Data Structures

Graph

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Outline

- Overview of Graph
- Terminologies in Graph
- Types of Graph
- Spanning Tree
- Application of Graph

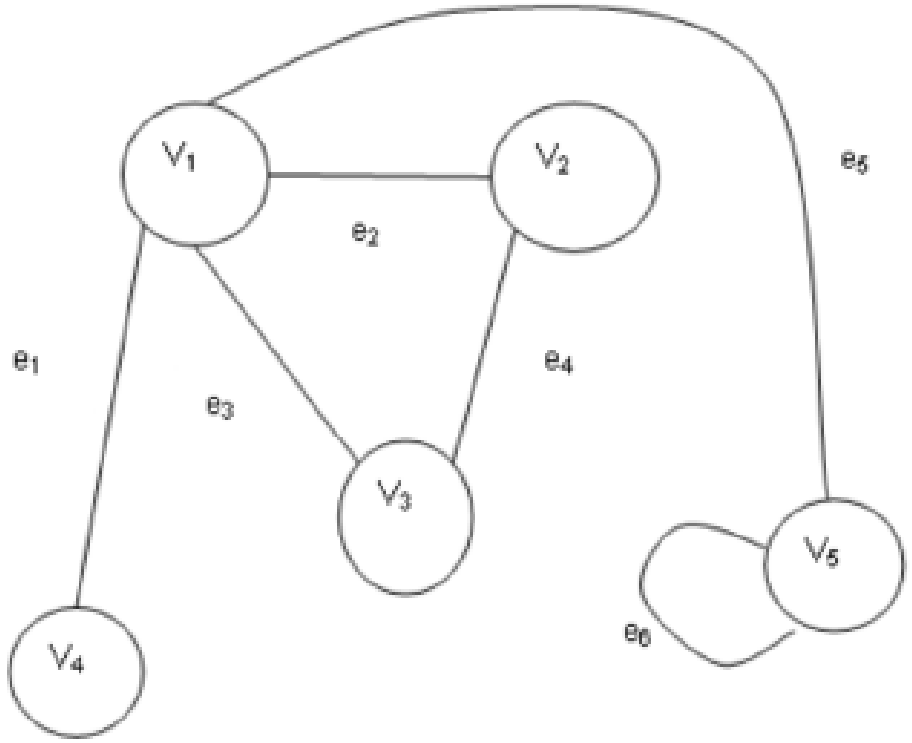
Overview of Graph

- Graph is a non-linear data structure that represents relationships (pairwise) between objects.
- There are many problems which can be formulated in terms of a set of entities and relationships between them.
- For example, towns are entities which are related (or linked) by roads (or railways) and one has to find the shortest route between them.
- Computer nodes can be entities which are connected and related through the networks and this picture can make easier in solving any type of routing problems.

