NCKU Programming Contest Training Course
Disjoint set
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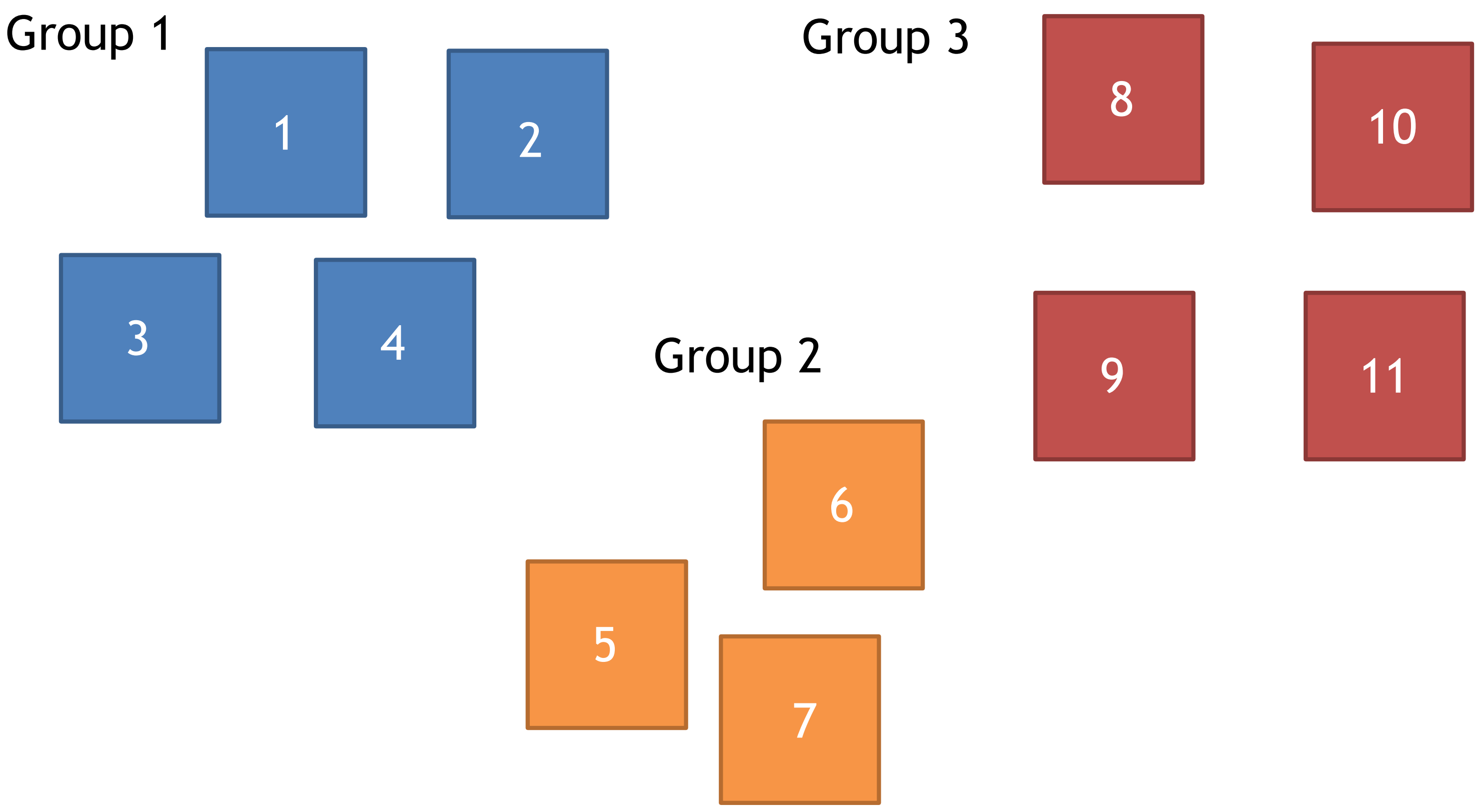
Disjoint Set

After classifying elements, we have several disjoint sets.



