Adv. C

Ch 02.01
Graph

Introduction...

- A graph is a general tree with no parent-child relationship.
- Graphs have many applications in computer science and other fields of science such as mapping, transportation, geography, electrical engineering, computer networks, solving games and puzzles.
- Graphs are used in various types of modeling.

Introduction...

- For example, graphs can be used to represent connecting roads between cities.
- In general, graphs represent a relatively less restrictive relationship between the data and items.
- It is a way of representing relationships that exists between pairs of objects.

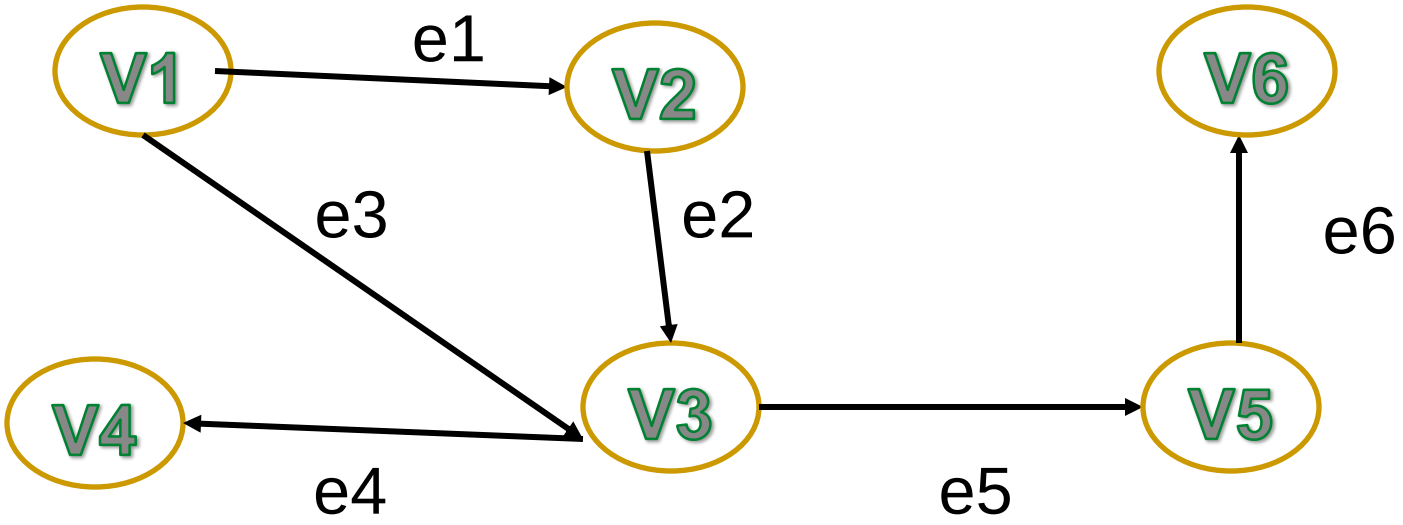
Introduction...

- A graph G consists 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}
- A graph can be represents as G=(V,E) where V is a finite and non empty set at vertices and E is a set of pairs of vertices called edges.

Introduction...

- In another words can say that, a graph is a set of objects (called vertices) together with a collection of pair wise connections between them.
- A graph G is similarly a set V of vertices and a collection E of pairs of vertices from V, called edges.
- Thus, a graph is a way of representing collections or relationships between pairs of objects from some set V.

Introduction :