Concept of Graph

A graph G consist of

1. Set of vertices V (called nodes), (V = {v1, v2, v3, v4.....}) and
2. Set of edges E (i.e., E {e1, e2, e3.....cm}

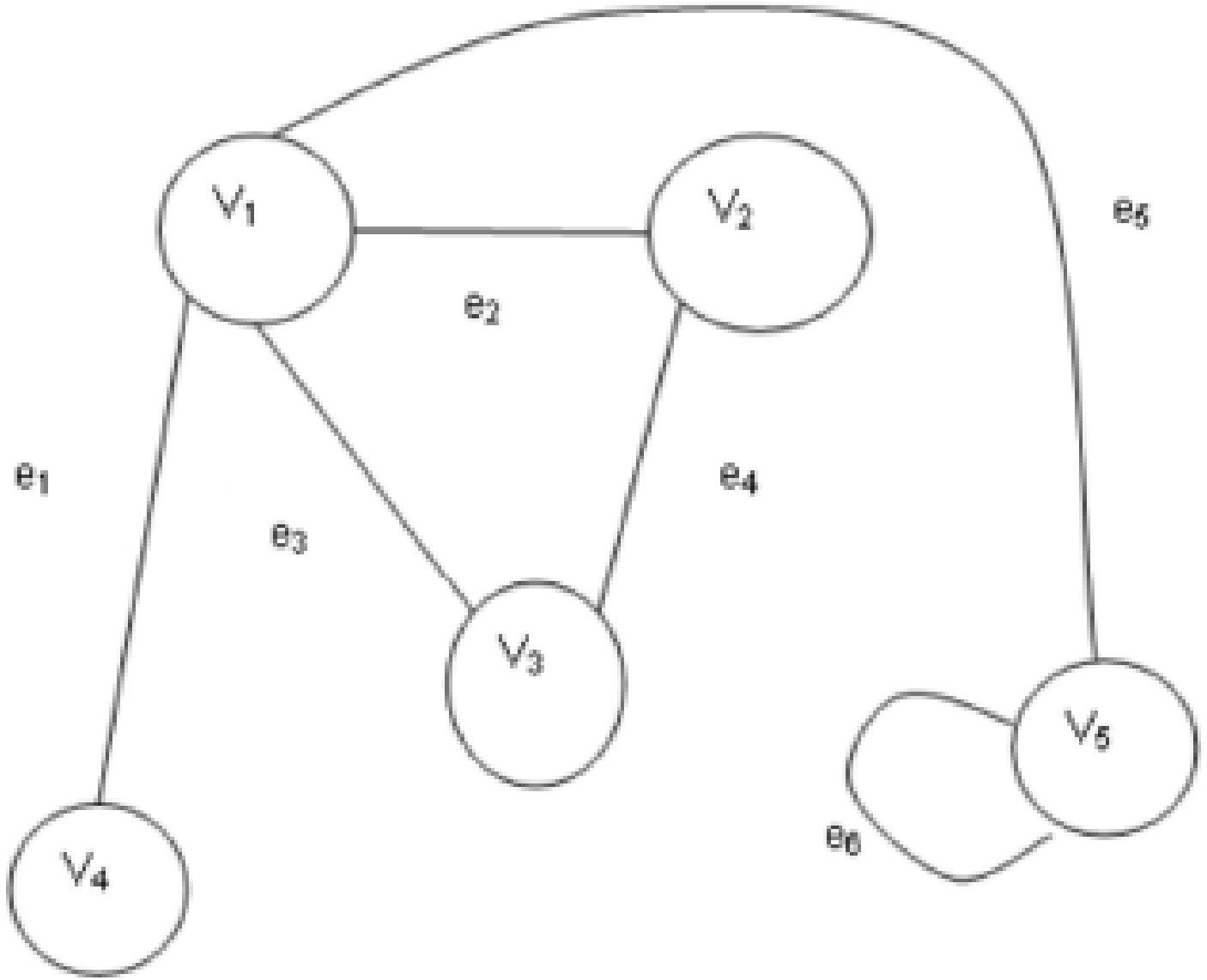


Terminologies in Graph

- Vertex
- Edge
  - Undirected edge
  - Directed edge
  - Weighted edge
- End vertices or Endpoints
- Origin
- Destination
- Adjacent
- etc

