玩儿转算法面试

liuyubobobo

栈和队列的使用

栈 Stack

栈的基础使用

20. Valid Parentheses

20. Valid Parentheses

给定一个字符串，只包含 (, [, { ,) ,] , } ，判定字符串中的括号匹配是否合法。

- 如 ”()” , “()[]{}” 是合法的
- 如 “(]”， ”([)]” 是非法的

20. Valid Parentheses

{ [( )] }

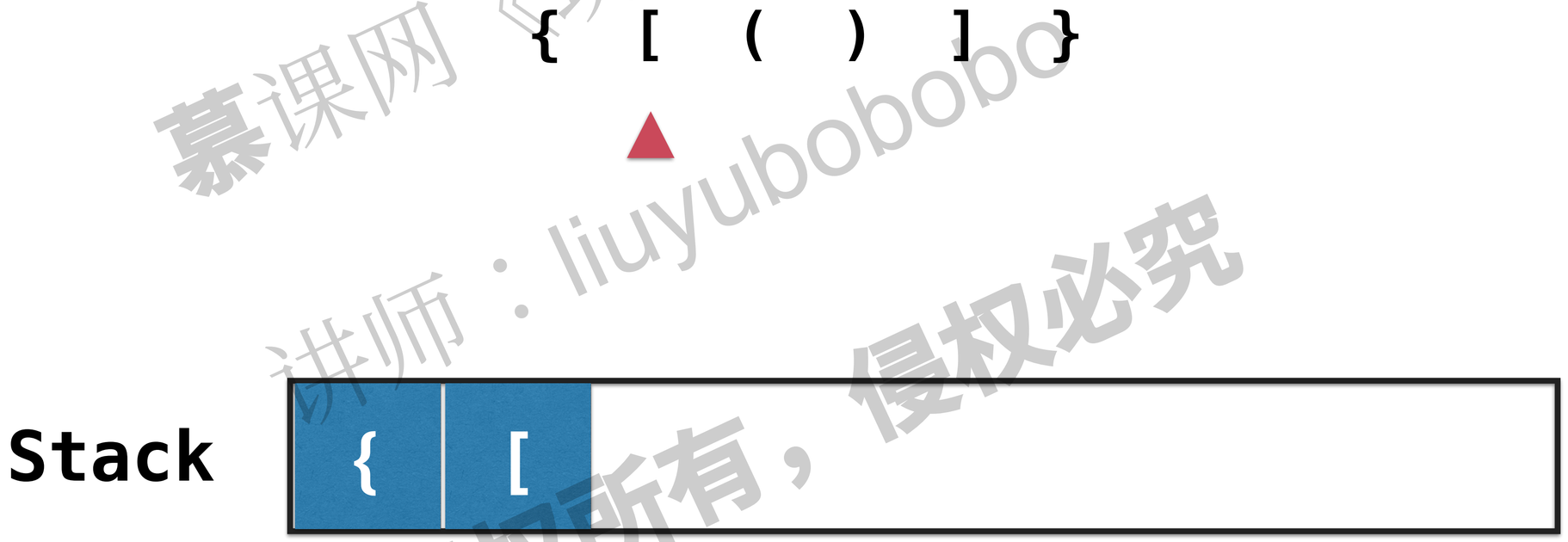
Stack

20. Valid Parentheses


```
{ [ ( ) ] }
  ▲
```

Stack

20. Valid Parentheses



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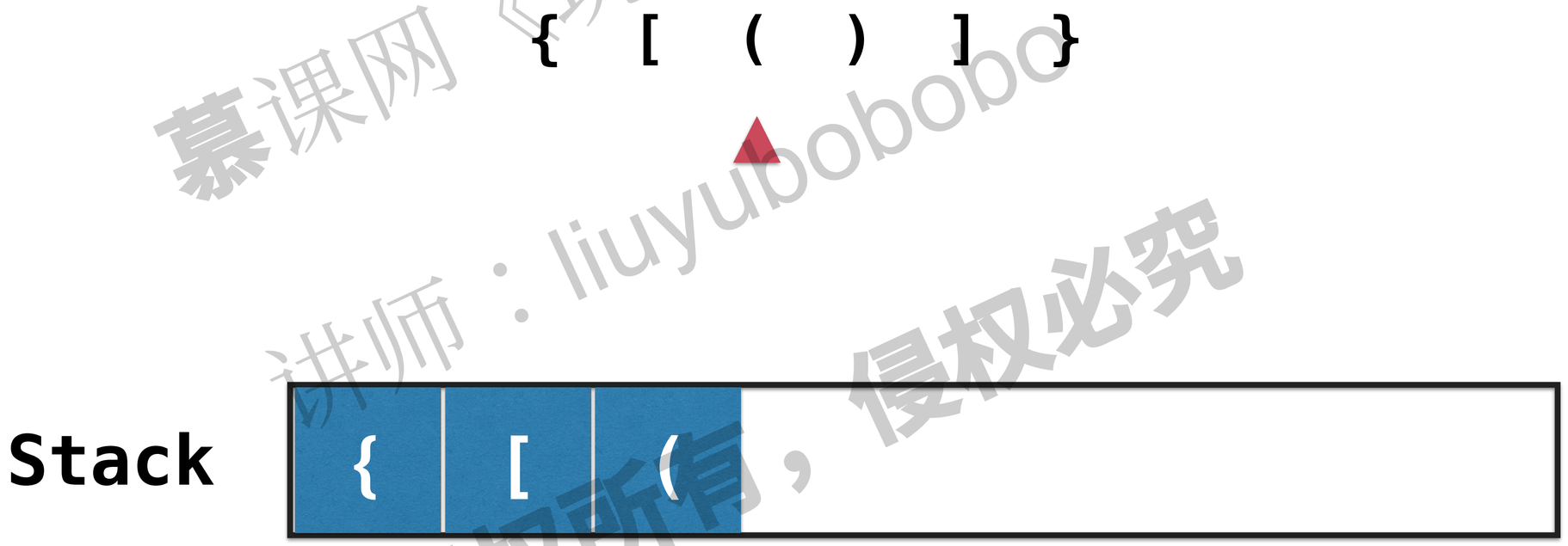