Disjoint Set

We want to know which group elements belonged to

Element 1 in group 1
Element 2 in group 1
Element 5 in group 2
Element 10 in group 3
…

Disjoint Set

- Main Operation
  - Union
  - Find

Disjoint Set

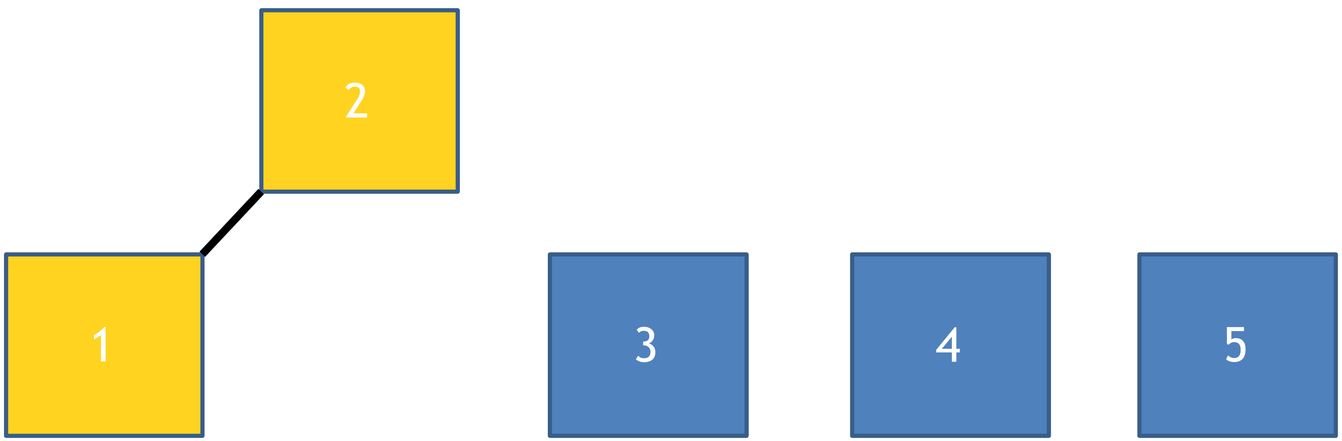
- Initial State

Disjoint Set

- Find(1) : return 1

Disjoint Set

- Union(1, 2)



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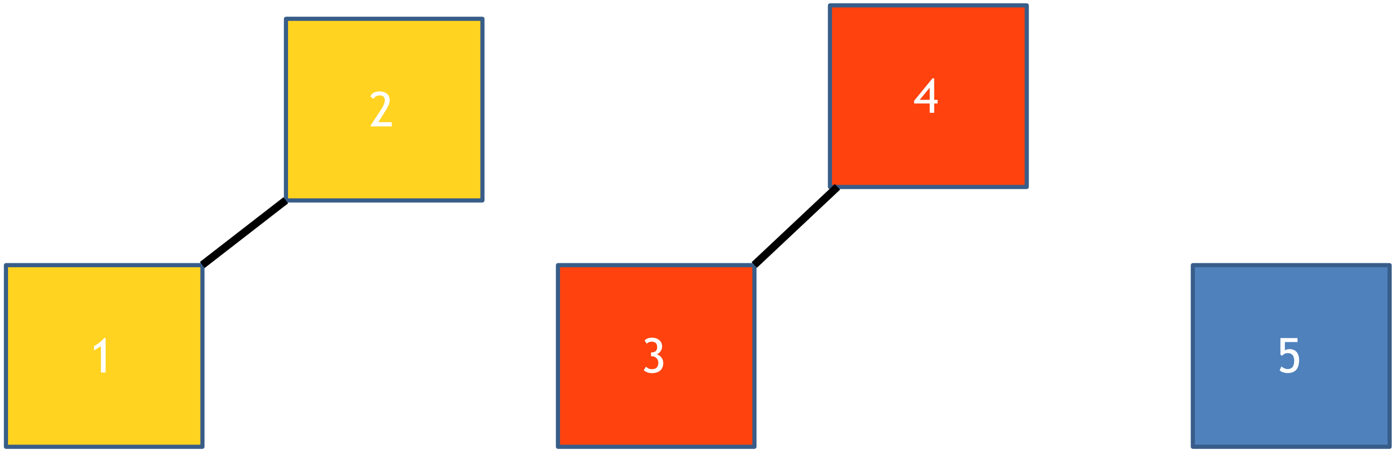
Disjoint Set

