NCKU Programming Contest Training Course
Disjoint Set
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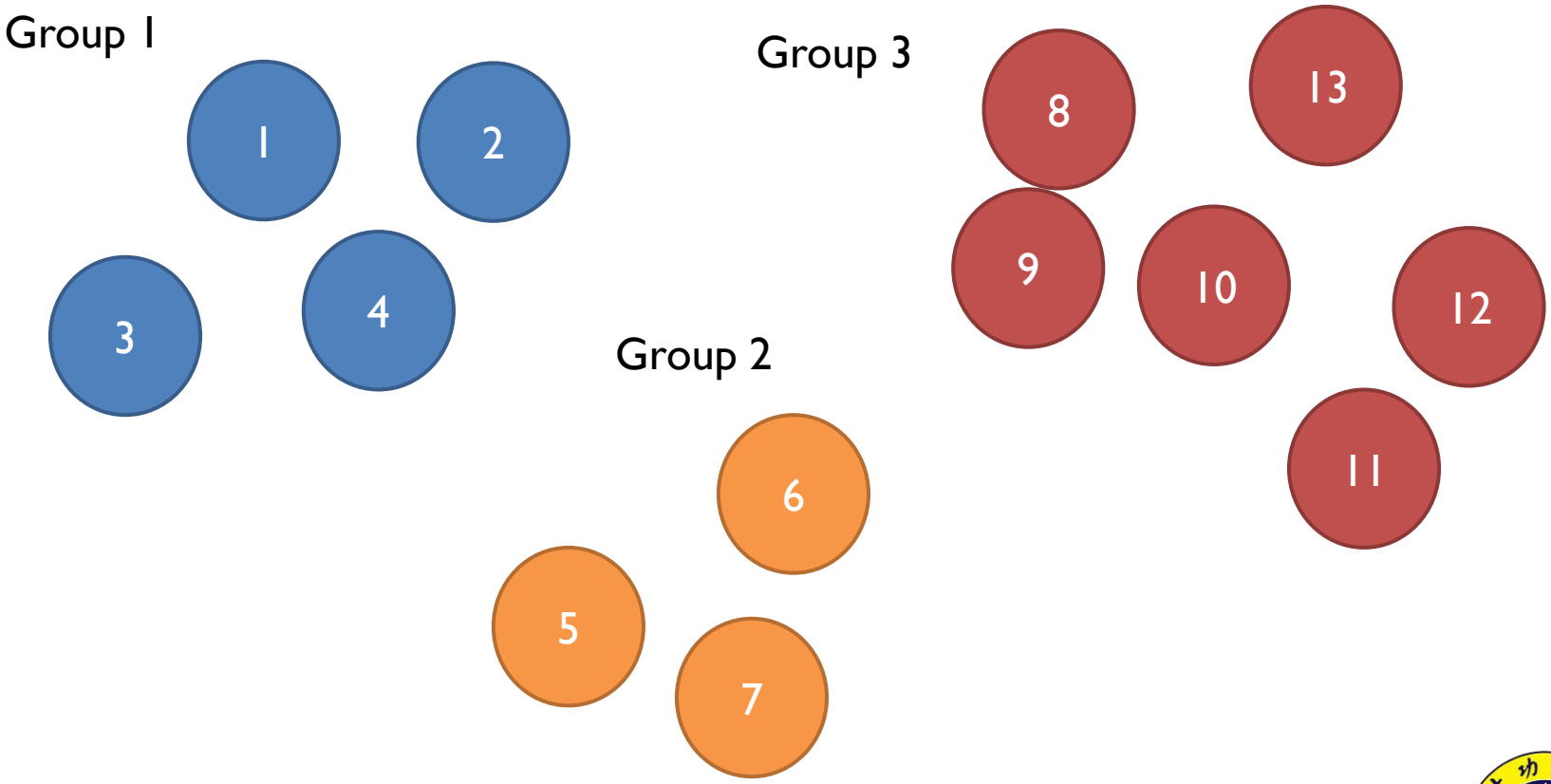
Disjoint Set

