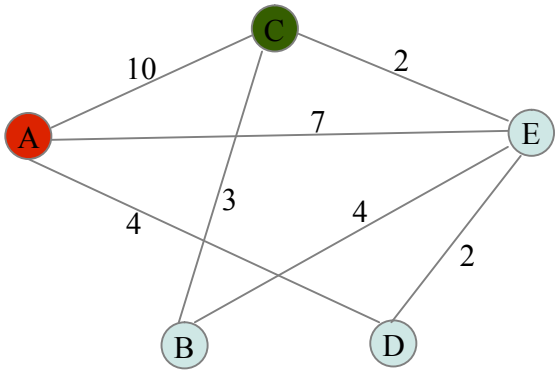
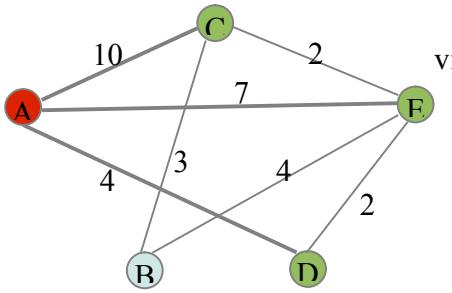
Description of Dijkstra's Algorithm

Dijkstra's algorithm has the purpose of finding the shortest possible path inside a **directed** or **undirected** graph. The algorithm has a side effect of generating the shortest path tree (SPT) for the given graph. Not MST !!



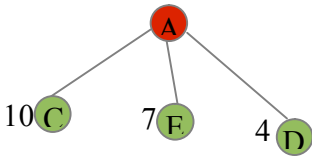
Trying to get from A to C in the shortest path (shortest path = minimum weight sums)

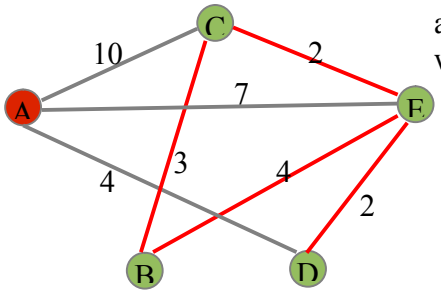


visited.

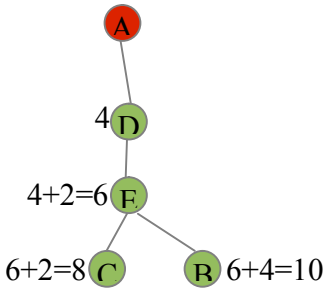
This first step marks the C, E, and D nodes as

In this moment the SPT is :





In this step, and following we check to see if there are any alternative routes to existing nodes which are better. The SPT is :

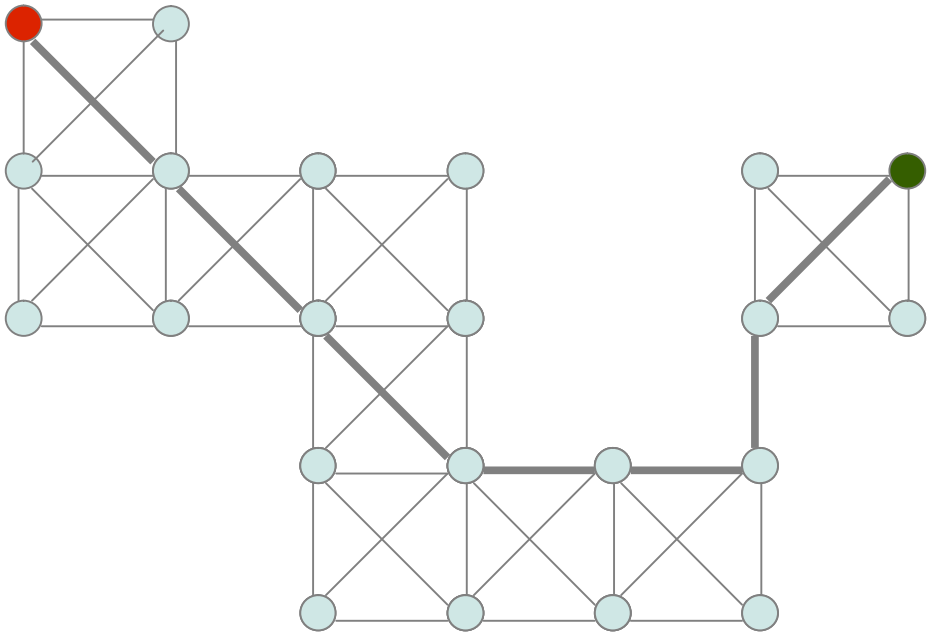


All edges have been processed. We know the shortest path (A → D → E → C) which adds up to a cost of 8. Note that the nodes are visited in alphabetical order. In this second step, before finding E → C, we found D → E (which yielded path A → D → E shorter than A → E).

The SPT contains the shortest path from A to ALL of the other nodes in the graph! It needs to be computed just once. Because of this it is used in routing algorithms. Routers compute from time to time

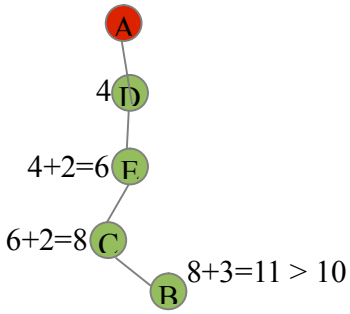
the shortest path from one place to another. After that information goes on the shortest path.
Wikipedia has a good Dijkstra's Algorithm animation :
http://upload.wikimedia.org/wikipedia/commons/4/45/Dijksta_Anim.gif
However it does not show how the SPT is formed.

Also on Wikipedia here is another animation :
http://upload.wikimedia.org/wikipedia/commons/2/23/Dijkstras_progress_animation.gif
This deals with a graph that looks as follows :



Note that all the edges in the graph have weight 1. This is unrealistic in real because a diagonal edge is $\sqrt{(2)}$ not 1. In practice it should be implemented using $\sqrt{(2)}$.

! Dijkstra works on directed graphs. Prim doesn't.
Even if Prim finds the MST it doesn't mean that that MST which Prim found includes the shortest path from a node to another ! If we apply Prim on the graph on the first page, we get a linear MST which looks like :



! Note the shortest path in the MST tree from A to B is 11.

In the SPT it's 10.