Dijkstra's algorithm

For each vertex (or node) in a graph, Dijkstra's algorithm finds the shortest path from the source node to that vertex. Figure 1. shows a graph with vertices A - F and edges with distances of 10,15,12,1,2 and 5.

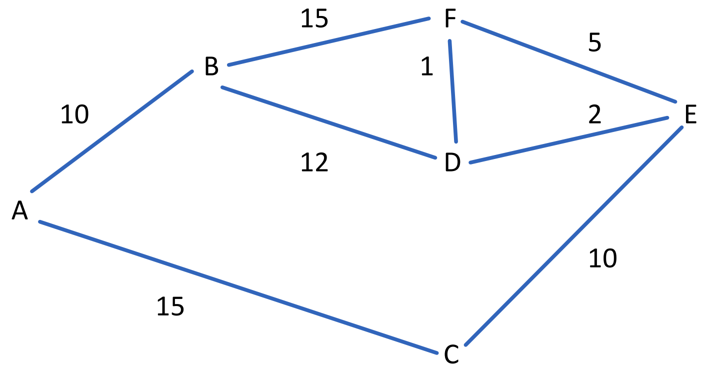


Figure 1. Graph in its initial state before the algorithm is applied.

When the algorithm is finished, the graph will have calculated the shortest paths.

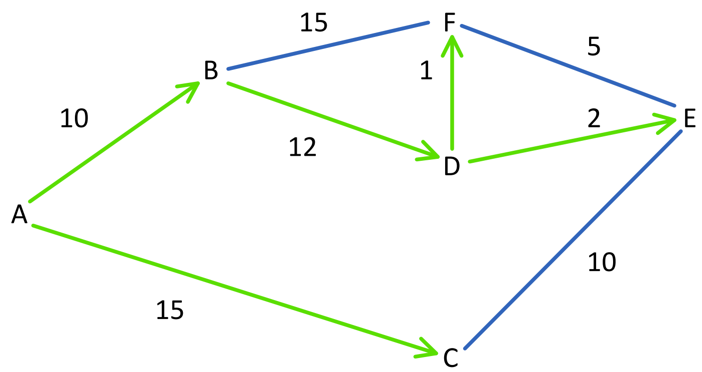
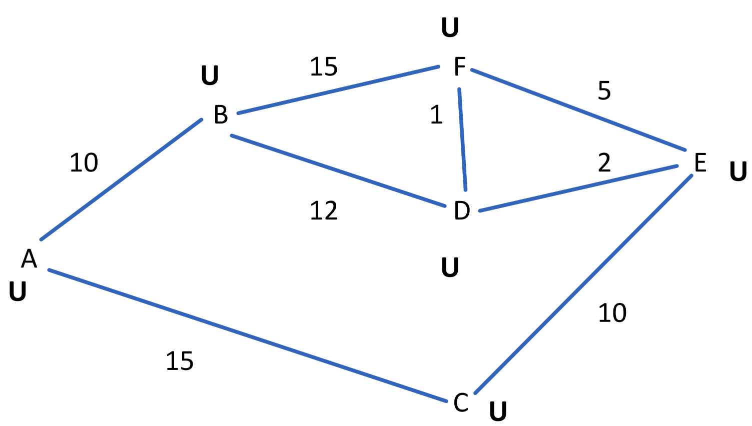


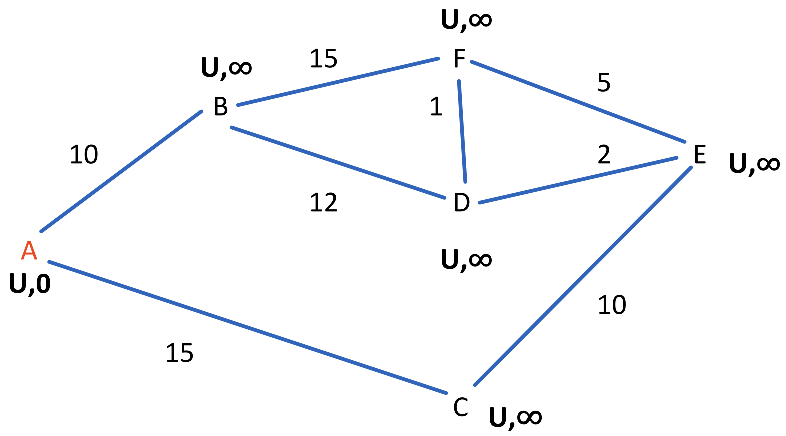
Figure 2. Graph with shortest paths from A to all other vertices.

