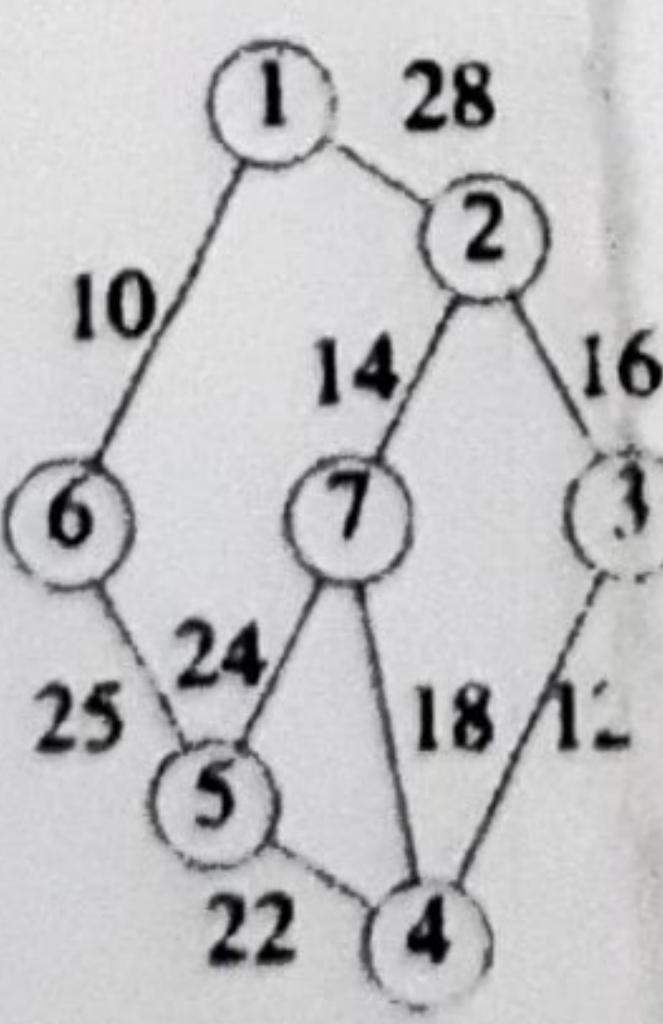


NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
END-SEMESTER EXAMINATION - MAY, 2024