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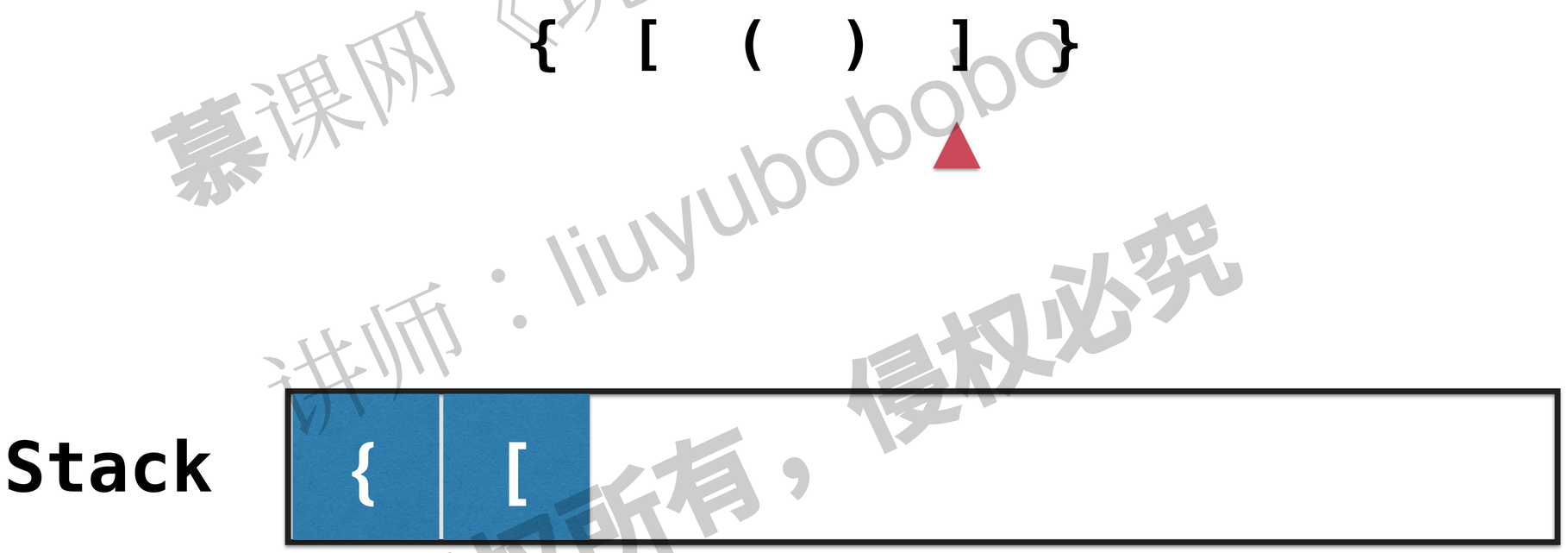

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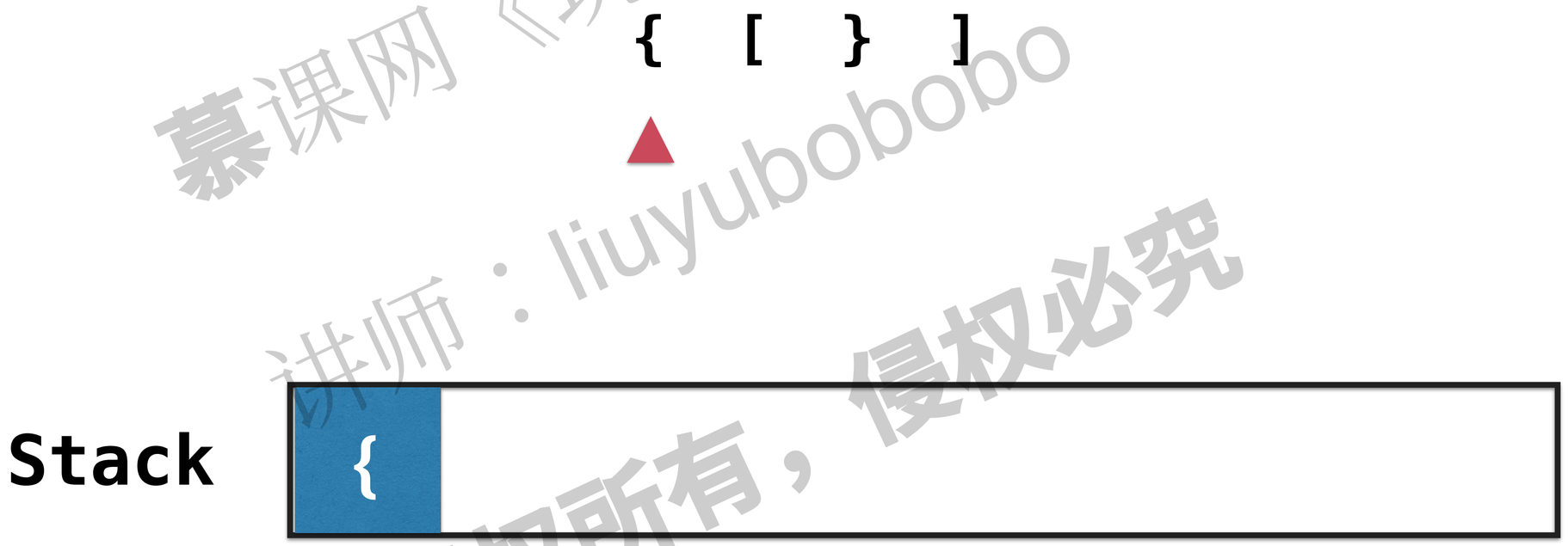
```
{ [ ( ) ] }
```

