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Graph Theory

Tree Traversal & Spanning of Tree

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TEAM DETAILS

TOPIC:

Tree Traversal, Spanning of tree & Minimum spanning of tree.

Members:

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Bhoomika K., Ayush K. & Arindam Hazra

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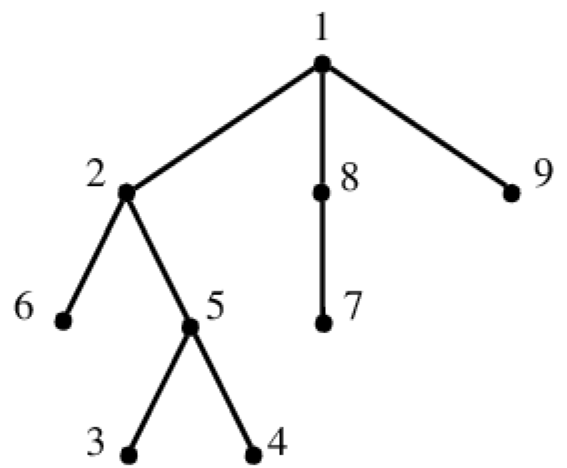
INTRODUCTION

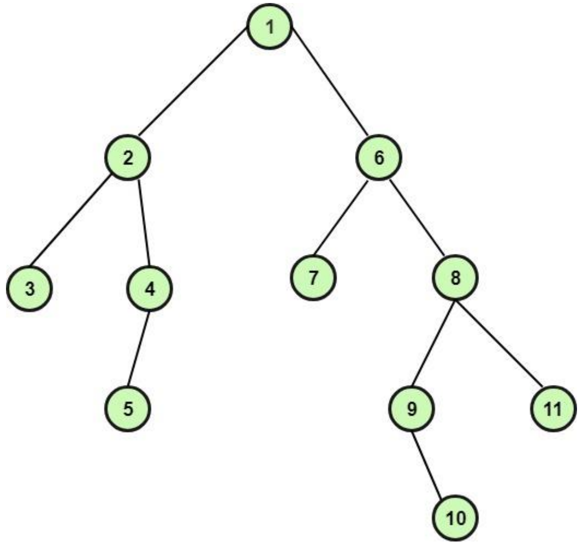
TREE

Tree is a connected graph with no cycle.
It has (n-1) edges. Also, it's every edge is a bridge.



Tree Traversal

Tree Traversals. A traversal of a graph is **an algorithm or process for "visiting" all of the vertices in a tree in a specified order that is determined by the graph structure**. Tree traversals are traversals that are defined in the special case that the graph is a rooted tree.



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Types of Tree Traversal

- Pre Order
- In Order
- Post Order

Pre Order Traversal

The Preorder Traversal of a binary tree is a recursive process. The Preorder Traversal of a tree is:

Visit the root of the tree.

Traverse the left subtree in Preorder.

Traverse the right subtree in Preorder.

[ROOT – LEFT – RIGHT]

In Order Traversal

The Inorder Traversal of a binary tree is a recursive process. The Inorder traversal of a tree is:

Traverse in Inorder the left subtree.

Visit the root of the tree.

Traverse in Inorder the right subtree.

[LEFT – ROOT – RIGHT]

Post Order Traversal

The Post order traversal of a binary tree is a recursive process. The Post order traversal of a tree is:

Traverse the left subtree in postorder.

Traverse the right subtree in postorder.

Visit the root of the tree.

[LEFT – RIGHT – RIGHT]

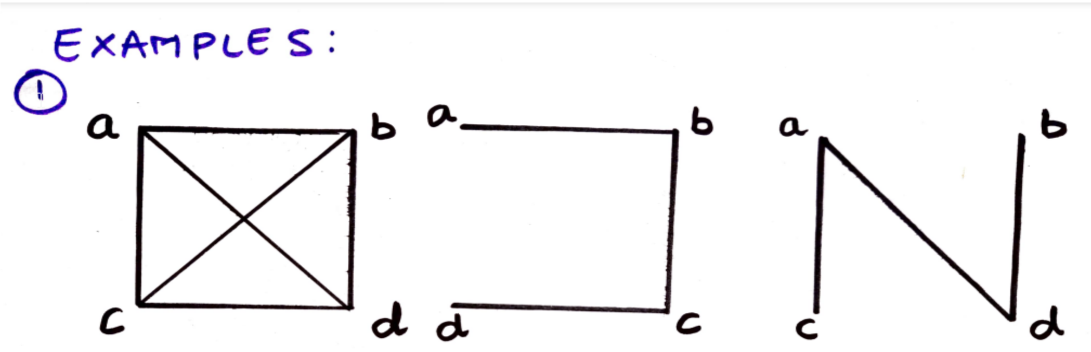
Spanning of Tree

Definition:

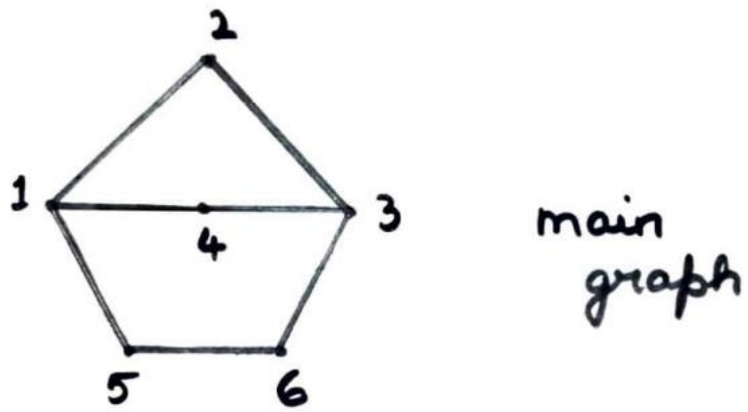
A spanning tree is a graph which contains all vertices and minimum number of edges.

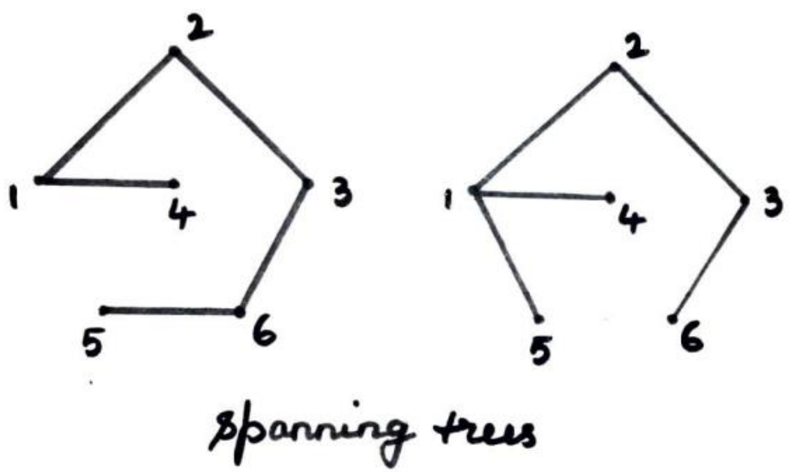
Note:

a) contains all vertices
b) minimum no. of edges



Examples for Spanning of Tree





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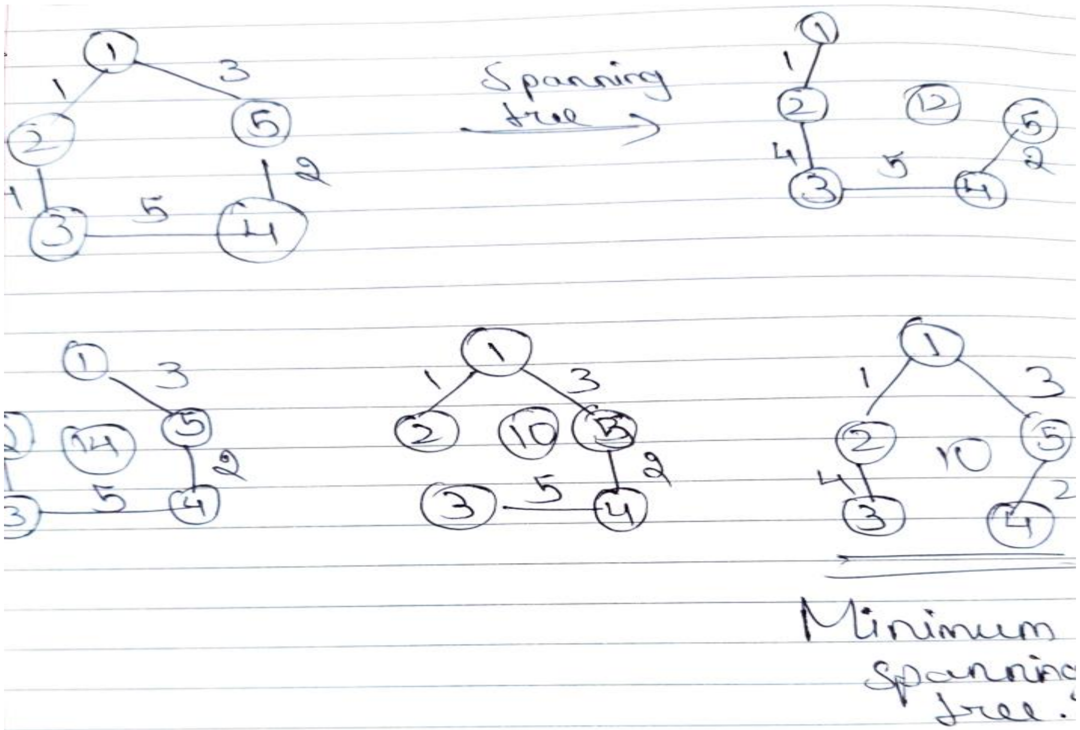
Minimum Spanning of Tree

Definition:

A Minimum Spanning Tree (MST) is a subset of edges of a connected weighted graph that connects all the vertices together with the minimum possible total edge weight.



Properties of Minimum Spanning of Tree

- (n-1) edges
- Weight o MST = Sum of weight o edges of MST
- Max path length between 2 vertices is (n-1)
- There will be only one path from one vertex to another.
- Removal of edges from a graph makes it disconnected.
- Graph with distinct weights where the MST will be unique.

