

DSA

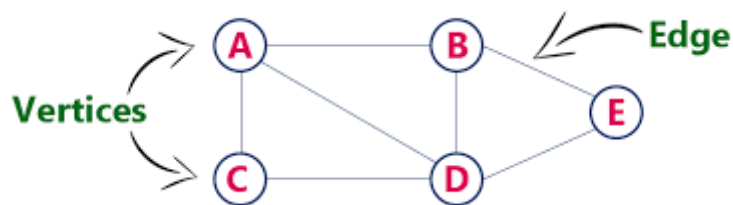
INTERNSHALA

Graphs

What is a Graph?

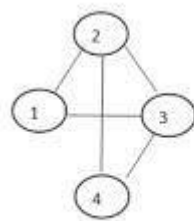
A graph is a non-linear data structure that consists of following two elements –

1. Nodes (vertices) : Nodes will contain data.
2. Edges : Each edge is made up of a unique pair of nodes.

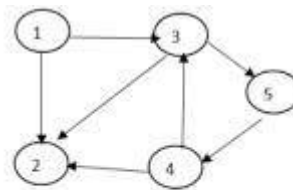


• Undirected graph

In an undirected graph all the edges are bidirectional.



Undirected graph



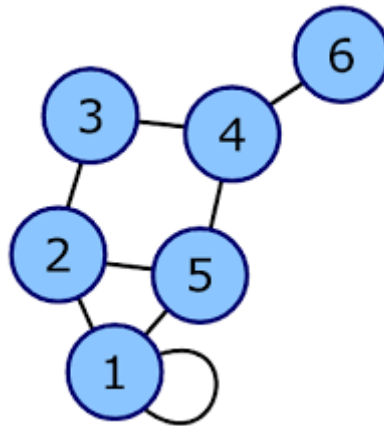
Directed graph.

• Directed graph (Digraph)

In directed graph all the edges are unidirectional.

Loop in a directed graph

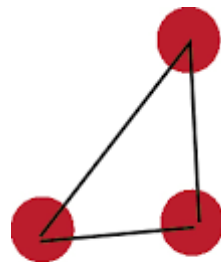
When a node has an edge to itself it is called a self-loop or buckle.



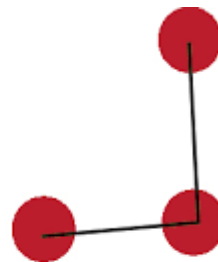
Cyclic graphs

A cyclic graph consists of a single cycle.

All the nodes are connected in a closed chain.



Cyclic



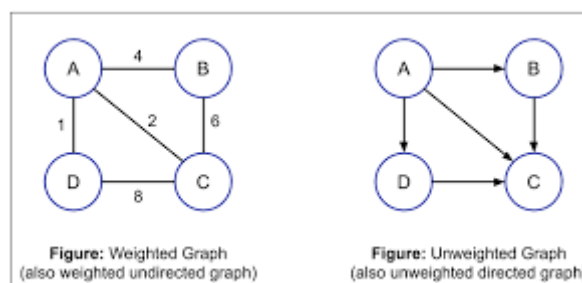
Acyclic

Weighted Vs. Unweighted graphs

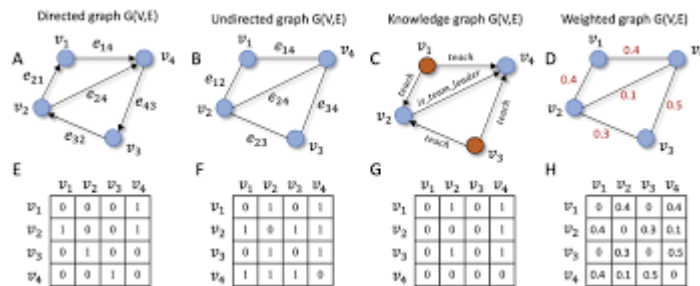
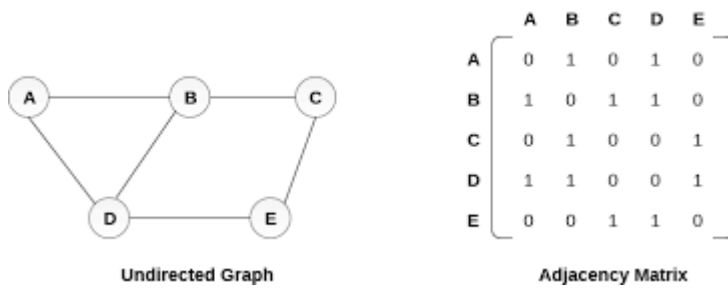
A weight is numerical value assigned to an edge of a graph.

