0 1 ← 2
0 1 ← 2
2 → 1 . 1

$\xrightarrow{1}$

0 2 2
0 2 2
2 2 2

[[2 2 0 1]] => -1

1₁ ← 2 → 1₁
1₂ 1₁ 1₂
1₃ 1₂ 1₃

$\xrightarrow{1}$

2 2 2
1 ← 2 → 1
1 1 1

↓ 1

2 2 2
2 2 2
1 ← 2 → 1

$\xleftarrow{1}$

2 2 2
2 2 2
2 2 2

~~2~~ 2 ~~2~~
1 ~~2~~ 1
1 1 1

×

n×m.

~~3~~ 2 ~~3~~
1 ~~3~~ 1
1 1 1

→

2 2 2
1 2 1
1 1 1

after 1 unit of time.

2 2 2
~~3~~ 2 ~~3~~
1 ~~3~~ 1

→

2 2 2
2 2 2
1 2 1

after 2 units of time.

2 2 2
2 2 2
~~3~~ 2 ~~3~~

→

2 2 2
2 2 2
2 2 2

after 3 units of time.

[2 2 0 1]

Brute Force.

TC: O((nm)²).

AS: O(1).

2 → 1 → 1 → 1 → 1 → 1
0 0 0 0 0 1
1 ← 1 ← 1 ← 1 ← 1 ← 1
1 0 0 0 0 0
1 1 1 1 1 1
0 0 0 0 0 1
1 1 1 1 1 1