20. Valid Parentheses

{ [}]

Stack

20. Valid Parentheses



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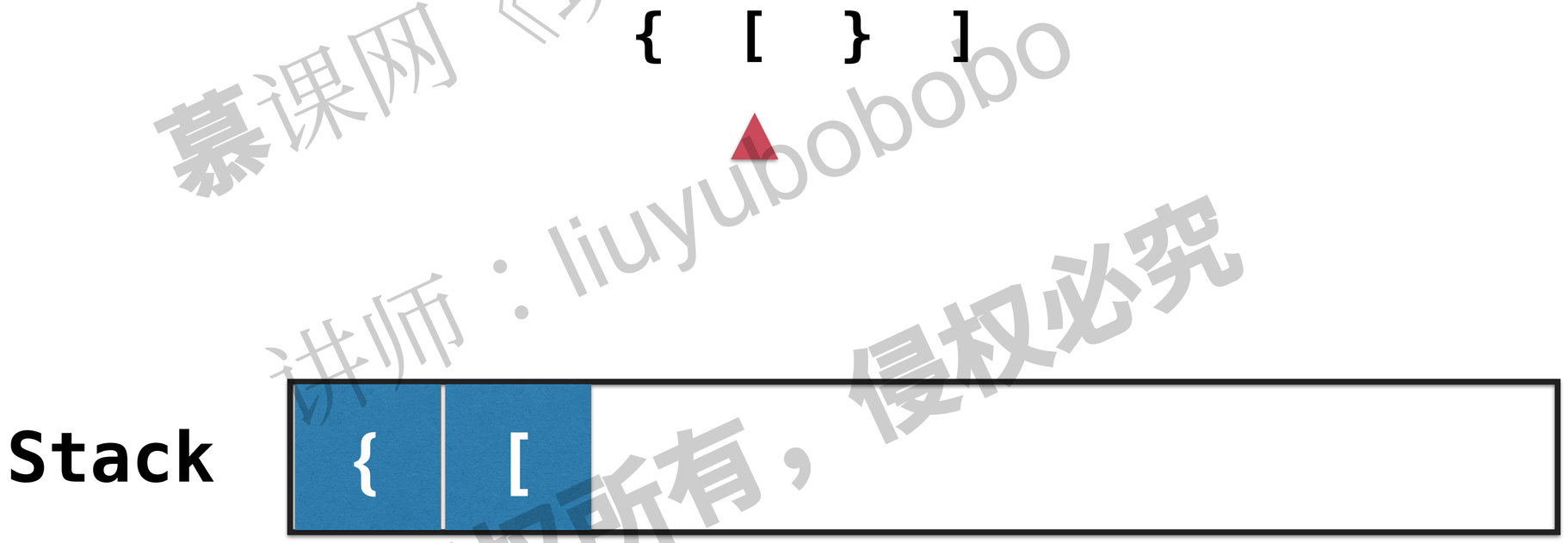

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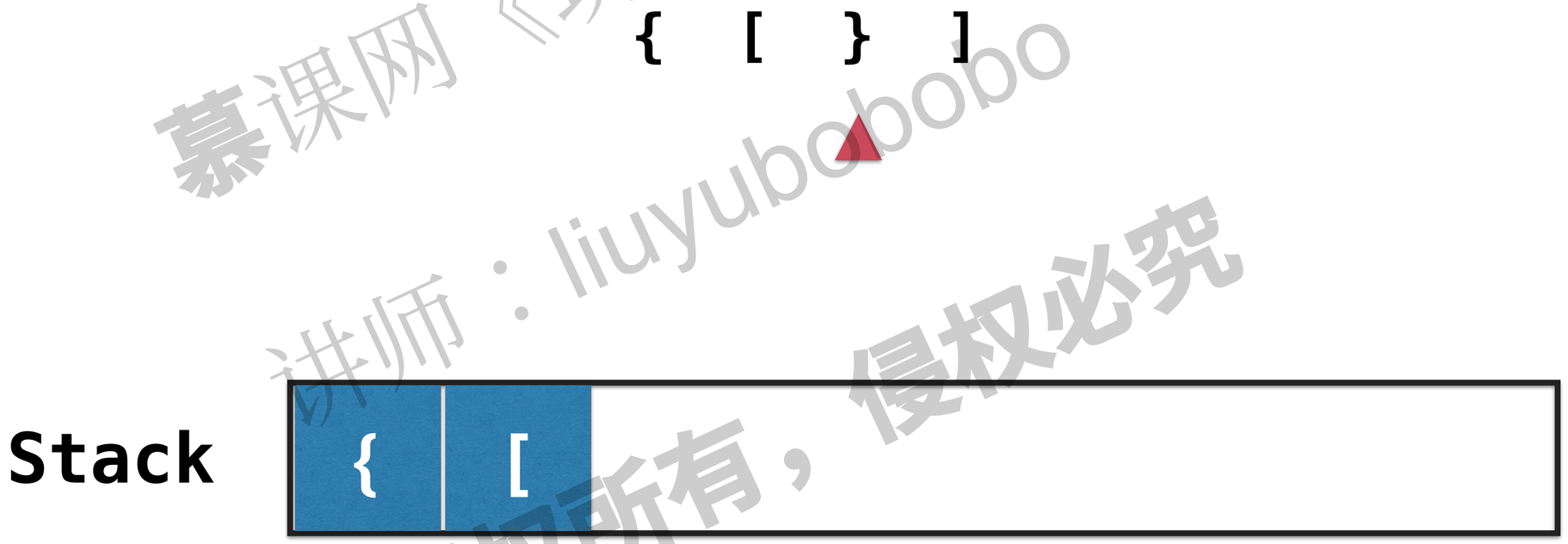