This numeric value is called an edge.

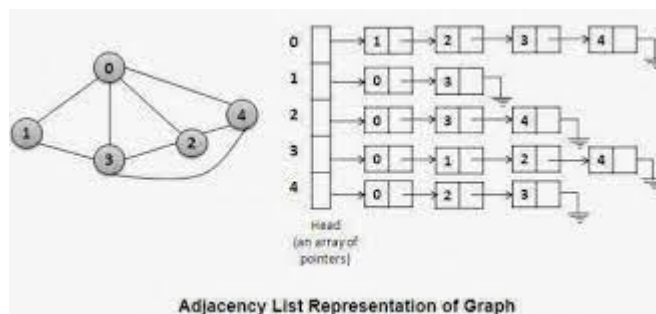
An unweighted graph does not have weight assigned to any edge.

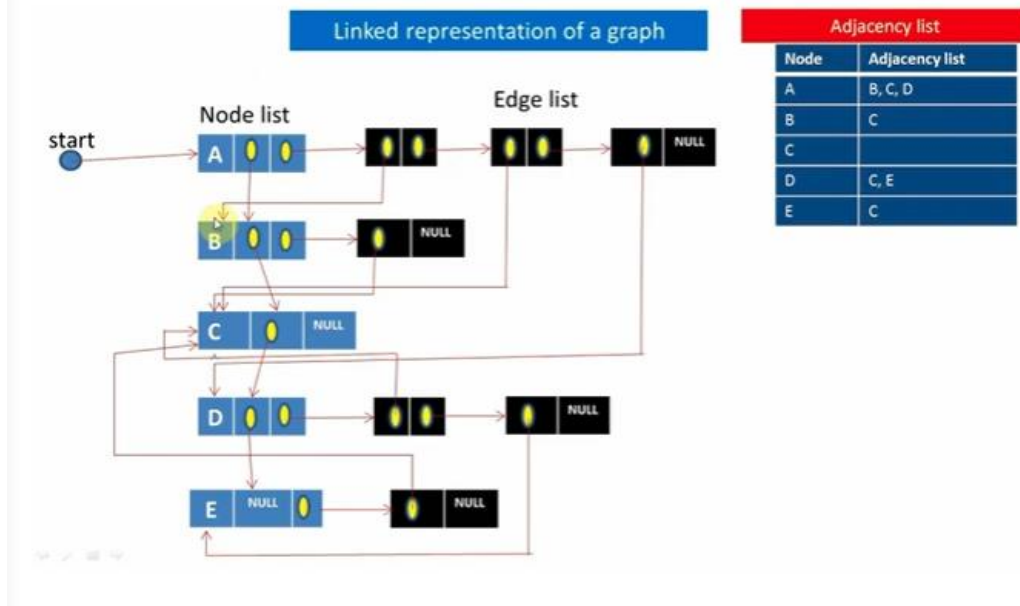


Representation through adjacent matrix



Linked representation





Map

- Fast key lookup data structure.
- Different from arrays where indices have to be only integers.
- Indices in maps can be of any data type.
- Indices into the elements of a map are called keys.
- Keys and associated values are stored in the map.
- Keys are always unique.

Hashing

- A file organization technique to compute unique addresses of records.
- The functions used by this technique are called hash functions.
- Popular hash functions:
 - Division/remainder method
 - Suppose we want to store records of 100 students of a university
 - Each student is assigned a 4-digit unique roll number

- The memory pool consists of 100 2-digit addresses from 00 to 99
- Calculating a unique address for storing record of a student with roll number 6534 –
 - Select a prime number m close to last address 99. Let $m = 97$
 - Find the remainder after dividing 6534 with 97.
 $R = 35$
 - 35 address location is selected from the memory pool for storing the record with roll number 6534
- Midsquare method
 - Calculating a unique address for storing record of a student with roll number 2592.
 - Square the key value 2592
 - Let $s = 6718464$
 - Now remove the digits from both sides of the square value so that we get a 2digit address $t = 84$
 - 84 address location is selected from the memory pool for storing the record with roll number 2592
- Folding
 - Calculate unique address for roll number 8247-
 - Chop the key value into two parts and add them
 - Let $c = 82+47 = 129$
 - Remove the leading digit 1 as addresses are 2-digit numbers only
 - 29 address location is selected from the memory pool for storing the record with roll number 8247.