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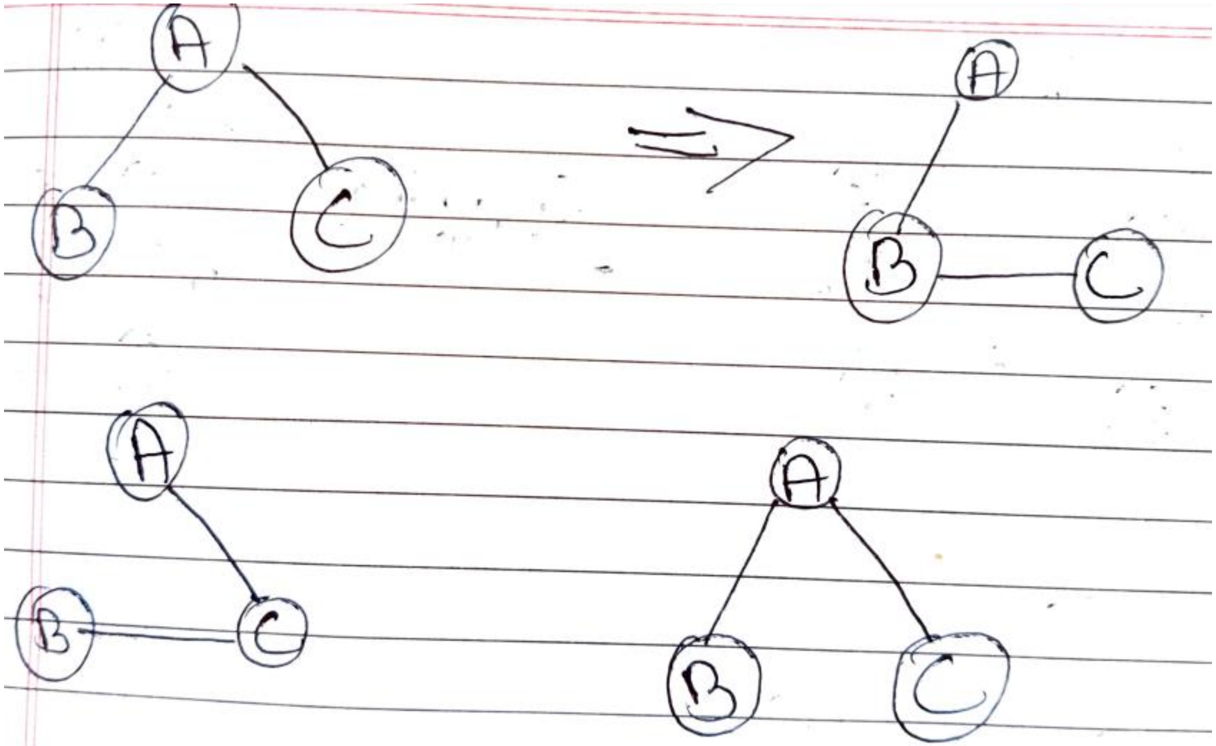
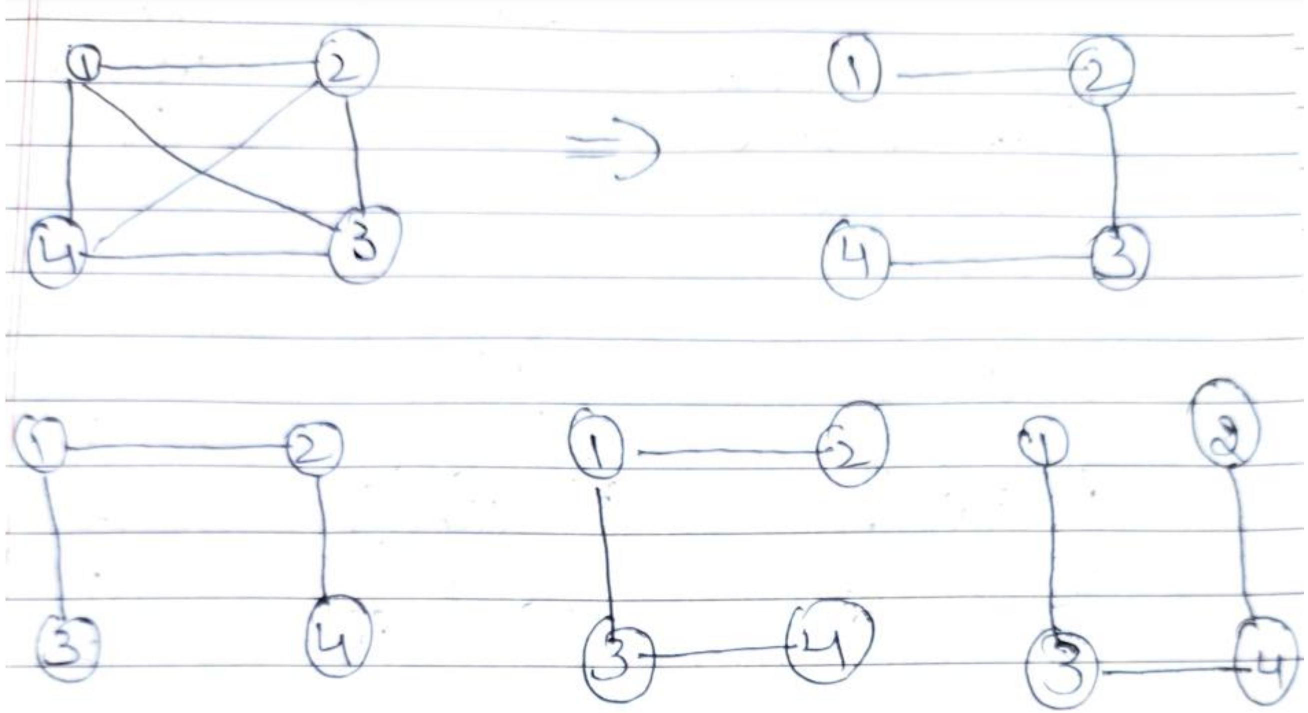
More about Minimum Spanning of Tree



