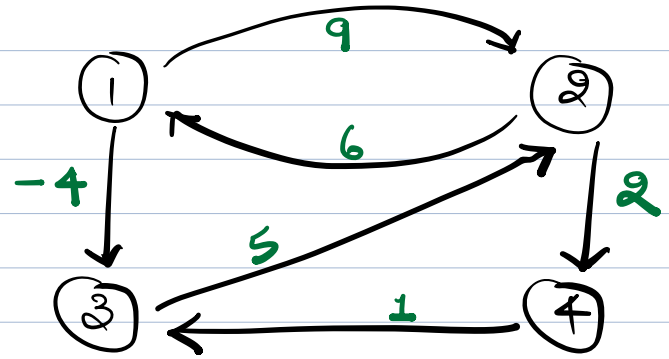


	1	2	3	4
1	0	9	-4	∞
2	6	0	∞	2
3	∞	5	0	∞
4	∞	∞	1	0

D0

Node 1

	1	2	3	4
1	0	9	-4	∞
2	6	0	2	2
→ 3	∞	5	0	∞
→ 4	∞	∞	1	0

D1

Node 2

	1	2	3	4
1	0	9	-4	11
2	6	0	2	2
→ 3	11	5	0	7
→ 4	∞	∞	1	0

D2

D[4][1] = ∞

D[4][2] + DP[2][ ]
∞ 2

DP[4][2] = ∞

DP[4][3] + DP[3][2]
1 5

Node 3

	1	2	3	4
1	0	1	-4	3
2	6	0	2	2
→ 3	11	5	0	7
→ 4	12	6	1	0

D3

K is intermediate.

$$d_k[i][j] = \min\left(d_{k-1}[i][j],\ d_{k-1}[i][k] + d_{k-1}[k][j] \right);$$

Code

D ⇒ Initial adjacency matrix.

```
for (K=0; K<N; K++) {
    for (i=0; i<N; i++) {
        if (i==K) { continue; }
        if (D[i][K] == INT_MAX){
            continue; }
        for (j=0; j<N; j++) {
            if (j==K) { continue; }
            if (i==j) { continue; }
            if (D[K][j] == INT_MAX){
                continue;
            }
            D[i][j] = min( D[i][j],
                D[i][K] + D[K][j]);
        }
    }
}
```

}

$$T.C. = O(V^3)$$

$$S.C. = \underline{\underline{O(1)}}$$

Q Google

Given a N×N chessboard.

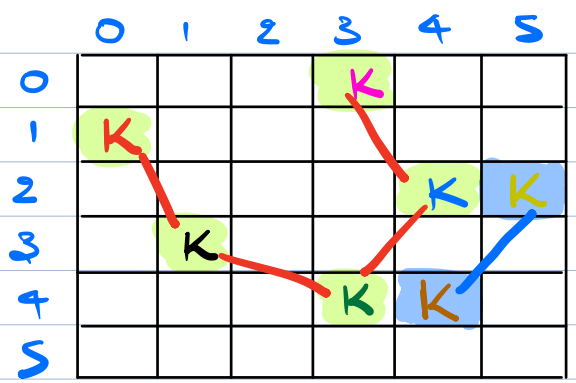
K Knights placed initially

↓ distinct

If a Knight is reachable from the other Knight then they can be swapped.

Find the no. of ways to arrange the Knights.

K = 5



5 4 3 2 1

= 5!

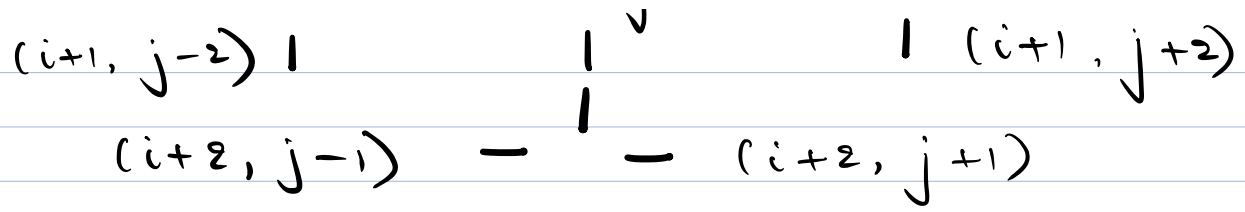
2 1

= 2!