- Union(3, 4)



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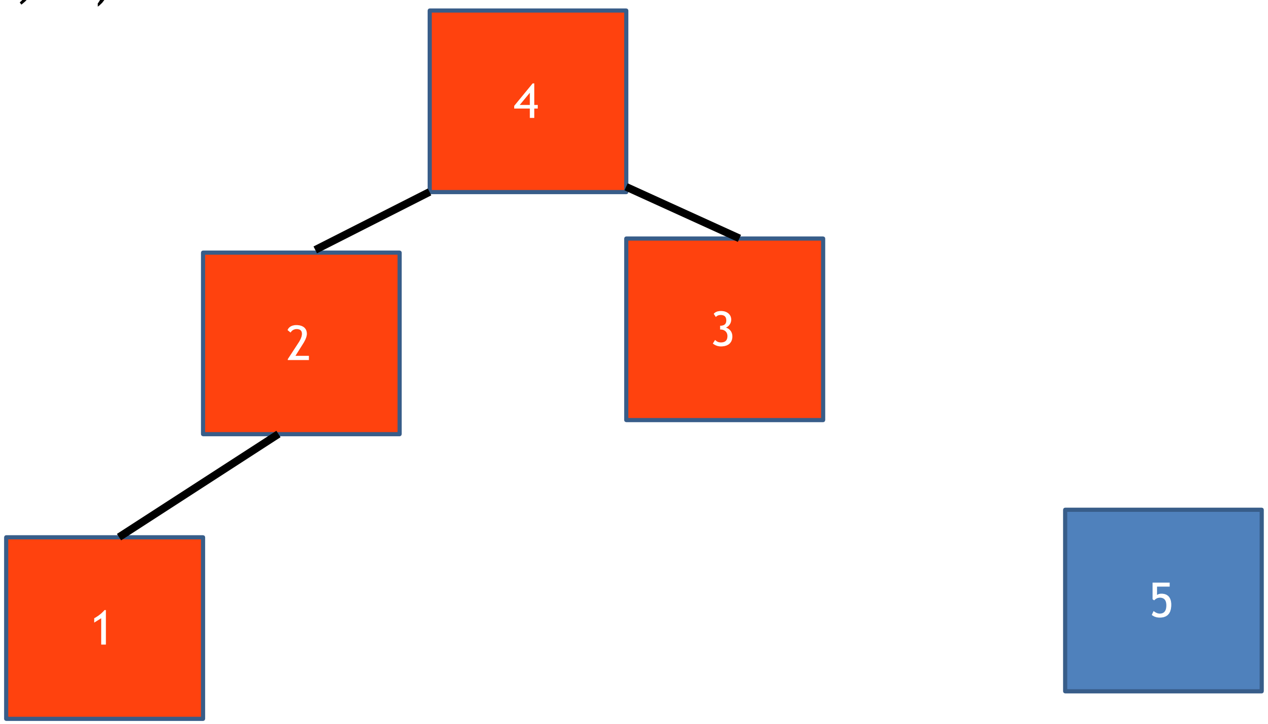
Disjoint Set

- Union(1, 3)