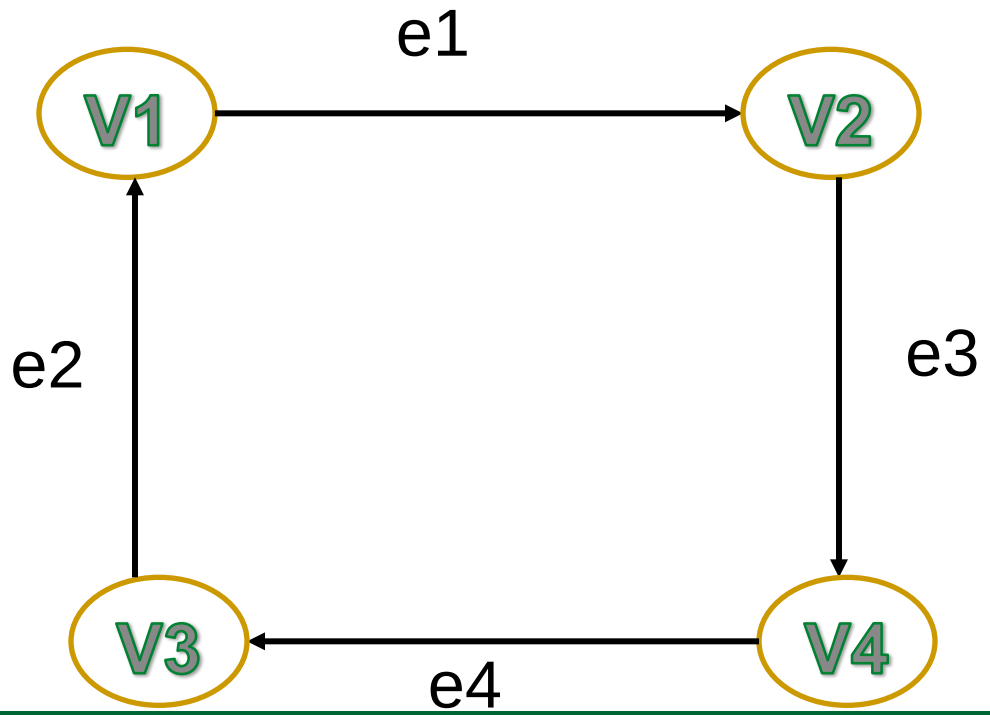
Introduction...

- Consider a graph, G shown in above figure.
- Then the vertex V and edge E can be represented as:
  - V={V1, V2, V3, V4, V5, V6} and E={e1, e2, e3, e4, e5, e6}
  - Thus E={(v1,v2) (v2,v3) (v1,v3) (v3,v4) (v3,v5) (v5,v6)}.
  - There are six edges and vertix in the graph.

Some terminology of graph...

1. Graph

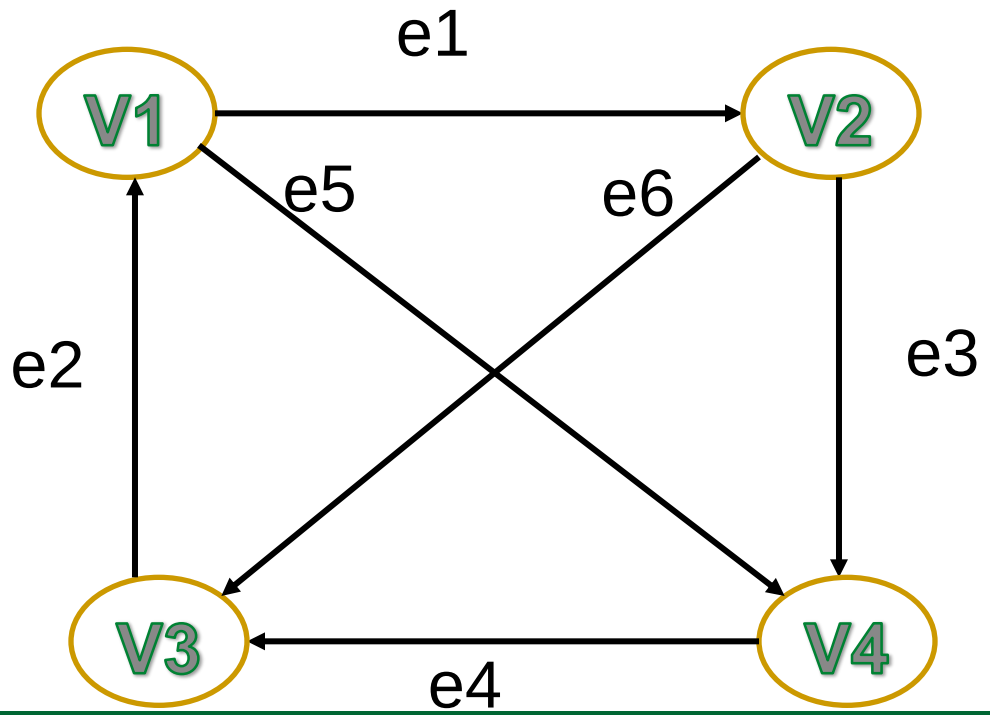
- A graph is set of vertices and edges.



Some terminology of graph...

