Let's begin at 9:05 PM

L90
Dijkstra's Algorithm and its applications

Join Discord - https://bit.ly/ly-discord

RECAP

Intuition

Weighted Graph (with non-negative weights)

Shortest Distances/ Paths

Dijkstra's Algorithm

The idea

1.) d[src] = 0 & d[all others] = inf | mark[all] = false

2.) N iterations :

   1.) find the node with shortest distance. (out of the unmarked nodes)

   2.) Mark it.

   3.) Do relaxation of its neighbours!

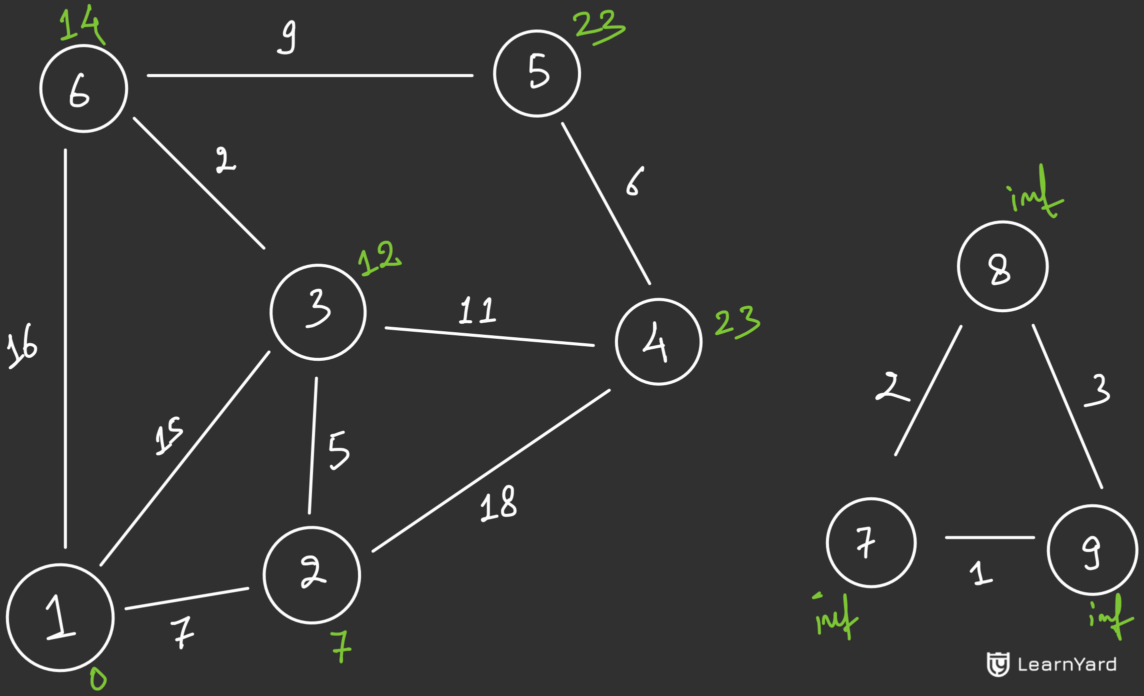
      a.) d[nb] = min(d[nb], d[cur] + W[cur -> nb]);

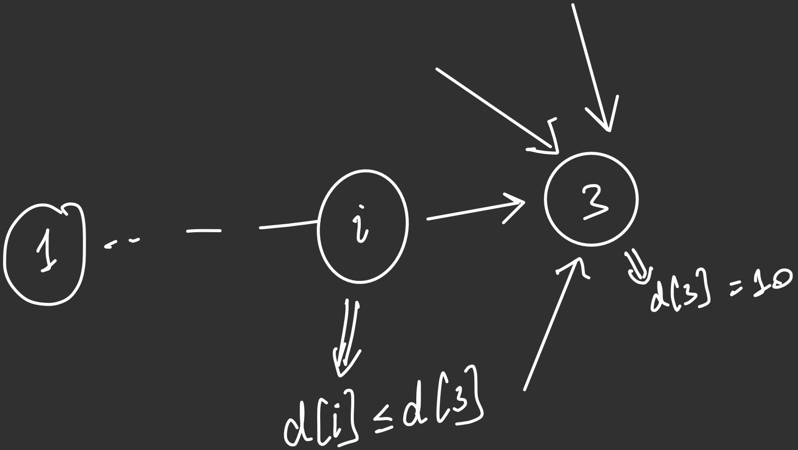
Pseudo-Code

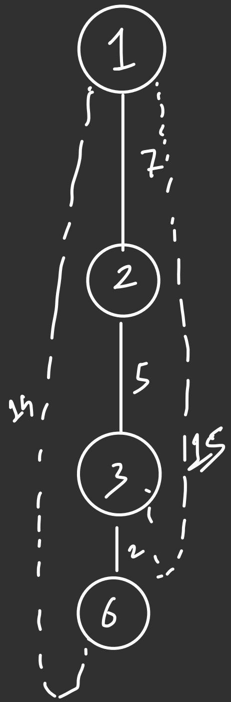
```
d[N+1] = {-inf--},  mark[N+1] = {-- false --}
d[src] = 0;
for( int it=0; it<N; ++it) {
    int dist = inf, curid = -1;
    for(int i=1; i≤N; ++i)
        if (mark[i]==false && d[i] ≤ dist)
            curid = i, dist = d[i];
    mark[curid] = true;
    for( Edge e : adj[cur])
        d[e.node] = min (d[e.node], d[cur] + e.weight);
```

⇒ Out of the unmarked nodes find the one with smallest d[] value

⇒ Relaxation Operatio


14
6
9
5
23
2
6
16
3
12
11
4
23
8
inf
2
3
15
5
18
7
1
9
inf
inf
1
7
2
0
7


1
i
3
d[i] ≤ d[3]
d[3] = 10


1
7
2
5
14
15
3
2
6

Time Complexity?

$O(N^2 + M)$ $\left[\text{or} \quad O(N^2) \right]$

Let’s optimise

(Use a set)

Let’s implement

More changes?

(Priority Queue instead of a set)

Thank You!

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!