Prim's Algorithm

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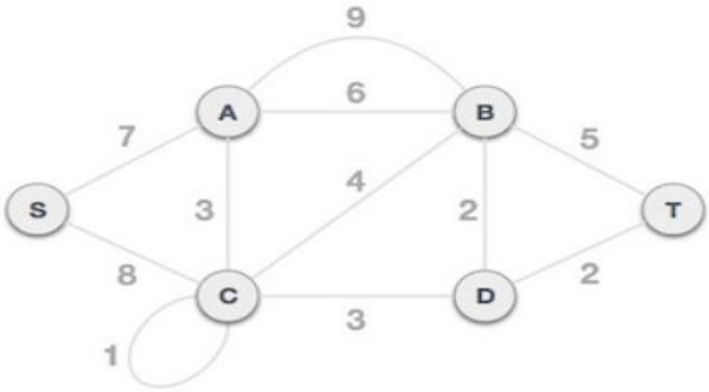
Prim's Algorithm

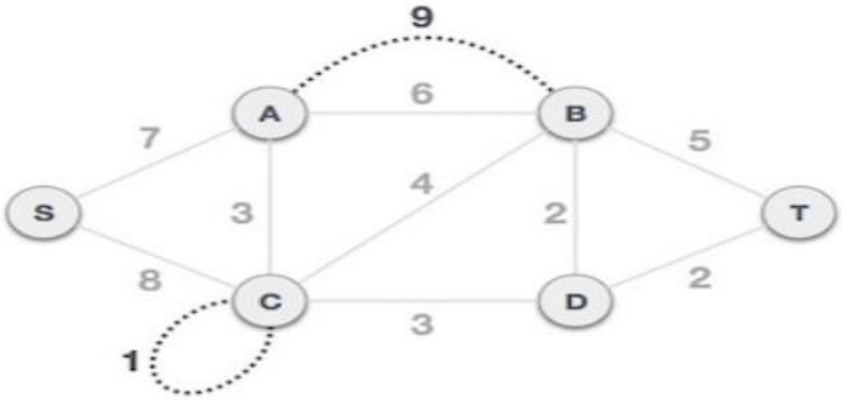
- It is a greedy algorithm that finds a **MST** for a **weighted undirected graph**.
- Start from an arbitrary vertex and keep adding edges with the lowest weight until the MST if formed.

Steps

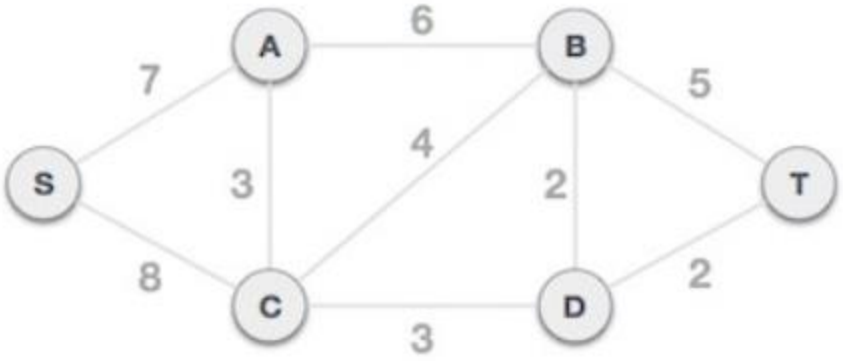
1. Remove all loops and parallel edges
2. Initialize the minimum spanning tree with a vertex chosen at random.
3. Find all the edges that connect the tree to new vertices, find the minimum and add it to the tree
4. Keep repeating step 3 until we get a minimum spanning tree

Prim's Algorithm Working

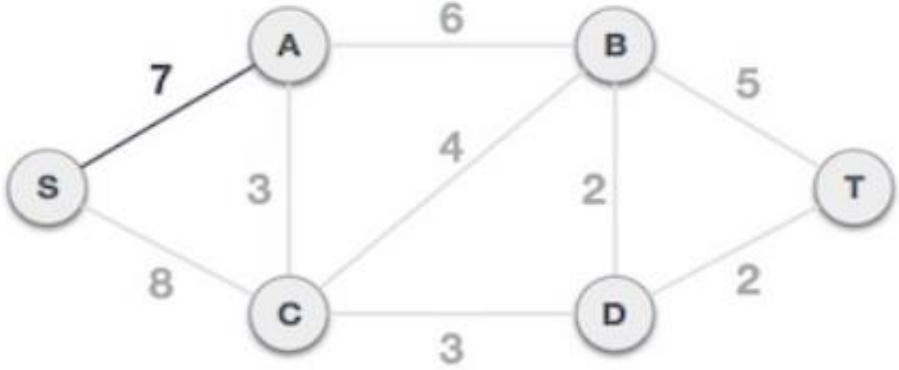




Step 1:
Remove all loops and parallel edges from the given graph. In case of parallel edges, keep the one which has the least cost



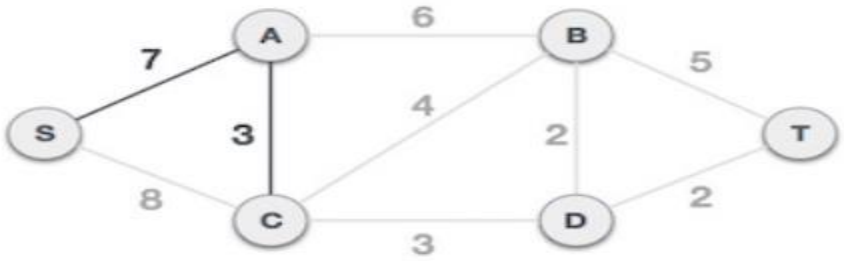
Step 2:
Choose any arbitrary node as root node. Say S