(i-2, j-1) — — (i-2, j+1)

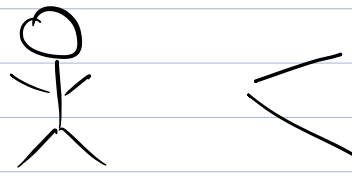
(i-1, j-2) | | (i-1, j+2)

— — (i, j) — —



$5! + 2!$ ✗

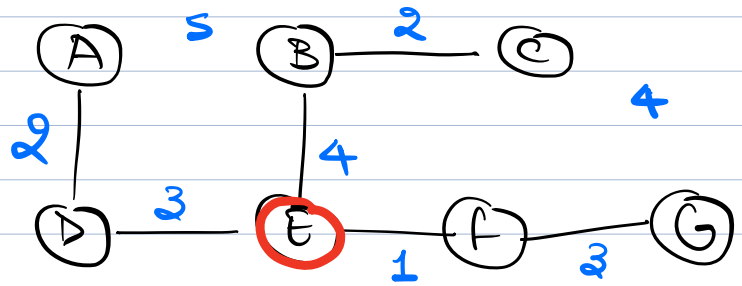
$5! \times 2!$ ✓



$= 3 \times 4$

$\forall$ CC $\Rightarrow$ count

$(CC1!) \times (CC2!) \times (CC3!) \ldots\ldots (CCk!)$



Undirected.

7 Nodes

8 Edges.

$\Sigma_{sum} = 24$

CG, AB = 15 (6) Min Edge Sum

CG, AD = 18 (6)

CG, DE = 17 (6)

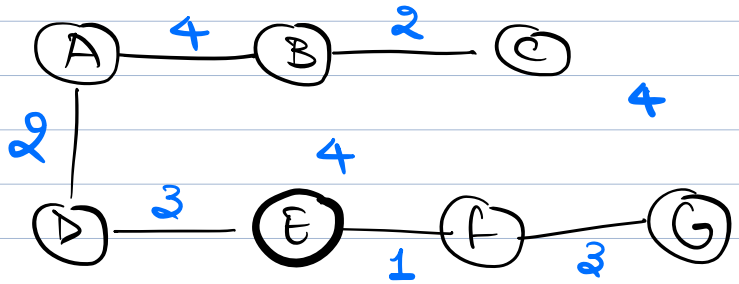
N nodes $\Rightarrow$ (N-1) edges

TREE

Spanning Tree

min edge sum

Minimum Spanning Tree



(AB, CG)

23-8

=15

(AB, BE)

23-8

=15

(BE, CG)

32-8

=15

Properties Of Spanning Tree

1) Remove an edge ⇒ Graph will be disconnected into 2 CC

2) Add an Edge ⇒ Cycle will be formed.

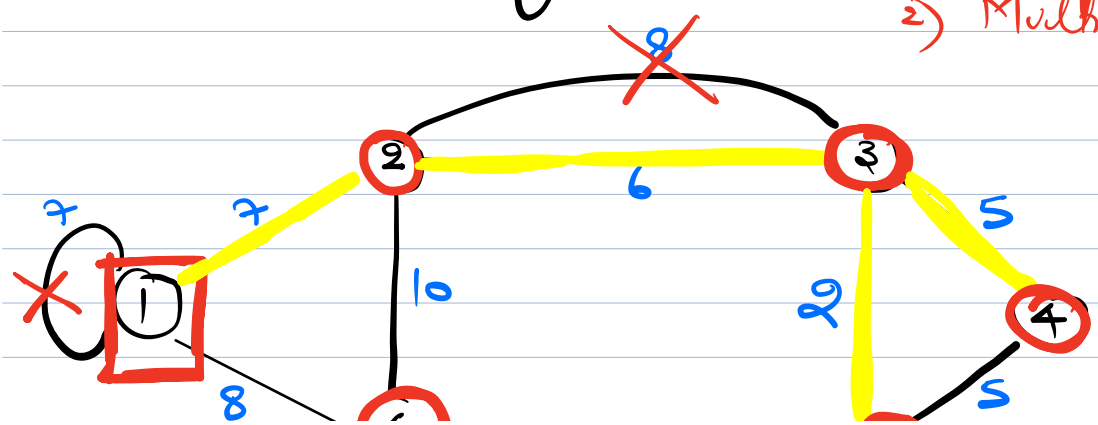
Find MST of a weighted graph

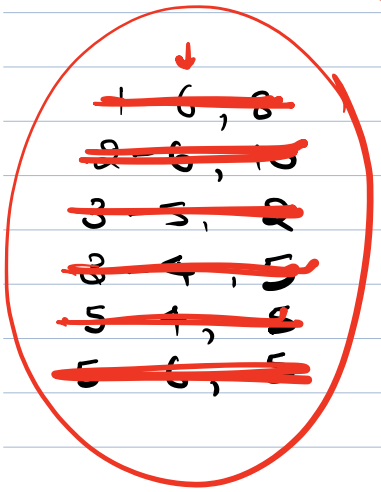
1) Prim's Algo
2) Kruskal's Algo.

---

1) Prim's Algo

1) Self loops
2) Multi edges.





5 - 4 X

⇒ Min Heap

H.W. Code