2. Complete Graph

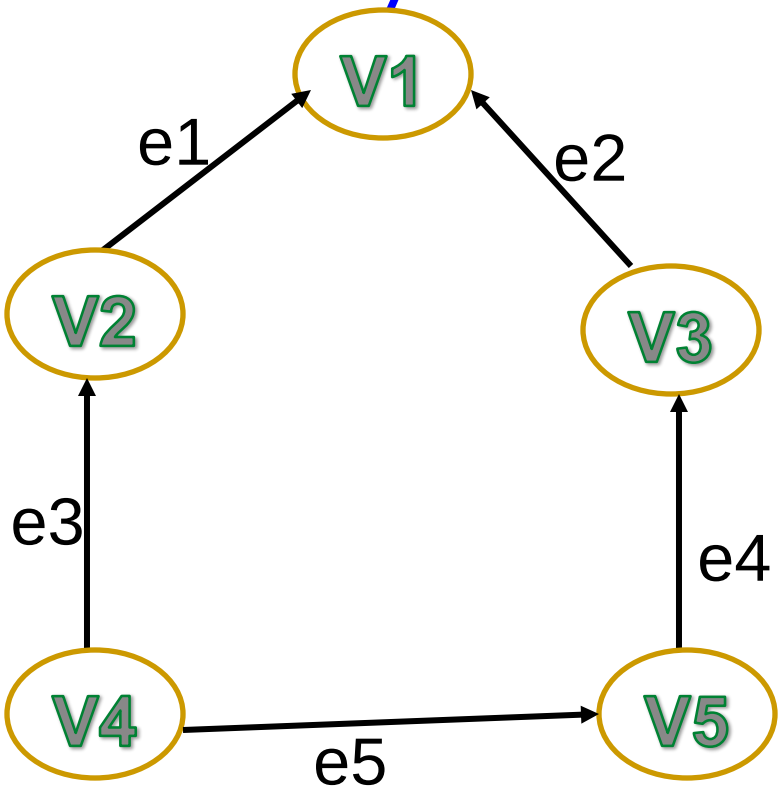
- A complete graph means all edges are connected to each other and not any one vertices is isolated.



Some terminology of graph...

3. Connected Graph

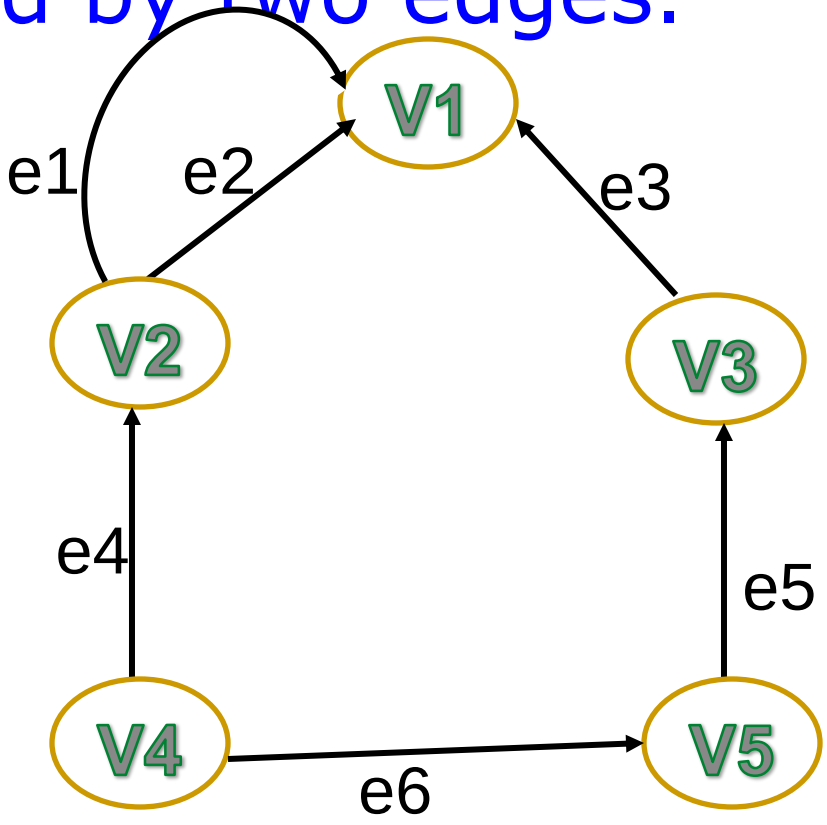
- A connected graph means there is exist a path between any two vertices of the graph



Some terminology of graph...