Running the algorithm

Iteration1.STEP1 - Set all the nodes to unvisited, marking them with a U.



Iteration1.STEP2 - Assign every node a temporary distance - set it to zero for the source node, A, and set all other nodes to infinity. Set the current node to A.



Iteration1.STEP3 - For each **unvisited** node *directly attached* to the current node, calculate the new temporary distance (follow the sequence of Figures 3a - 3c).

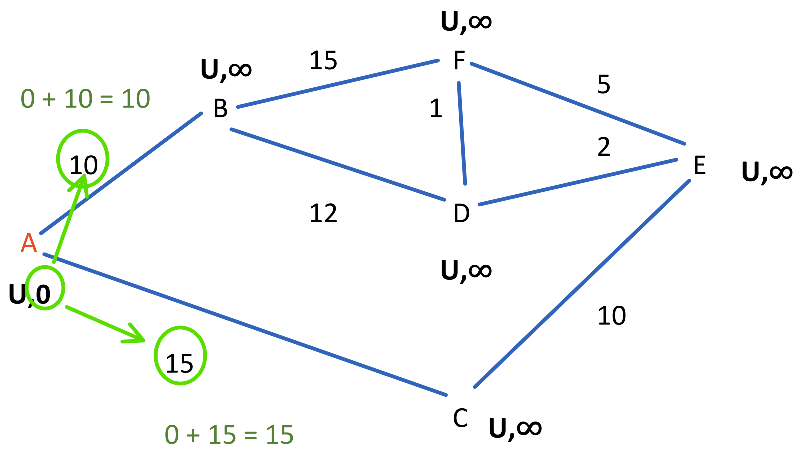


Figure 3a. Add the temporary distance on the current node to the edges of the unvisited nodes.

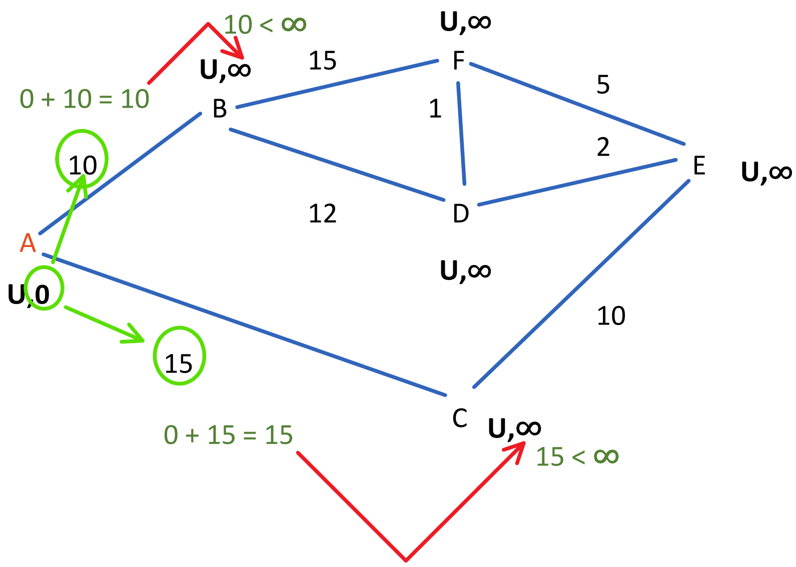


Figure 3b. Compare the new temporary distance with the temporary distance on the unvisited node. For each node, record the value that is smaller.

