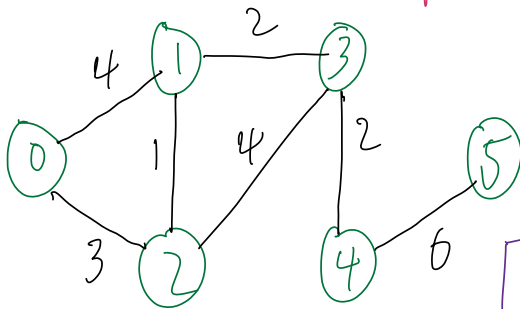


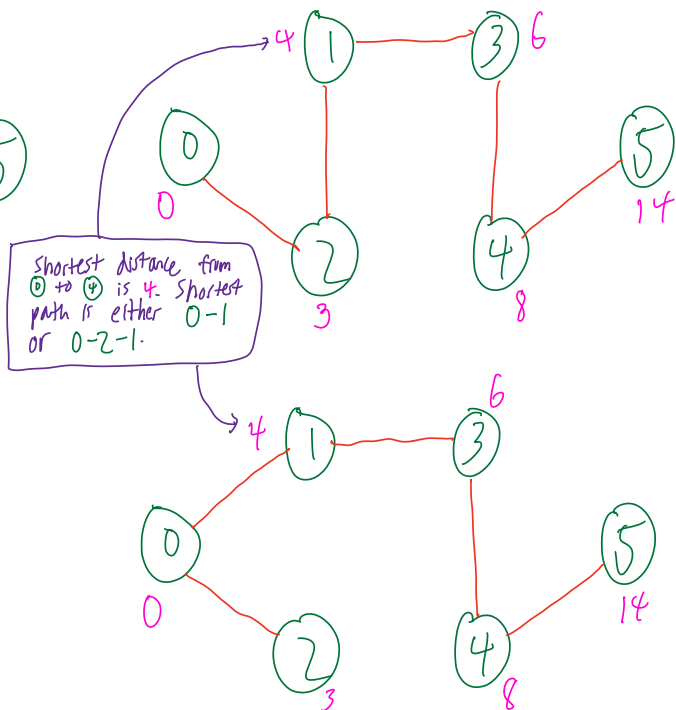
Dijkstra's Alg

- Goal: Find shortest path tree (a tree that contains shortest paths from source s to every other node).

Undirected Graph



Possible Shortest Paths Trees from 0



• How it works

① Create distTo and edgeTo lists and priority queue PQ (which prioritizes nodes closest to source)

- $\text{distTo}(v)$: best known distance from source s to v
- $\text{edgeTo}(v)$: best known vertex predecessor to v
- PQ contains all unvisited vertices in order of distTo

② Initialize:

- for each index i corresponding to vertex i , set $\text{distTo}(i) = \infty$; except vertex $0 \rightarrow \text{distTo}(0) = 0$.
- for each index i corresponding to vertex i , set $\text{edgeTo}(i) = \text{null}$.

③ Repeat:

- Visit v : remove closest vertex v from PQ

- Relax edges

for each outgoing edge e from v :

if $\text{dist}(s, v) + e < \text{distTo}(w)$:

$\text{distTo}(w) = \text{dist}(s, v) + e$

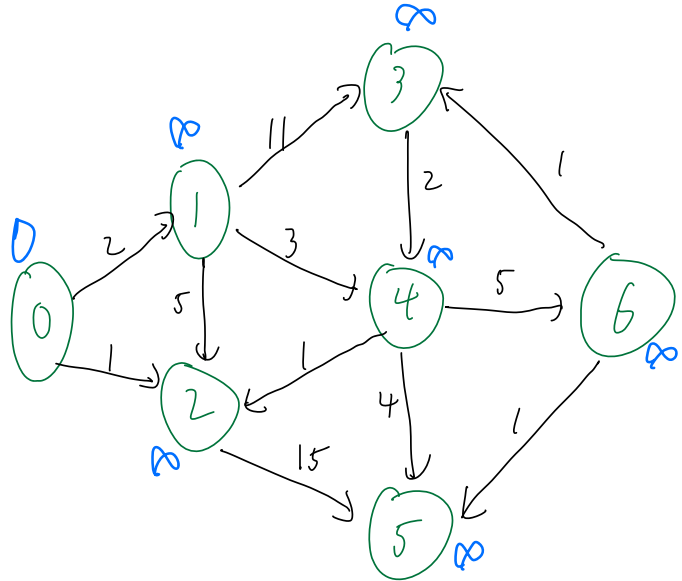
$\text{edgeTo}(w) = v$

④ End: when PQ is empty

• Example:

Iteration 0:

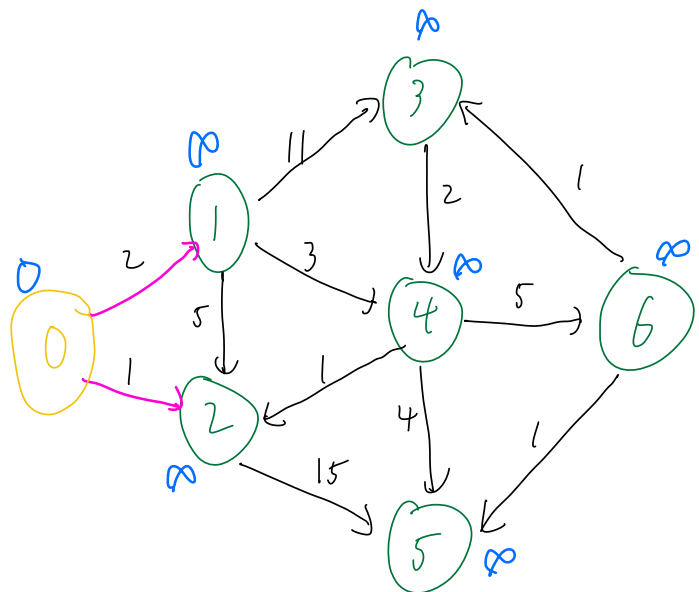
Node #	distTo	edgeTo
0	0	null
1	∞	null
2	∞	null
3	∞	null
4	∞	null
5	∞	null
6	∞	null



PQ: (0:0), (1: ∞), (2: ∞), (3: ∞), (4: ∞), (5: ∞), (6: ∞)

Visit vertex 0

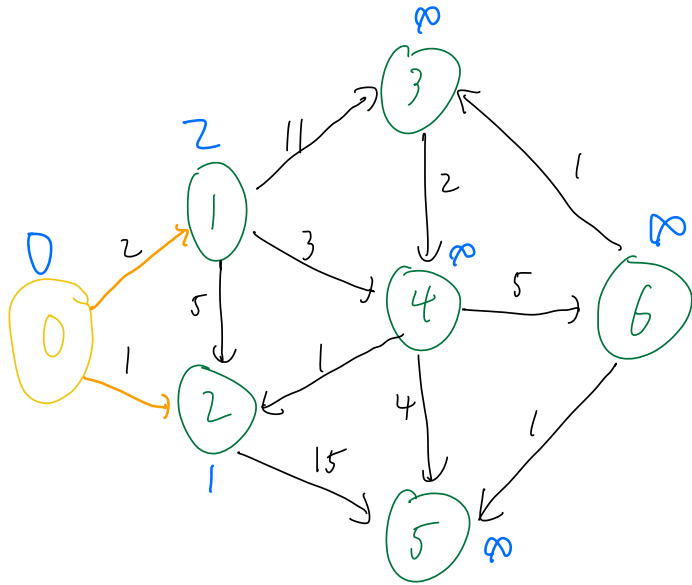
Node #	distTo	edgeTo
0	0	null
1	∞	null
2	∞	null
3	∞	null
4	∞	null
5	∞	null
6	∞	null



PQ: (1: ∞), (2: ∞), (3: ∞), (4: ∞), (5: ∞), (6: ∞)

Relax outgoing edges from vertex 0

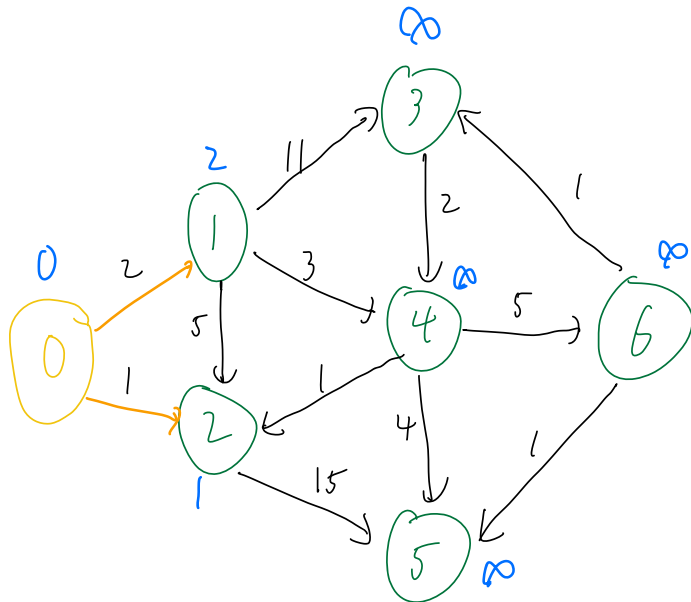
<u>Node #</u>	<u>distTo</u>	<u>edgeTo</u>
0	0	null
1	2	0
2	1	0
3	∞	null
4	∞	null
5	∞	null
6	∞	null



