

(*)

Dijkstra's Algorithm

(Single Source Shortest path)

- o Dijkstra's Algorithm is a Graph Algorithm that finds the shortest path from a source vertex to all other vertices in a Graph (Single Source shortest path).
- o It is Developed by Edsger Dijkstra in 1959.
- o It is type of Greedy Algorithm that only works on Weighted Graphs having Positive weights.
- It Works for directed or Undirected Graph.

Algorithm

- (i) Initialize weights, source node = 0, and other nodes = ∞
- (ii) For Current Node, consider all Unvisited nodes and calculate the distance. (Always assign smaller values).
- (iii) When all neighbors are considered current node is marked visited and never explored again.

#JPwebdevelopers

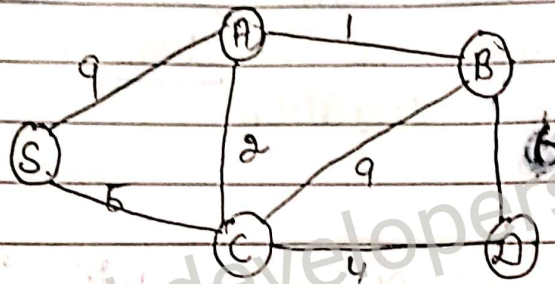
#JPNNotes

(iv) Stop when all nodes are visited

Formula of Relaxation! if $(d[u] + c[u,v] < d[v])$
 $d[v] = d[u] + c[u,v]$

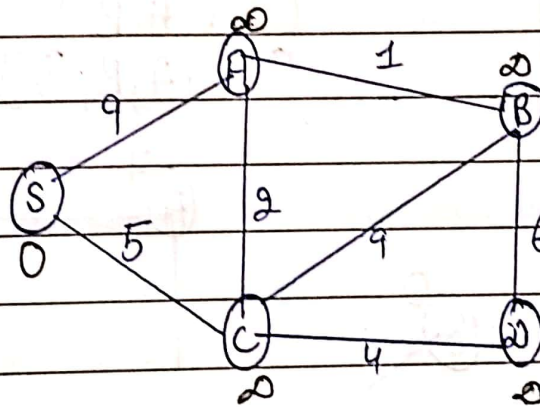
Example

↓
initial cost
Cost from one node to another



Sol:

Set of Visited Vertices (s)	S	A	B	C	D
	0	∞	∞	∞	∞



S → A
S → C

Set of Visited Vertices (S)	S	A	B	C	D
[S]	0	9	∞	5	∞

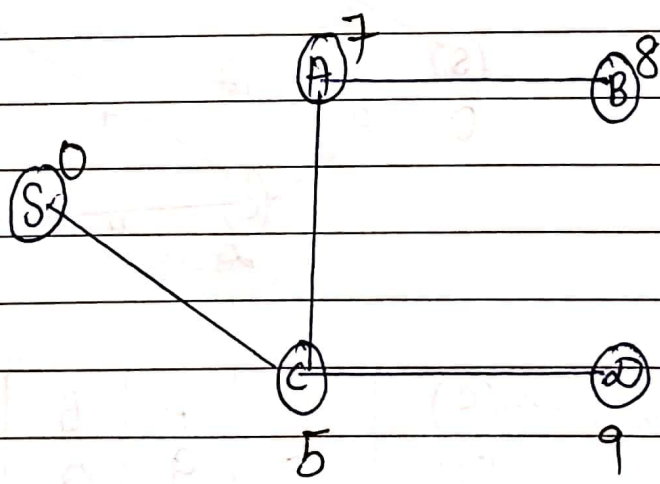
→ Choosing vertex C since it has not been visited (not in S) and $dist[C]$ is minimum

Set of Visited Vertices (S)	S	A	B	C	D
[S]	0	9	∞	5	∞
[S, C]	0	7	14	5	9

→ Continuing on similar lines, and steps get repeated till all the vertices are visited (added to S). $dist[]$ also get updated in every iteration.

Result:-

Set of Visited (S)	S	A	B	C	D
[S]	0	9	∞	5	∞
[S, C]	0	7	14	5	9
[S, C, A]	0	7	8	5	9
[S, C, A, B]	0	7	8	5	9
[S, C, A, B, D]	0	7	8	5	9



Notes by: - jpwebdevelopers

Advantages of Dijkstra's Algorithm

- It is very popular in the Geographical Maps.
- It is used to identify the shortest path.
- It is used to locate the points on the map that correspond to the graph's vertices.

Disadvantages

- It conducts a blind scan, which takes a lot of processing time.

Applications

- In applications for social networking.
- To determine the quickest route.

Complexity

Time complexity - $O(E \log V)$
Space " " - $O(V)$