COP 3503 1/23/24

0. W office Hours (Virtual)
1. Volunteer OMC – add Webcourses
2. Disjoint Set
   - what it does
   - how to visualize, store
3. DJ Set Applications
   - artwork
   - destroy connections (Spr 22 hmk)
   - islands
   - closing form

DJSet 1 ... n + oobs

0 ... n-1

{0} {1} {2} ... {n-1}

{1} {2} {3} {4} {5} {6}

union(2,5)

{1} {2,5} {3} {4} {6}

union(4,6)

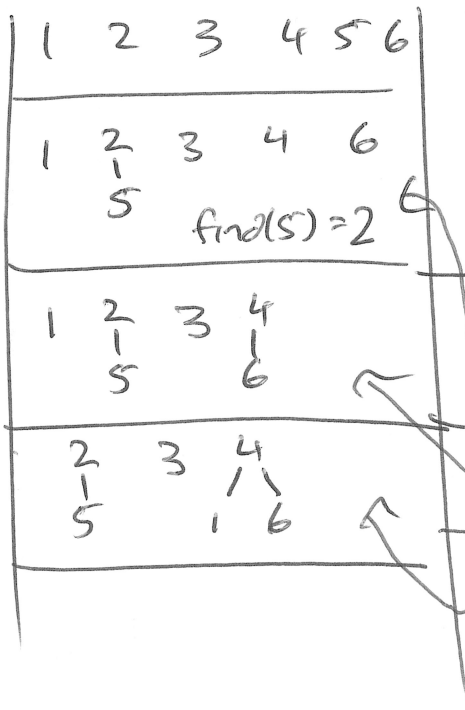
{1}, {2,5}, {3}, {4,6}

union(1,6)

{1,4,6}, {2,5}, {3}

union(4,6) ⇒ no change

{1,4,6}, {2,5}, {3}

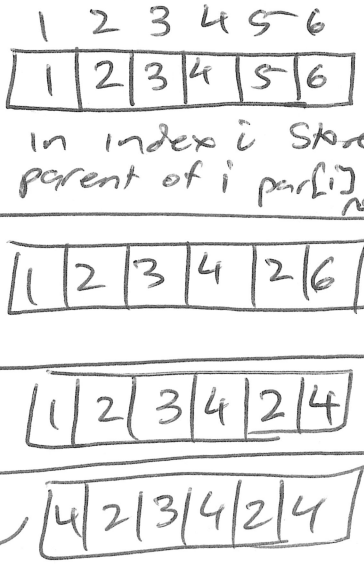


Union

A ∪ B

find(A)

return root of set A.

