



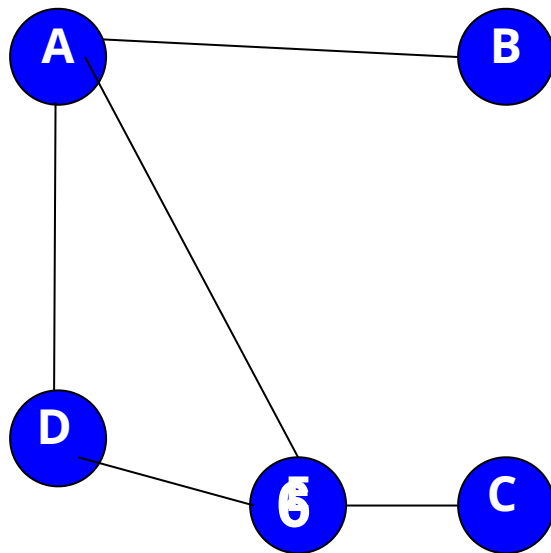
Data Structures

Graphs

COMP128 Data Structures



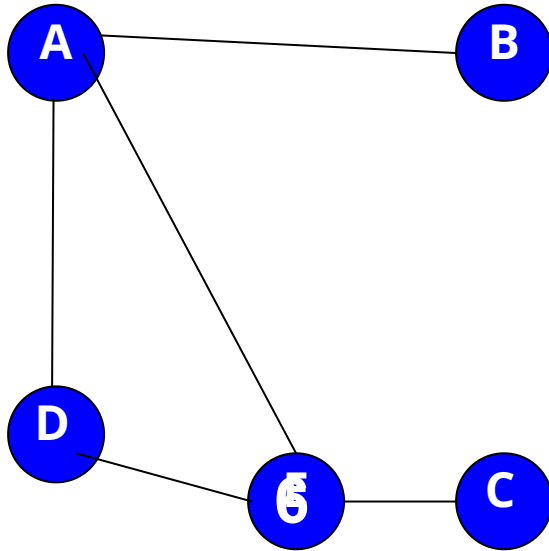
Graph Basics



How do we describe a graph?



Graph Basics



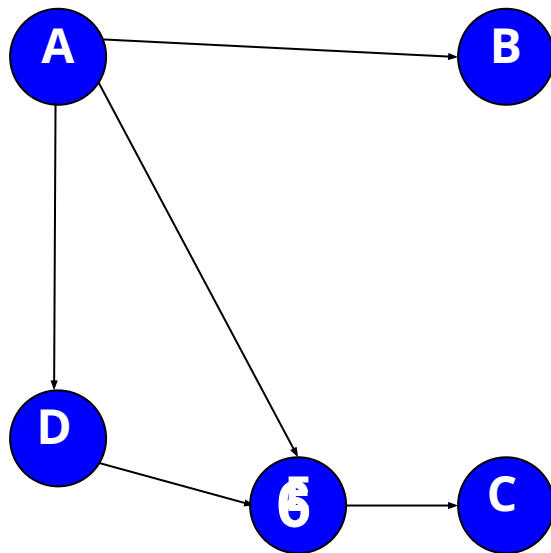
A graph is a data structure that consists of a set of **vertices** (or nodes) and a set of **edges** (relations).

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

$E = \{\{A, B\}, \{A, D\}, \{A, E\}, \{C, E\}, \{D, E\}\}$



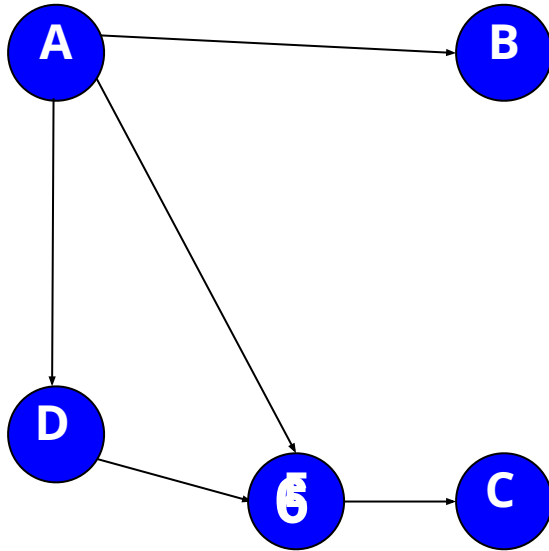
Graph Basics



What other information can we add to a graph?