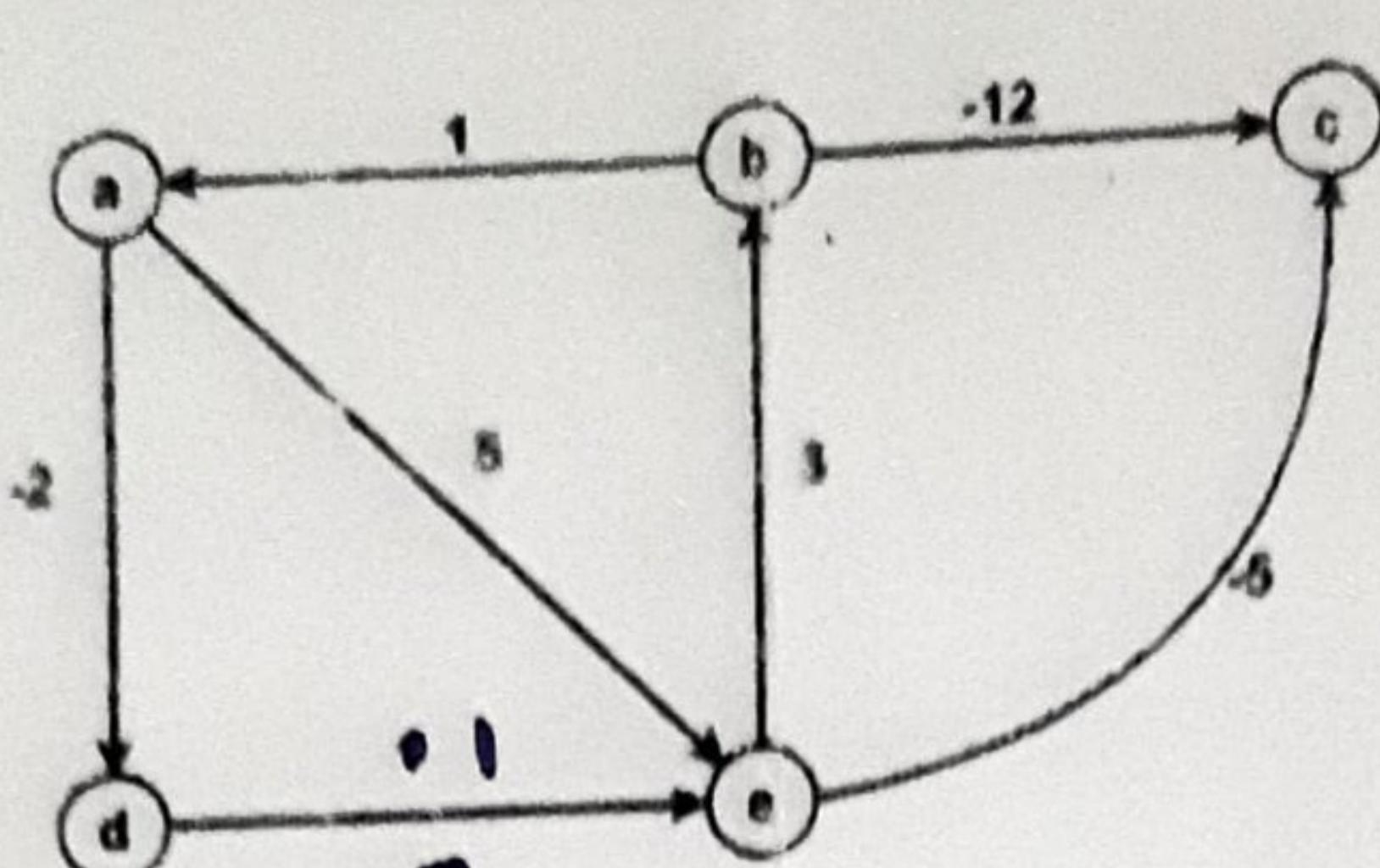
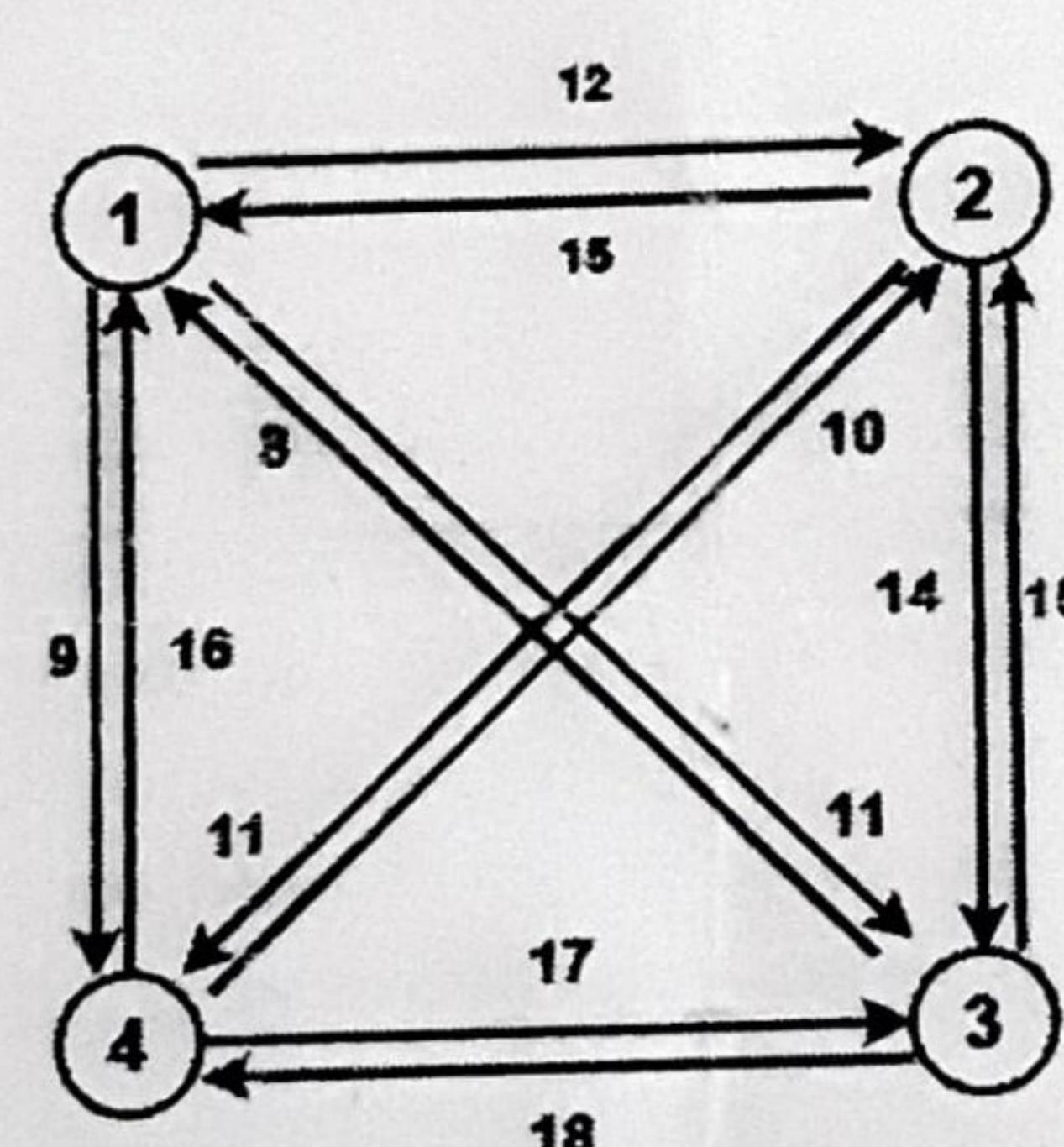
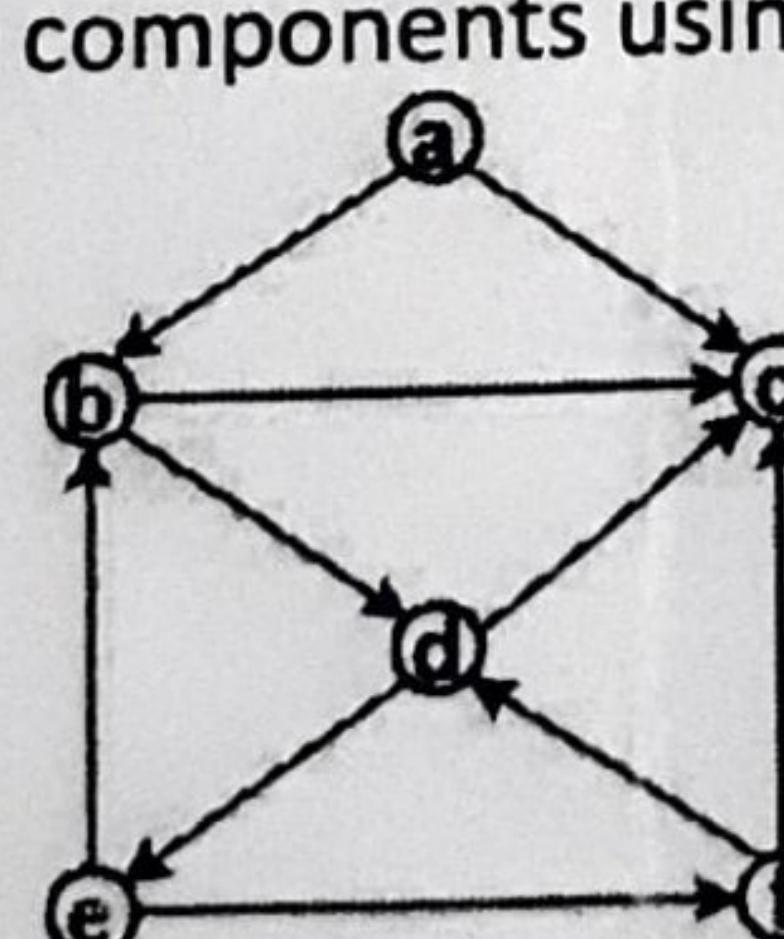
B. Tech (Computer Science & Engineering) IVth Semester (SECTION - A, B, and C)
 Course: Design and Analysis of Algorithms Max. Marks: 60 Max. Time: 3 Hrs.
 Course Code: CS44115 (for B.Tech-CSE and DD-CSE-CS & DS) / CS47101 (for DD-MA-MCT)

