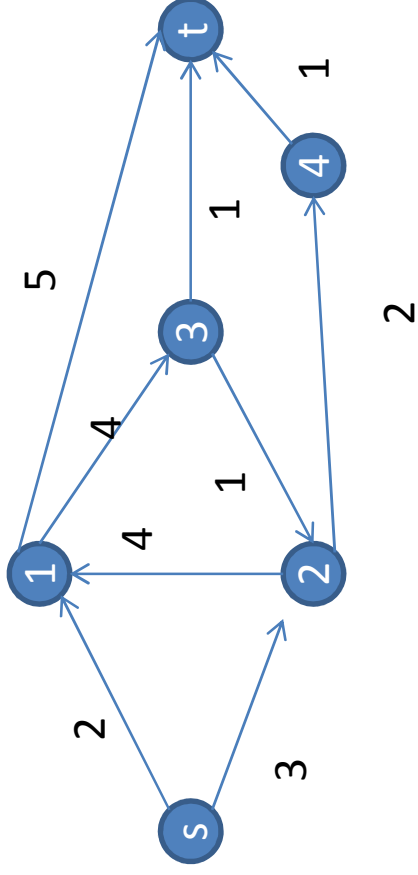


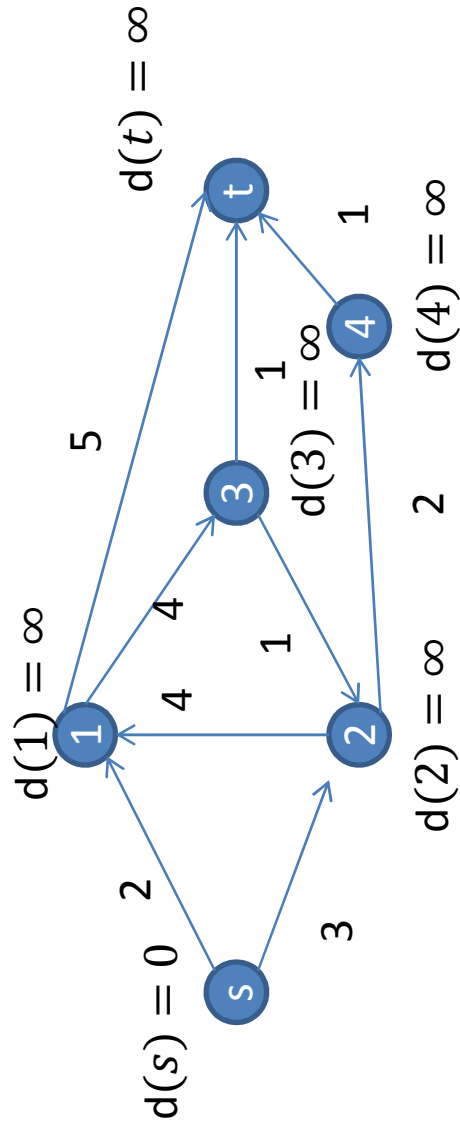
Recitation 7

Deterministic Models

Find a shortest path from s to t using Dijkstra Algorithm

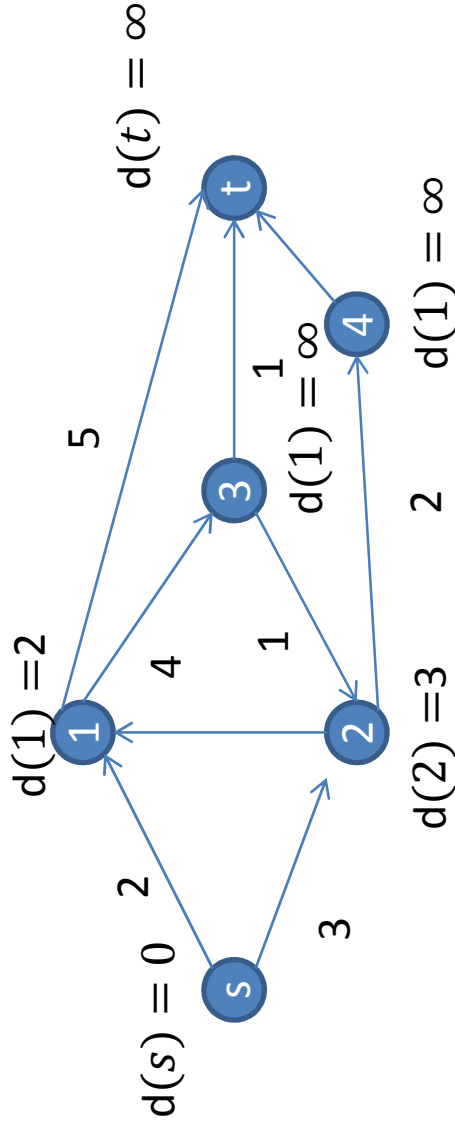