Graph Basics

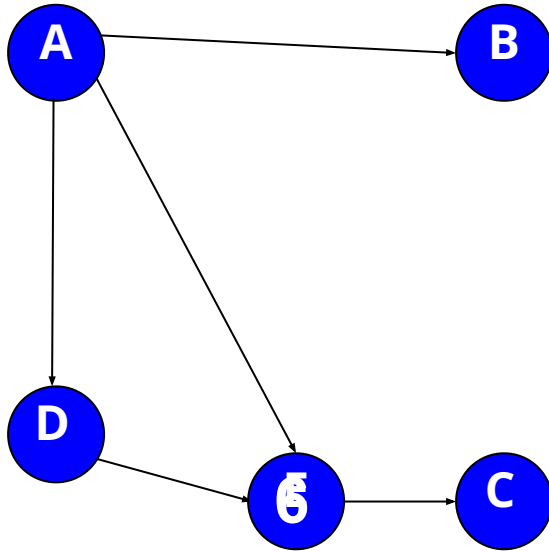


The edges of a graph are directed if the existence of an edge from A to B does not necessarily guarantee a path in both directions.

- A graph that contains directed edges is called a **directed graph**.
- A graph that contains undirected edges is called **undirected graph**.



Graph Basics

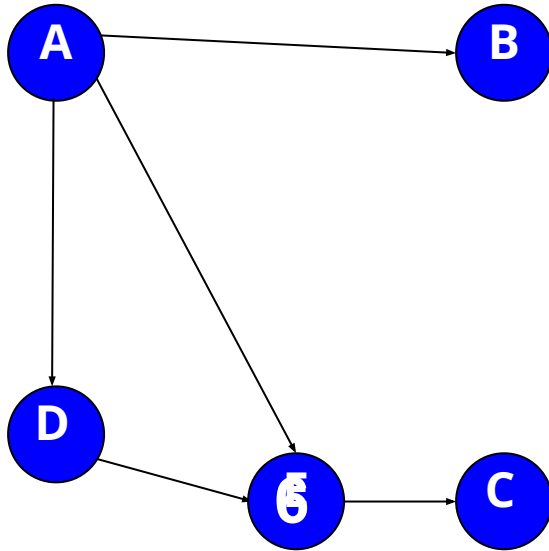


A vertex is **adjacent** to another vertex if there is an edge to it from that other vertex.

- A is adjacent to D
- D is not adjacent to A



Graph Basics

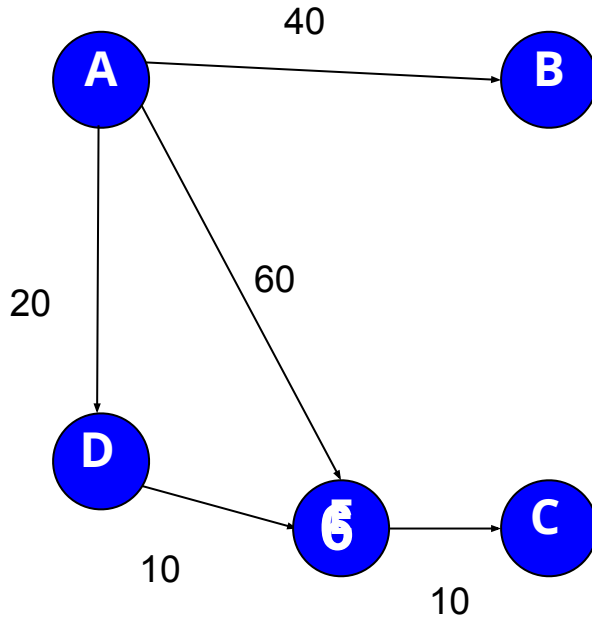


The **degree** of a vertex is the number of edges that are incident to it.

What is the degree of **A**?



Graph Basics

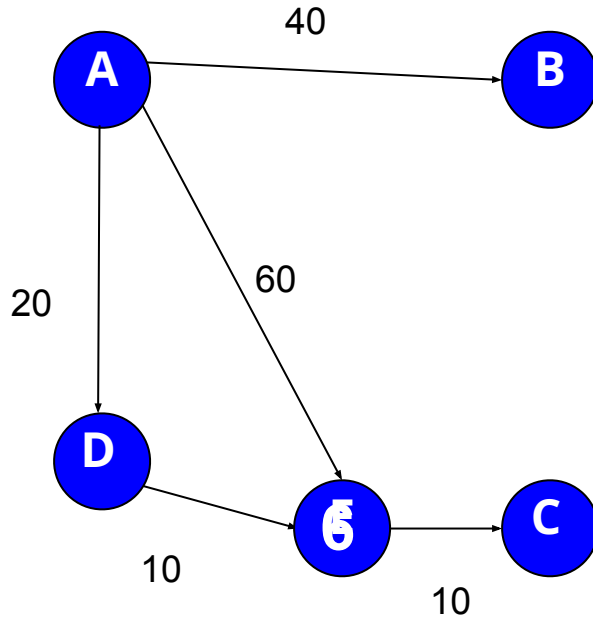


Edges can have weights associated with them. For example, the distance between different places.