栈顶元素反映了在嵌套的层次关系中，最近的需要匹配的元素

实践：解决20

150. Evaluate Reverse Polish Notation

逆波兰表达式求值。给定一个数组，表示一个逆波兰表达式。求其值。

- 如：[“2”，“1”，“+”，“3”，“*”]，表示 (2+1)*3 = 9
- 如：[“4”，“13”，“5”，“/” ，“+”]，表示4+(13/5) = 6

150. Evaluate Reverse Polish Notation

逆波兰表达式求值。给定一个数组，表示一个逆波兰表达式。求其值。

- 运算的种类 （ +, - ,*, / ）
- 字符串表达的数字种类 （整数）

71. Simplify Path

给定一个Unix系统下的路径，简化这个路径。

- 如 /home/ ， 简化后为 /home
- 如 /a/./b/../../c/ ， 简化后为 /c

71. Simplify Path

给定一个Unix系统下的路径，简化这个路径。

- 这个路径是否一定合法?
- 不能回退的情况? （如 /../，返回 / ）
- 多余的/? （如 /home//hello/，返回 /home/hello ）

栈和递归的紧密关系

递归算法

二叉树中的算法

144. Binary Tree Preorder Traversal

94. Binary Tree Inorder Traversal

145. Binary Tree Postorder Traversal

144. Binary Tree Preorder Traversal

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void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
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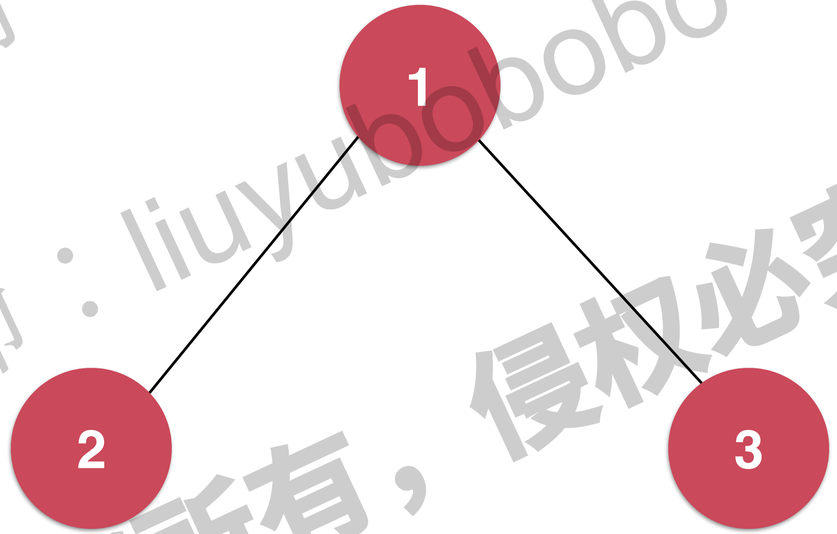
144. Binary Tree Preorder Traversal



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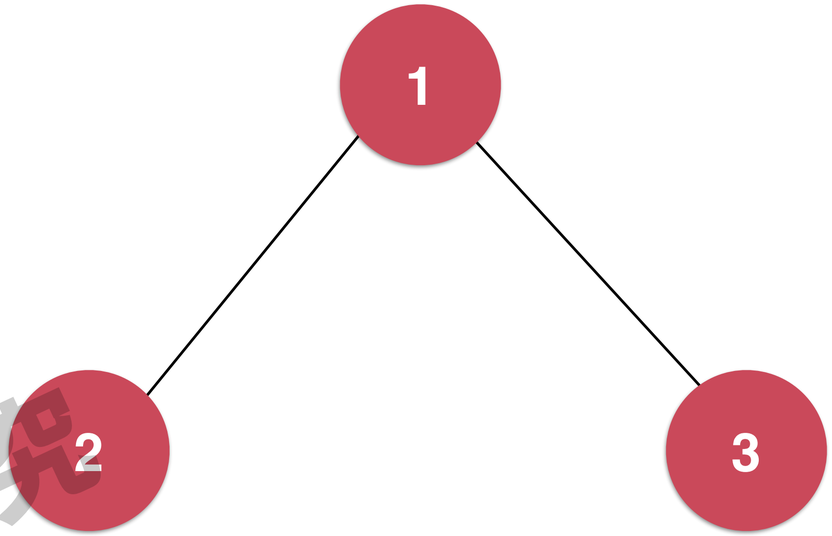

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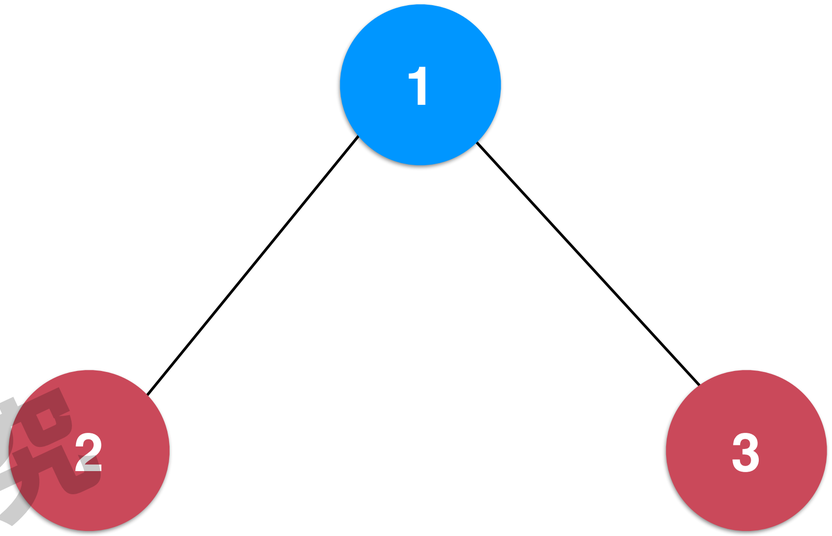

