

Dijkstra's Algorithm

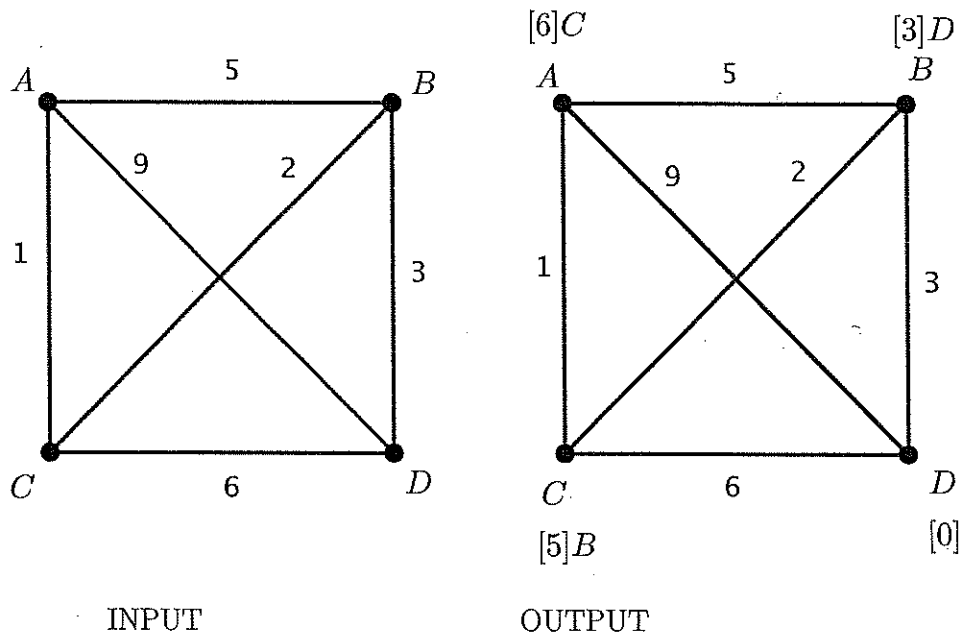
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Dijkstra's Algorithm is EFFICIENT and OPTIMAL

Output from Dijkstra's Shortest Path Algorithm for a Weighted Graph

A vertex is selected to be the destination. It is given the label $[0]$. Each other vertex is ultimately labeled with a number (the total shortest distance to the destination vertex) and the name of a vertex (the first step to take along the shortest path). So the label $[12]D$ means "you are at a distance of 12 from your final destination, and you should now go to D ."

Example:



Use the output to determine the shortest path from A to D . List the vertices along this path.

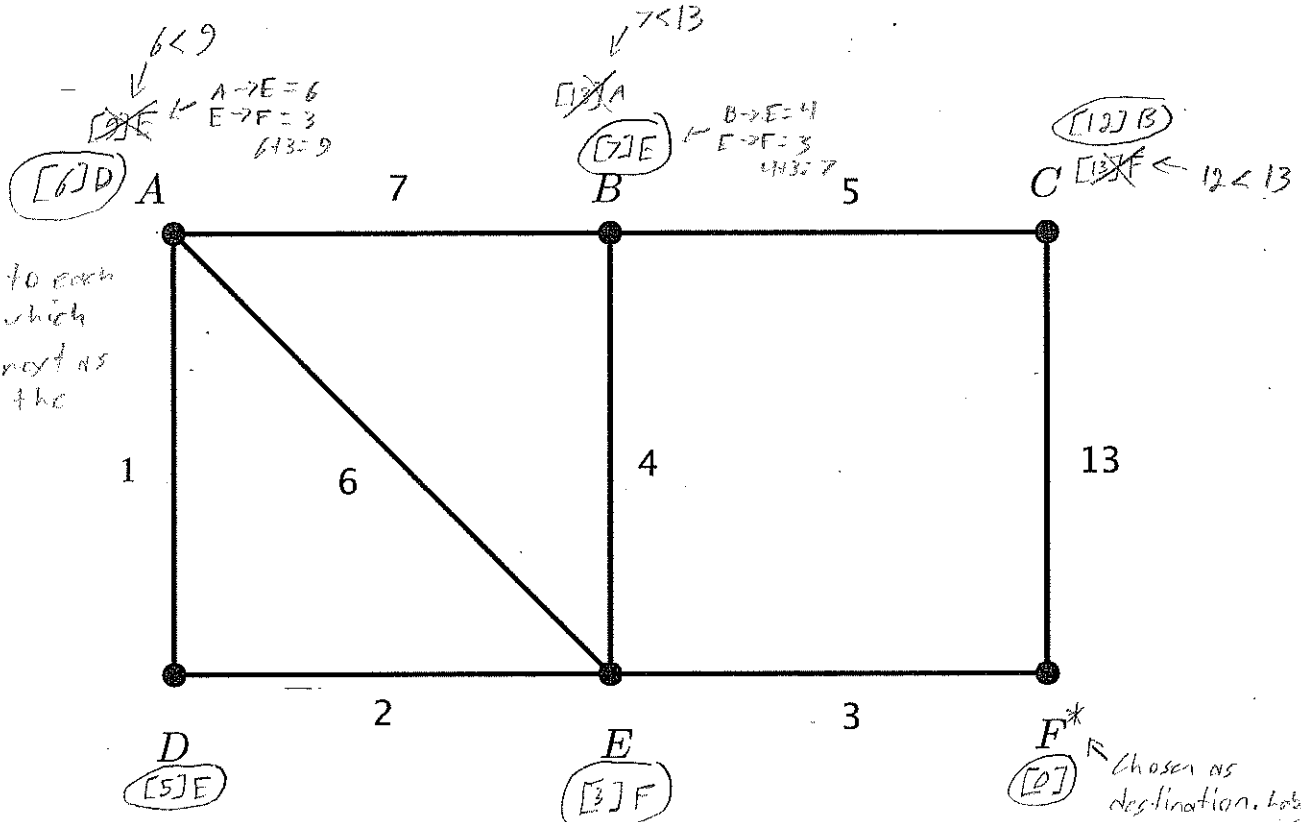
$A \rightarrow C \rightarrow B \rightarrow D$

Running Dijkstra's Algorithm

1. A vertex is selected to be the destination. It is given the label [0]. Each other vertex is ultimately labeled with a number (the total shortest distance to the destination vertex) and the name of a vertex (the first step to take along the shortest path). Initially these labels are temporary and may be revised. They are made permanent one by one.
2. Locate the vertex X having the temporary label with the smallest distance. Circle that label, marking it as permanent.
3. For each vertex Y directly connected to X having a temporary label, add these numbers:
 - the weight of the edge from this vertex to X , and
 - the distance from X to the destination.

Label this vertex Y with this sum (distance) and with X UNLESS Y is already labeled with a smaller distance.

4. Repeat steps 2 and 3 until all labels are permanent.



* The letter next to each number tells you which vertex to go to next as you move toward the destination.

D has the smallest label, so make that permanent. Then do the same thing you did with E. You can ignore writing a new label for E since E already has a permanent label.

3 is smaller than 13, so we make this label permanent when doing step 2. Then, label the vertices that are directly connected to E with the distance from that vertex to E plus the distance from E to F, which is 3 in this case. Then write E next to these numbers.