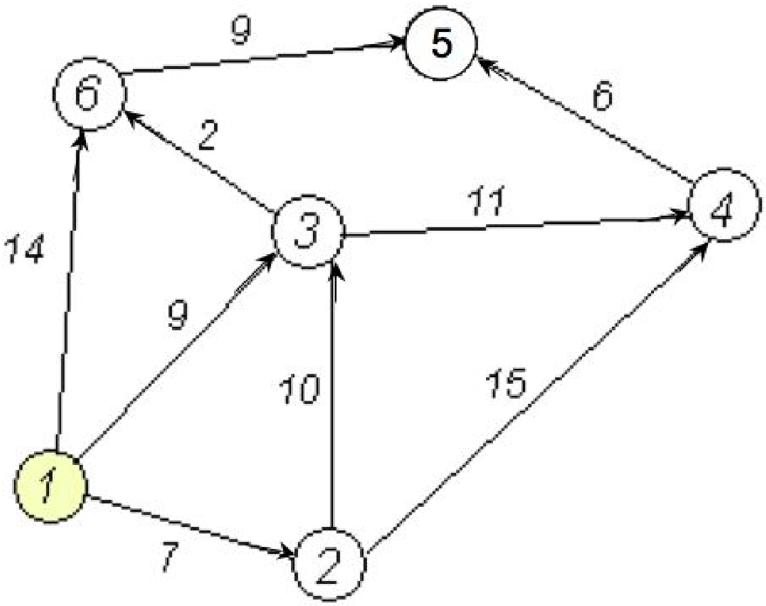
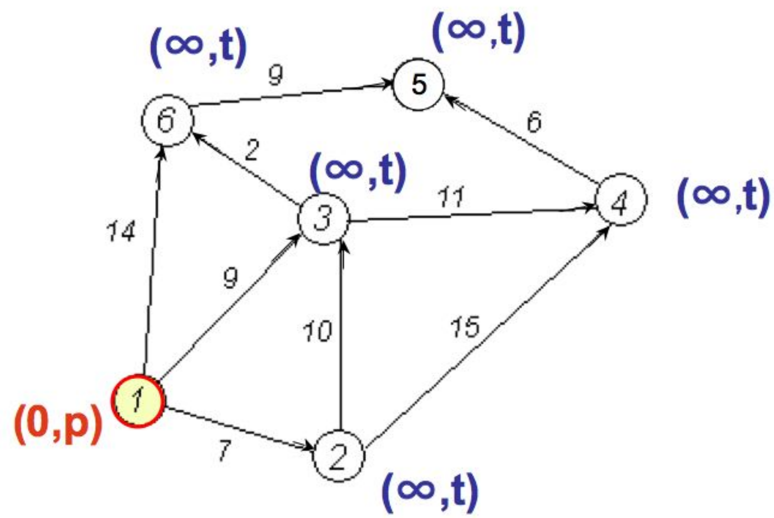
Dijkstra's Algorithm: Example



We want to find the shortest path from node 1 to all other nodes using Dijkstra's algorithm.

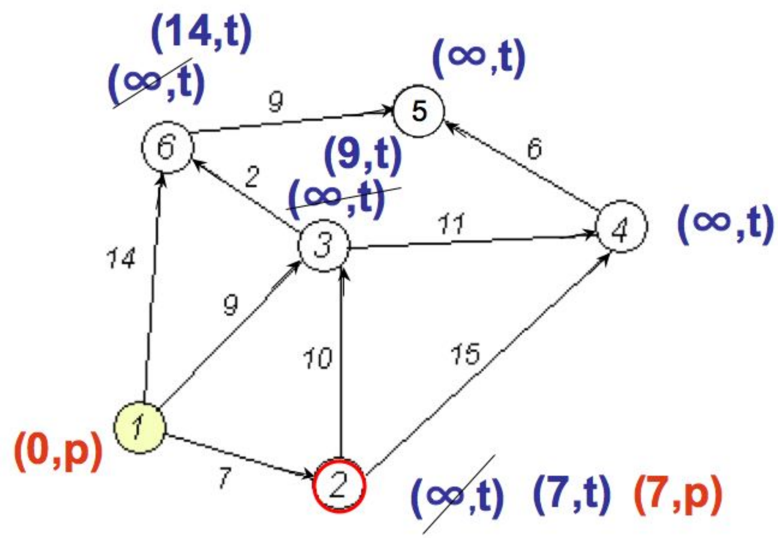
Initialization - Step 1

- Node 1 is designated as the current node
- The state of node 1 is $(0, p)$
- Every other node has state (∞, t)