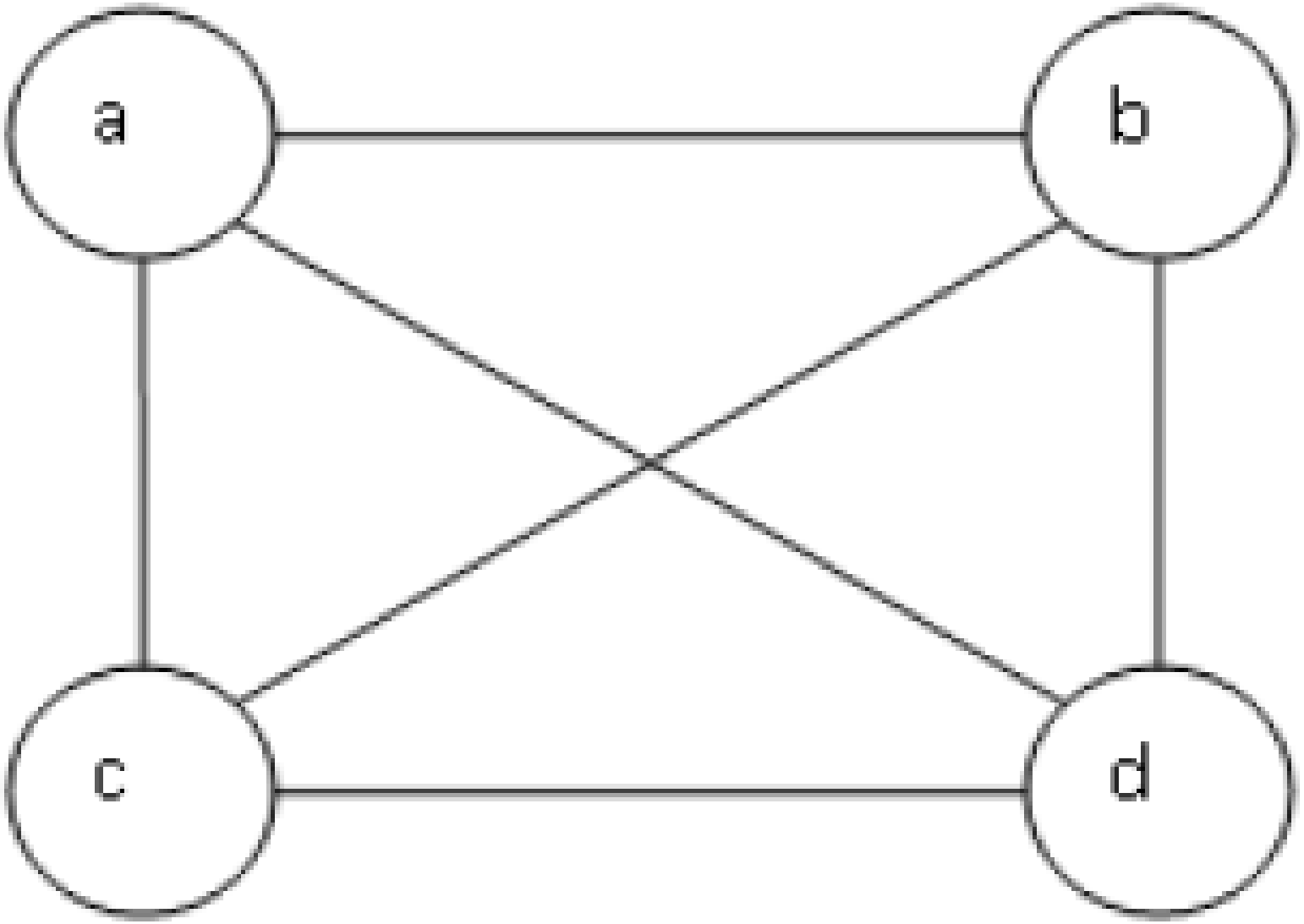
Types of Graph

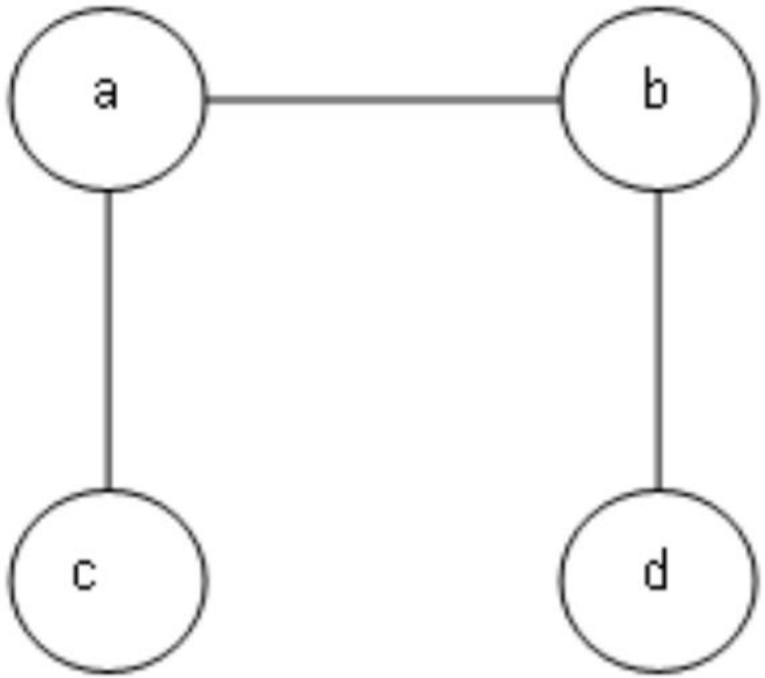
1. Directed graph
2. Undirected graph
3. Weighted graph
4. Multigraph
5. Sparse graph
6. Null graph
7. Mixed graph
8. Simple graph


V_1
V_2
V_3
V_4
V_5
e_1
e_2
e_3
e_4
e_5
e_6

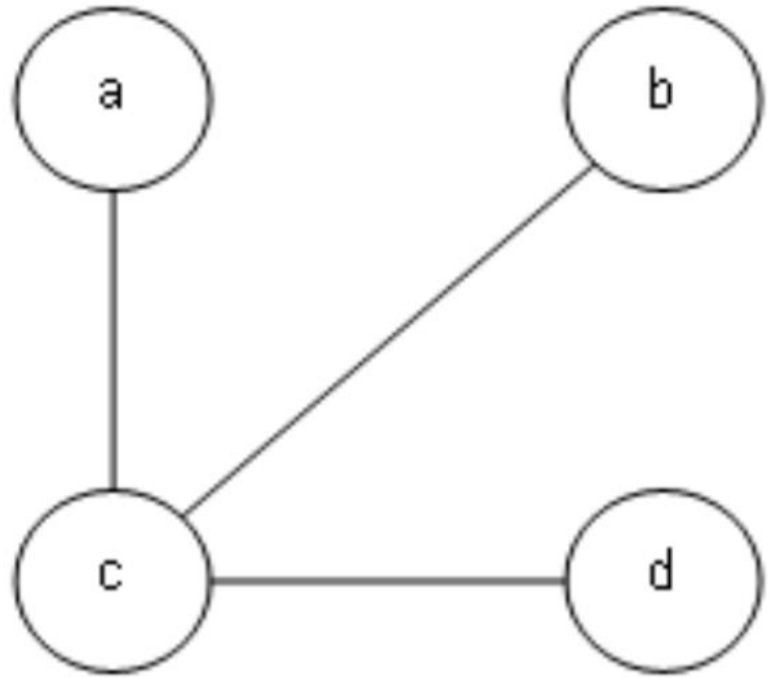
Spanning Tree

- A spanning tree T is defined as an undirected tree of a connected graph G which is composed of all the vertices and the edges **necessary** to connect all the nodes of graph *G*.
- With spanning Tree, every vertex lies in the tree but no loops are formed
- If the Graph G has n vertices, then it has n-1 edges without any cycles
- A single graph can have many spanning trees.