- A graph with weighted edges is known as a **weighted graph**.



Graph Basics

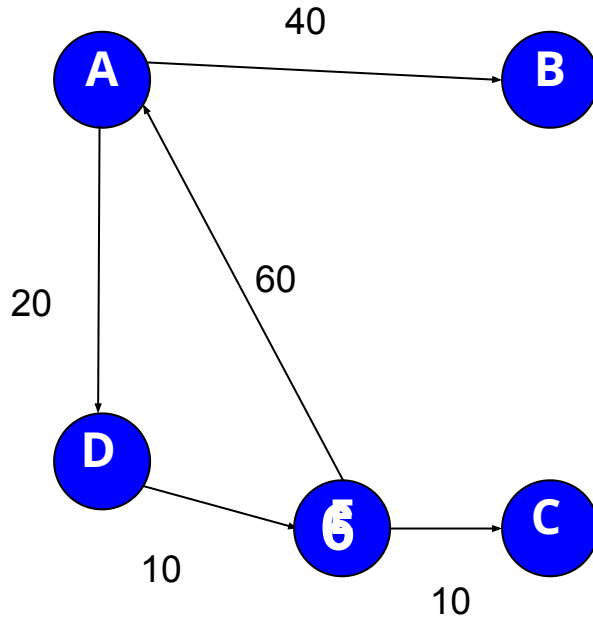


A **path** is a sequence of vertices in which each successive vertex is adjacent to its predecessor.

- In a **simple path** the vertices and edges are distinct, except that the first and last vertices may be the same.



Graph Basics

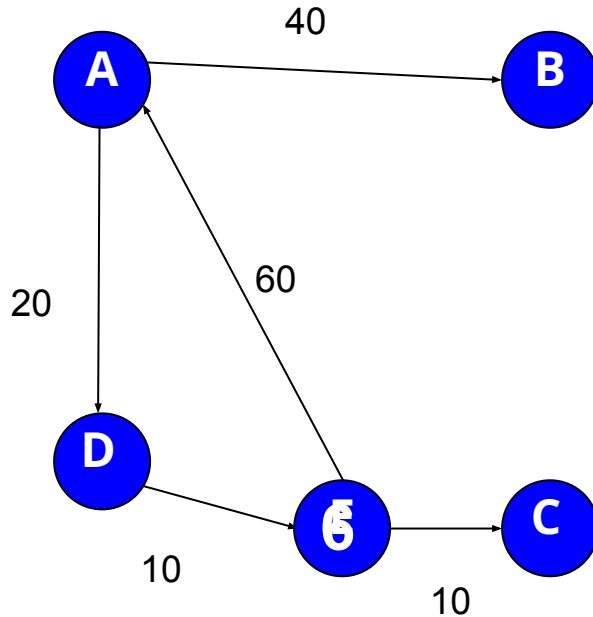


A **path** is a sequence of vertices in which each successive vertex is adjacent to its predecessor.

- A **cycle** is a simple path in which only the first and last vertices are the same.



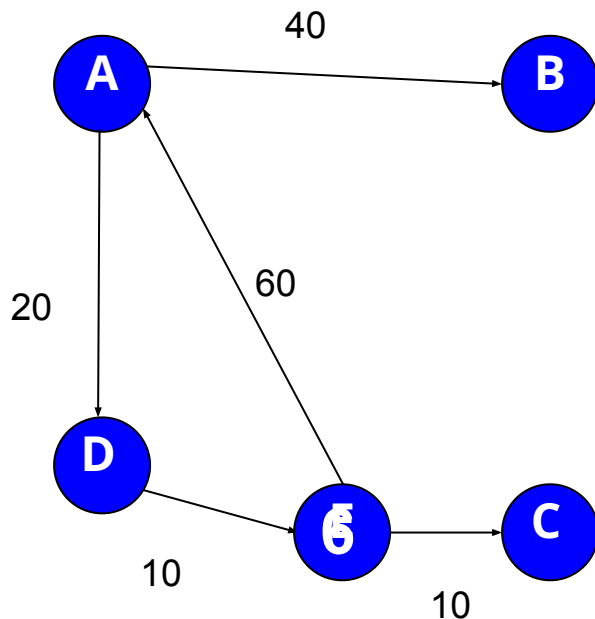
Graph Applications



What problems and applications do you think graphs can help you solve?



Graph Applications



What problems and applications do you think graphs can help you solve?

- Checking if there is a path from A to B
 - Course prerequisites
 - Friends/connections
 - Maze
- Least cost or shortest path
 - Driving directions





In-class Activity

Wiki Racer Activity