Initialization: $d(s) = 0, d(i) = \infty$

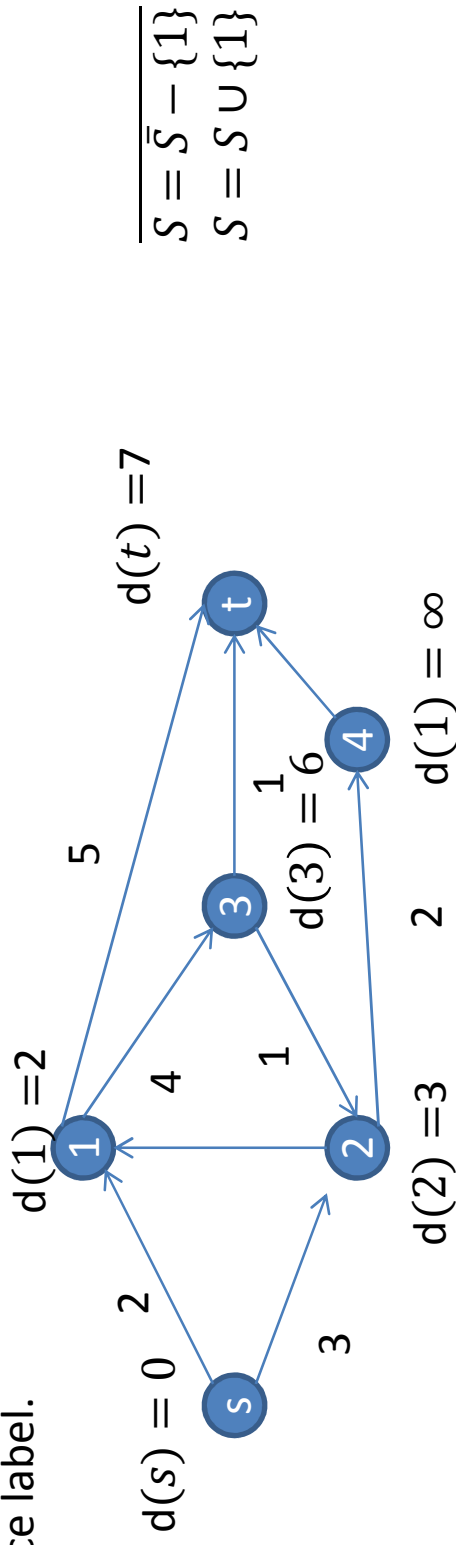


Pick the node with minimum distance label and update distance of adjacent nodes. In this step s is the node with minimum distance label.