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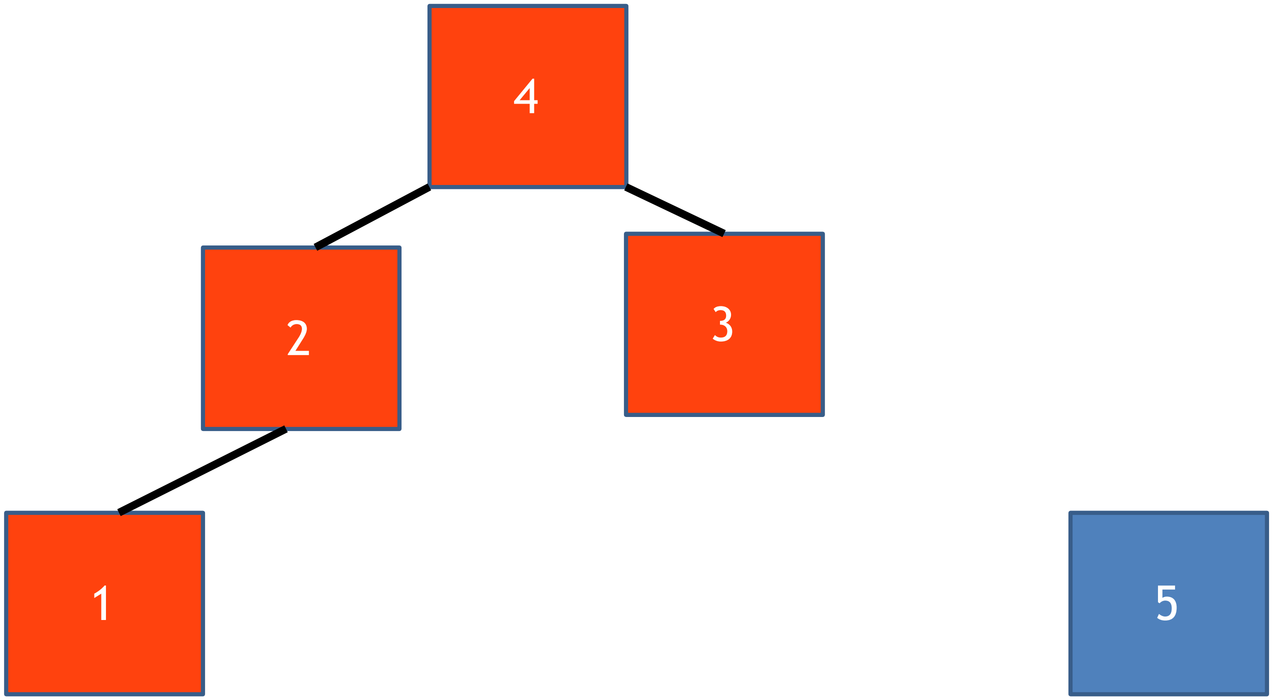
Disjoint Set

- Find(1) => 4
- Find(5) => 5



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Disjoint Set

- Find
  - Find the root of each group
  - Rebuild tree

- Union
  - Combine two group

```
for i = 0 to n
    p[i] = i;

int Find(int x)
{
    if(x == p[x]) return x;
    return p[x] = Find(p[x]);
}

void Union(int x, int y)
{
    int X = Find(x);
    int Y = Find(y);

    p[X] = Y;
}
```

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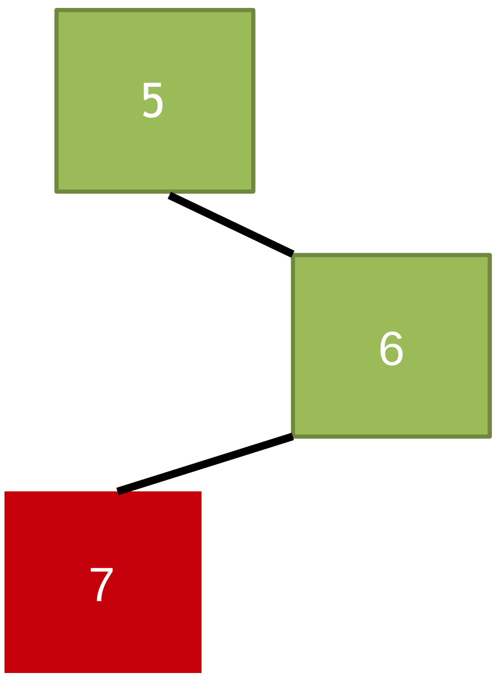
Disjoint Set