Instruction:

1. Answer all questions.
2. The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

Q. No	Question	Marks	LO	BL										
			CO											
1	<p>a. What is the complexity of the below program?</p> <pre>void function(int n) { int i, j, k, count = 0; for(i=n/2; i<=n; i++) for(j=1; j + n/2 <=n; j++) for(k=1; k<=n; k = k * 2) count++; }</pre> <p style="text-align: right;"><i>n³ log n</i></p>	SM	CO1 & CO2	Apply Understand Evaluate Create Analyze										
2	<p>b. Suppose we're using quick sort to process data that we're receiving from a connection in a networked system. We want to cover our system from the possibility of being "sabotaged" by hostile connections—we could receive data that is specifically crafted to cause quick sort to have its worstcase performance and thus make our system consume excessive resources and time. Assuming that quick sort simply chooses the first element as the pivot, what is the arrangement of data that produces the worst-case performance in quick sort?</p>	SM	CO4	Apply Understand Evaluate Create Analyze										
3	<p>a. For the graph given below, find a Minimum Spanning Tree through Prim's algorithm by taking '1' as the starting node. Show all the stages in the diagrammatic form only.</p>  <p>b. Show the timing analysis of Kruskal's & Prim's Algorithms.</p>	4M	CO3	Understand Apply Evaluate Create Analyze										
4	<p>a. Solve the below 0/1 knapsack problem using the Least Cost Branch and Bound method. The knapsack capacity is 15. Show the complete state space tree to solve this problem and mention which items are loaded to maximize the profit.</p> <table border="1"> <tr> <td>Profit</td> <td>10</td> <td>10</td> <td>12</td> <td>18</td> </tr> <tr> <td>Weight</td> <td>2</td> <td>4</td> <td>6</td> <td>9</td> </tr> </table> <p>b. What is the main purpose of studying NP-Completeness? What is the difference between NP Hard and NP-Complete problem? Proof that Clique Decision Problem (CDP) is a NP Hard Problem</p>	Profit	10	10	12	18	Weight	2	4	6	9	SM	CO5	Understand Apply Evaluate Create Understand
Profit	10	10	12	18										
Weight	2	4	6	9										