4. Multiple Edges

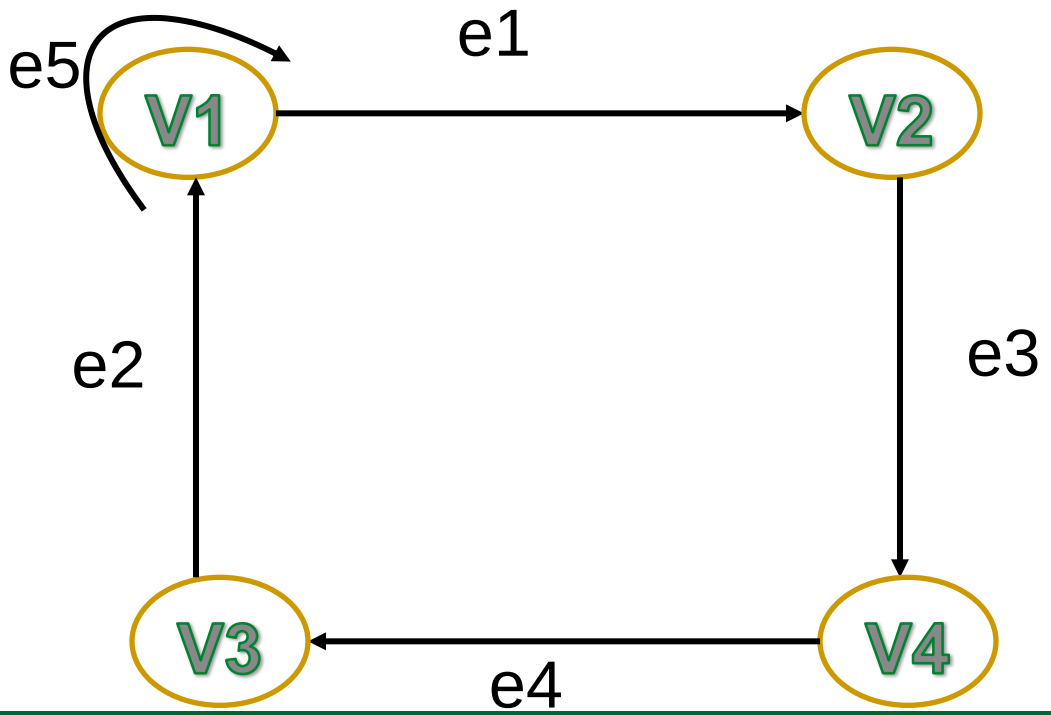
- A multiple edges means two vertices are connected by two edges.



Some terminology of graph...

5. Loop in Graph

- If any edges starts and end points are same, then that edge is called loop in graph.



Graph traversal...

- Like tree, non linear data structure, the graph is also traversal techniques are as follow:
- There two techniques of graph:
  - 1. Depth First Search (DFS)
  - 2. Breath First Search (BFS)
- This two traversal techniques use three statuses during the traversal each of the nodes n in graph as bellow:

Graph traversal...

State	Status	Description
Ready	1	The start position of node n.
Waiting	2	The processed on the n node in stack or queue.
Processed	3	After n node is the processing.

Graph traversal...

1. Depth First Search (DFS)

- This graph traversal technique is simple and easy to implement.
- In this traversal technique used stack to store the value of nodes.
- In this technique each node is encountered it is marked 1 indicated to notify the node has been visited.
- The DFS technique start with first node and marked with 1 and continue this process until all nodes are marked.

Graph traversal...

- When the first start node all an unmarked adjacent node of A is now selected and marked to become next start node possible to leaving first node.

Graph traversal...

2. Breath First Search (BFS)

- This graph traversal technique is simple and easy to implement.
- In the traversal technique used queue to store the value of nodes.
- In this technique is used to find the shortest distance between the starting node and destination node.
- Here calculated by all path start node to end distances and than choose the proper path for processed to searching.

Graph traversal...

- If required in processing than removing on to an adjacent node with heavy weight value of any edge and repeating the process until choose best path and visited all possible paths.

Shortest path problem...

- In our real life, we can always first find out shortest path to go to our home and same logic is applied to find out between two nodes distance using shortest path algorithms.
- Warshall's algorithms find out the path between the nodes.
- We can modify Warshall algorithms for to obtain a matrix, which gives the lengths of shortest paths between the nodes.