$$e - n + 1$$
$$\cancel{3} - \cancel{3} + 1$$
$$= 1$$

More about Minimum Spanning of Tree



$(e-n+1)$

$6-4+1$

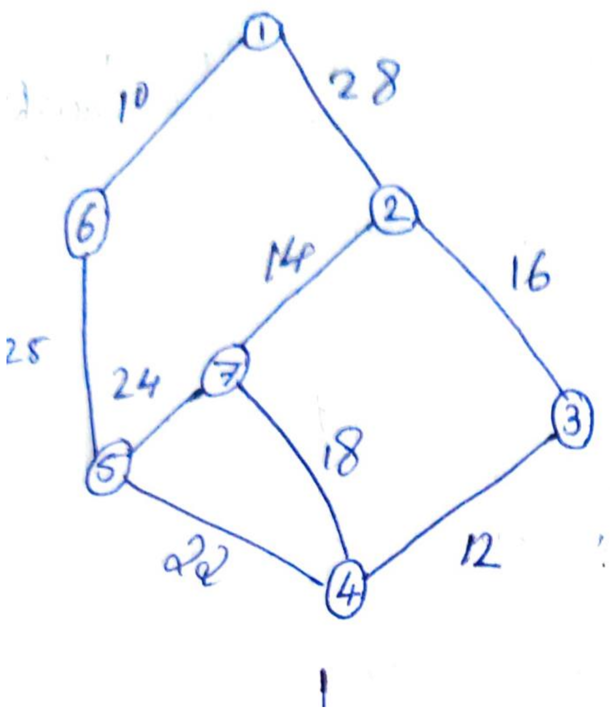
$2+1$

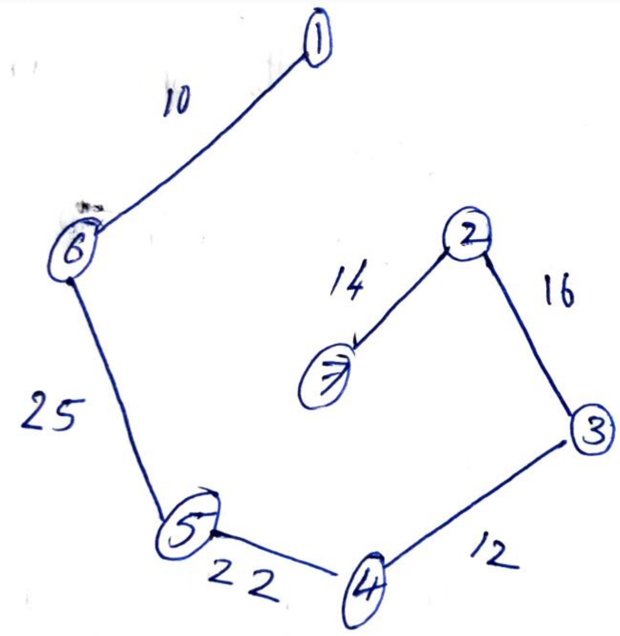
3 //

$n^{n-2} = 16$

are the possible S.T

Kruskal Algorithm





Kruskal Algorithm

Definition:

Kruskal algorithm is **used to find the minimum spanning tree for a connected weighted graph**. The main target of the algorithm is to find the subset of edges by using which we can traverse every vertex of the graph.

Step 1: Arrange all the edges of the given graph G(V,E) in ascending order as per their edge weight.

Step 2: Choose the smallest weighted edge from the graph and check if it forms a cycle with the spanning tree formed so far.

Step 3: If there is no cycle include this edge to spanning tree else discard it.

Step 4: Repeat Step 2 and 3 until (n-1) edges are left.

Question Paper Solution

If G is a tree with n vertices then it has $(n-1)$ edges.

Proof: Let n be the no of vertices in tree.

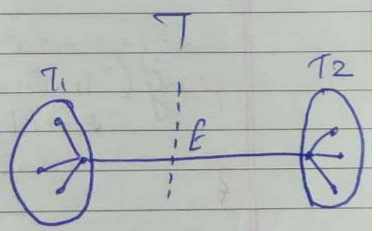
$\Rightarrow$ If $n=1$, then the number of edges $= n-1 = 0$

$\Rightarrow$ If $n=2$, then the number of edges $= n-1 = 1$

$\Rightarrow$ If $n=3$, then the number of edges $= n-1 = 2$

Let us assume that the theorem holds good for all ~~vertices~~ the tree with no of vertices less than n.

Let T be a tree with n vertices.
'e' be an edges with end vertices u & v
Removal of edge disconnect T into 2 components T_1 & T_2.



Let T_1 has n_1 vertices
T_2 has n_2 vertices

Let $n_1 < n$ & $n_2 < n$
$n1 + n2 = n$

Total number of edges in T
$= (n1-1) + (n2-1) + 1$; $n1+2-1$; $\underline{\underline{n-1}}$
$= n1 + n2 - 1 - 1 + 1$

Hence Proved.