We have a collection of disjoint sets of elements



Disjoint Set

We want to know which group some elements is in

Element 1 in group 1

Element 2 in group 1

Element 5 in group 2

Element 10 in group 3

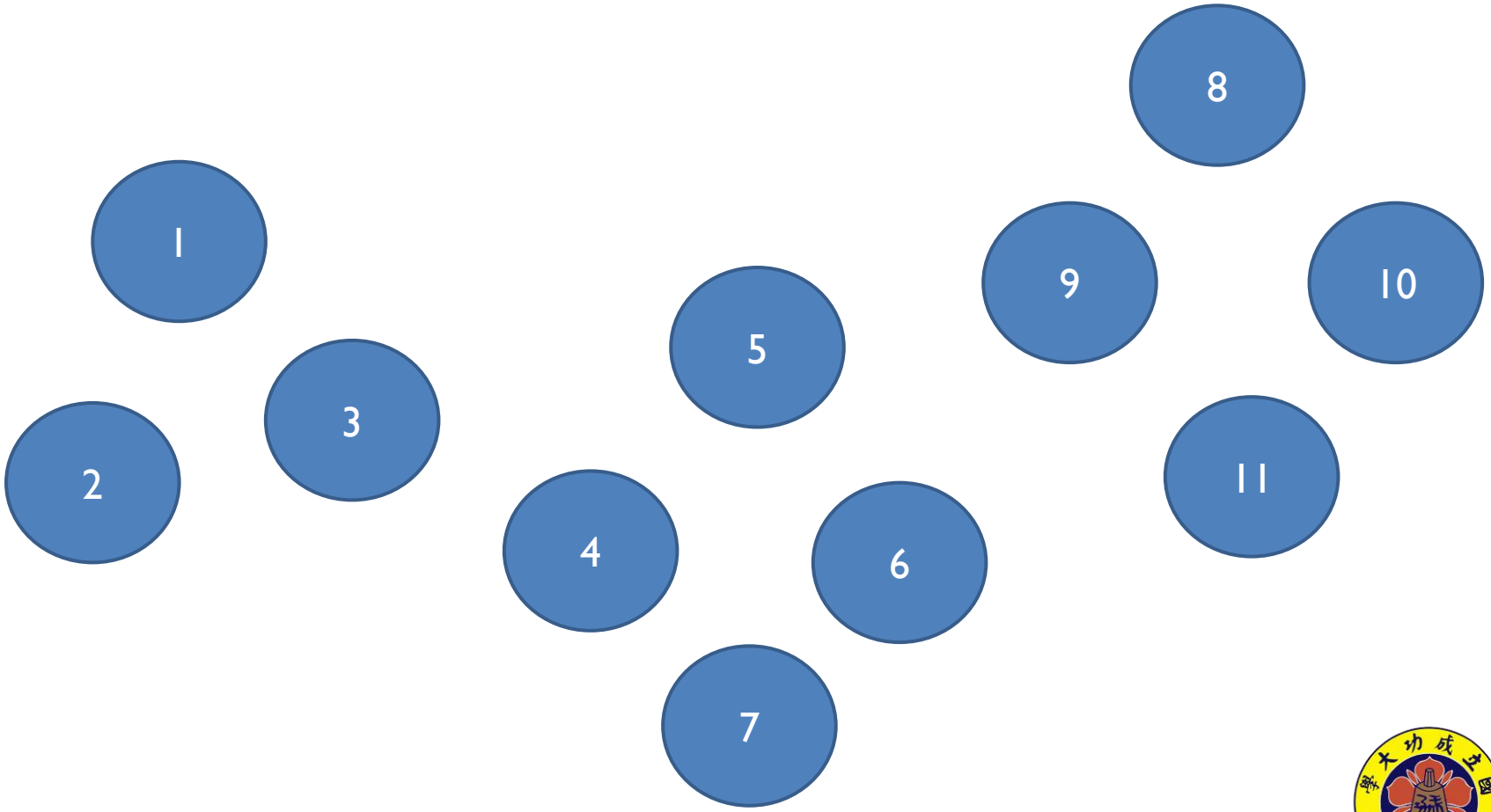