- Find(7) :



X = 7

```
for i = 0 to n
    p[i] = i;

int Find(int x)
{
    if(x == p[x]) return x;
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void Union(int x, int y)
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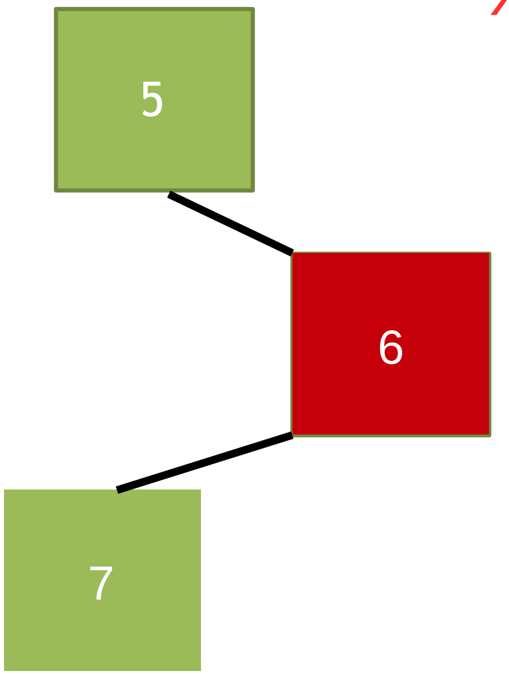
Disjoint Set

- Find(7) :

X = 6

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void Union(int x, int y)
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    int X = Find(x);
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    p[X] = Y;
}
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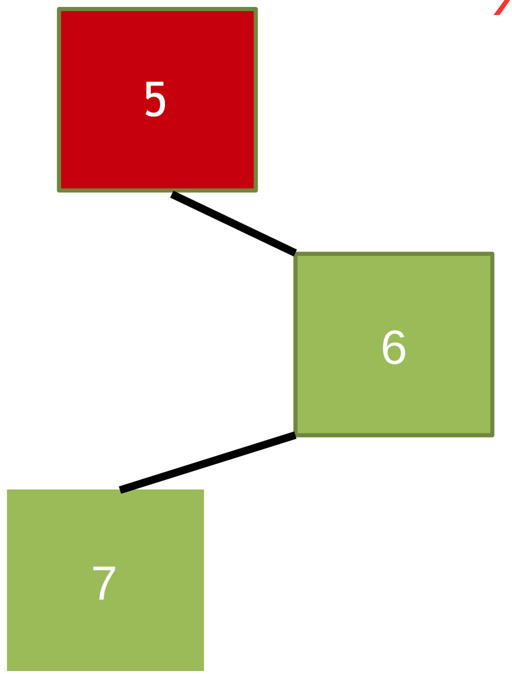
Disjoint Set

- Find(7) : return 5

X = 5

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Disjoint Set

