

Let's begin at 9:05 PM

L92
Graphs Problem Solving 3

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

Practice! Let's aim for 3 problems again.

(We'll accomplish it today, even if it goes
30 mins over 11pm)

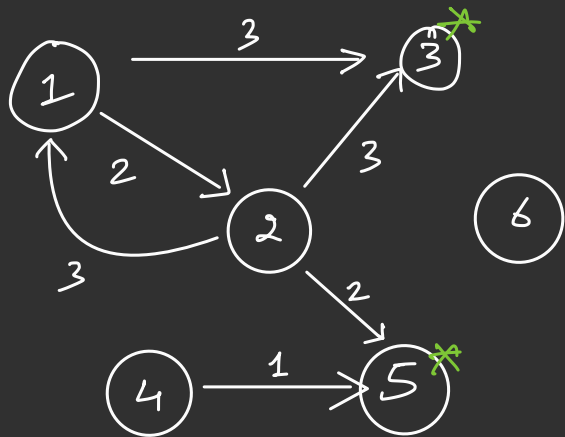
1. Closest Hospital

Question

1. A **weighted directed** graph is given. Some nodes are hospitals while others are not. For each node, find the distance **to** the nearest hospital.
2. Constraints:
 - a. $1 \leq N, M \leq 10^5$
 - b. $1 \leq \text{numHospitals} \leq N$
3. Input:
 - a. First Line: Integers N & M
 - b. Next M Lines: $A_i B_i W_i$ (Edge from A_i to B_i of weight W_i)
 - c. Next Line : numHospitals (number of hospitals)
 - d. Next Line : *numHospitals* number of integers which tells the node numbers which are the hospitals.

$$1 \leq W \leq 10^3$$

6	6	
1	2	2
2	3	3
1	3	3
2	1	3
4	5	1
2	5	2
2		
3	5	



Output

↳ 3 2 0 1 0 -1

Intuition / Solution

Find the distance to go to the
closest hospital from the node i



Solve the reverse problem
on reverse graph

Single Source

```
pq.push(src);
```

```
d[src] = 0;
```

Multi-source

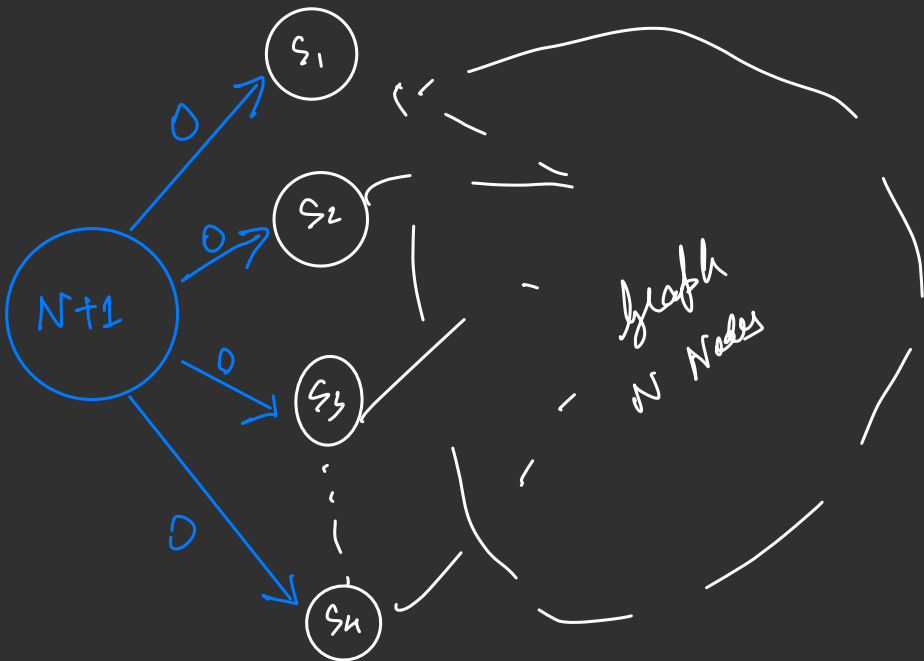
```
for (int src : sources) {
```

```
    pq.push(src);
```

```
    d[src] = 0;
```

```
}
```