…

Disjoint Set

- Main Operation
  - Union
  - Find

Disjoint Set

- Initial State



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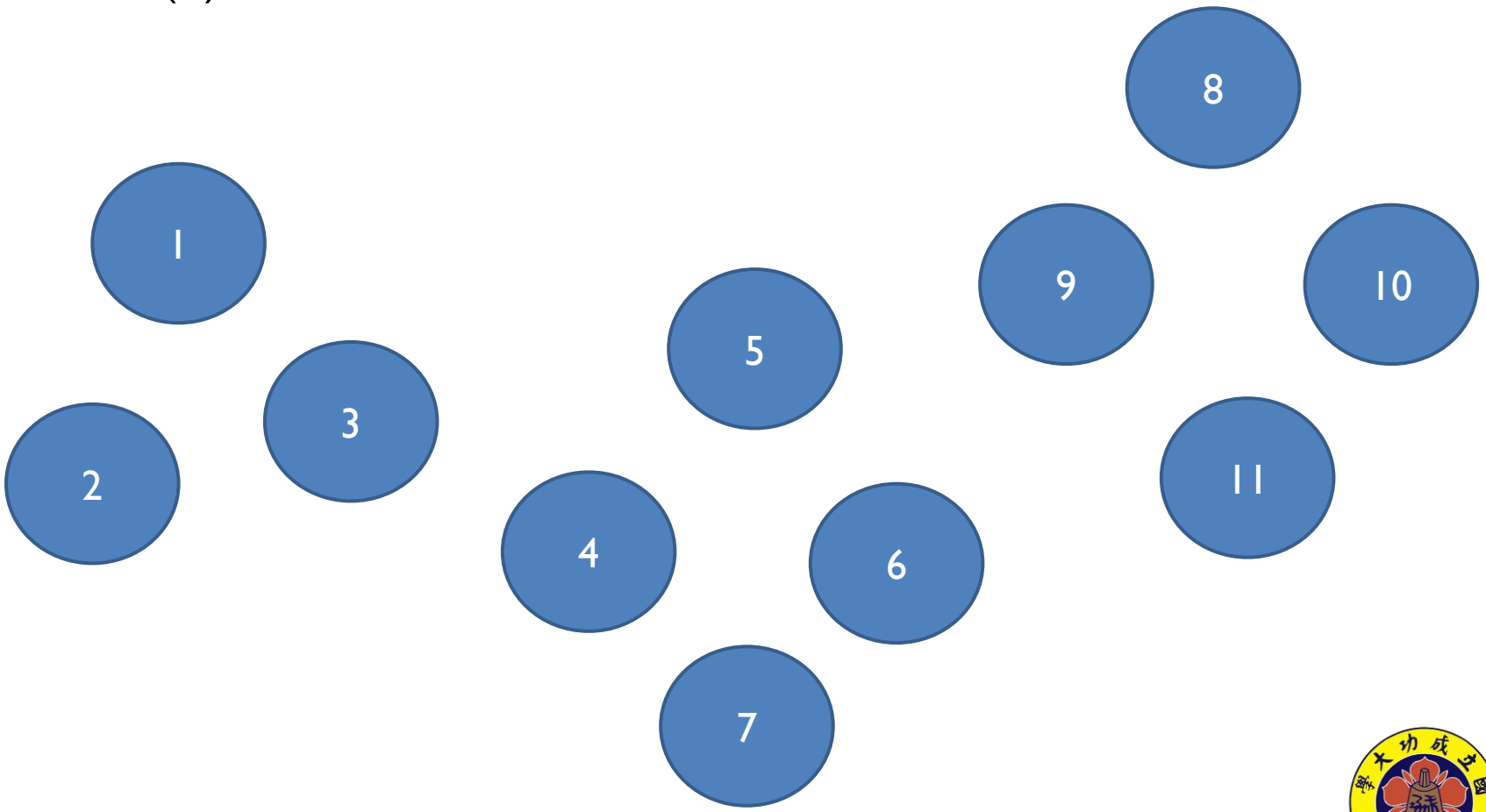
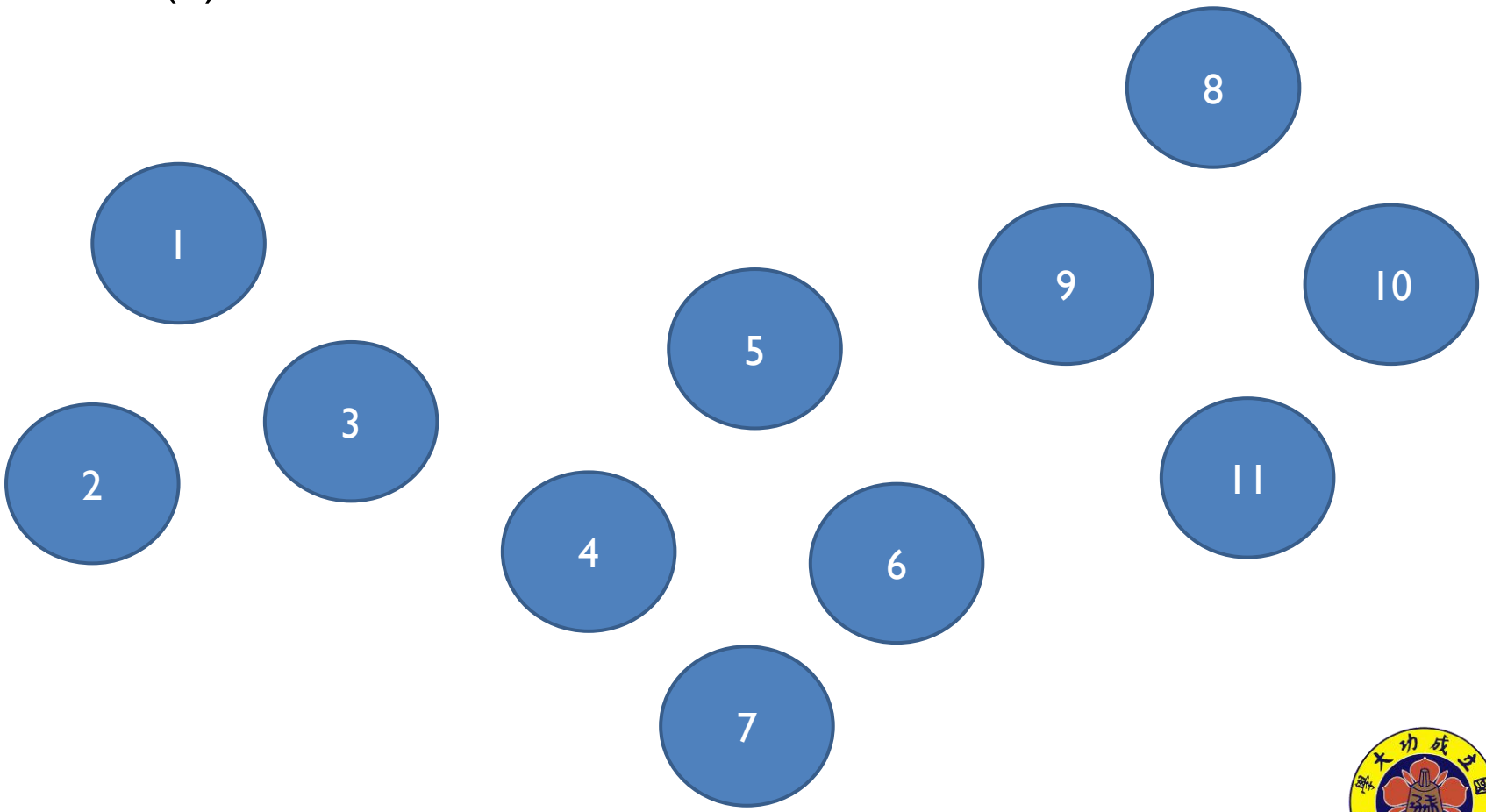
Disjoint Set