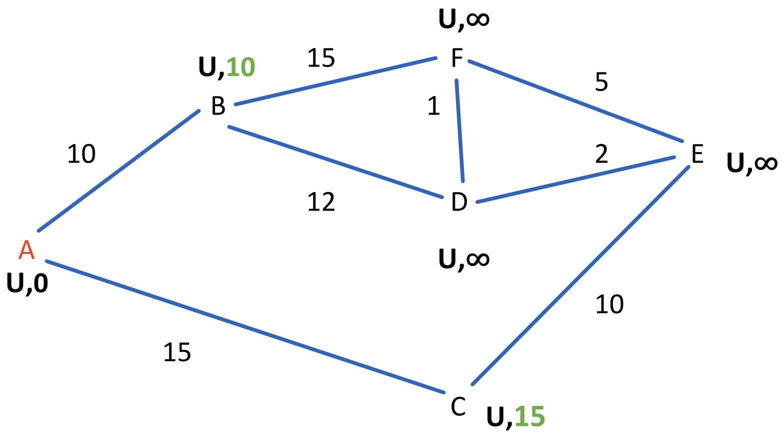
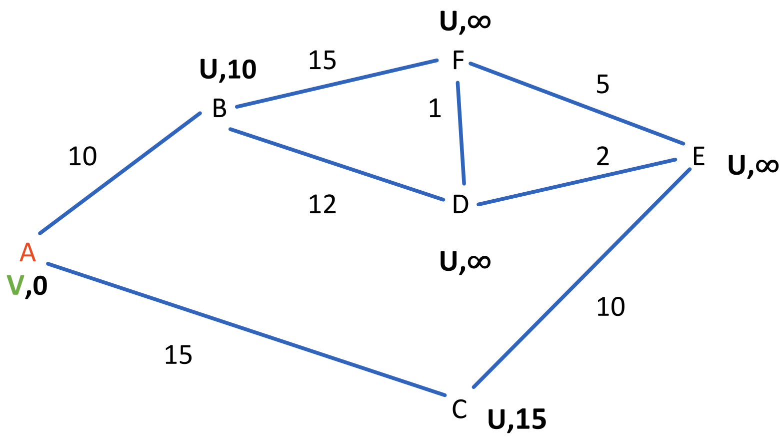


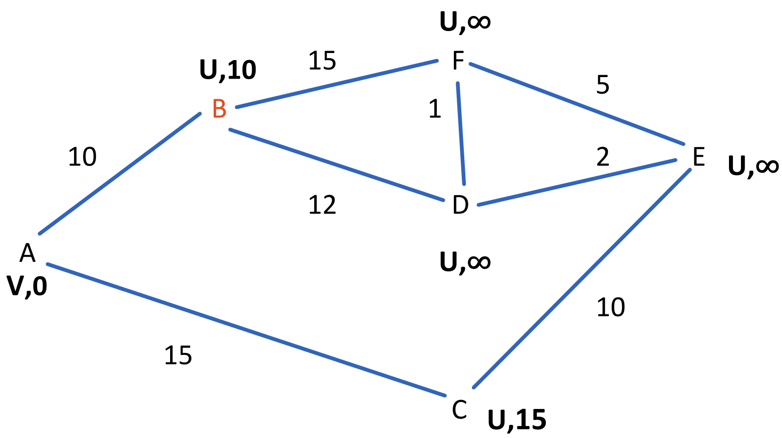
Figure 3c. Update the temporary distance on the unvisited node with the smaller value.

Iteration1.STEP4 - Mark the current node as visited.



Iteration1.STEP5 - Stop the algorithm if all the nodes are visited. There are still unvisited nodes. Continue algorithm.

Iteration1.STEP6 - Set the current node to the node with the smallest temporary distance in the unvisited set. Start a new iteration, jumping to STEP3.



Iteration2.STEP3 - For each unvisited node directly attached to the current node, calculate the new temporary distance (follow the sequence of Figures 4a - 4c).

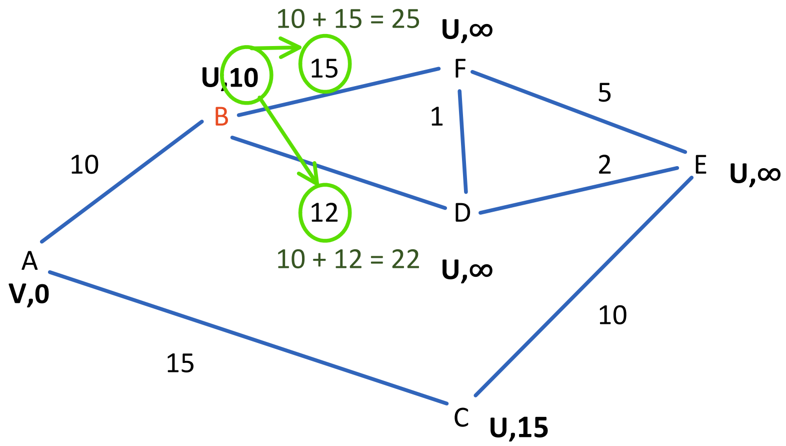


Figure 4a. Add the temporary distance on the current node to the edges of the unvisited nodes.