Let $\bar{S} = \bar{S} - \{s\}$ and $S = S \cup \{s\}$

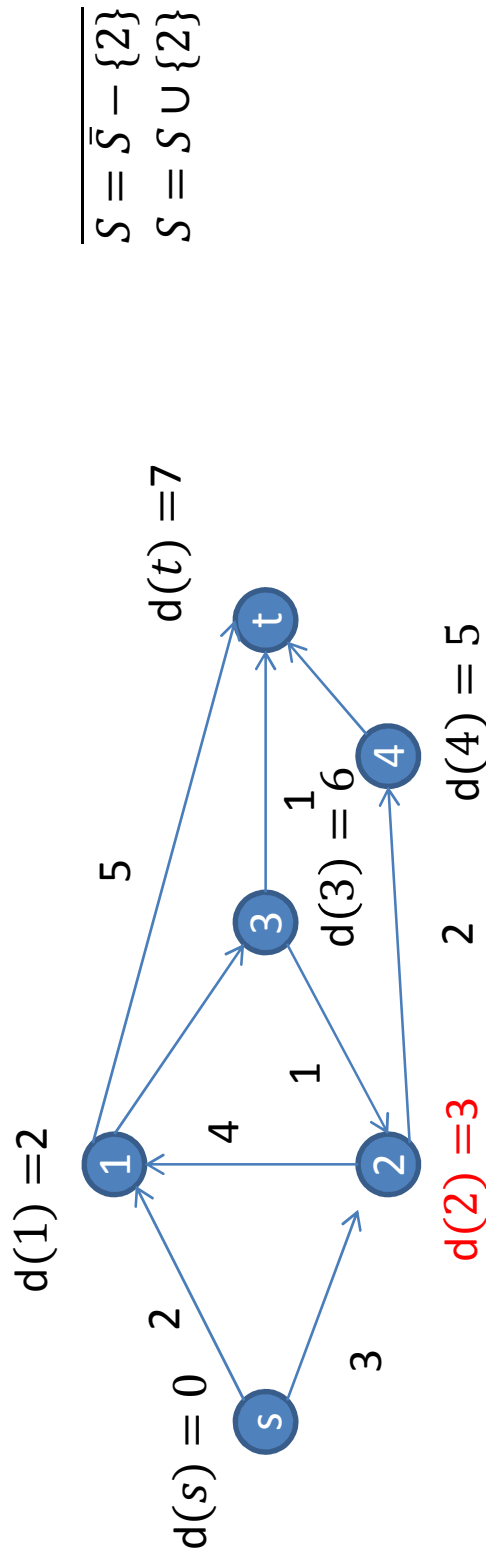


$S \neq \emptyset$ then pick the node in S with minimum distance label and update distance of adjacent nodes. In this step 1 is the node with minimum distance label.



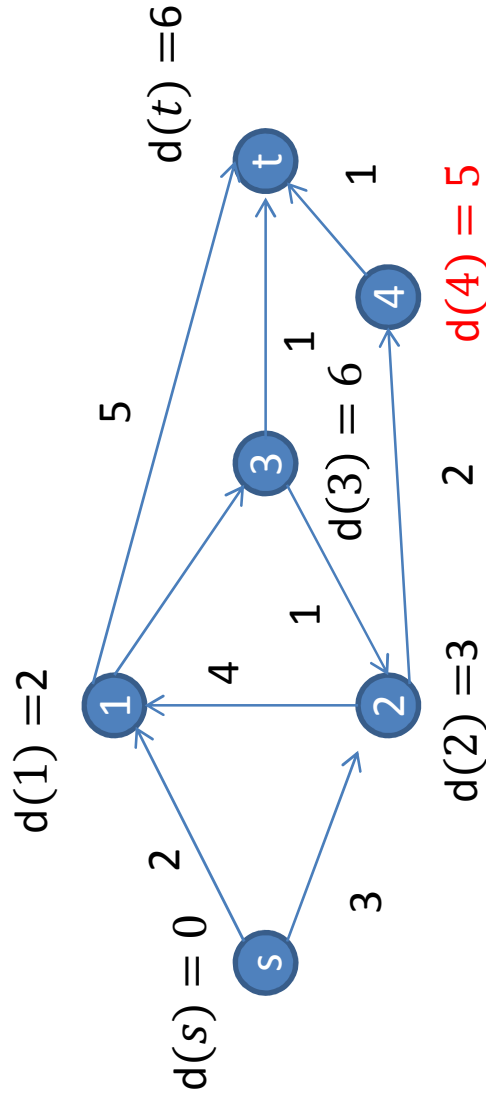
Pick the node with minimum distance label in \bar{S} and update distance of adjacent nodes. In this step node 2 is the node with minimum distance label.

Let $\bar{S} = \bar{S} - \{2\}$ and $S = S \cup \{2\}$



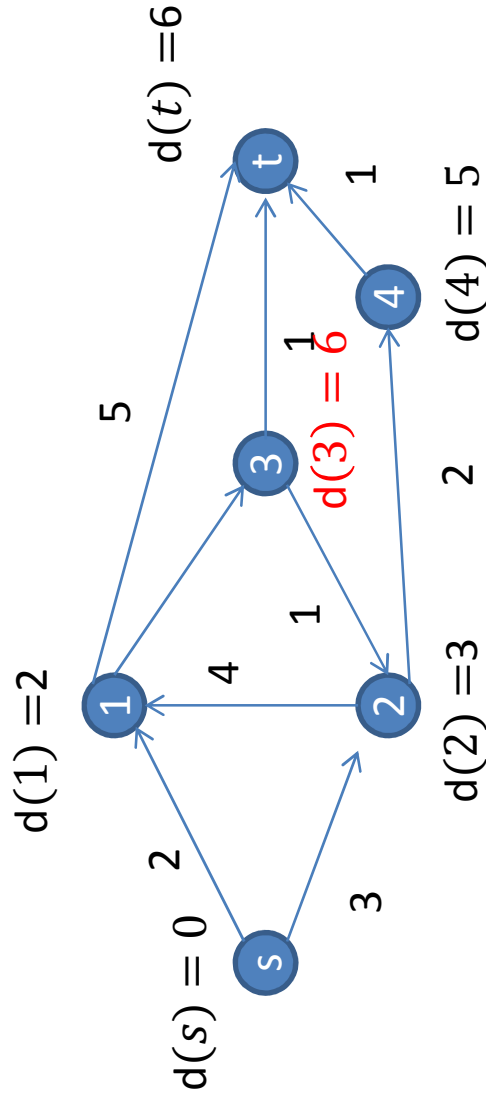
Pick the node with minimum distance label in \bar{S} and update distance of adjacent nodes. In this step node 4 is the node with minimum distance label.