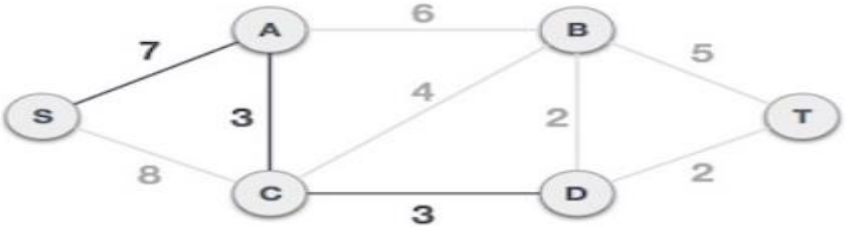
Step 3:
Check outgoing edges and select the one with less cost

Prim's Algorithm Working

Now, the tree S-7-A is treated as one node and we check for all edges going out from it. We select the one which has the lowest cost and include it in the tree.

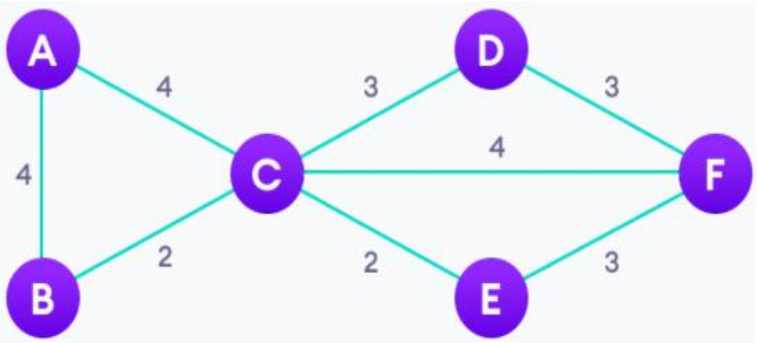


After this step, S-7-A-3-C tree is formed. Now we'll again treat it as a node and will check all the edges again. However, we will choose only the least cost edge. In this case, C-3-D is the new edge, which is less than other edges' cost 8, 6, 4, etc.



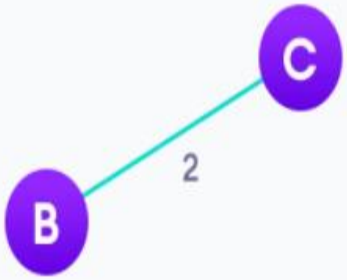
After adding node **D** to the spanning tree, we now have two edges going out of it having the same cost, i.e. D-2-T and D-2-B. Thus, we can add either one. But the next step will again yield edge 2 as the least cost. Hence, we are showing a spanning tree with both edges included.

Prim's Algorithm: Example

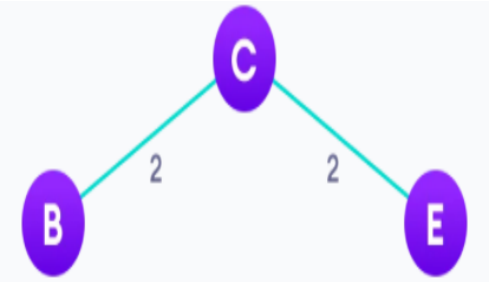


Start with a weighted graph

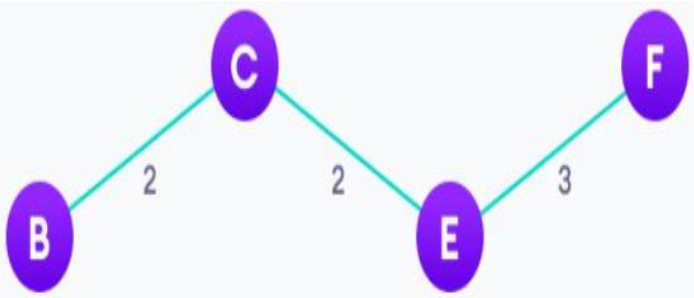
Choose a vertex



Choose the shortest edge from this vertex and add it

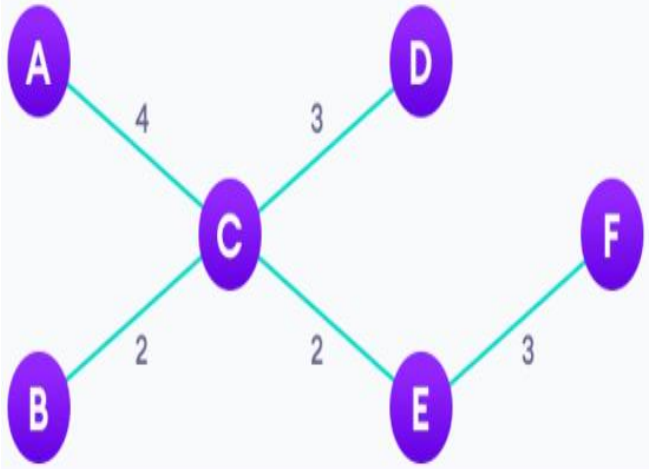


Choose the nearest vertex not yet in the solution



Choose the nearest edge not yet in the solution,

if there are multiple choices, choose one at random



Repeat until you have a spanning tree