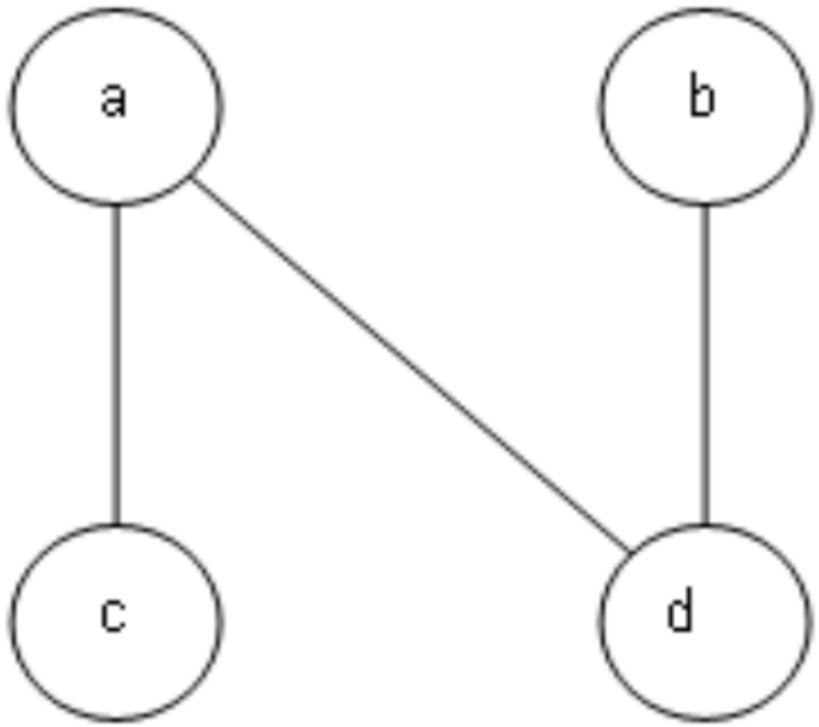

a
b
c
d



(i)



(ii)



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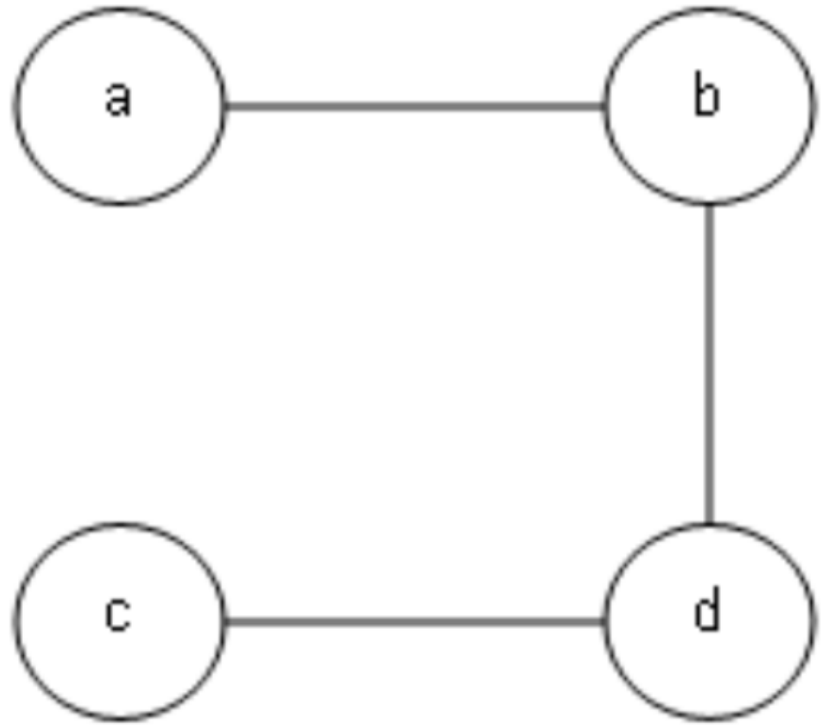

(iv)

Applications of Graph

- Topological Sorting
- Weighted Shortest Path – Dijkstra’s algorithm
- Minimum Spanning Tree