Step 2

- Nodes 2, 3,and 6 can be reached from the current node 1
- Update distance values for these nodes

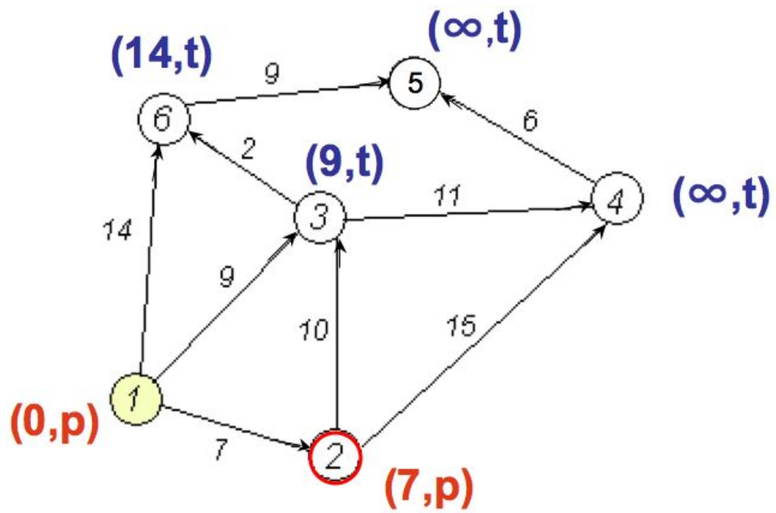


$$d_2 = \min\{\infty, 0+7\} = 7$$
$$d_3 = \min\{\infty, 0+9\} = 9$$
$$d_6 = \min\{\infty, 0+14\} = 14$$

- Now, among the nodes 2, 3, and 6, node 2 has the smallest distance value
- The status label of node 2 changes to permanent, so its state is $(7, p)$, while the status of 3 and 6 remains temporary
- Node 2 becomes the current node

Step 3

Graph at the end of Step 2

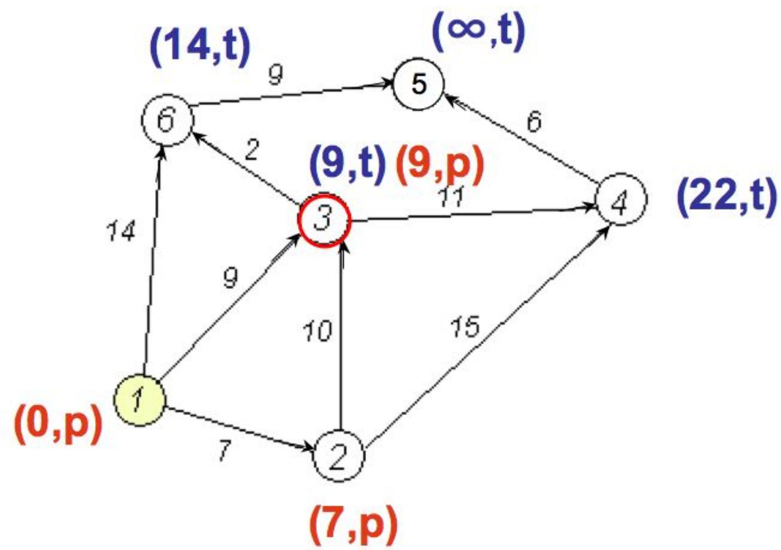


We are not done, not all nodes have been reached from node 1, so we perform another iteration (back to Step 2)

