

数据结构(上)

九章算法强化班 第2章



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1. Union Find 并查集
2. Trie 字典树
3. Sweep Line 扫描线

Union Find

并查集

一种用来解决集合查询合并的数据结构
支持 $O(1)$ find/ $O(1)$ union

并查集可以干什么？

1. 判断在不在同一个集合中。
 - find 操作
2. 关于集合合并
 - union 操作



1. 查询 Find (递归？ 非递归？)

2. 合并 Union

- 模板代码

```
HashMap<Integer, Integer> father = new HashMap<Integer, Integer>()
```

```
int find(int x){  
    int parent = father.get(x);  
    while(parent!=father.get(parent)) {  
        parent = father.get(parent);  
    }  
    return parent;  
}
```

- Key
 - 老大哥之间合并
 - 跟小弟没关系

```
HashMap<Integer, Integer> father = new HashMap<Integer, Integer>()
```

```
void union(int x, int y){  
    int fa_x = find(x);  
    int fa_y = find(y);  
    if(fa_x != fa_y)  
        father.put(fa_x, fa_y);  
}
```

BIG BROTHER



IS WATCHING
YOU

```
class UnionFind{
    HashMap<Integer, Integer> father = new HashMap<Integer, Integer>();
    UnionFind(){}

    int find(int x){
        int parent = father.get(x);
        while(parent!=father.get(parent)) {
            parent = father.get(parent);
        }
        return parent;
    }
    void union(int x, int y){
        int fa_x = find(x);
        int fa_y = find(y);
        if(fa_x != fa_y)
            father.put(fa_x, fa_y);
    }
}
```


Find the Connected Component in the Undirected Graph

<http://www.lintcode.com/en/problem/find-the-connected-component-in-the-undirected-graph/>

<http://www.jiuzhang.com/solutions/find-the-connected-component-in-the-undirected-graph/>

连通块: 无向图一个块中节点你找得到我, 我也找得到你

- 弱连通块
 - 有向图一个块中，你找得到我，我可以找不到你
- 强连通块
 - 有向图一个块中，你找得到我，我也找得到你

Find the Weak Connected Component in the Directed Graph

<http://www.lintcode.com/en/problem/find-the-weak-connected-component-in-the-directed-graph/>

<http://www.jiuzhang.com/solutions/find-the-weak-connected-component-in-the-directed-graph/>

- 参考模板
- 平摊时间复杂度 $O(1)$

```
int compressed_find(int x){  
    int parent = father.get(x);  
    while(parent!=father.get(parent)) {  
        parent = father.get(parent);  
    }  
    int temp = -1;  
    int fa = x;  
    while(fa!=father.get(fa)) {  
        temp = father.get(fa);  
        father.put(fa, parent) ;  
        fa = temp;  
    }  
    return parent;  
}
```

Google Interviewer: Number of Islands

www.lintcode.com/zh-cn/problem/number-of-islands

<http://www.jiuzhang.com/solutions/number-of-islands/>



Google Interviewer: Number of Islands II

<http://www.lintcode.com/zh-cn/problem/number-of-islands-ii/>

<http://www.jiuzhang.com/solutions/number-of-islands-ii/>

Facebook Interviewer: Graph Valid Tree

<http://www.lintcode.com/problem/graph-valid-tree>
<http://www.jiuzhang.com/solutions/graph-valid-tree/>

Union Find $O(n)$

Surrounded Regions

<http://www.lintcode.com/en/problem/surrounded-regions/>

<http://www.jiuzhang.com/solutions/surrounded-regions/>

- 1、关于集合合并。
- 2、判断在不在同一个集合中。

Trie

字典树

Snapshot Interviewer: Implement Trie

<http://www.lintcode.com/en/problem/implement-trie/>
<http://www.jiuzhang.com/solutions/trie/>

-

Hash vs Trie

时间复杂度Hash $O(1)$ 是对于一个字符串

什么样的题目适合Trie？

- 一个一个字符串遍历
- 需要节约空间

Microsoft Interviewer: Word Search II

<http://www.lintcode.com/en/problem/word-search-ii/>

<http://www.jiuzhang.com/solutions/word-search-ii/>

- Given a dictionary[aca, acc] and a matrix of upper alphabets
 - acaf
 - acad
 - acae
- Find all words in the dictionary that can be found in the matrix.

Snapshot Interviewer: Add and Search Word

<http://www.lintcode.com/en/problem/add-and-search-word/>
<http://www.jiuzhang.com/solutions/add-and-search-word/>



Typeahead

搜索引擎

设计算法获得IP到城市的Map

<http://www.jiuzhang.com/qa/262/>

- 一个一个字符串遍历
- 需要节约空间

Sweep-Line

扫描线

Amazon Interviewer: Number of Airplane in the sky

<http://www.lintcode.com/en/problem/number-of-airplanes-in-the-sky/>

<http://www.jiuzhang.com/solutions/number-of-airplanes-in-the-sky/>

- 数据结构的题目：
- Union Find: 集合合并, 查找元素在集合里面
- Trie: 快速找到一个元素, 一个字母一个字母查找
- Sweep-line: 区间拆分

Thank You