- Find(1) : return 1



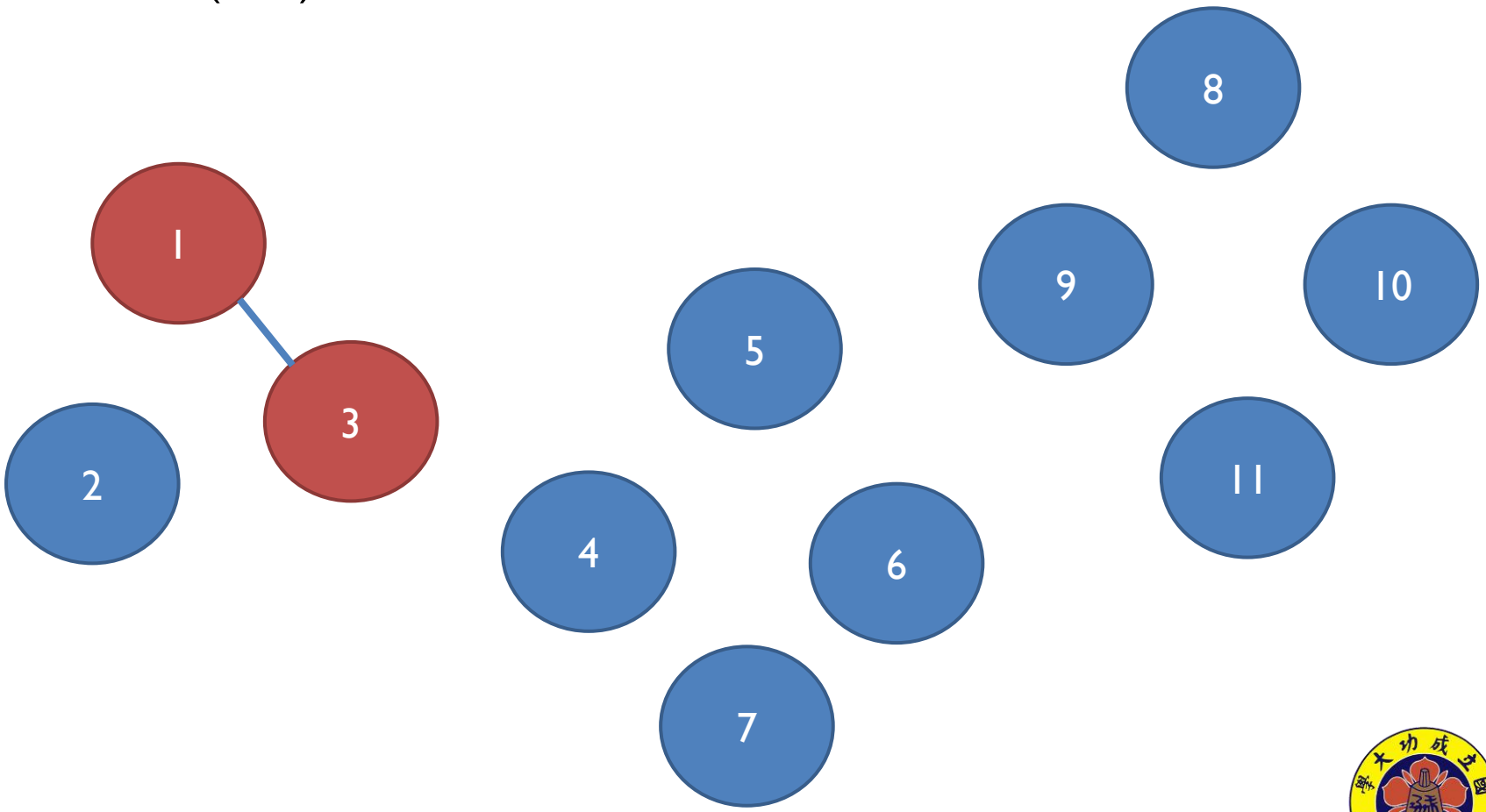
Disjoint Set

- Find(4) : return 4



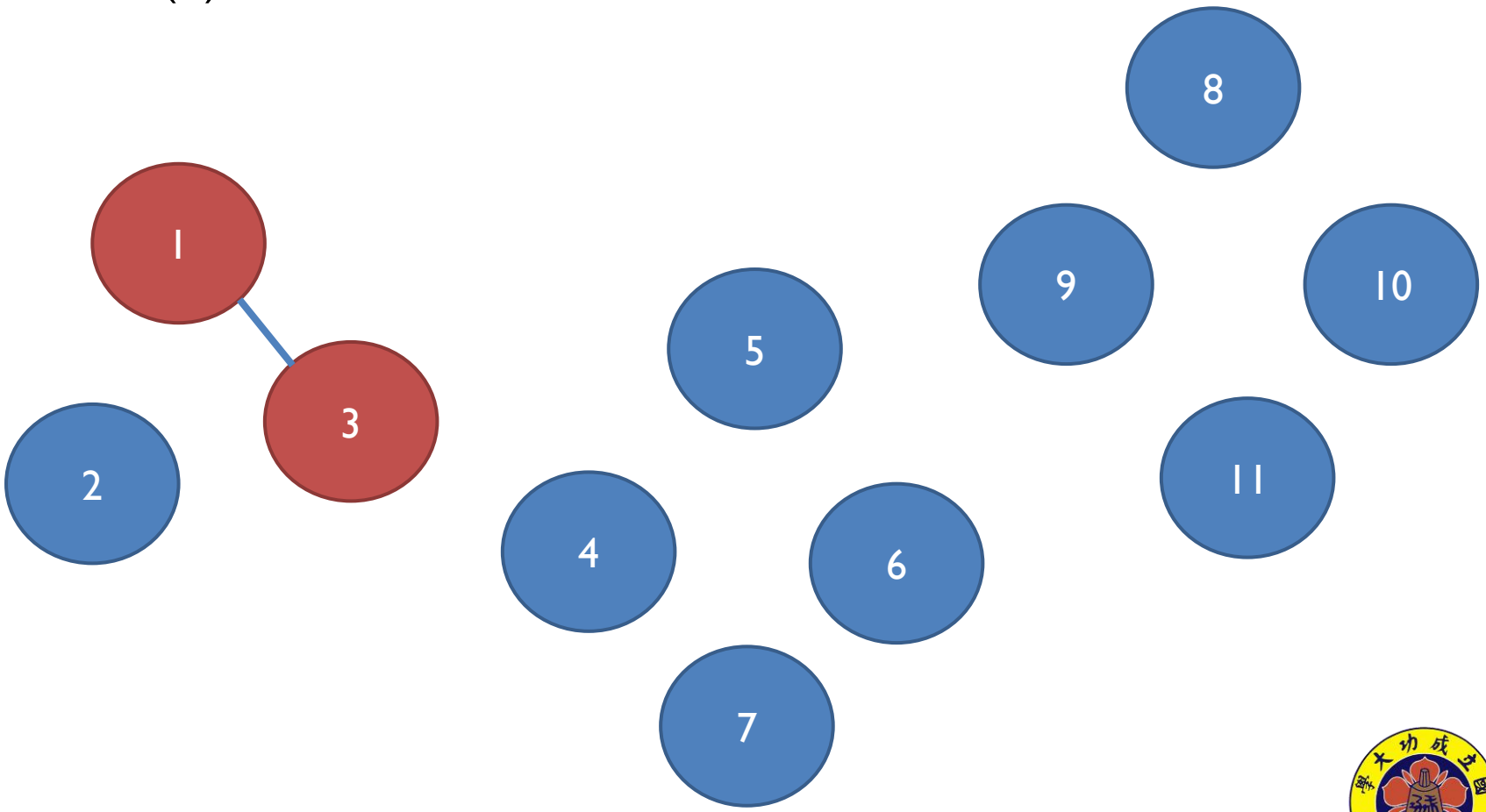
Disjoint Set

- Union(1, 3)