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			5M	CO3	Understand
4	<p>a. Run the Bellman-Ford single source shortest path algorithm on the following graph, starting from vertex a. How does the Bellman-Ford algorithm differ from Dijkstra's algorithm?</p> 				Apply
6	<p>b. Model and restate the following scenario as a graph-colouring problem. Clearly indicate what represents the vertices, edges and colours. State that how zoo will attempt to find the chromatic number of such a graph.</p> <p>"A zoo plans to remodel by removing all cages and instead placing animals in large, open, enclosed areas. Any animals that cannot live together in harmony (i.e. a lion and a elk) must be put in different enclosures. The zoo would like to determine the minimum number of enclosures needed so that each animal can live peacefully."</p>	SM	COS	Evaluate	
8	<p>Given a Complete directed graph with TSP Problem for n=4. Solve Travelling Salesman problem by using Dynamic Programming.</p> 	10M	CO3	Apply	
6	<p>a. Find the strongly connected components using DFS in below graph.</p> 	5M	COS	Evaluate	
	<p>b. Write down the algorithm to find the articulation point in Connected graph.</p>	SM	COS	Remember	

National Institute of Technology Patna
Computer Science and Engineering Department

Course: CS4564 Artificial Intelligence

4th Even Semester M. Sc. Mathematics and Computing

End semester Examination May 2024

Time: 3 hrs.

Marks: 60

Answer all questions

Qs. No.	Question	Marks	CO	BO
1	a. Describe Semantic net, Frame and Script in Knowledge representation. b. Describe the best first and A* search methods	7 5	CO1 CO1	Comprehensive Comprehensive
2	a. Describe the terms deductive, inductive and abductive reasoning with examples. b. Write the characteristics and types of an agent.	6 6	CO1 CO1	Comprehensive Comprehensive
3	a. Describe the MAS architecture for a medical and intelligent tutoring system. b. Write some instruction of LISP	7 5	CO1 CO2	Comprehensive Analytical
4	a. Describe The Bayes conditional probability and the Bayesian network b. Write on Naïve Bayes.	9 3	CO1 CO2	Comprehensive Analytical
	a. Describe with examples the planning methods in AI and situation calculus. b. write with example the k-NN method with examples.	9 3	CO1 CO2	Comprehensive Analytical

National Institute of Technology Patna
Department of Mathematics

Mid Semester Examination :May 2024

MA47101 : Numerical Analysis / MA48101 : Numerical Methods for Engineers
Branch: B. Tech + M. Tech (Dual Degree) MCT & MST
Semester: 4th Semester

Maximum Marks: 60
Time: 03.00 hours

Answer Any Ten Questions

1. If bisection method is used with the initial interval $[a_0, b_0] = [2, 3]$, how many iterations are required to assure that an approximate solution of the nonlinear equation $f(x) = 0$ is obtained with an absolute error that is at most 10^{-5} .
2. Draw the graph of a function that satisfies the hypothesis of bisection method on the interval $[0, 1]$ such that the errors e_1, e_2, e_3 satisfy $e_1 > e_2$, and $e_2 < e_3$ where e_i 's refer to the error at i th iteration. Give formula for one such function.
3. Use the secant method and the method of false position to find solutions to within 10^{-5} for the following problem $3xe^x = 0$ on the interval $[1, 2]$.
4. Describe Newton-Raphson's method to find real root of an algebraic transcendental equation. Also find the real cube root of 12 correct to five decimal by Newton-Raphson's method.
5. Find the real root of the equation $x \log_{10} x - 1.2 = 0$ correct to five significant digits.
6. Evaluate the integral $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's '3/8' rule. Hence obtain the approximate value of π .
7. Define Lagrange's interpolation formula. Obtain Lagrange's interpolatory polynomial for the following data:

x	1	3	5	7	10
f(x)	13	31	25	37	101

8. A river is 80 feet wide. The depth d (in feet) of the river at a distance x from one bank is given by the following table:

x:	0	10	20	30	40	50	60	70	80
d:	0	4	7	9	12	15	14	8	3

Find approximately the area of the cross-section of the river using Trapezoidal and Simpson's rule.

Please turn over...

6. Use the two-point Gaussian quadrature rule to approximate

$$I = \int_{-1}^1 \frac{dx}{x+2}$$

and compare the result with the trapezoidal.

10. Find the Newton form of interpolation polynomial for the following data:

x	-3	-1	0	3	5
y	-30	-22	-12	330	3458

11. Obtain the central difference formula for $f'(x)$ using polynomial interpolation with nodes at $x - h$, x , $x + h$, where $h > 0$.

— All the Best —

ENS SEMESTER EXAMINATION MAY'2024
 DEPARTMENT OF MATHEMATICS

Subject: Graph Theory and Application (MA47102)

Course : Mathematics and computing

Time: 3hrs

Semester: 4th sem.