Another Implementation of Step 2

- Nodes 3 and 4 can be reached from the current node 2
- Update distance values for these nodes

$$d_3 = \min\{9, 7 + 10\} = 9$$
$$d_6 = \min\{\infty, 7 + 15\} = 22$$



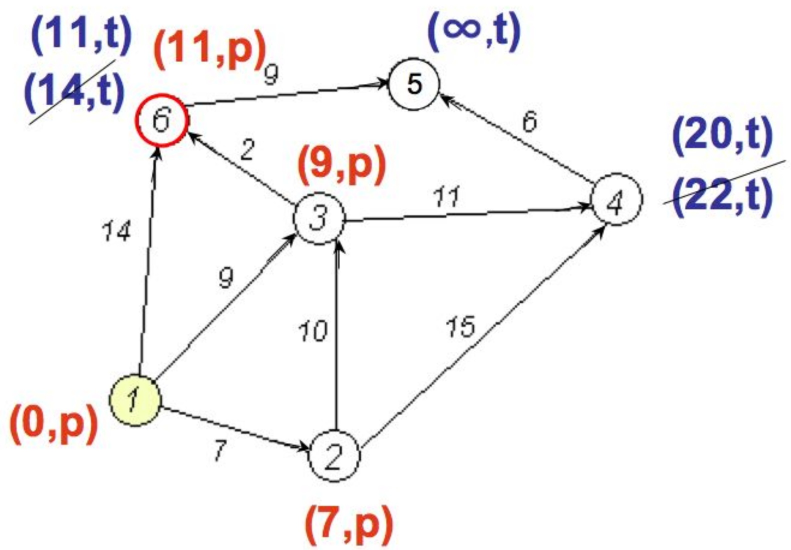
- Now, between the nodes 3 and 4 node 3 has the smallest distance value
- The status label of node 3 changes to permanent, while the status of 6 remains temporary
- Node 3 becomes the current node

We are not done (Step 3 fails), so we perform another Step 2

Another Step 2

- Nodes 6 and 4 can be reached from the current node 3
- Update distance values for them

$$d_4 = \min\{22, 9 + 11\} = 20$$
$$d_6 = \min\{14, 9 + 2\} = 11$$



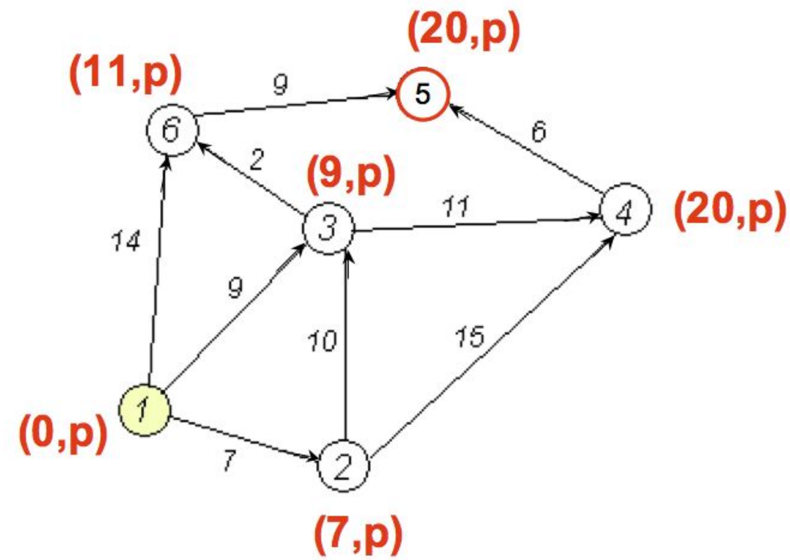
- Now, between the nodes 6 and 4 node 6 has the smallest distance value
- The status label of node 6 changes to permanent, while the status of 4 remains temporary
- Node 6 becomes the current node

We are not done (Step 3 fails), so we perform another Step 2

Another Step 2

- Node 5 can be reached from the current node 6
- Update distance value for node 5

$$d_5 = \min\{\infty, 11 + 9\} = 20$$



- Now, node 5 is the only candidate, so its status changes to permanent

- Node 5 becomes the current node

From node 5 we cannot reach any other node. Hence, node 4 gets permanently labeled and we are done.