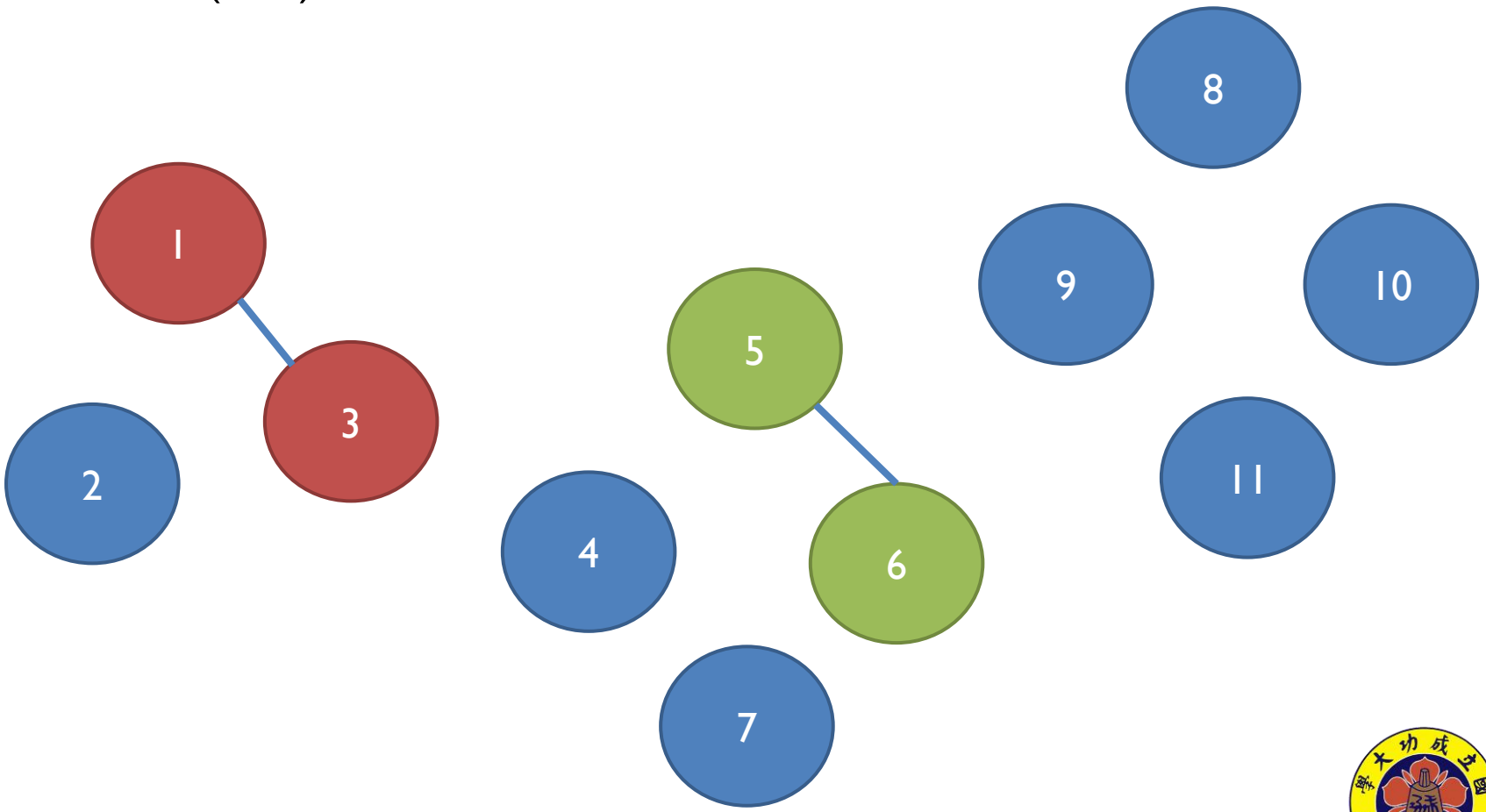
Disjoint Set

- Find(3) : return 1



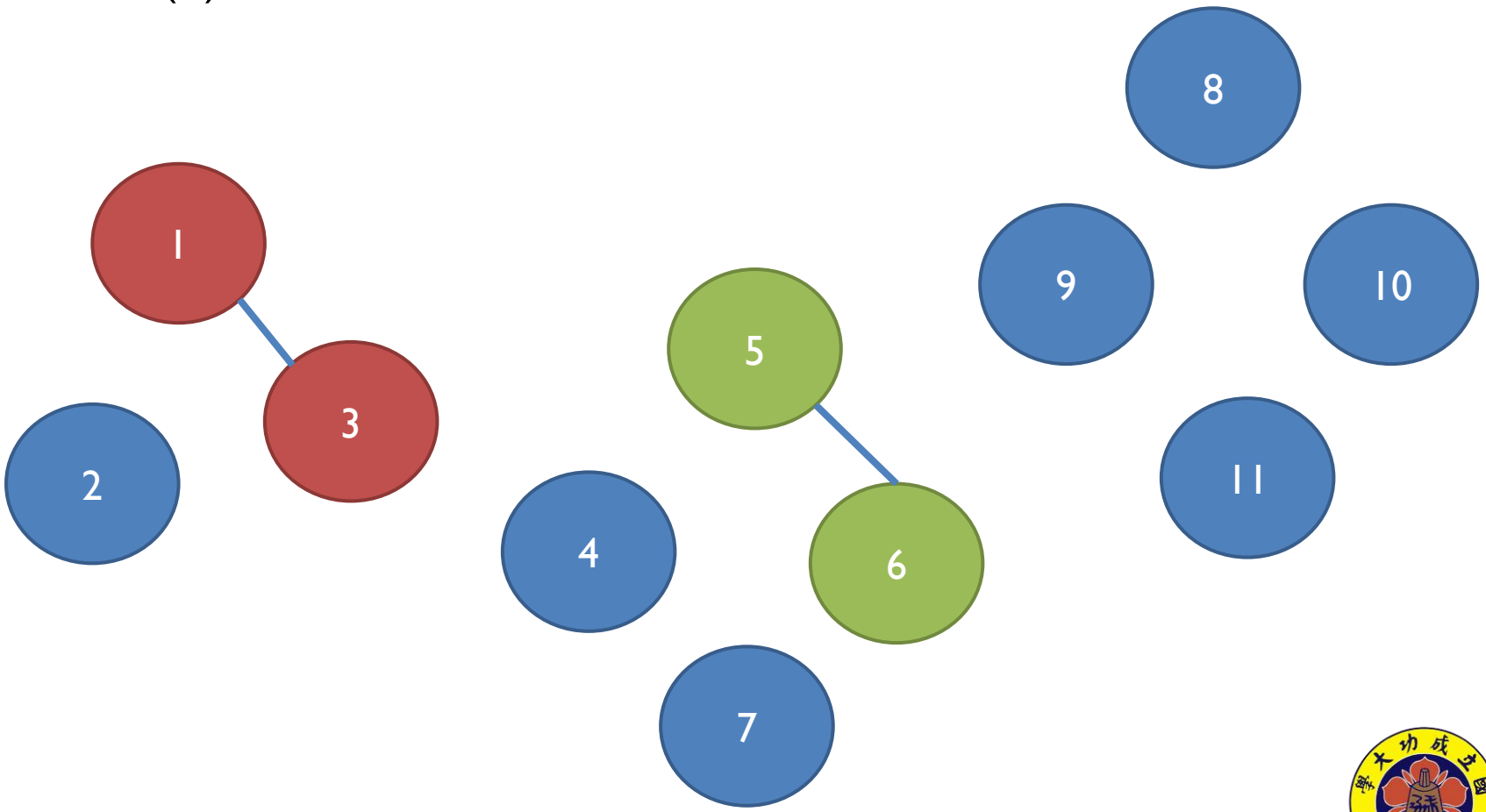
Disjoint Set

- Union(5, 6)