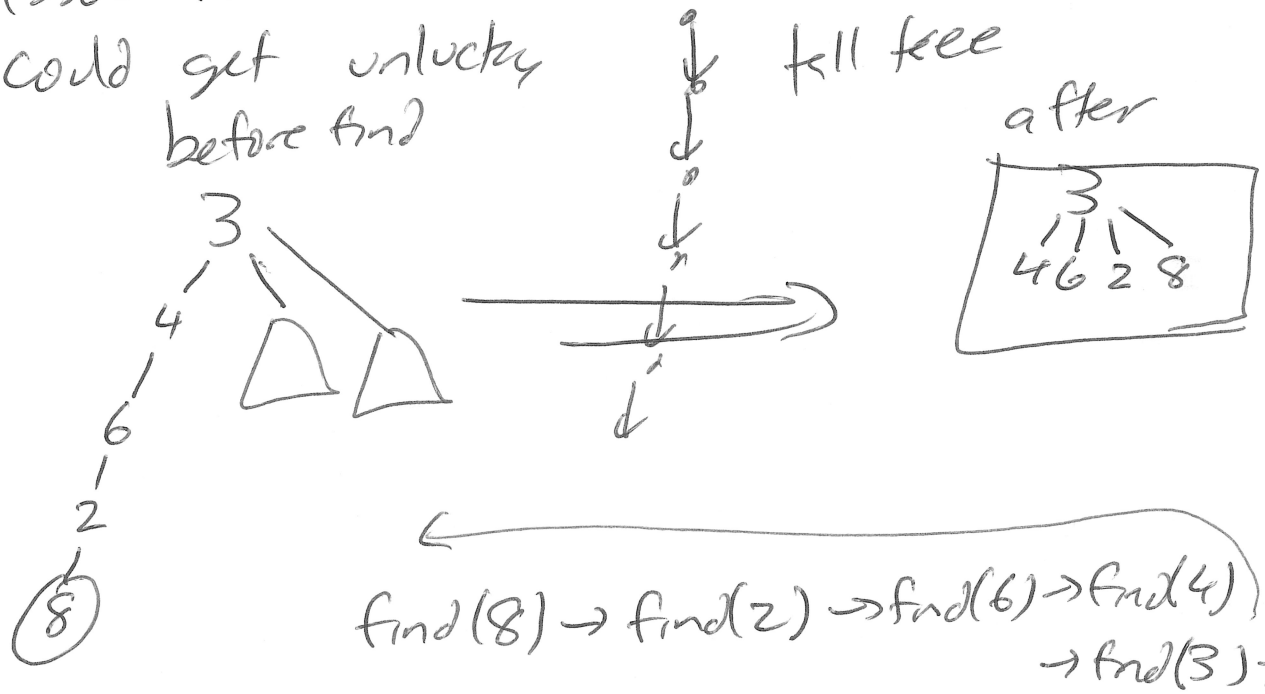


```
union(a, b) {
    a = find(a)
    b = find(b)
    par[a] = b
}
```

pseudo code

Run-time find $O(h)$, h = tallest trees

Issue: if we always choose 1 way, we could get unlucky



find(8) → find(2) → find(6) → find(4) → find(3) → 3

```
int find(int u) {
    if (par[u] == u) return u;
    return par[u] = find(par[u]);
}
```

$O(\text{inverseackermen func}(n))$

Small

Const time practical purposes

Radio Problem

Input: n (# of towers)

(x_0, y_0)
(x_1, y_1)
:
(x_{n-1}, y_{n-1})

} locations towers

Output: Min int r such radius of (10000, 1000)
r connects all towers

$0 < r < \cancel{20,000}\ 40,000$

(-10,000, 10000)

binary search on r

```
low = 0, high = 40000
while (low < high) {
    int mid = (low + high) / 2;
    if (conDo(mid))
        high = mid;
    else
        low = mid+1;
}
```

{0} {1} {2}
pt

```
for (i=0 to n-1
    j = i+1 to n-1
        if close(i,j)
            djset(i,j)
```

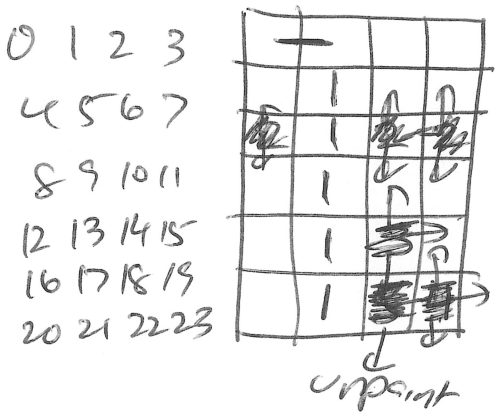
Artwork

Kattis id: artwork

Draw brushstroke – breaks apart white regions

opposite of what a DJ set does

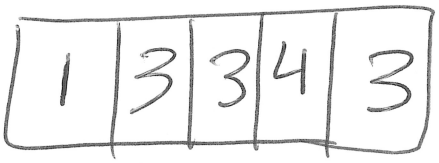
Imagine "unpainting" (going backward)



If 2 sq adj white

djset.union(0,1)

union(1,2)



Problem Solving Idea: If going forwards you split stuff, read everything in, then simulate backwards and you'll be unioning things! (with a DJ Set ☺)