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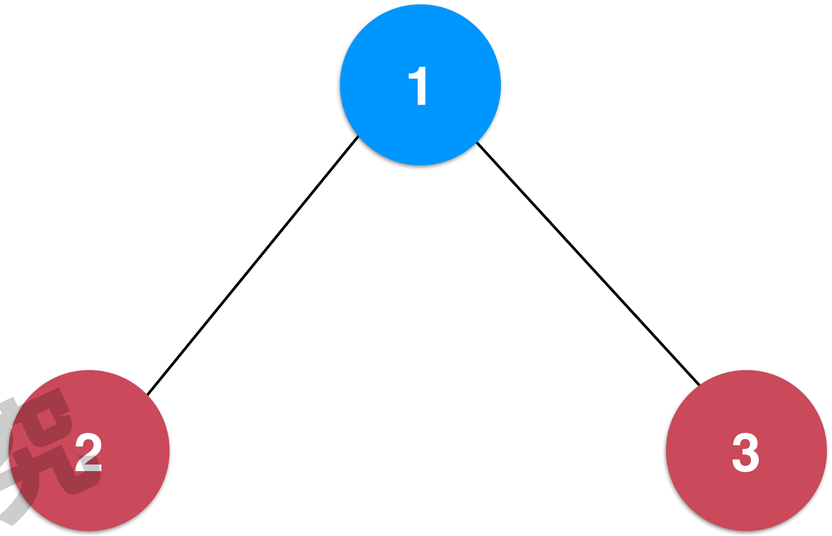

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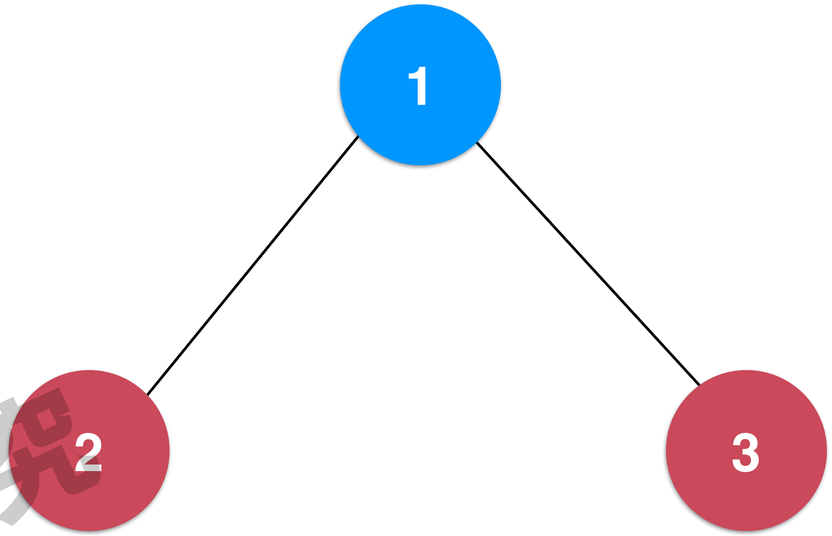

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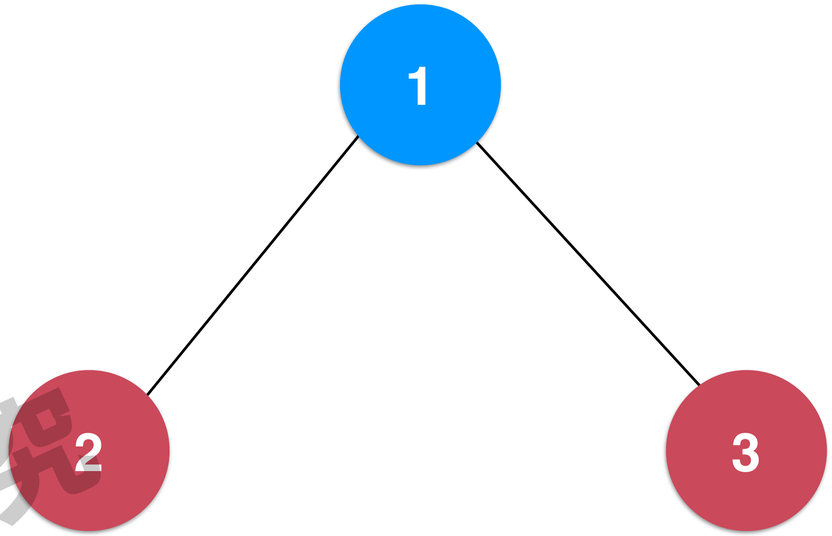


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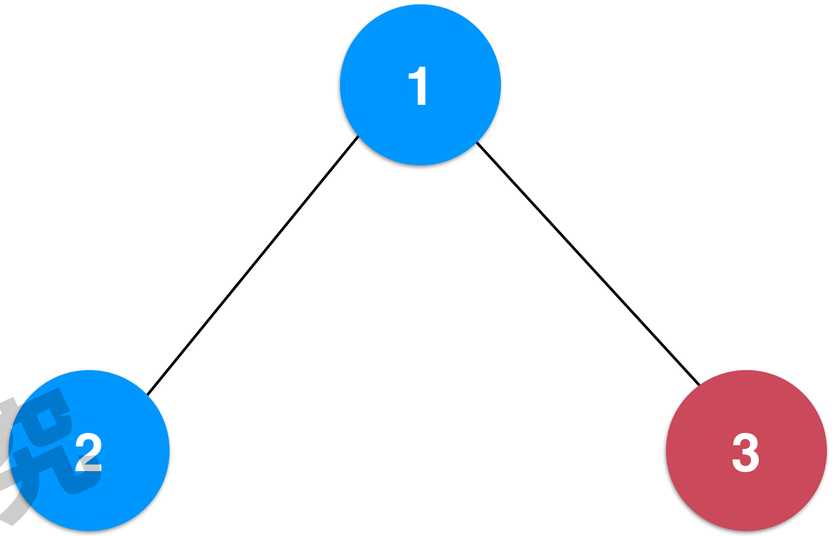


