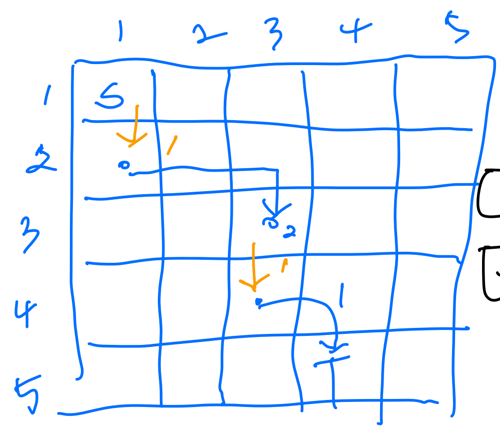


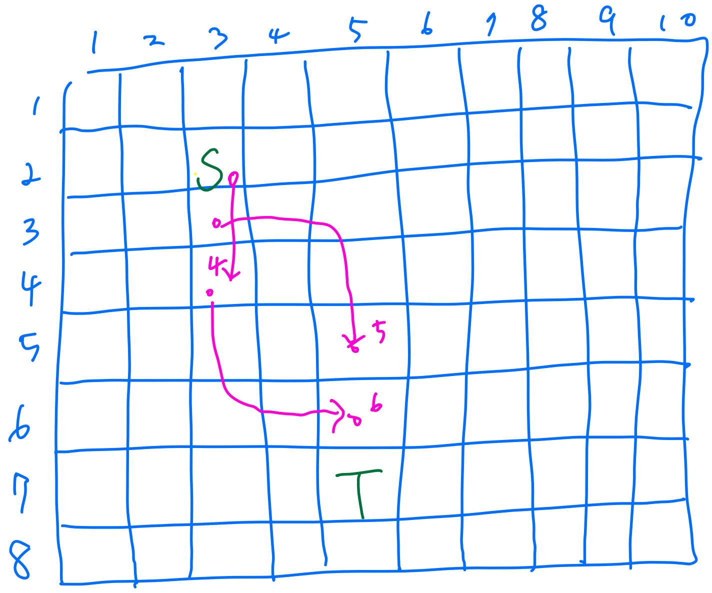
S=[1,1]
T=[4,5]

Special [[1,2,3,3,2], [3,4,4,5,1]]

Verify min or not.

[1,2,3,3,2] < |1-3| + |2-3| = 3

[3,4,4,5,1] < |3-4| + |4-5| = 2



S=[3,2]
T=[5,7]

X1	Y1	X2	Y2	C		Calculated
3	2	3	4	4	>	2
3	3	5	5	5	>	4
3	4	5	6	6	>	4

S-T = |3-5| + |2-7| = 7

Start pos = [StartX, StartY]
Target pos = [TargetX, TargetY]

Find min cost W/ or w/o Special Roads

Special Roads = [$X1_i$, $Y1_i$, $X2_i$, $Y2_i$, cost]

Start & Target length == 2

$1 <= StartX <= TargetX < 10^5$
$1 <= StartY <= TargetY < 10^5$
Special Road length = 5
$StartX <= x_i$, $StartY <= y_i$
$1 <= cost < 10^5$

1. Special Roads may or may not be minimum
2. Minimum cost ⇒ shortest path
   Verify special Road = minimum
   Relaxation (if $d[v] > d[u] + w(u,v)$
   $d[v] = d[u] + w(u,v)$

   $O(V^2)$ w/ Brute force adjacent matrix

   $O(V^2)$ w/ adjacent list

   $O(V \lg E + E \lg V)$ w/ min heap
   No negative cycle

   Weighted Direct Graph

Pseudo

```
# Verify Special Roads
for x1, x2, y1, y2, c in Special Roads
    if c < (|x1 - x2| + |y1 - y2|):
        g(x1, x2).add(x2, y2, c)
        starts.add(x1, y1)
        ends.add(x2, y2)

# add
```

Start [1, 1] Target [4, 5]

SR [1, 2, 3, 3, 2], [3, 4, 4, 5, 1]

$g(1,2) = (3,3,2)$ $g(3,4) = (4,5,1)$

Starts [(1, 2), (3, 4), (4, 5)]

ends [(3, 3), (4, 5), (1, 1)]