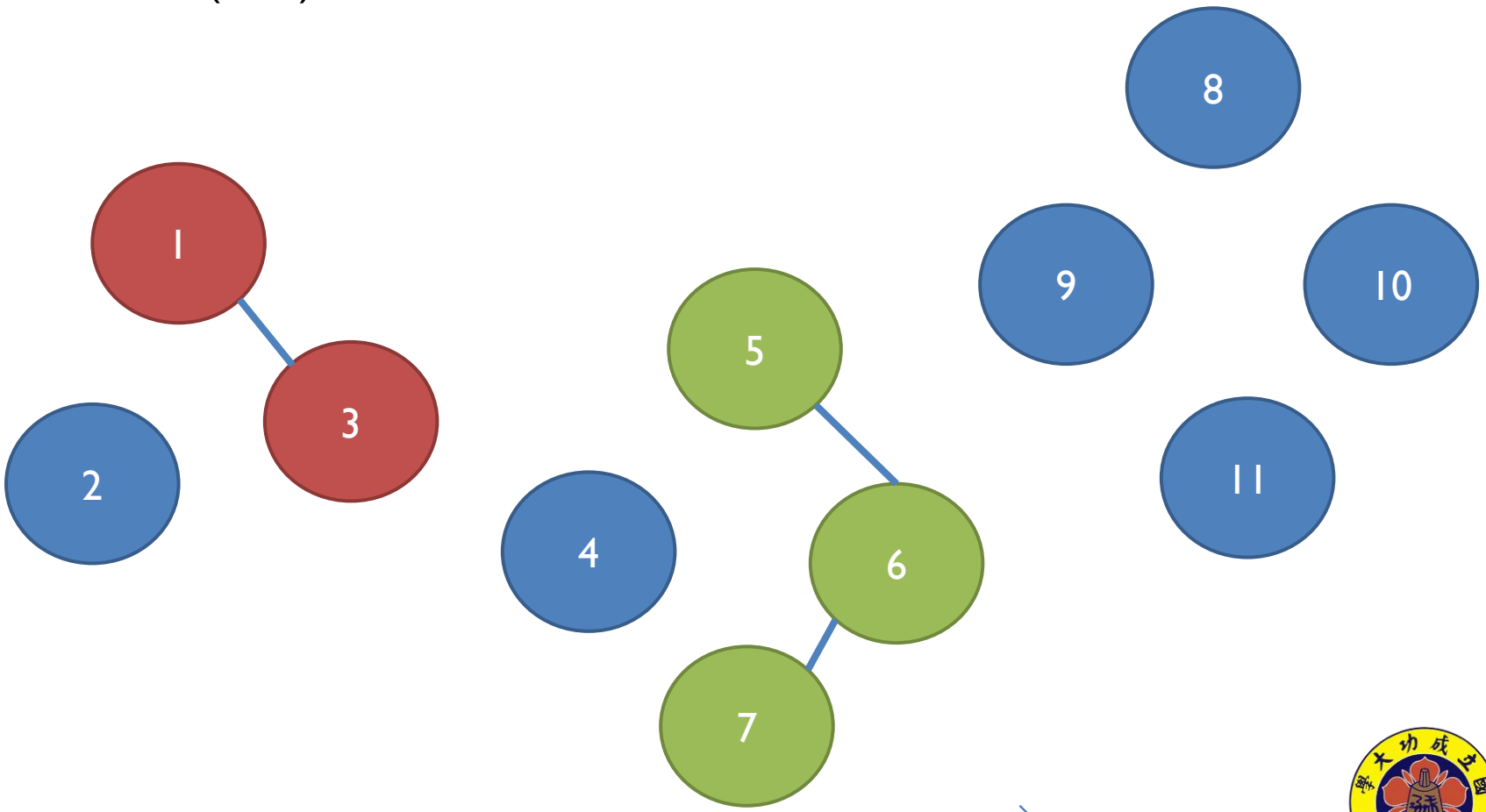
Disjoint Set

- Find(6) : return 5



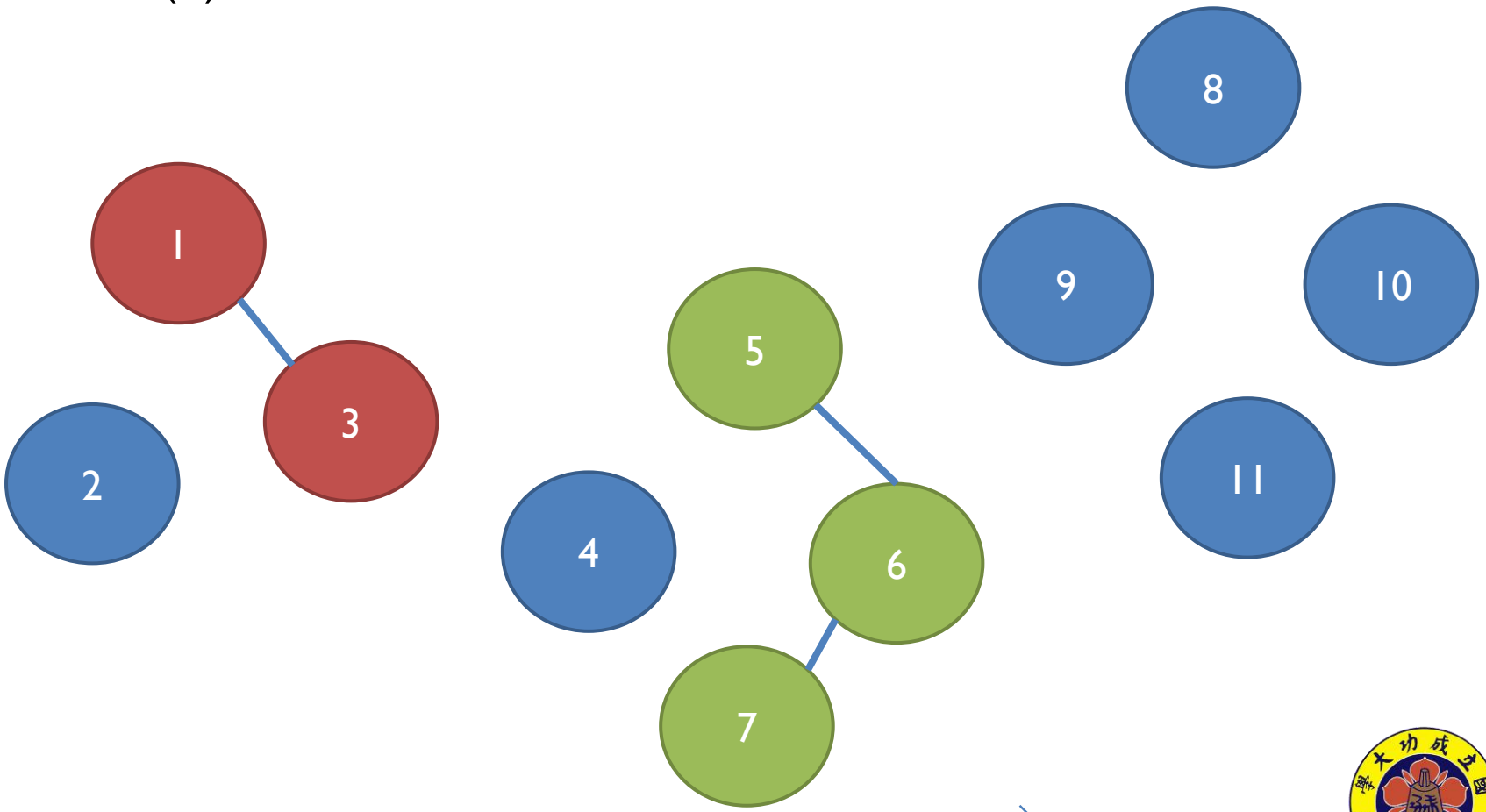
Disjoint Set

- Union(6, 7)



