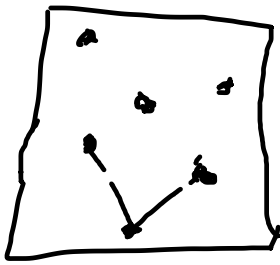
MST

Kruskal-MST



- $T \leftarrow \emptyset$ on V
- Sort(E) in increasing order
- Examine sorted edges
  - If the edge connects two unconnected components then add edge to T.
  - Else, discard edge and continue.

Disjoint-Set DS

$S = \{S_1, \ldots, S_2\}$

- Make-Set(v)
  - v must not belong to any existing set
- Find-Set(u):
  return the representative of the set S_u containing u
- Union(u, v) -
  Replace S_u and S_v with $S_u \cup S_v$.

Pseudocode

```
Kruskal-MST(V, E, w)
    T ← ∅
    for each v ∈ V:
        Make-Set(v)
    Sort(E) // in non-dec. order
    for each edge (u, v) ∈ E:
        if Find-Set(u) ≠ Find-Set(v):
            T ← T ∪ {(u, v)}
            Union(u, v)
    return T
```

Time complexity:

$O(E \lg E) + V \cdot T_{make\text{-}set} + 2E T_{find\text{-}set} + O(E) + E \cdot Union$

Make-Set(u)	$O(1)$
Find-Set(u)	$O(h)$
Union(u, v)	$O(h)$

Initialize: $O(1) + V \cdot O(1) + O(E \lg E)$

Loop: $2E \cdot O(h) + O(E) + E \cdot O(h)$

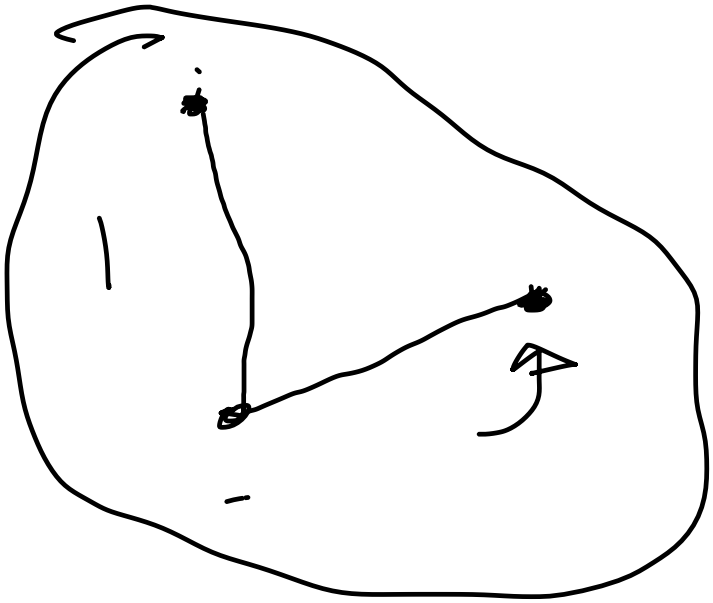
$$O(1) + V \cdot O(1) + O(E \lg E)$$

$$+ 2E \cdot O(n) + O(E) + E \cdot O(n)$$

$$= O(E \lg E) + O(E \cdot V)$$

$$\log V$$

$$O(E \lg V)$$



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