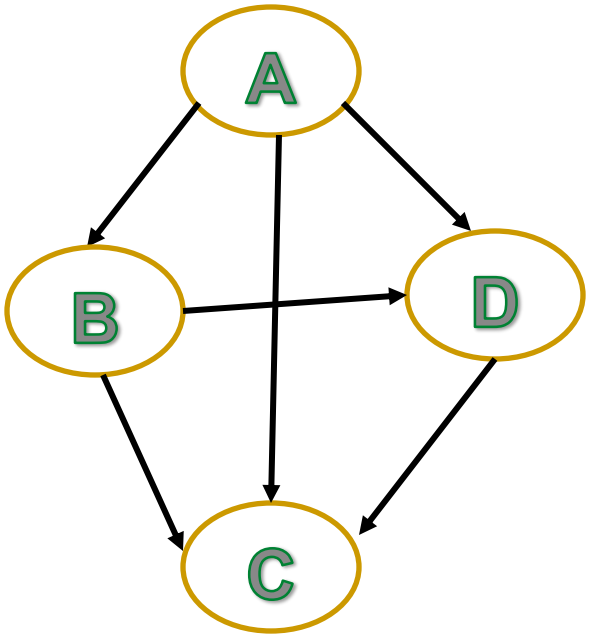
Shortest path problem...

- The shortest path algorithm produces the required matrix, which shows the minimum length between two nodes.
- Any graph, in adjacency matrix all the zero entries are replaced by infinity, which shows that there is no edge between two nodes.

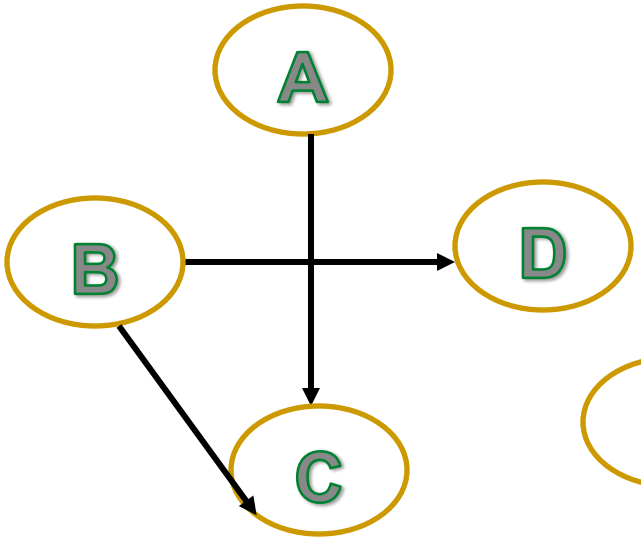
Minimal spanning tree...

- In this algorithms find out minimal distance to all vertices in the original graph and those edges that are required to connect all the vertices in the original graph.
- If any pair of vertices there exist two paths than remove one path because the minimal spanning tree has a property that for any pair of vertices there exists only one path to connect between them.

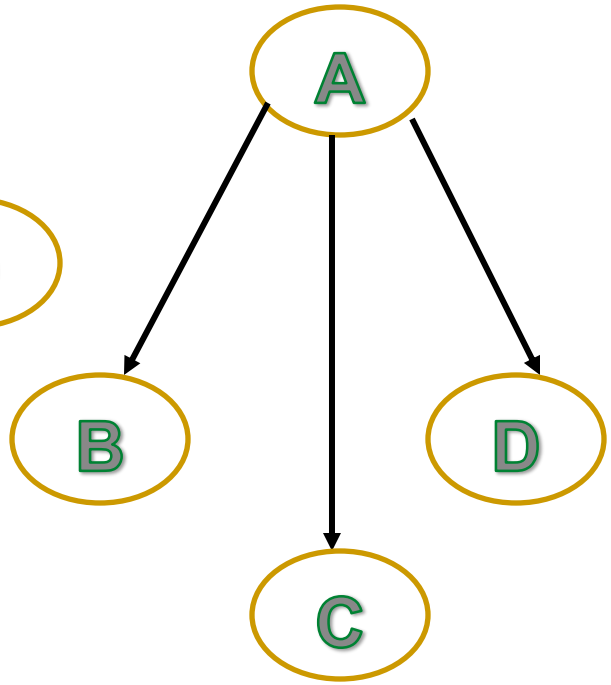
Minimal spanning tree...



Original Graph



DFS



BFS

Assignments...

- Q-1: What is Graph? Give the introduction of graph.
- Q-2: Explain both type of traversing the graph.
- Q-3: Explain shortest path problem
- Q-4: Write a short note on minimal spanning tree.