0 ~~2~~ 2
0 ~~2~~ 2
2 ~~2~~ ~~2~~

	0	1	2
0	~~2~~	2	~~2~~
1	~~2~~	~~2~~	~~2~~
2	~~2~~	~~2~~	~~2~~

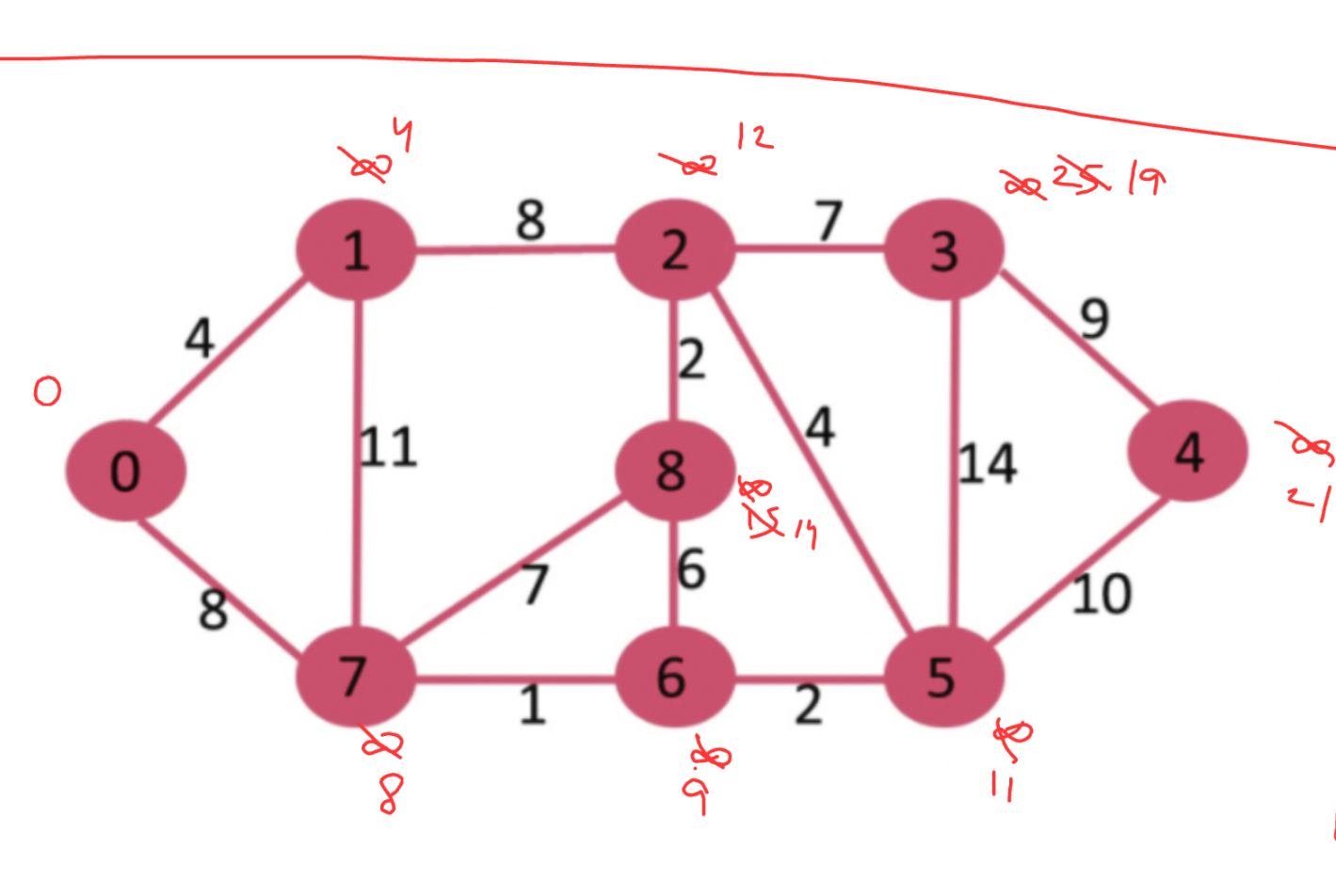
time = ~~1~~ ~~2~~ ~~3~~ 4

~~(0, 1)~~ ~~(0, 0)~~ ~~(0, 2)~~ ~~(1, 1)~~
~~(1, 0)~~ ~~(1, 2)~~ ~~(2, 1)~~
~~(2, 0)~~ ~~(2, 2)~~

return (t-1)

[1 0 2]
[3 4 5]

TC: O(nm)
AS: O(nm).



0 → (1,4) (7,8)
1 → (0,4) (7,11) (2,8)
2 → (1,8) (8,2) (5,4) (3,7)
3 → (2,7) (5,14) (4,9)
4 → (3,9)

{dist, node}

set.

~~(0, 0)~~ ~~(4, 1)~~ ~~(8, 7)~~ ~~(12, 2)~~ ~~(15, 8)~~ ~~(9, 6)~~
~~(11, 5)~~ ~~(25, 3)~~ ~~(21, 4)~~ ~~(14, 8)~~
~~(19, 3)~~

TC: O((V+E) log V)

dist U ↳ (U) —dist UV→ (V)

dist V = dist U + dist UV

1	3	5	0
6	2	1	4
3	2	10	11
2	5	6	1

Merge Sort

[3, 5, 2, 7, ¦ 9, 8, 1, 6].

[2, 3, 5, 7] [1, 6, 8, 9].

[2, 3, 5, 7, 1, 6, 8, 9]

[1, 2, 3, 5, 6, 7, 8, 9]

TC: O(n log n).

T(n) = 2T(n/2) + n

start mid end

(start, mid) (mid+1, end)

→ (start, mid-1) (mid, end).

[0, 1, 2, 3]

mid = 1

[0]. mid = 0

[0, 1, 2] mid = 1

start 7 8 9 10 11 12 end

[. . . . . 2 5 7 3 4 6 . . . . .]

0 1 2 3 4 5
[2, 3, 4, 5, 6, 7]

n → n/2 → (n)
n/2 → n/4
n/4 → n/8 n/8
n/4 ~~n/8~~ ←

temp → O(n)
Rec. stack → O(log n).

W = 50
vals[] → [60, 100, 120]
wts[] → [10, 20, 30]
6 5 4

cap = ~~50~~ ~~40~~ ~~20~~ 0

6/0 1 2 3 49

value = ~~0~~ ~~60~~ ~~160~~ 240.

$\cancel{120}^{40} \times \frac{2}{3} = 80$

Considering max values first.

cap = ~~50~~ ~~20~~ 0   value = ~~0~~ ~~120~~ 220.

×

Considering min wts first.
W = 50
vals: [10, 20, 200]
wts: [20, 30, 50].

×

Considering max val/wts.
W = 50
vals: [60, 100, 120]
wts: [10, 20, 30]
val/wt = 6 5 4

Cap = ~~50~~ ~~40~~ ~~20~~ 0   val = ~~0~~ ~~60~~ ~~160~~ 240

W = 50
vals: [10, 20, 200]
wts: [20, 30, 50].
0.5 0.66 4

cap = ~~50~~ 0   val = ~~0~~ 200.

(val/wt, wt)

100/30

~~3.33~~
3.33

int/int → int

double/int
int/double } → double.