of a graph. Find the chromatic number of the following graphs.



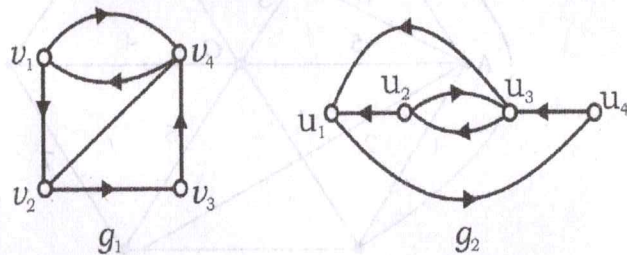
- (c) Apply Dijkstra's algorithm to find a shortest path from vertex A to vertex D in the given weighed graph.



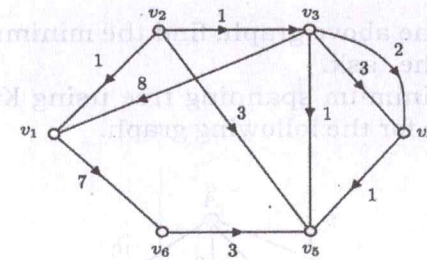
3. (a) Solve the Chinese Postman Problem for the following weighted graph starting from the vertex A.



- (b) Show that the following digraphs G_1 and G_2 are isomorphic.



- (c) Apply Bellman-Ford algorithm to find the lengths of shortest paths from V_1 to all other vertices.



4. (a) To finish a basement, a contractor must arrange for certain task to be completed. As shown in table below, brief codes for reference and the time required for each activity are given.

Task	Code	Time
Floor installation	F	4
Plumbing	PI	3
Electrical work	E	5
Wallboard	W	3
Varnish doors and moldings	V	1
Paint	Pa	2
Install doors and moldings	D	1
Lay Carpet	C	2