Disjoint Set

- Find(7) : return 5



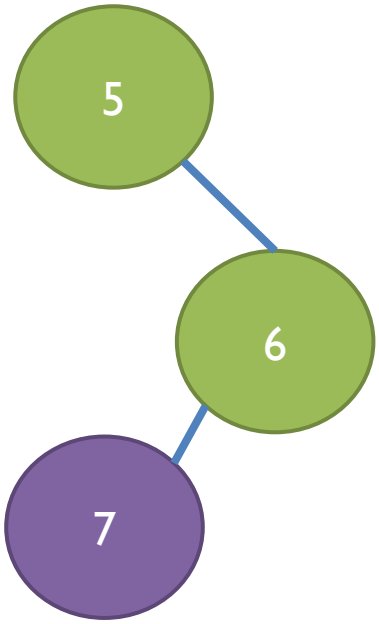
Disjoint Set

- Find
  - Find the root of each group
- 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;
}
```

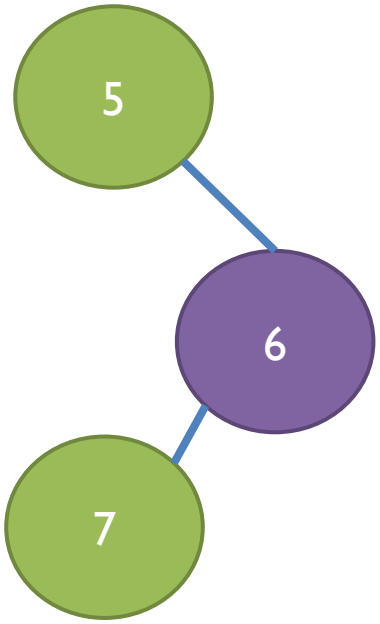
Disjoint Set

- Find(7) :



Disjoint Set

- Find(7) :



Disjoint Set

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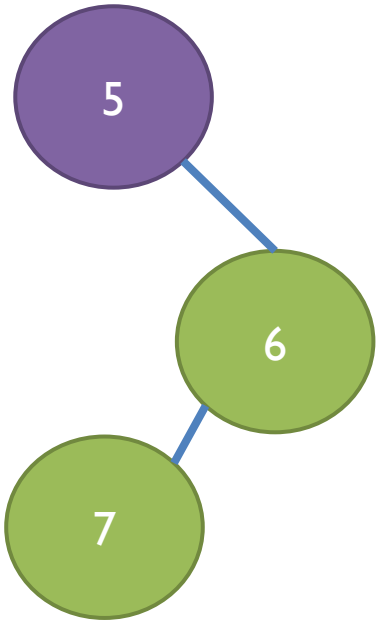

Disjoint Set

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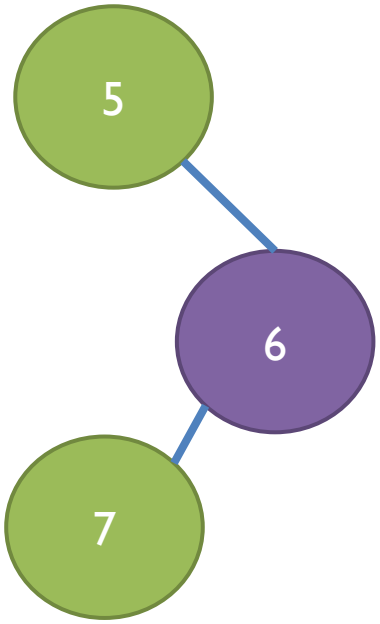
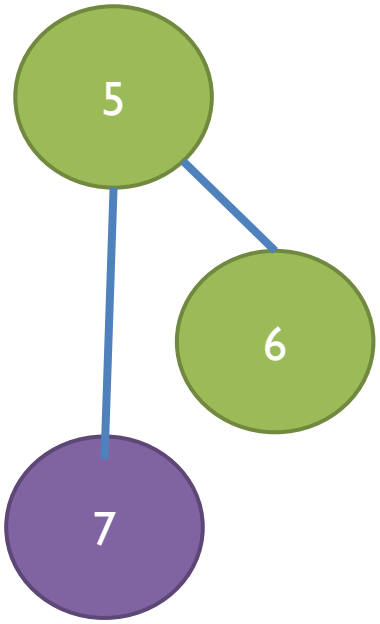


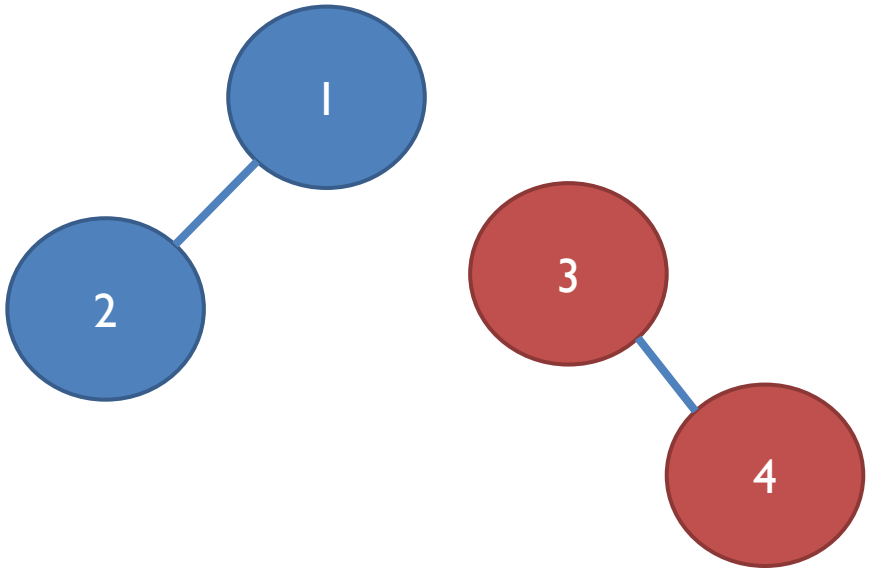
Disjoint Set

- Find(7) : return 5



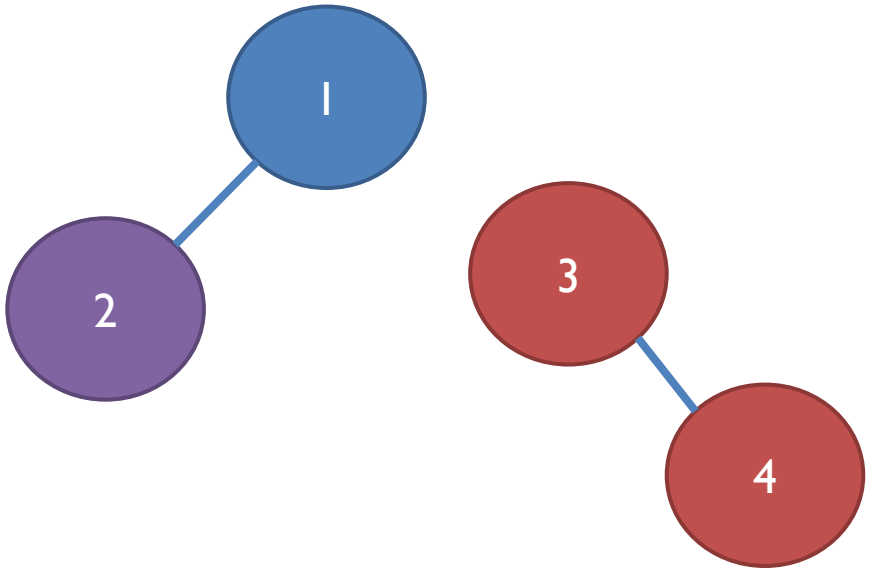
Disjoint Set

- Union(2, 4)



Disjoint Set

- Union(2, 4)



Disjoint Set

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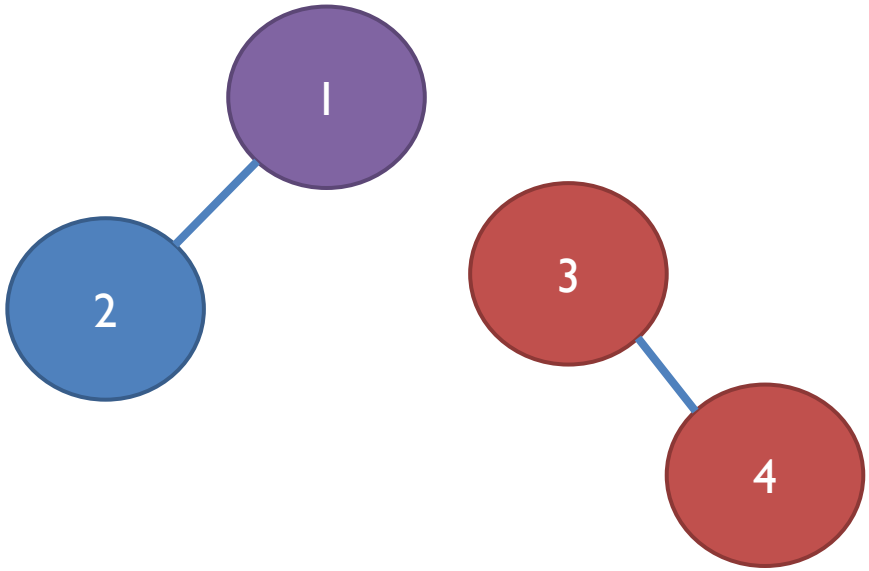

Disjoint Set

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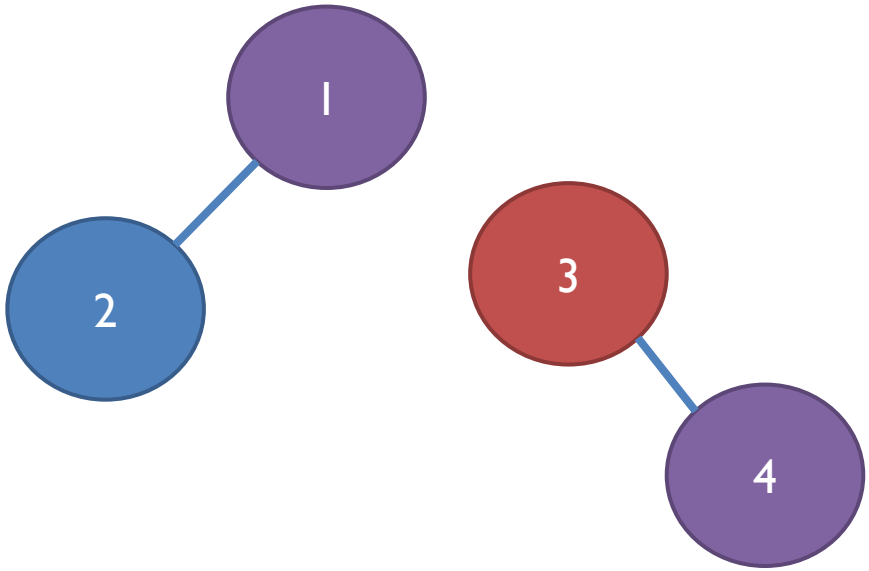

Disjoint Set

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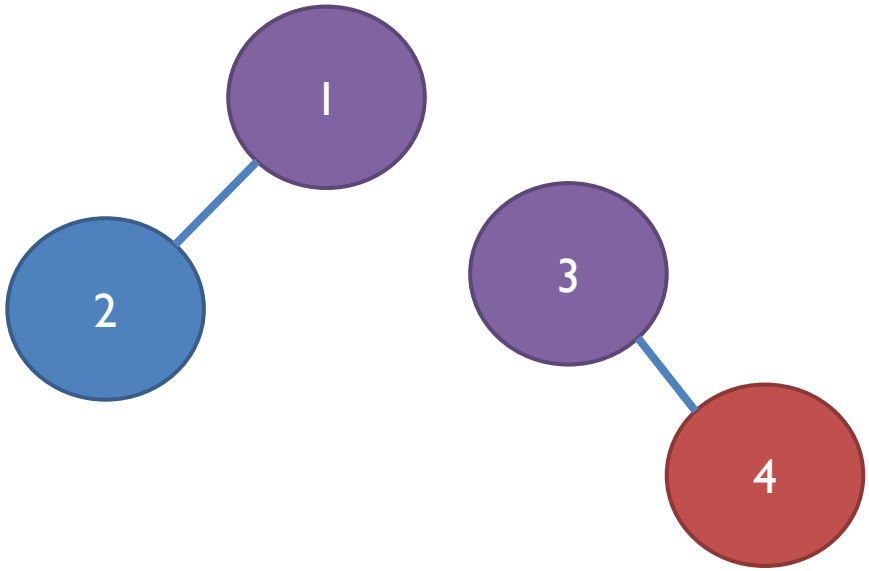

Disjoint Set

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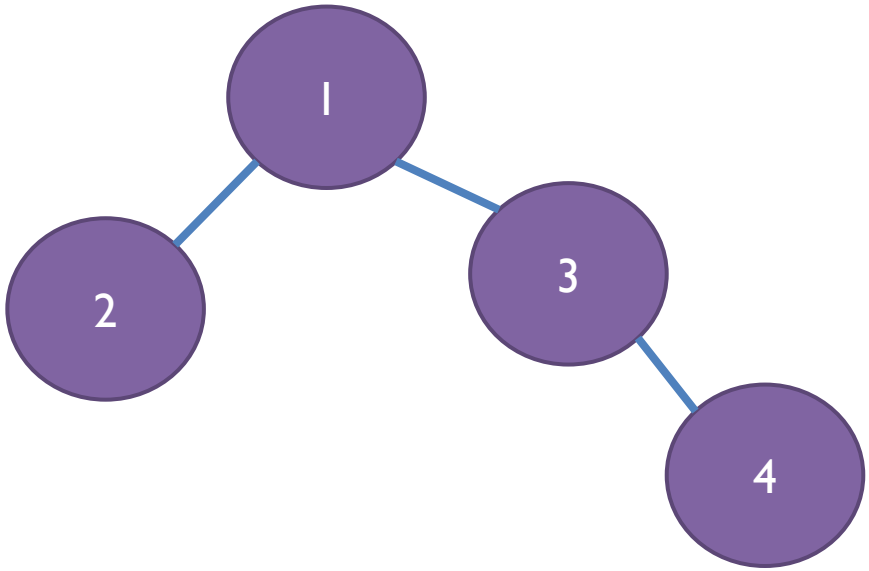

Example - 1

UVa 10583 - Ubiquitous Religions

Problem Description

There are so many different religions in the world today that it is difficult to keep track of them all. You are interested in finding out how many different religions students in your university believe in. You know that there are n students in your university ($0 < n \leq 50000$). It is infeasible for you to ask every student their religious beliefs. Furthermore, many students are not comfortable expressing their beliefs. One way to avoid these problems is to ask m ($0 \leq m \leq n(n-1)/2$) pairs of students and ask them whether they believe in the same religion (e.g. they may know if they both attend the same church). From this data, you may not know what each person believes in, but you can get an idea of the upper bound of how many different religions can be possibly represented on campus. You may assume that each student subscribes to at most one religion.