Prim’s Algorithm

Definition:

Prim’s algorithm is an algorithm that starts from one vertex and continues to add the edges with the smallest weight until the goal is reached.

Step 1: We have to select a random vertex.

Step 2: Connect the edges that have minimum weights in order to complete the tree.

Step 3: All loops and parallel edges should be removed before finding Minimum Spanning of Tree using Prim’s Algorithm.

Step 4: No cycles should be formed.

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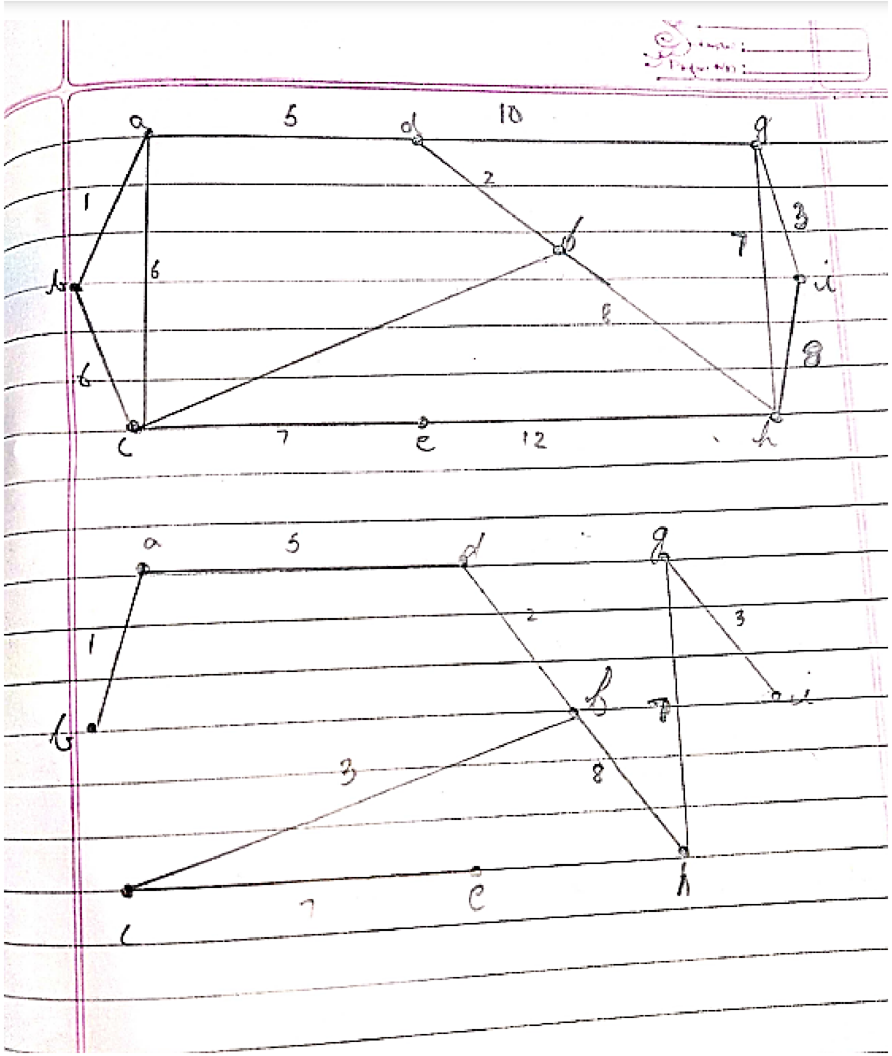
Prim's Algorithm



Difference between Prim's & Kruskal's Algorithm

Prim's Algorithm

- The Tree being formed is always connected at any point of time.
- Prim's algorithm starts from a random vertex and then continues to add the edge with minimum weight to the tree until the (n-1) form of edges is not formed.
- Prim's algorithm is faster for dense graphs.

Kruskal's Algorithm

- The Tree being formed is usually disconnected while solving, but at the ends turns out to be connected.
- Kruskal's algorithm starts from the vertex having the least edge weight and then continue to add the next minimum edge to the tree until (n-1) condition is not met.
- Kruskal's algorithm is faster for sparse graphs.

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Conclusion

Thank You!