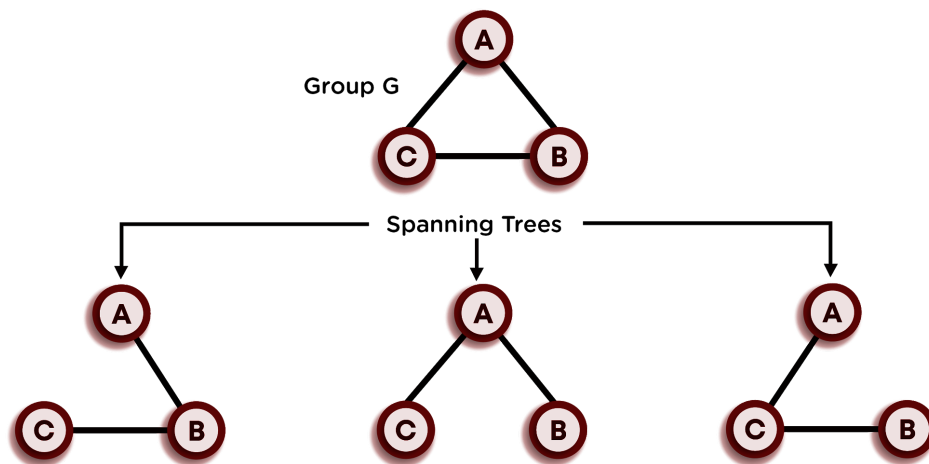# Minimum Spanning Tree(MST)

A tree is a graph, which:
- Is always connected.
- Contains no cycle.

If we are given an undirected and connected graph, a **spanning tree** is a tree that contains all the vertices(V) of the graph and |V|-1 edges. For a given graph, we can have multiple spanning trees.

Refer to the example below for a better understanding of spanning trees.

If there are *n* vertices and *e* edges in the graph, then any spanning tree corresponding to that graph contains *n* vertices and *n-1* edges.

Properties of spanning trees:
- A connected and undirected graph can have more than one spanning tree.
- The spanning tree is free of loops, i.e., it is acyclic.
- Removing any one of the edges will make the graph disconnected.
- Adding an extra edge to the spanning tree will create a loop in the graph.

Minimum Spanning Tree(MST)

In a weighted graph, the MST is a spanning tree with a minimum weight than all other spanning trees of that graph. Refer to the image below for better understanding, where the edges marked in bold represent the edges of the spanning tree
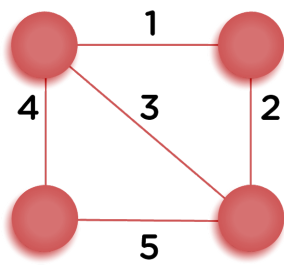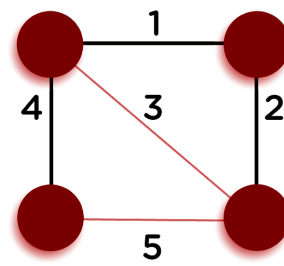
Undirected
graph
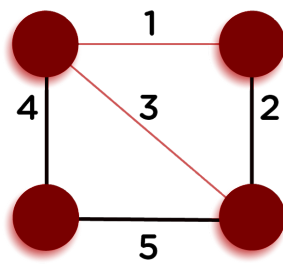
Spanning
tree

Cost=11(=4+5+2)

Minimum Spanning
tree

Cost=7(=4+1+2)