Example - 1

Input

The input consists of a number of cases. Each case starts with a line specifying the integers n and m. The next m lines each consists of two integers i and j, specifying that students i and j believe in the same religion. The students are numbered 1 to n. The end of input is specified by a line in which n = m = 0.

Output

For each test case, print on a single line the case number (starting with 1) followed by the maximum number of different religions that the students in the university believe in.

Example - 2

UVa 10685 Nature

Problem Description

In nature, there are alimentary chains. At the basis of this chain, we generally have the vegetals. Small animals eat those vegetals and bigger animals eat the smaller. There can be cycles in the chain, as when some animal dies he starts a decomposition process which will transform its body into minerals that are a source of energy for the vegetals.

In this problem you will have to find the largest alimentary chain for a given group of creatures. You can consider that if A is predator of B then they are in the same chain.

Example - 2

Input

The input file contains several input sets. The description of each set is given below: Each set starts with two integers C (1 ≤ C ≤ 5000), the number of creatures, and R (0 ≤ R ≤ 5000), the number of relations. Follow C lines with the names of the creatures, each consisting of lower case letters (a, b, …, z). No name is longer than 30 letters. Then there will be R lines describing the relations. Each line will have 2 names of creatures, meaning that the second creature is a predator of the first one. You can assume that no creature is a predator of himself. Input is terminated by a set where C = R = 0. This set should not be processed. There is a blank line beteween two input sets.

Output

For each input set produce one line of output, the size of the largest alimentary chain.

Homework

Total 4 Problem

- Uva(3)
  - 793, 10583, 10685, 10158
- POJ(1)
  - 1703