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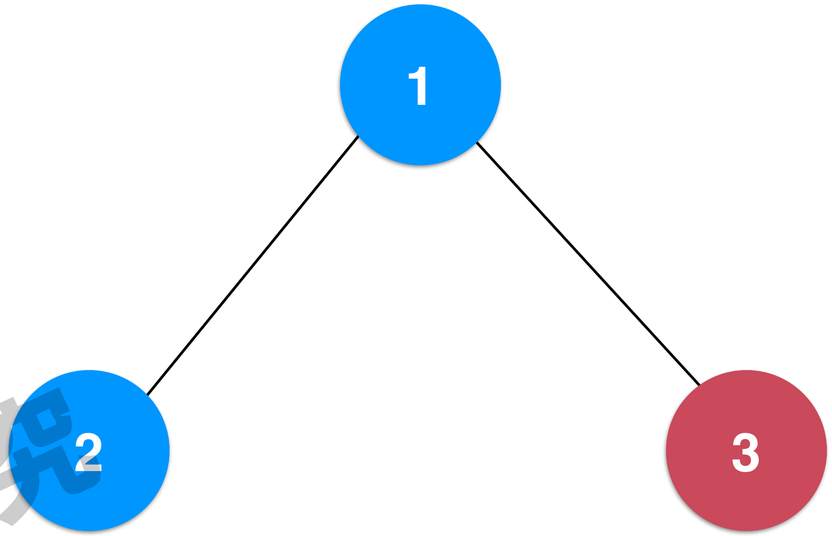

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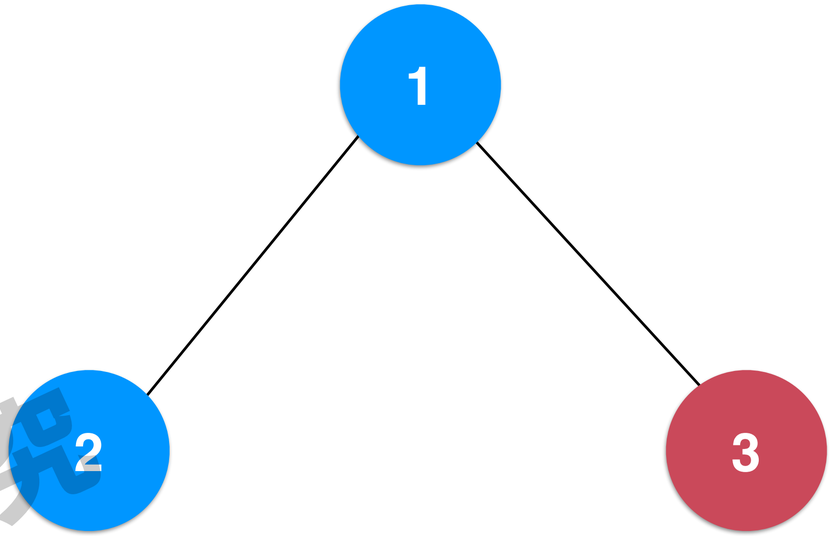


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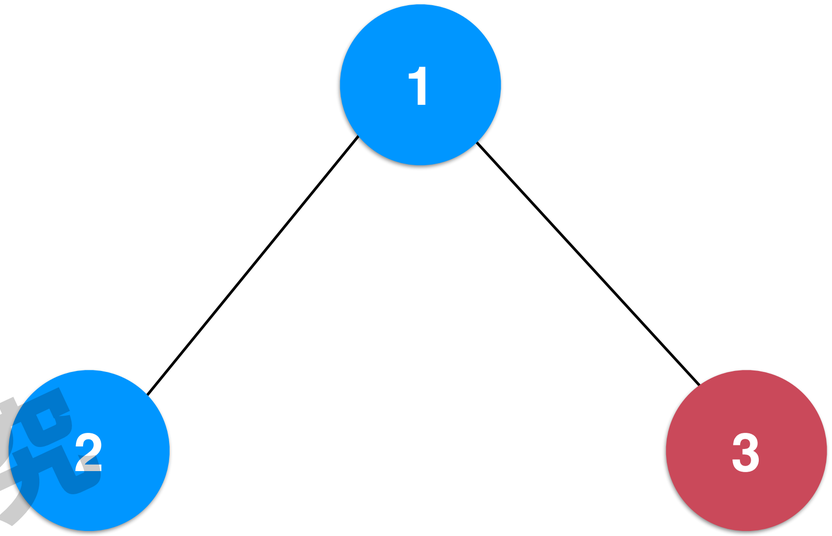