$g(1,2) = (3,3,2)$

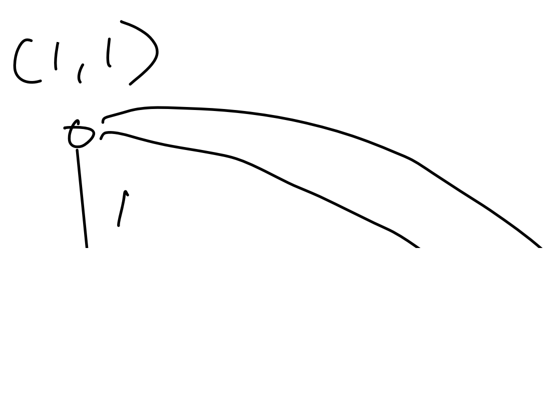
$g(3,4) = (4,5,1)$

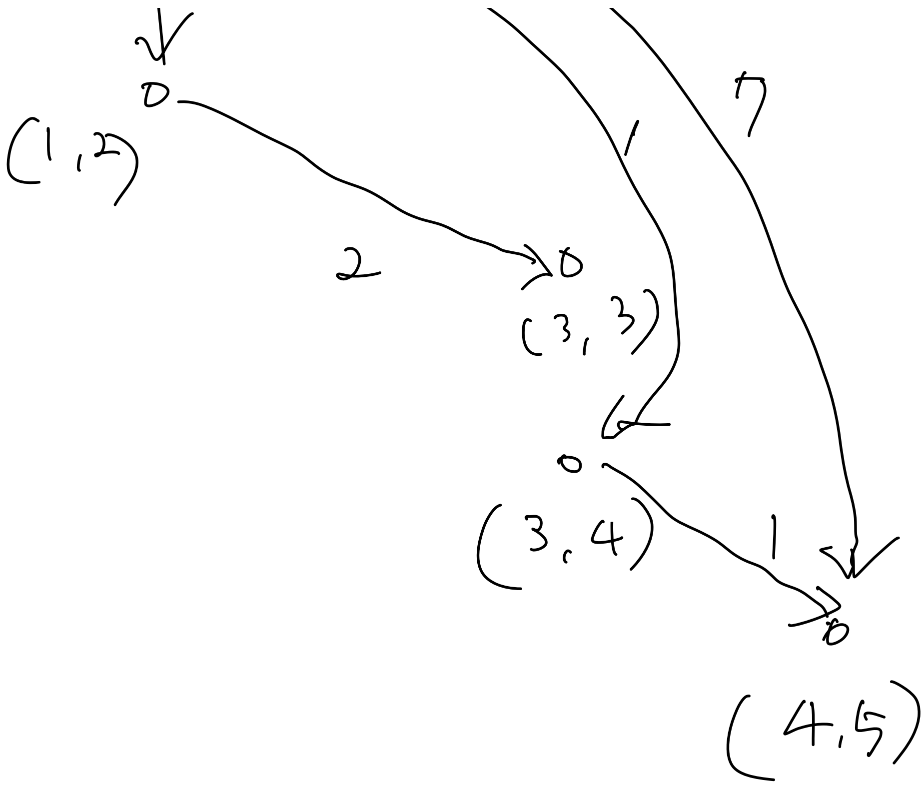
$g(1,1) = ((4,5,7),(1,2,1),(3,4,5))$

$g(4,5) = ((1,2,6),(4,5,0),(3,4,2))$

$g(3,3) = ((4,5,3),(1,2,3),(3,4,1))$

dist[v] = inf





(1,2)
2
(3,3)
1
7
(3,4)
1
(4,5)

$$minimal = |Start[0] - Target[0]| + |Start[1] - Target[1]|$$

Start $[1,1]$ Target $[4,5]$

SR $[1,2,3,3,2]$, $[3,4,4,5,1]$

$g(1,2) = (3,3,2)$ $g(3,4) = (4,5,1)$

Starts $[(1,2),(3,4),(4,5)]$

ends $[(3,3),(4,5),(1,1)]$

$g(1,2) = (3,3,2)$

$g(3,4) = (4,5,1)$

$g(3,3) = (1,2,3)$

$g(3,3) = (3,4,1)$

$g(3,3) = (4,5,3)$

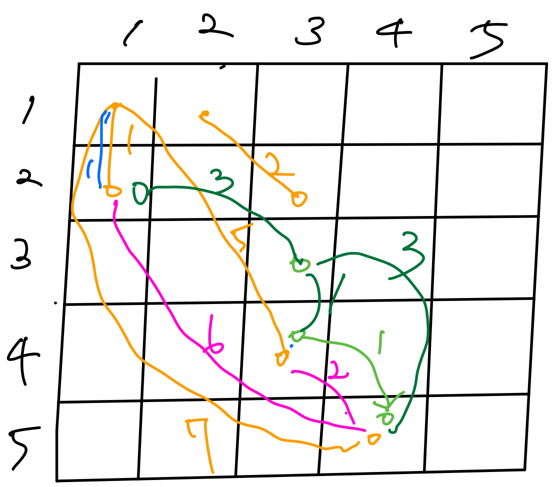
$g(4,5) = (1,2,6)$

$g(4,5) = (3,4,2)$

$g(4,5) = (4,5,0)$

$g(1,1) = (1,2,1)$

$g(1,1) = (3,4,5)$



$g(1,1) = (4, 5, 1)$