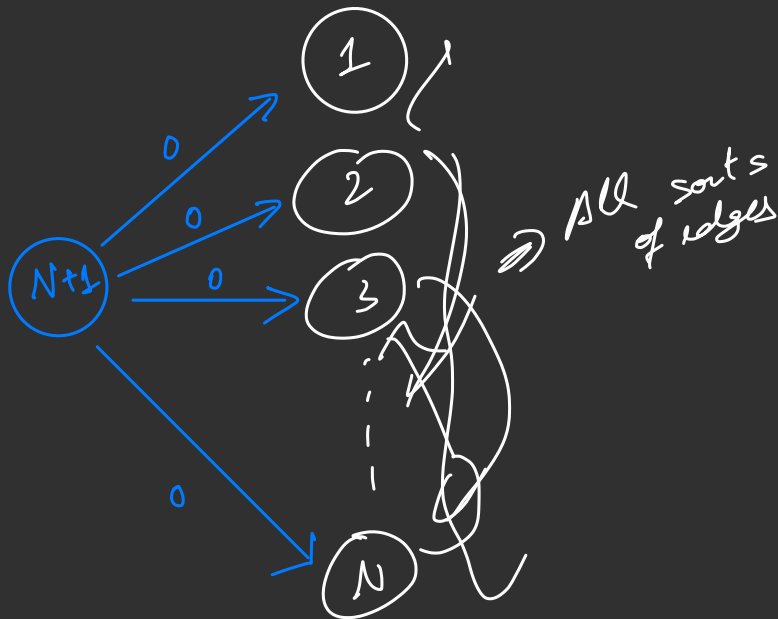
(1 to N)



Let's Implement

2. Best Path

Intuition / Solution



Single source BF

$d[src] = 0;$

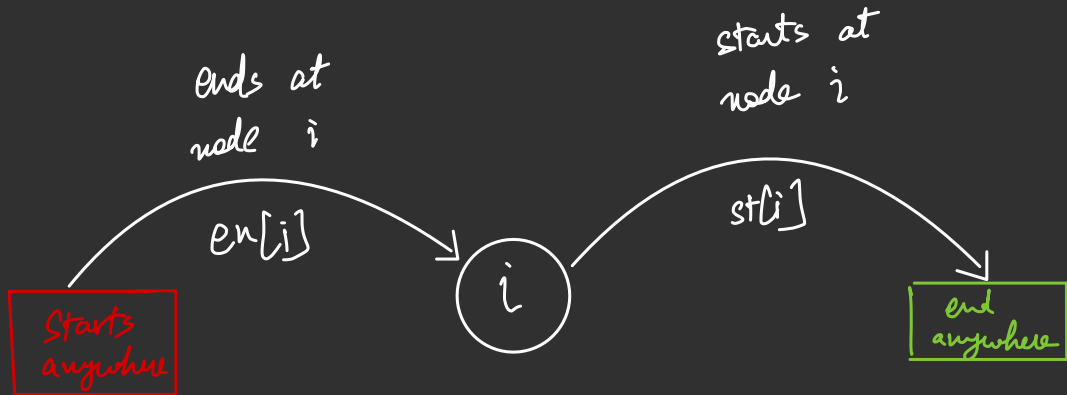
$d[---] = \text{inf}$

Multi-source

$d[---] = \text{inf};$

for (int src : sources)

$d[src] = 0;$



$$ans[i] = en[i] + st[i]$$

Let's Implement

3. K-th Path

Intuition / Solution

E_1, E_2, \dots, E_M

$\underbrace{\hspace{10em}}$
Smallest K
edges

(sorted in inc.
order of
wt)

Max. $2K$ nodes (≤ 800)

Dijkstra from all

$$\hookrightarrow (2K) * (3K) * \log(2K)$$

$$\Rightarrow 6K^2 \log K \Rightarrow 2.5 * 10^7$$

Floyd Warshall

$$\hookrightarrow (2K)^3 \Rightarrow 5.12 * 10^8$$

Let's Implement

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!