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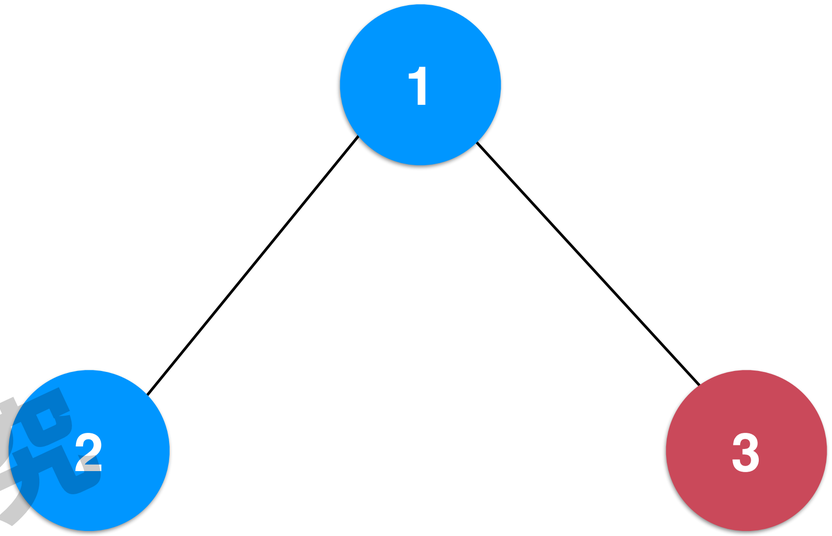


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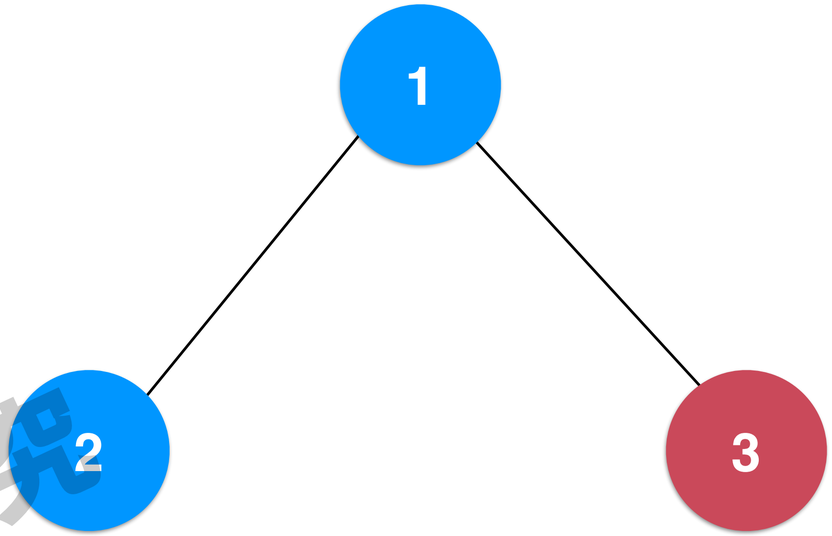

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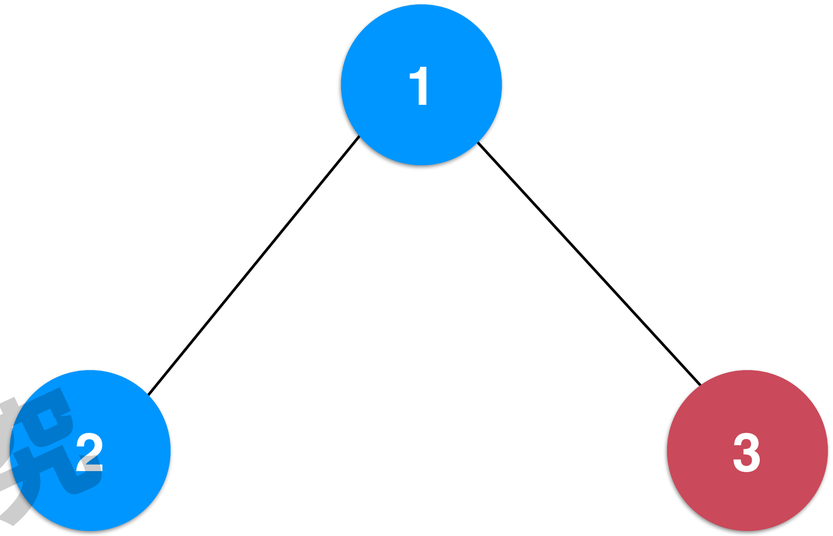

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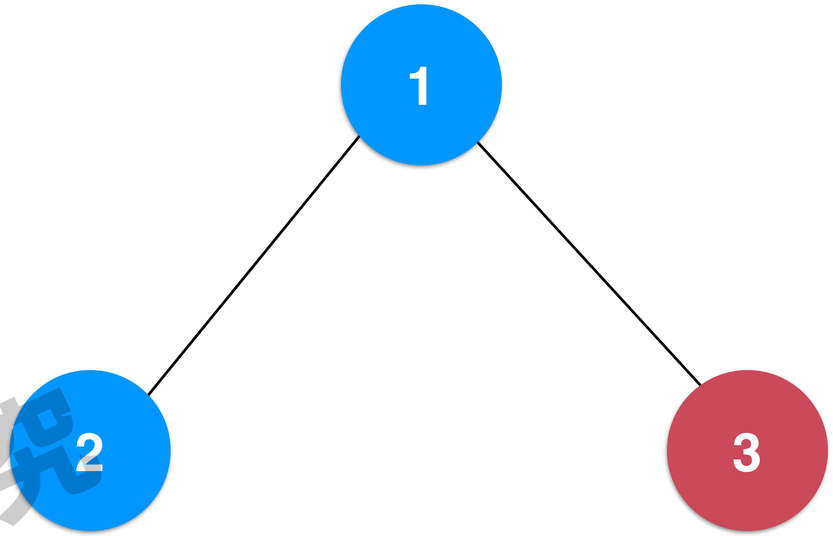