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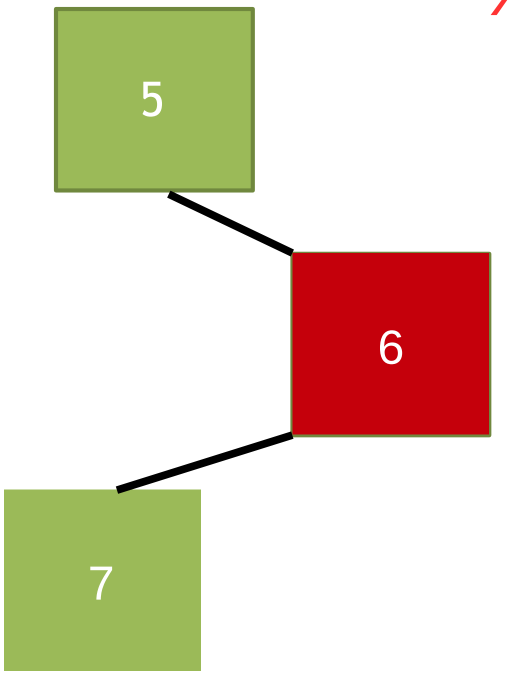


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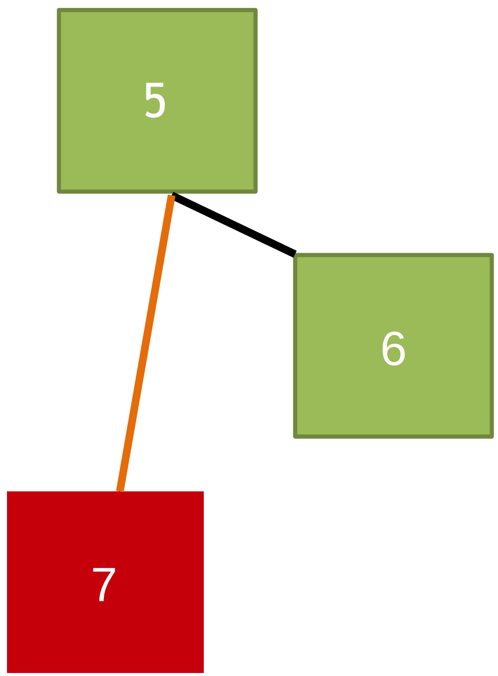
Disjoint Set

- Find(7) : return 5



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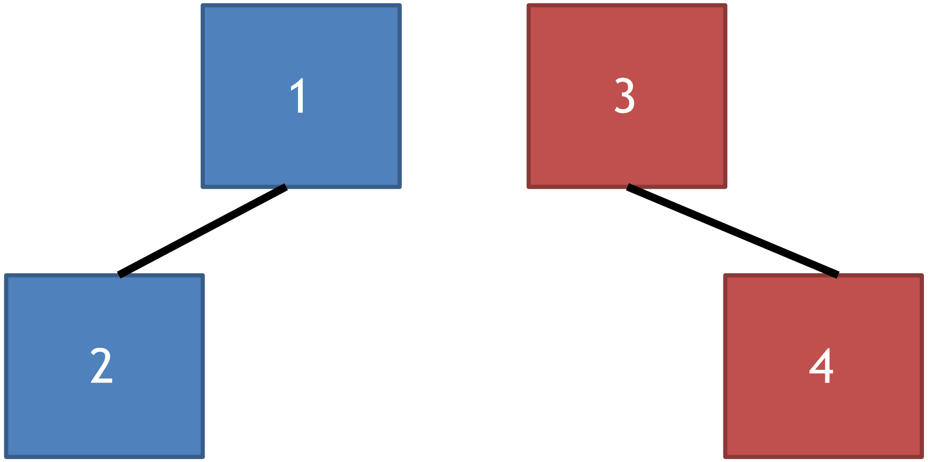
Disjoint Set

- Union(2, 4)

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Disjoint Set

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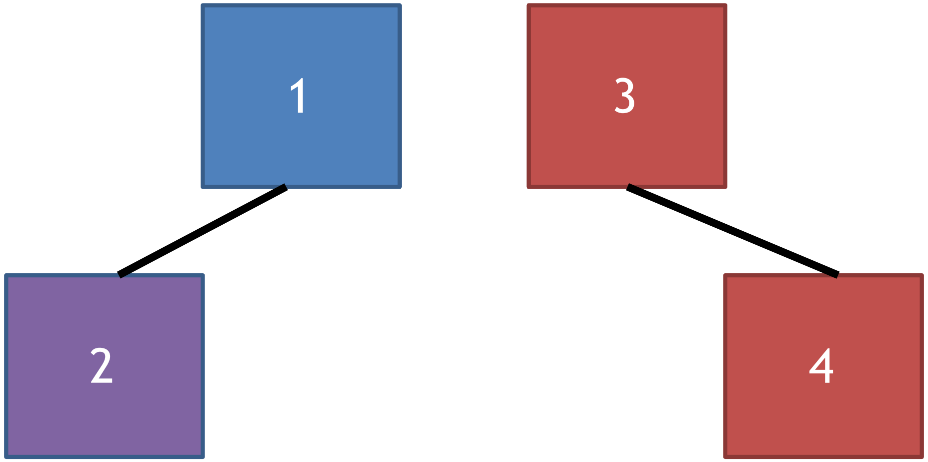


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Disjoint Set

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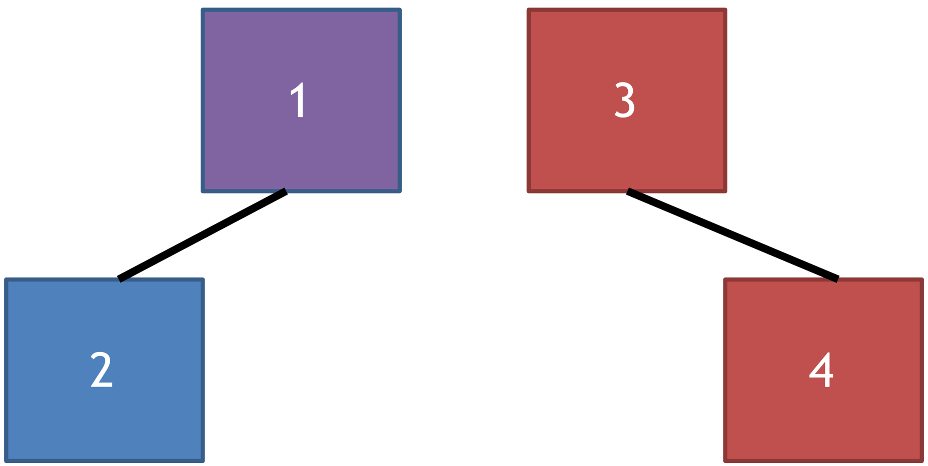