F.M.: 100 (w'age 60%)

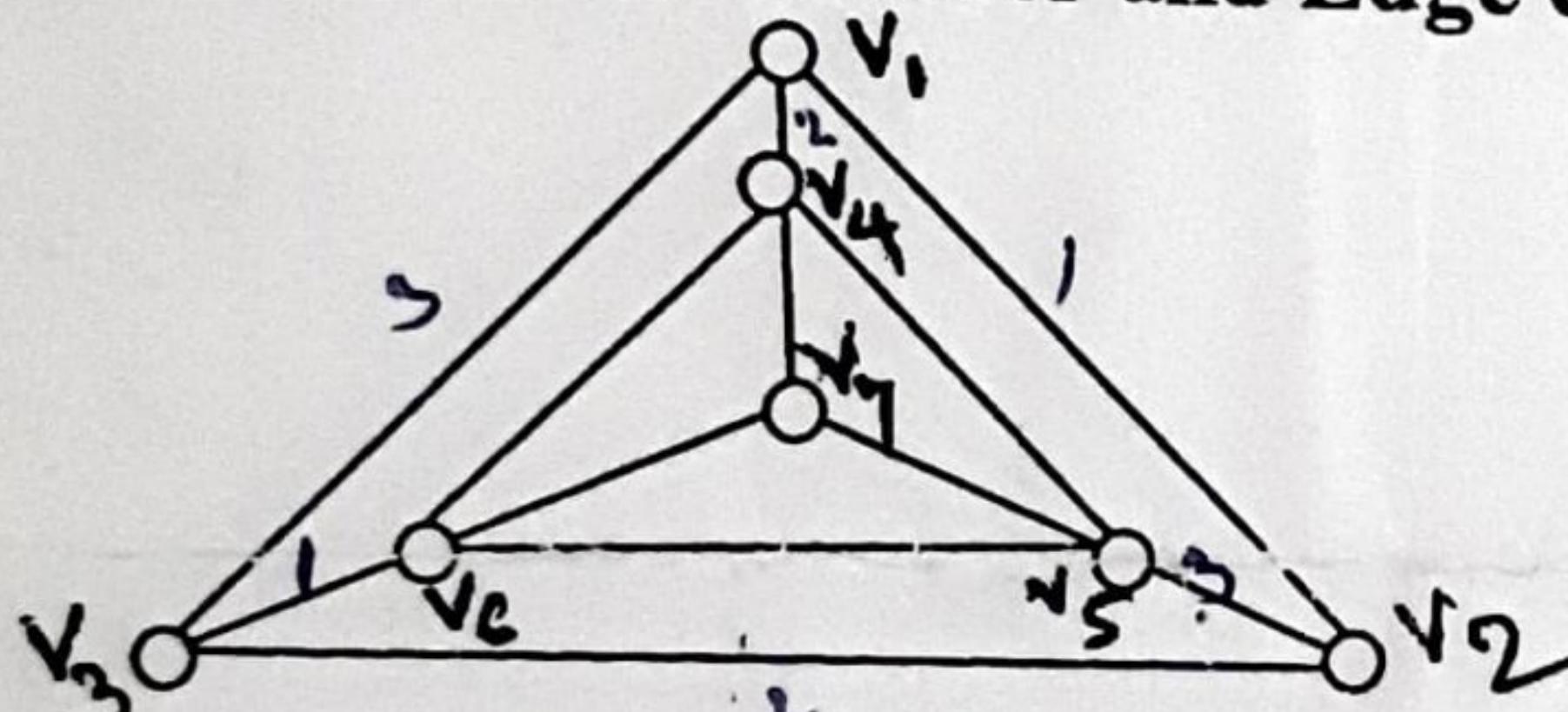
Answer any Five questions

✓ Explain any three of the following:

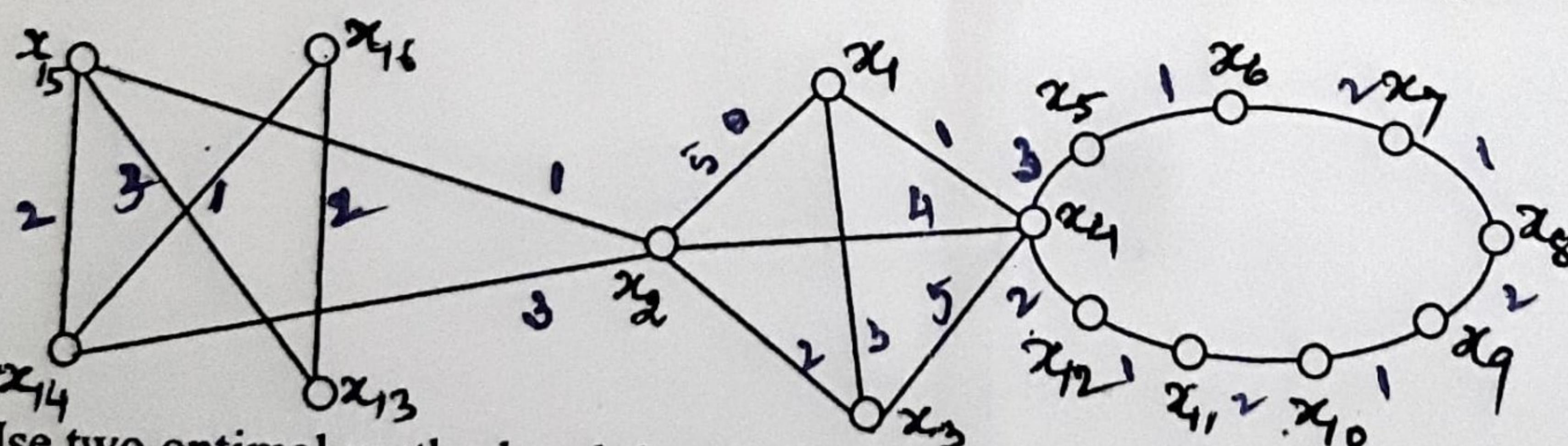
- (a) Matching, maximal matching, Perfect matching with example
- (b) Eulerian graph; Eulerian Cycle and Hamilton graph; Hamiltonian Cycle
- (c) Planar Graph, Jordan curve and Region. Find the number of regions in a tree, a cycle and K_4 .
- (d) State and proof Euler's formula.