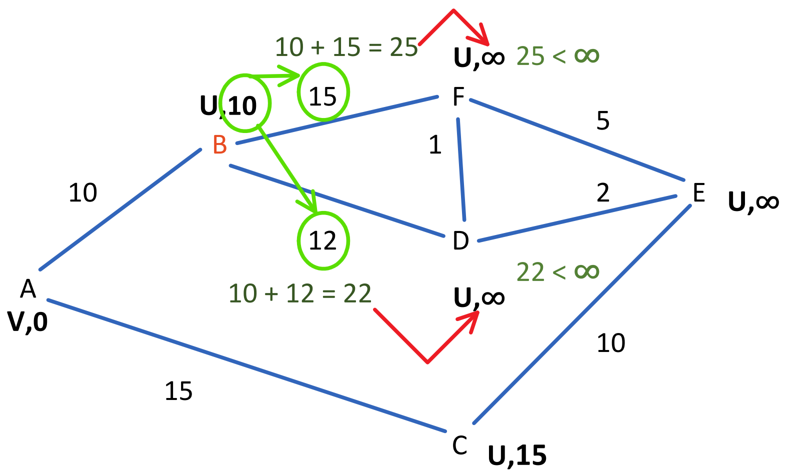


Figure 4b. Compare the new temporary distance with the temporary distance on the unvisited node. For each node, record the value that is smaller.

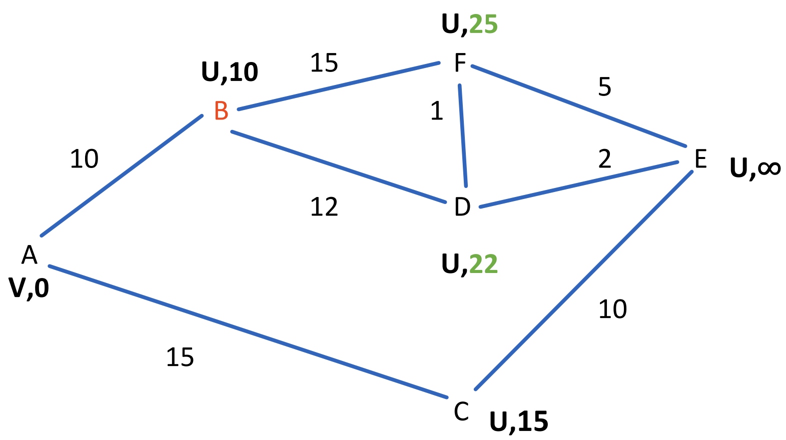
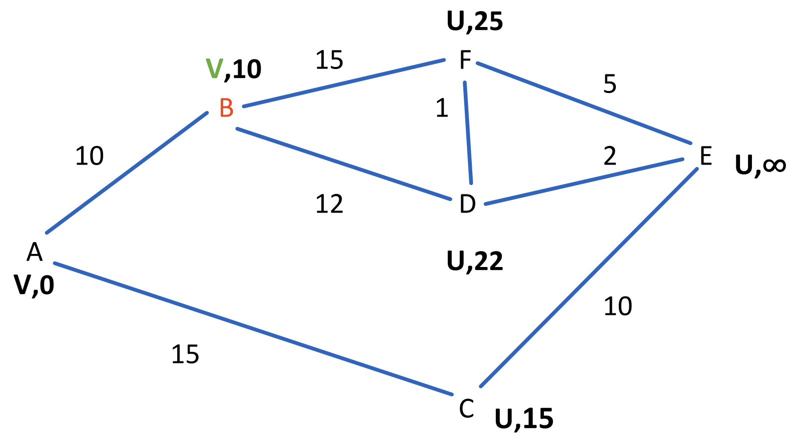


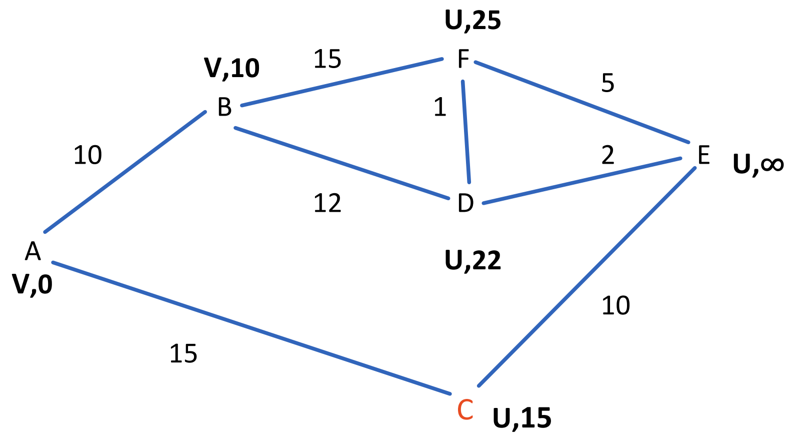
Figure 4c. Update the temporary distance on the unvisited node with the smaller value.

