Minimum Spanning Tree (MST)

*A **minimum spanning tree (MST)** is defined as a **spanning tree** that has the minimum weight among all the possible spanning trees.*

The minimum spanning tree has all the properties of a spanning tree with an added constraint of having the minimum possible weights among all possible spanning trees. Like a spanning tree, there can also be many possible MSTs for a graph.

Applications of Minimum Spanning Trees:

- **Network design**: Spanning trees can be used in network design to find the minimum number of connections required to connect all nodes. Minimum spanning trees, in particular, can help minimize the cost of the connections by selecting the cheapest edges.
- **Image processing**: Spanning trees can be used in image processing to identify regions of similar intensity or color, which can be useful for segmentation and classification tasks.
- **Biology**: Spanning trees and minimum spanning trees can be used in biology to construct phylogenetic trees to represent evolutionary relationships among species or genes.
- **Social network analysis**: Spanning trees and minimum spanning trees can be used in social network analysis to identify important connections and relationships among individuals or groups.

Algorithms to find Minimum Spanning Tree

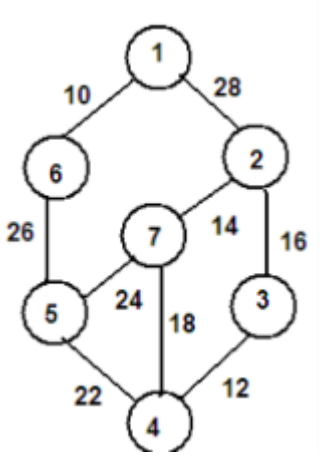
There are several algorithms to find the minimum spanning tree from a given graph, some of them are listed below:

1. Prim's Algorithm
2. Kruskal's Algorithm

KRUSKAL'S ALGORITHM

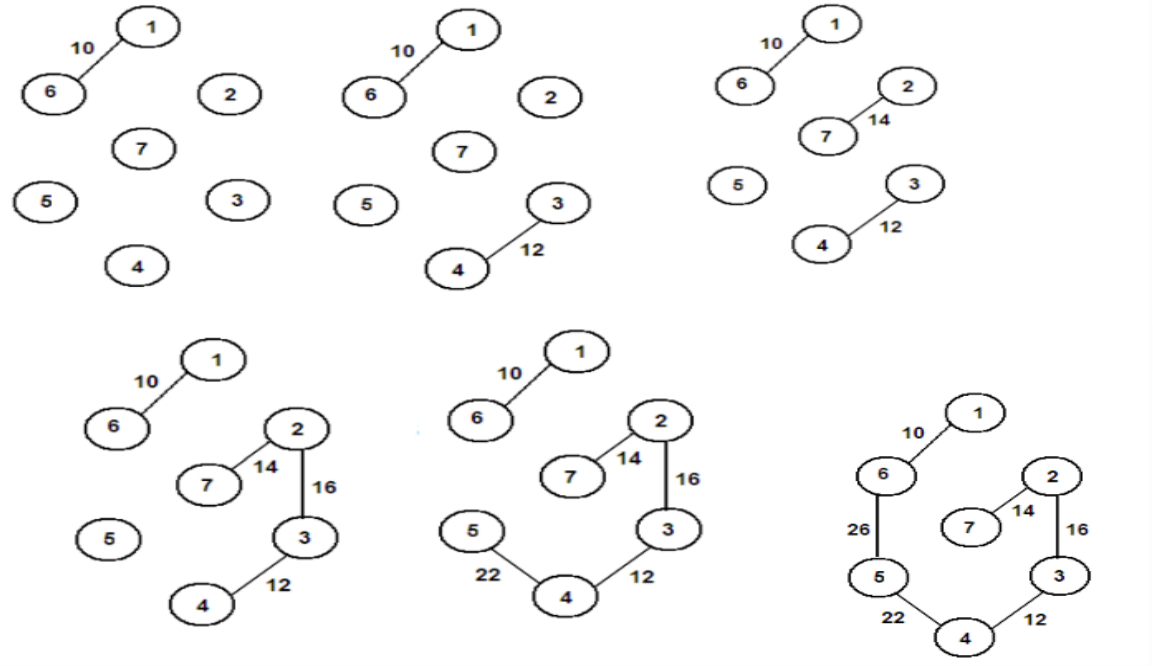
The Kruskal's algorithm follows greedy approach. At every stage of the solution, it takes that edge which has the minimum cost and builds the minimum spanning tree.

Example:



Consider the above graph. Now let us apply the Kruskal's algorithm to construct a minimum spanning tree.

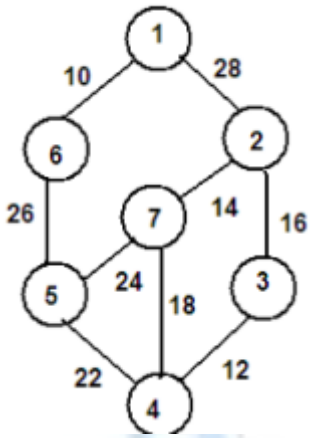
Solution:



PRIM'S ALGORITHM

The other popular algorithm used for constructing the minimum spanning tree is the Prim's algorithm, which also follows the greedy approach. We can consider the same example as above and solve it using Prim's algorithm.

Example:



Solution :