✓ (a) Define Vertex coloring, Vertex chromatics number and Edge coloring, Edge chromatics number of a graph.

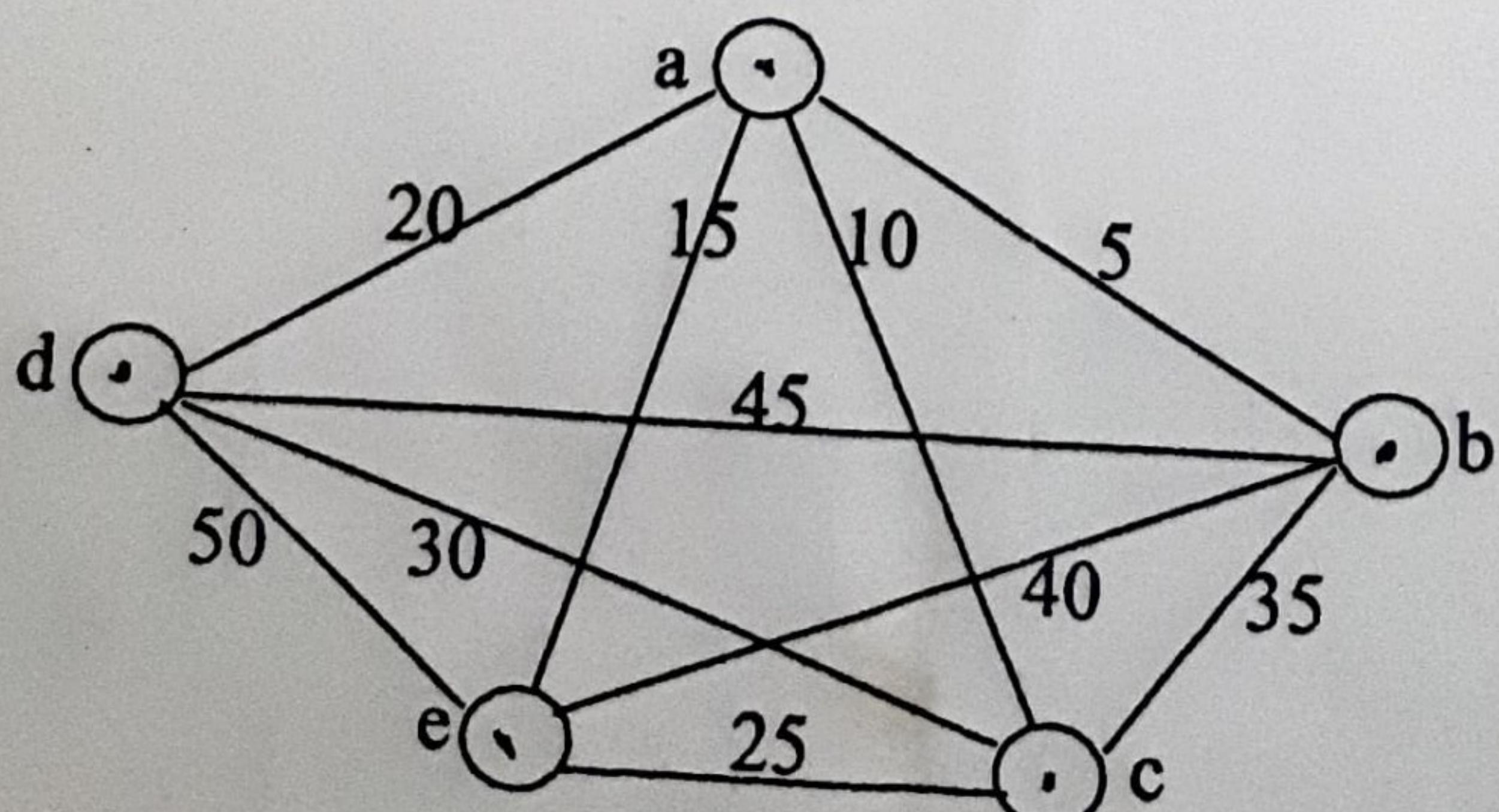
(b) Find the **Vertex chromatic number** and **Edge chromatic number** of the following graph:



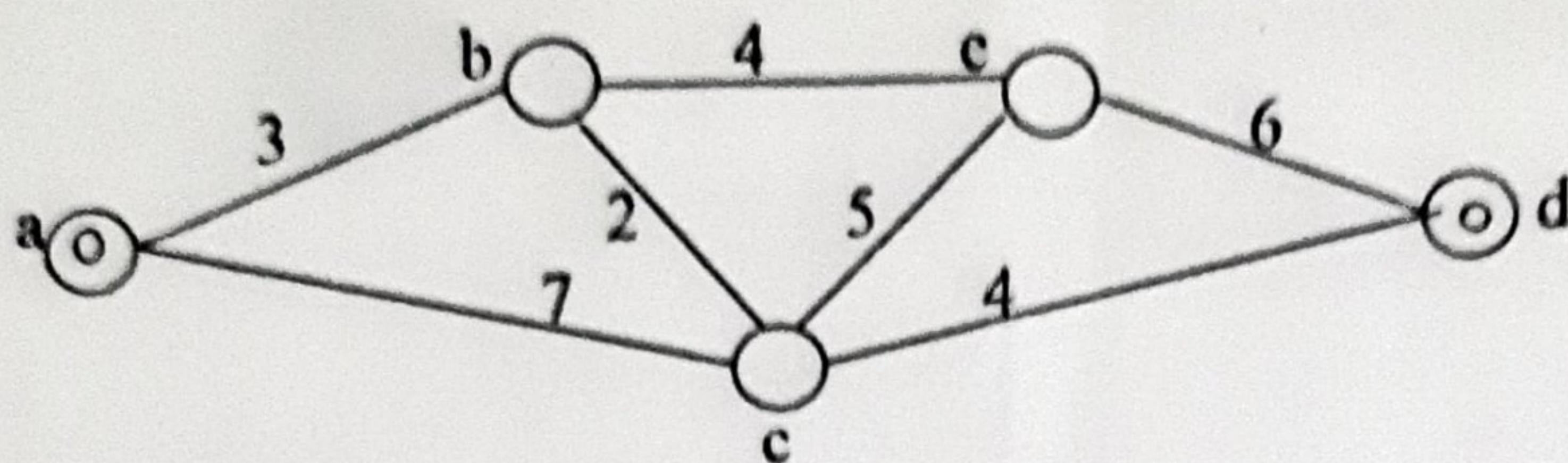
3. Find the **color classes** in the two different colorings of following the graph.



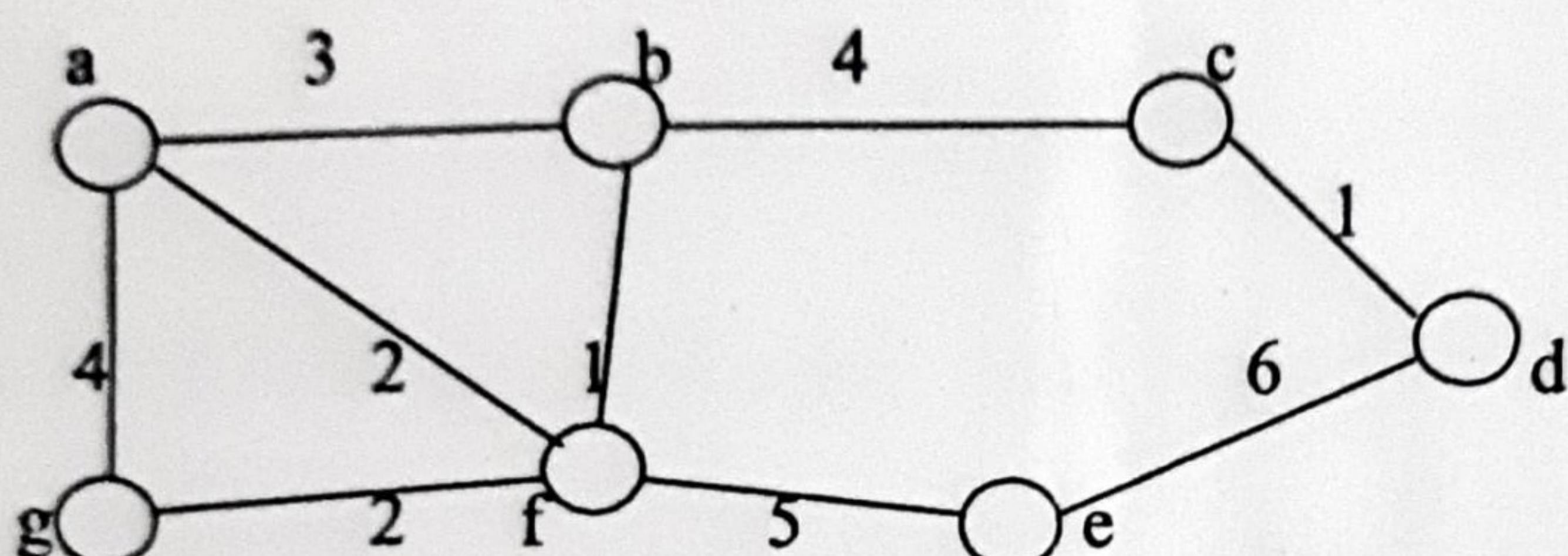
✓ Use two optimal method and the closet insertion method for the Travelling salesman problem for complete weighted graph given below:



✓ 8(a) Write Dijkstra's algorithm for shortest path in weight graph. Apply this algorithm to find the shortest path from a to d in the graph given below:



(b) Write Prims/ Kuruskal algorithm for minimum cost spanning tree. Apply any algorithm to find the minimum cost spanning tree in the graph given below:



6(a) If G and H are isomorphic graphs, then the degrees of the vertices of G are the same as the degrees of the vertices of H .

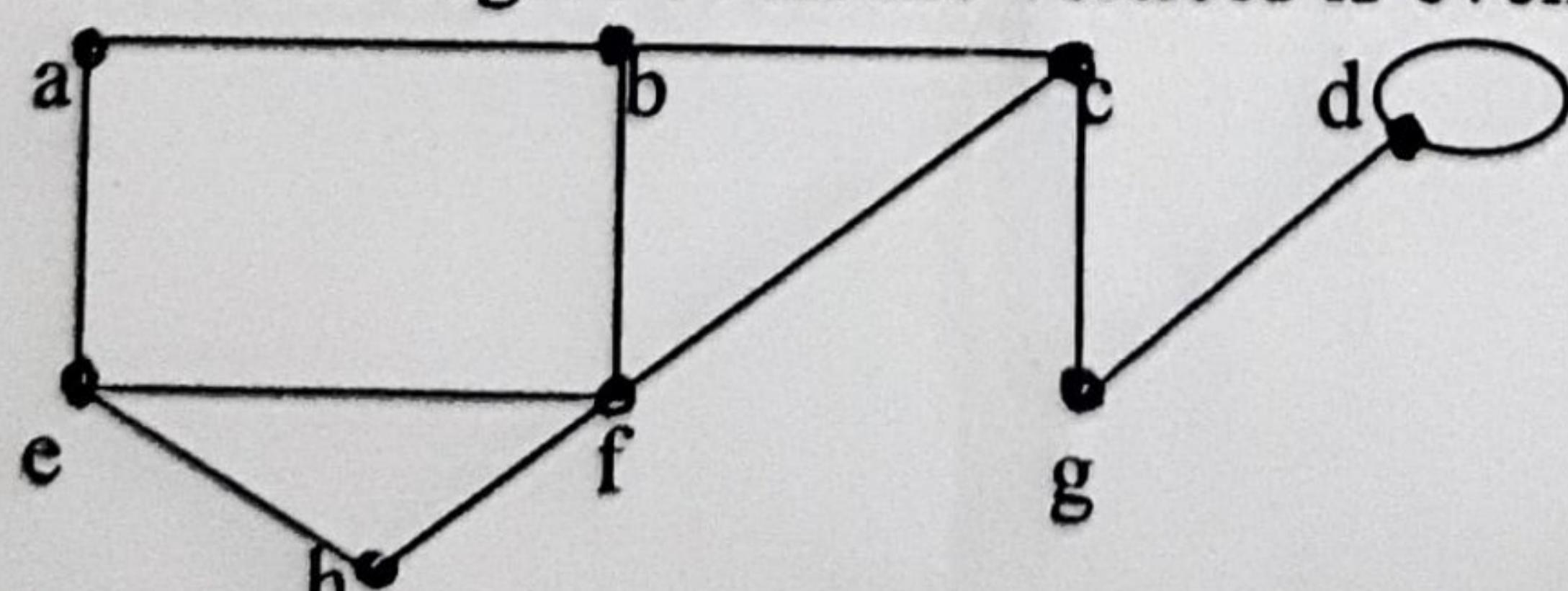
(b) A connected graph G with two or more vertices is edge traceable if and only if it has exactly two vertices of odd degree.

7(a) Let G be a graph of order n . If $\deg u + \deg v \geq n - 1$ for every two nonadjacent vertices u and v of G , then G is connected and $\text{diam}(G) \leq 2$.

(b) Let R be the relation defined on the vertex set of a graph G by, where $u, v \in V(G)$, if u is connected to $u - v$ path. Then R is an equivalence relation

✓ 8(a) Explain Degree of Vertex.

Verify that the sum of the degree of all the vertices is even for the following graph:



(b) Explain Cut Set, Cut vertices, Cut edge.

Which of the following sets of edges of the graph given in figure and what is the edges connectivity of the graph?

- (i) $\{SU, SV\}$ (ii) $\{UV, WX, YZ\}$
- (iii) $\{UX, VX, WX, YZ\}$ (iv) $\{YT\}$
- (v) $\{WX, XZ, YZ\}$ (vi) $\{UW, WX, WY\}$