Iteration2.STEP4 - Mark the current node as visited.

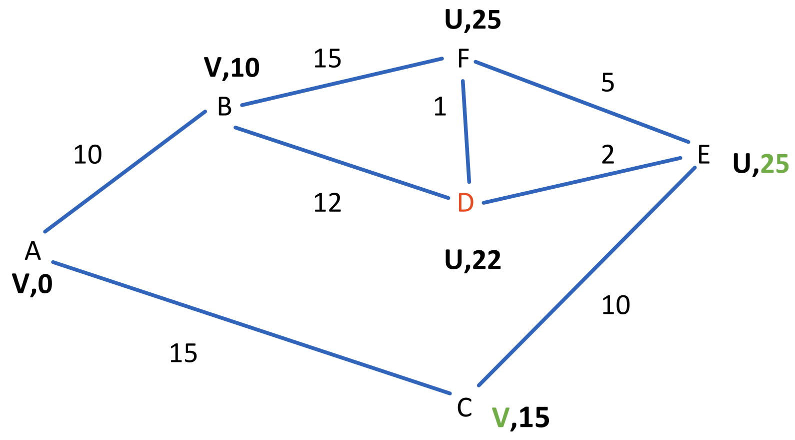


Iteration2.STEP5 - Stop the algorithm if all the nodes are visited. There are still unvisited nodes. Continue algorithm.

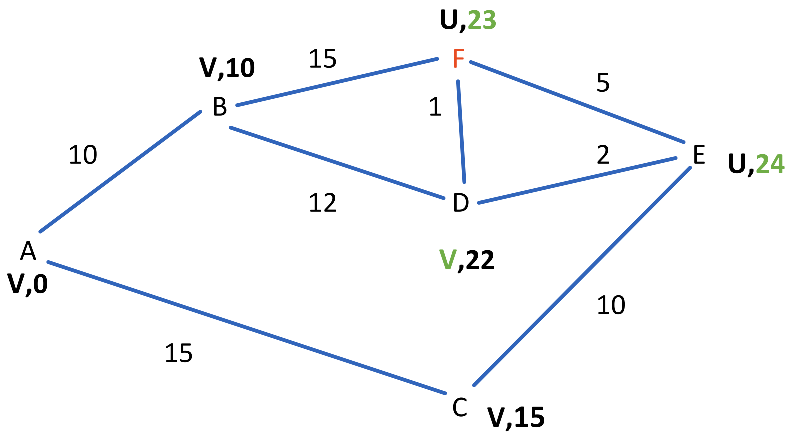
Iteration2.STEP6 - Set the current node to the node with the smallest temporary distance in the unvisited set. Start a new iteration, jumping to STEP3.



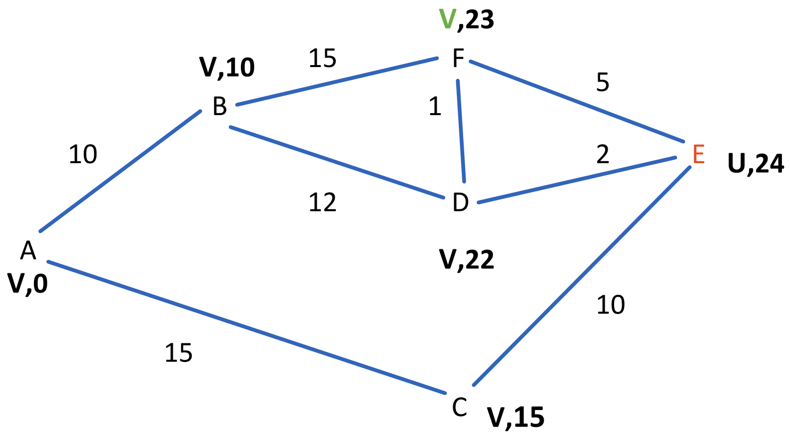
Iteration 3 - Run the same steps (3 - 6) as before. Updates are in green; new current node is in red.



Iteration 4 - Run steps 3 - 6 to get the following result.



Iteration 5 - Run steps 3 - 6 again; the temporary distance on E is not updated (24 < 23 + 5).



Iteration 6 - Run steps 3 - 5; the algorithm will stop. The temporary distance on a vertex represents the distance from A to it, along its shortest path.