Let $\bar{S} = \bar{S} - \{4\}$ and $S = S \cup \{4\}$



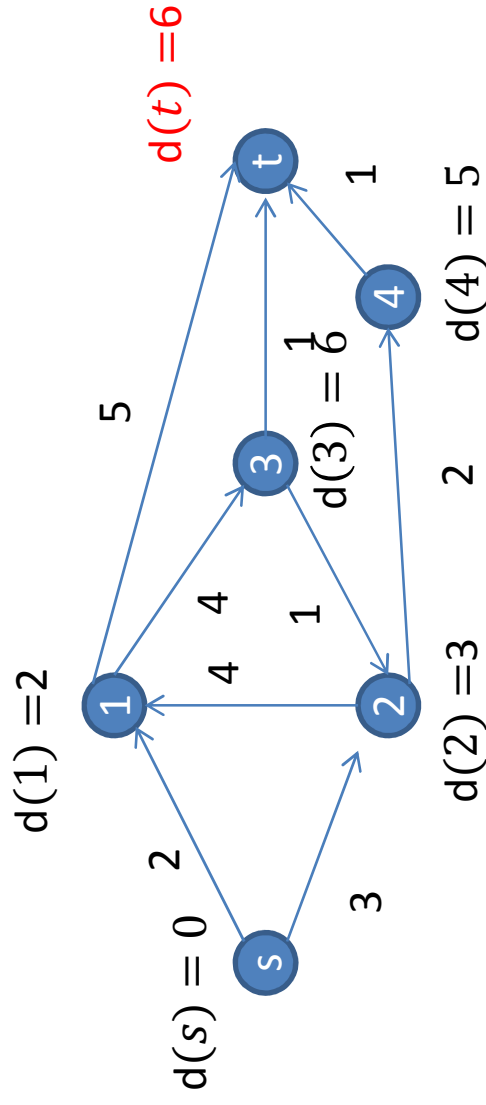
Pick the node with minimum distance label in \bar{S} and update distance of adjacent nodes. In this step node 3 is the node with minimum distance label.

Let $\bar{S} = \bar{S} - \{3\}$ and $S = S \cup \{3\}$

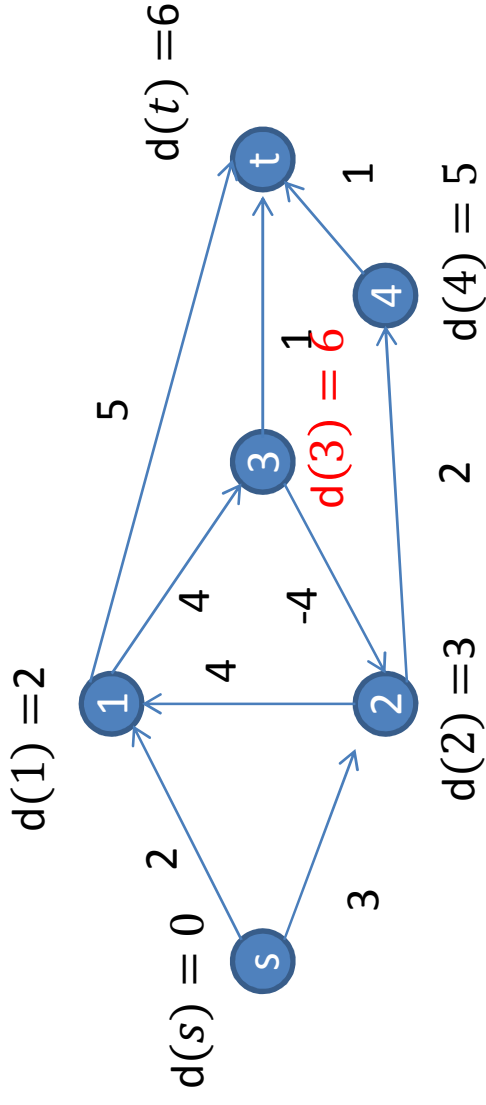


Pick the node with minimum distance label in \bar{S} and update distance of adjacent nodes. In this step node t is the node with minimum distance label.

