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1120160 20 ECE.

DSA Lab 11 : Theory

Q1. What is a Graph ? Explain in ~~the~~ brief the basic terminologies used in graph.

⟹ Graphs are non-linear data structures comprising a finite set of nodes and edges. The nodes are the elements and edge are ordered pair of connections between the nodes.

The basic terminologies used in graphs are :

① Graph representation : Generally, a graph is represented as a pair of sets (V, E). V is the set of vertices or nodes. E is the set of edges.

② Node or vertex : The elements of a graph are connected through edges.

③ Adjacent nodes : Two nodes are called as adjacent if they are connected through an edge.

④ Edges : A path or a line between two e vertices in a graph.

⑤ Path : Path is a sequence of edges between two nodes. It is essentially a traversal starting at one node and ending at another.

⑥ Unidirected Graph: An unidirected graph is one where the edges do not specify a particular direction. the edges are bi-directional

⑦ Directed Graph: traversed in specified direction only.

⑧ Weighted Graph: the edges are associated with a weight

Q2. State and explain different representation of Graphs.

→ Different Representation of graphs are:

1. Adjacency matrix:

In this representation, the graph is represented using a matrix of size total number of vertices ~~by a total number~~ that means the with 4 vertices is represented using a matrix of size 4×4.

2. Incidence matrix:

In this representation, the graph is represented using a matrix of size total number of vertices by a total number of edges. that means graph with 4 vertices and 6 edges is represented using a matrix of size 4×6.

3. Adjacency list:

In this representation, every vertex of graph contains list of its adjacent vertices

Q3. Explain Prim's and Kruskal's Algorithm with suitable example.

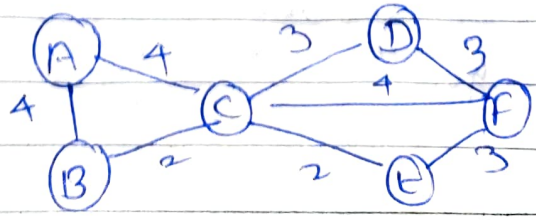
→ • Prim's algorithm:

- It is a minimum spanning tree algorithm that takes a graph as input and finds the subset of the edges of that graph which, form a tree that includes every vertex and has the minimum sum of weights among all the trees that can be formed from the group.

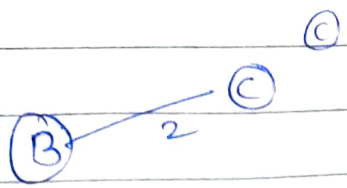
The steps for implementing Prim's algorithm are as follows:

1: Initialize minimum spanning tree
2: Find all the edges that connect the tree to new vertices, find the minimum and add it to the tree.
3: Keep repeating step 2 until we get a minimum spanning tree.

Example:-

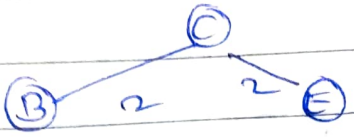


1. Start with a weighted graph.

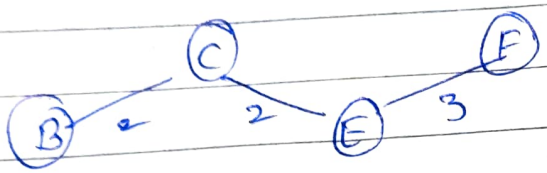


step 2: choose a vertex

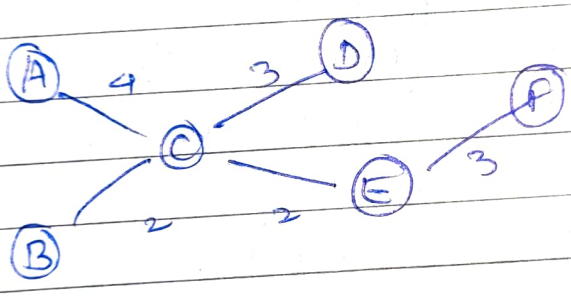
step 3: choose the shortest edge from this vertex and add it.



step 4: choose the nearest vertex not yet in the solution.



step 5: choose the nearest edge not yet in the solution, if there are multiple choices, choose one at random.

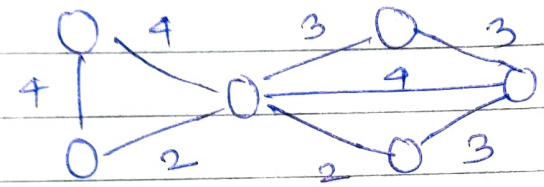


step 6: Repeat until you have a spanning tree.

- **Kruskal's Algorithm:**

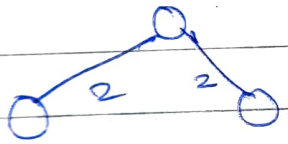
- It is a minimum spanning tree algorithm that takes a graph as input and finds the subset of the edges of that graph which form a tree that includes every vertex and has a minimum sum of weight among all the trees that can be formed form the graph.
- It falls under a class of algorithms called greedy algorithm that finds the local optimum.

Step 1 : Sort all the edges from low weight to high.
Step 2 : Take the edge with the lowest weight and add it to the spanning tree. if adding a edge created a cycle, then reject the edge.
Step 3 : Keep adding edges until we reach all vertices.

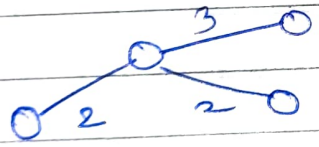


step 1 : start with a weighted graph.

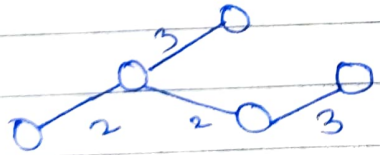
step 2 : choose the edge with the least weight if there are more than 1, choose anyone.



step 3 : choose the next shortest edge and add it.



step 4 : choose the next shortest edge that doesn't create a cycle and add it.



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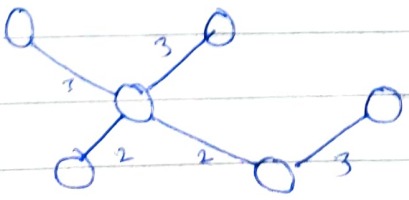

step 6 : Repeat until you have a spinning tree.