PQ: (2:1), (1:2), (3:∞), (4:∞), (5:∞), (6:∞)

Iteration 2

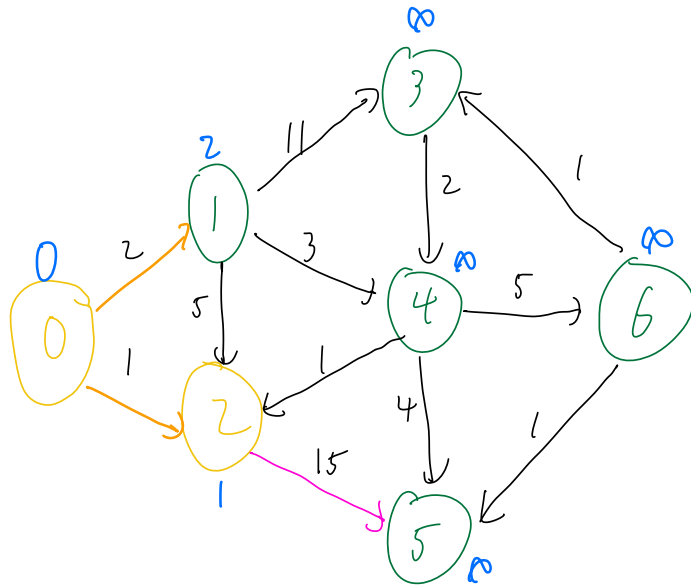
<u>Node #</u>	<u>distTo</u>	<u>edgeTo</u>
0	0	null
1	2	0
2	1	0
3	∞	null
4	∞	null
5	∞	null
6	∞	null



PQ: (2:1), (1:2), (3:∞), (4:∞), (5:∞), (6:∞)

Visit vertex 2

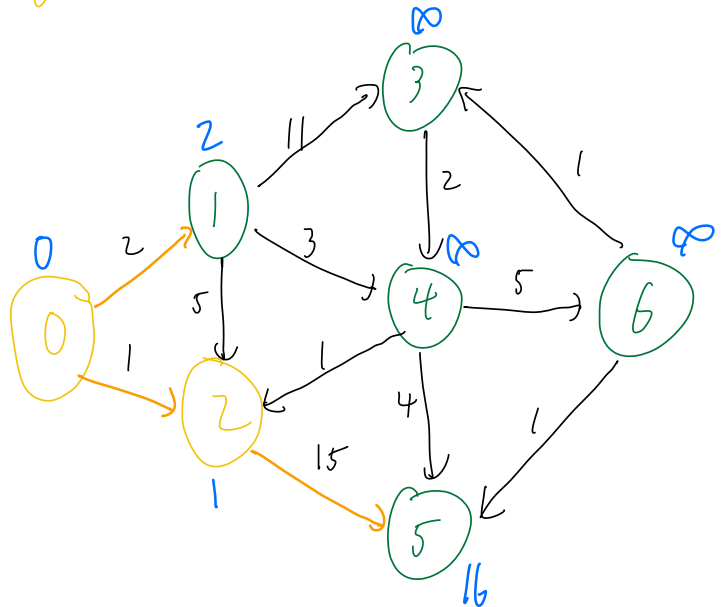
Node #	distTo	edgeTo
0	0	null
1	2	0
2	1	0
3	∞	null
4	∞	null
5	∞	null
6	∞	null



PQ: (1:2), (3: ∞), (4: ∞), (5: ∞), (6: ∞)

Relax outgoing edges from vertex 2

Node #	distTo	edgeTo
0	0	null
1	2	0
2	1	0
3	∞	null
4	∞	null
5	16	2
6	∞	null



PQ: (1:2), (5:16), (3: ∞), (4: ∞), (6: ∞)

;

END

<u>Node #</u>	<u>distTo</u>	<u>edgeTo</u>
0	0	null
1	2	0
2	1	0
3	11	6
4	5	1
5	9	4
6	10	4

PQ: empty