Let $\bar{S} = \bar{S} - \{t\}$ and $S = S \cup \{t\}$



What if initial length of $c_{32} = -4$?



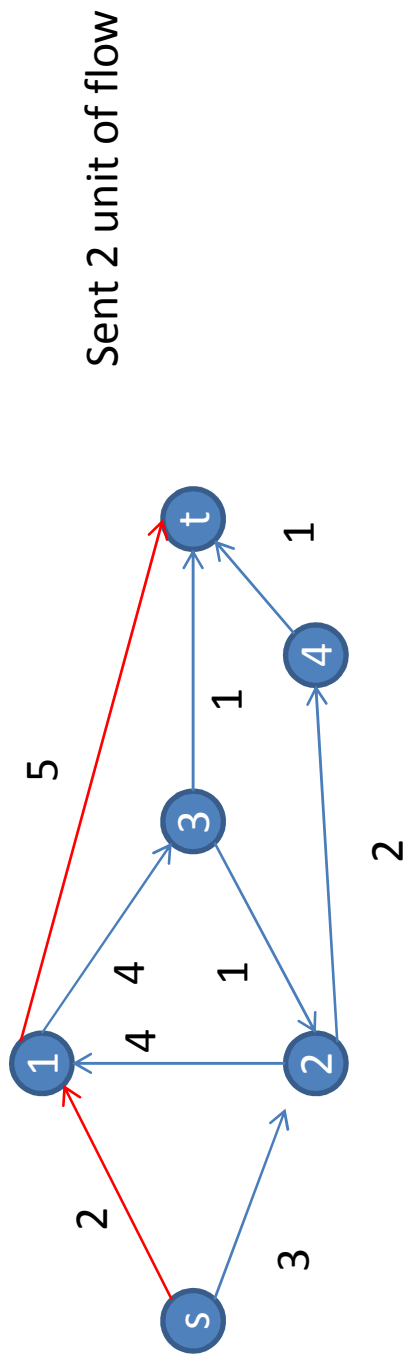
When node 3 is permanently labeled, the distance of node 2 is updated to $d(2)=2$. But given that the adjacent list of $d(2)$ is never updated again, $d(4)$ is never going to be updated and then $d(t)$ will never be updated. Even though the shortest path from s to t have length 5.

DIJKSTRA NEEDS THAT LENGTHS ARE NONNEGATIVE!!

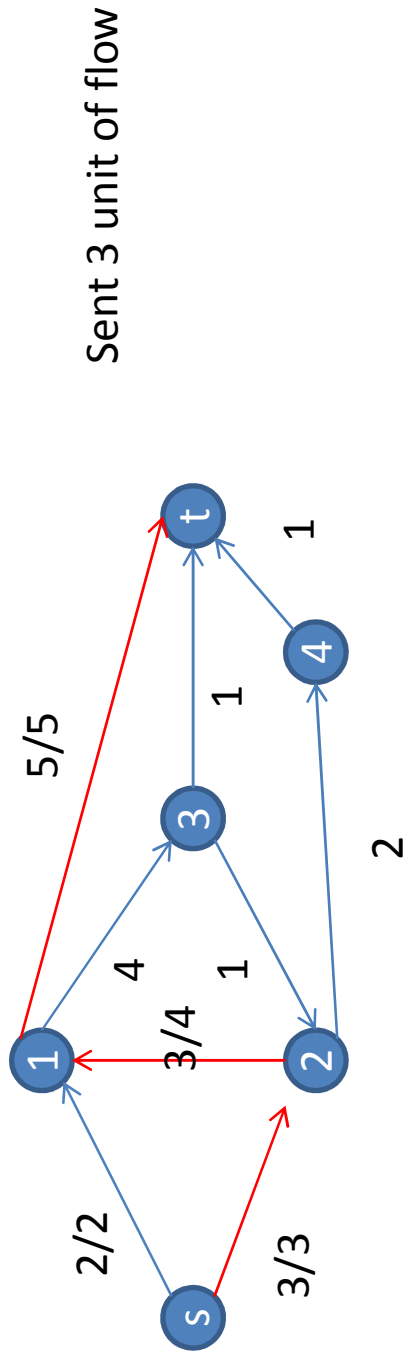
Max Flow Example

Now assume that each arc have associated a capacity. How can we find the max flow from s to t ?

What about trying to find a path from s to t to send as much flow as we can?



Max Flow Example



There is no capacity left to send more flow from s to t . Check the arcs going out of the source, they are working at full capacity.