

\*

MST.

Union - Find

Pointer implementation -

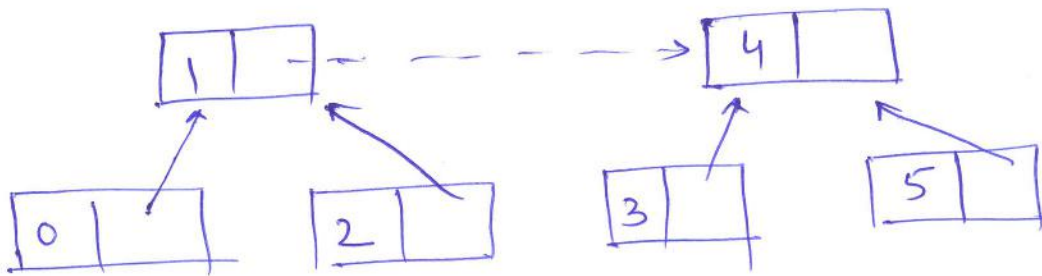
① Union (0, 1)

④ Union (5, 4)

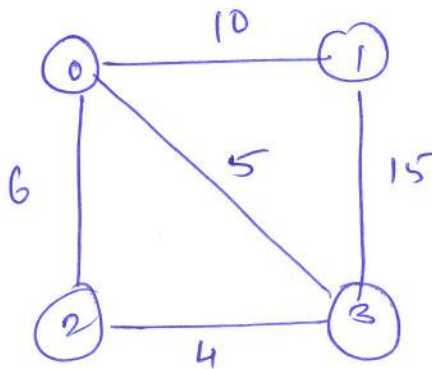
② Union (2, 1)

⑤ Union (1, 4)

③ Union (3, 4)



Consider following example -



Edges

2 - 3	4
0 - 3	5
0 - 2	6
0 - 1	10
1 - 3	15

## Data Structures Required.

\* struct Graph { V, E, struct edge }  
struct edge { src, dest, weight }  
struct subset { parent }

### Initializations -

V = 4 , E = 5

graph → edge[0].src = 0

graph → edge[0].dest = 1

graph → edge[0].weight = 10.

for all edges (same as above).

subset[0].parent = 0

subset[1].parent = 1

subset[2].parent = 2

subset[3].parent = 3.

Initially ⇒

V ⇒ 0 1 2 3

Parent ⇒ 0 1 2 3.

## Main function

next-edge = graph → edge[0].

int x = find(subset, next-edge.src)

int y = find(subset, next-edge.dest)

if (x != y)

{ include next-edge in result.

} union(subset, x, y)

```
int find ( struct subset subsets [], int i )
```

```
{  
    if ( subsets[i]. parent != i )  
        subsets[i]. parent = find ( subsets, subsets[i]. parent ;  
    return subsets[i]. parent ;  
}
```

```
void Union ( struct subset subsets [], int x, int y )
```

```
{  
    int xroot = find ( subsets, x )  
    int yroot = find ( subsets, y )  
    subsets[yroot]. parent = xroot ;  
}
```

edge 1  $\Rightarrow$  2-3.

$x = \text{find}(\text{subset}, 2)$

$y = \text{find}(\text{subset}, 3)$

$2 \neq 3 \Rightarrow$  include edge.

$\text{Union}(\text{subset}, 2, 3)$

$V \Rightarrow$       0      1      2      3

Parent  $\Rightarrow$     0      1      2      2

edge 2 = 0 - 3.

$x = \text{find}(\text{subset}, 0) \Rightarrow 0$

$y = \text{find}(\text{subset}, 3) \Rightarrow 2$

include edge as  $0 \neq 2$

Union (0, 2)

$V \Rightarrow$                       0   1   2   3

Parent  $\Rightarrow$                 0   1   0   2

edge 3 = 0 - 2

$x = \text{find}(\text{subset}, 0) \Rightarrow 0$

$y = \text{find}(\text{subset}, 2) \Rightarrow 0$

Discard

edge 4 = 0 - 1

$x = \text{find}(\text{subset}, 0) \Rightarrow 0$

$y = \text{find}(\text{subset}, 1) \Rightarrow 1$

$0 \neq 1 \Rightarrow$  include edge.  
Union (0, 1)

$V \Rightarrow$                       0   1   2   3.