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Disjoint Set

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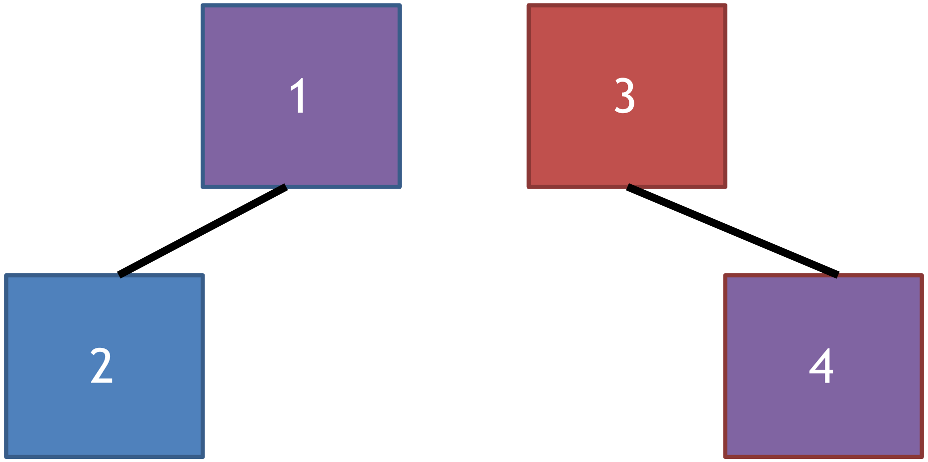


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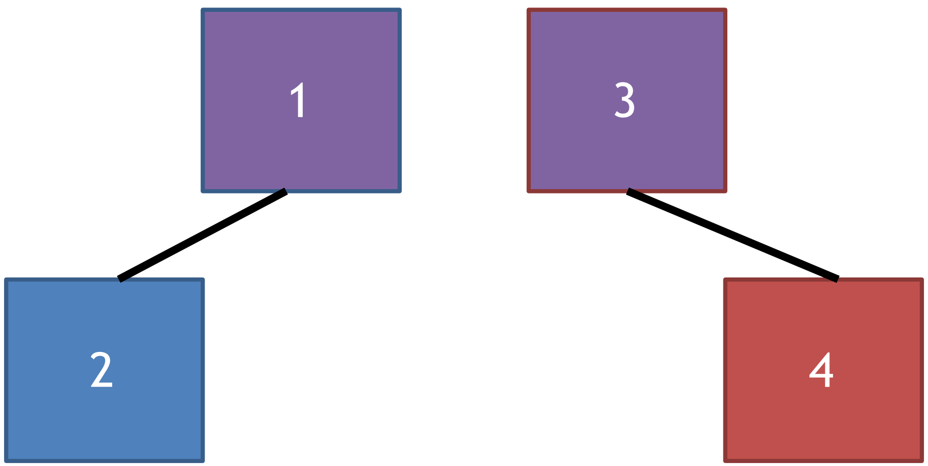
Disjoint Set

- Union(2, 4)

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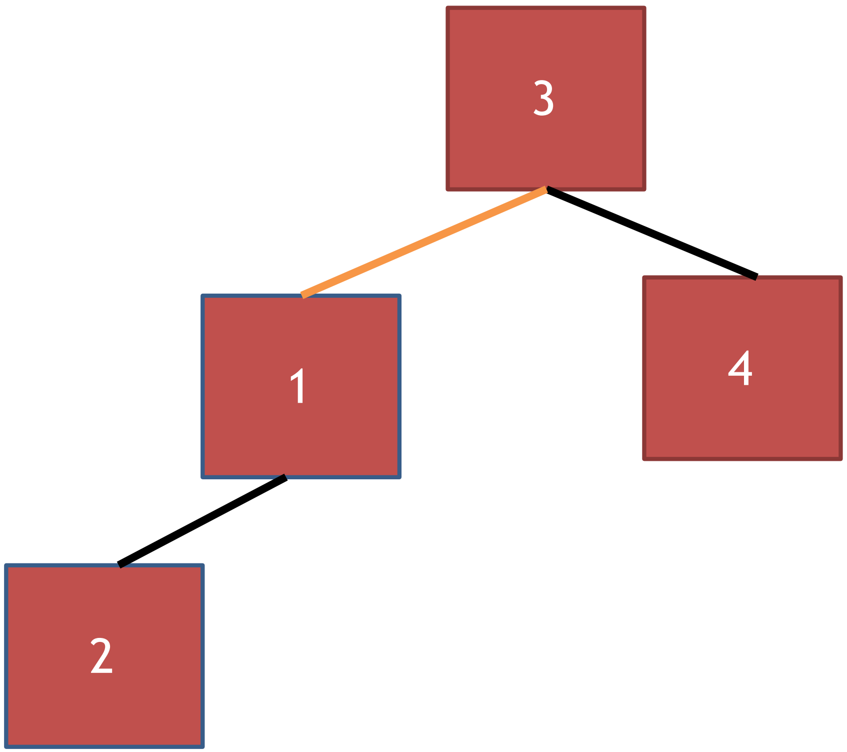
Disjoint Set

- Union(2, 4)

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}

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{
    int X = Find(x);
    int Y = Find(y);

    p[X] = Y;
}
```

Example 1

UVa 793 – Network Connections

Problem Description

Bob, who is a network administrator, supervises a network of computers. He is keeping a log connections between the computers in the network. Each connection is bi–directional. Two computers are interconnected if they are directly connected or if they are interconnected with the same computer. Occasionally, Bob has to decide, quickly, whether two given computers are connected, directly or indirectly, according to the log information. Write a program which based on information input from a text file counts the number of successful and the number of unsuccessful answers to the questions of the kind: is $computer_i$ interconnected with $computer_j$?

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Exercise

- Uva(6)
  - 793, 879, 10583, 10685, 10158, 11987
- POJ(1)
  - 1703