Parent  $\Rightarrow$                 0   0   0   2.

edge 5 = 1 - 3.

$x = \text{find}(\text{subset}, 1) \Rightarrow 0$

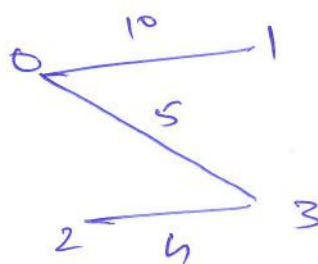
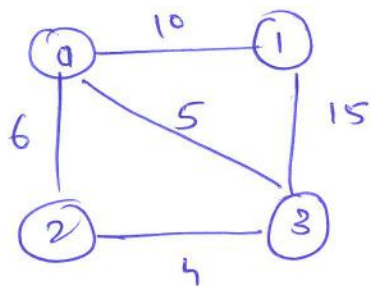
$y = \text{find}(\text{subset}, 3) \Rightarrow 0$

Discard

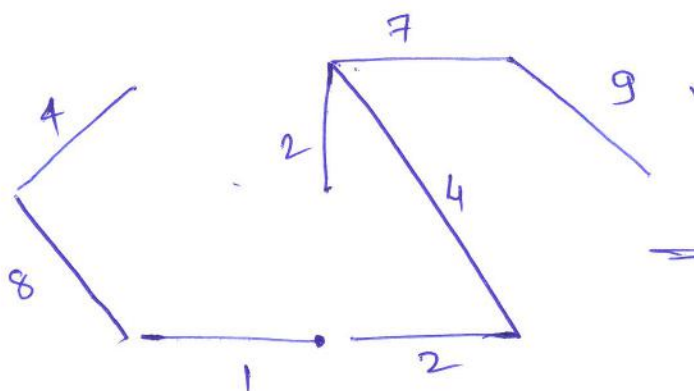
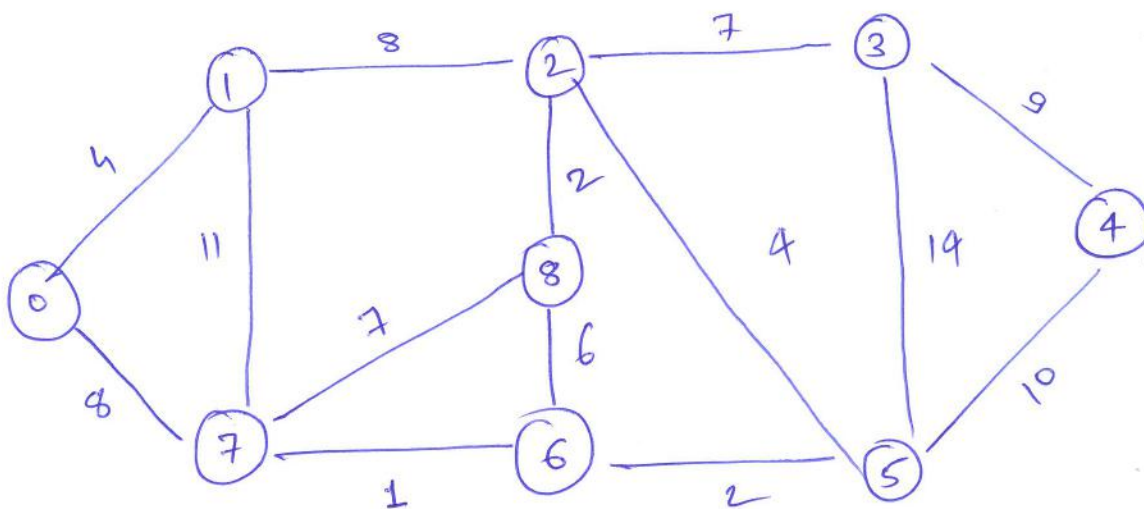


# Test cases -

①



②



⇒ MST.

③