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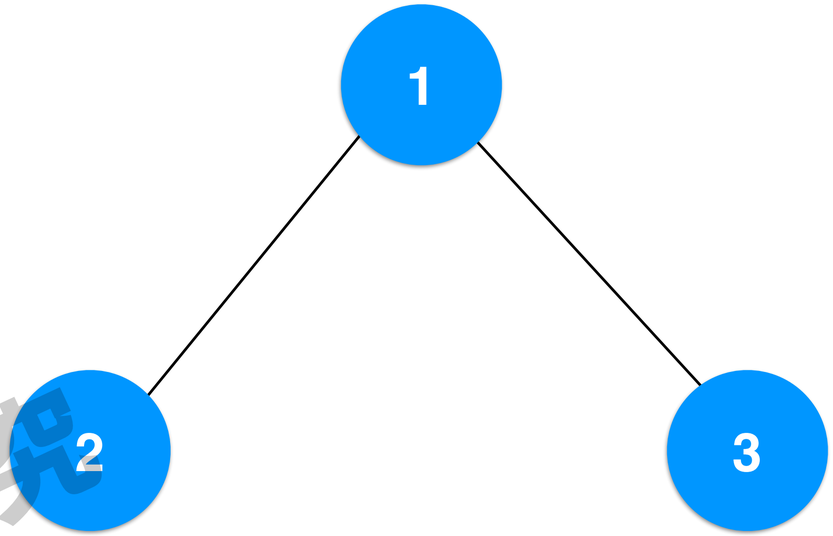


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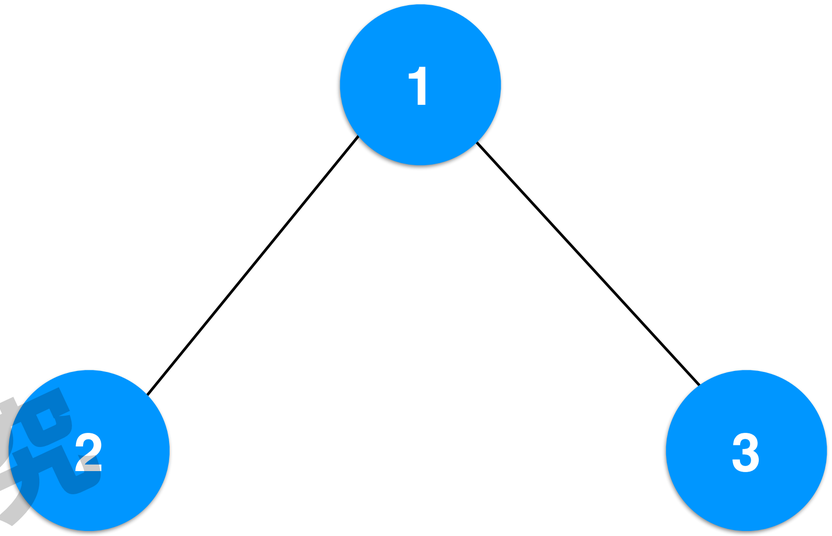


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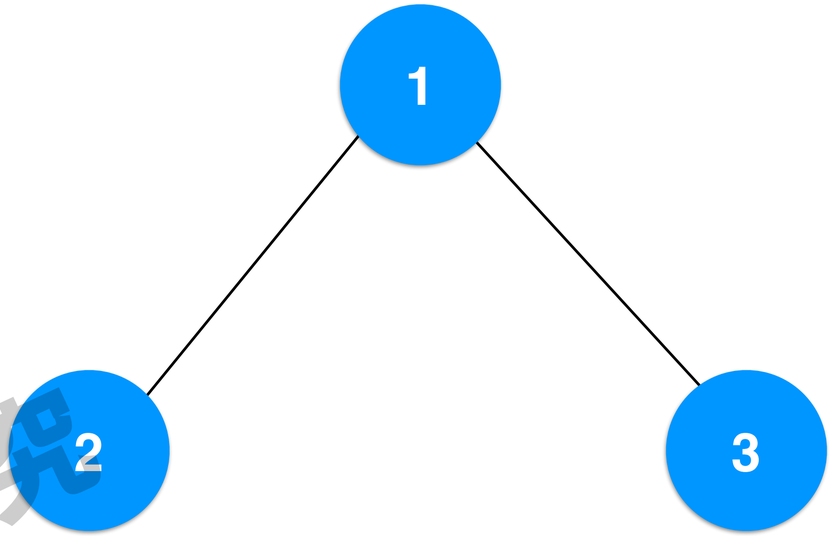


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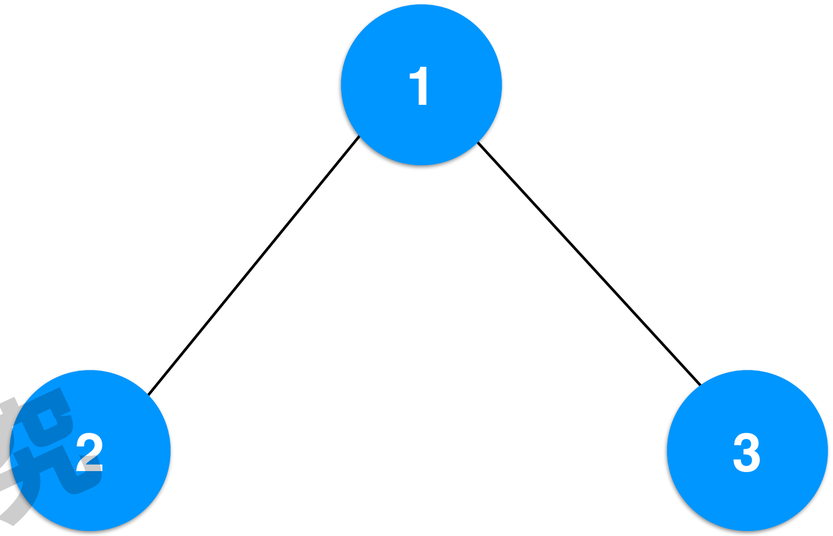


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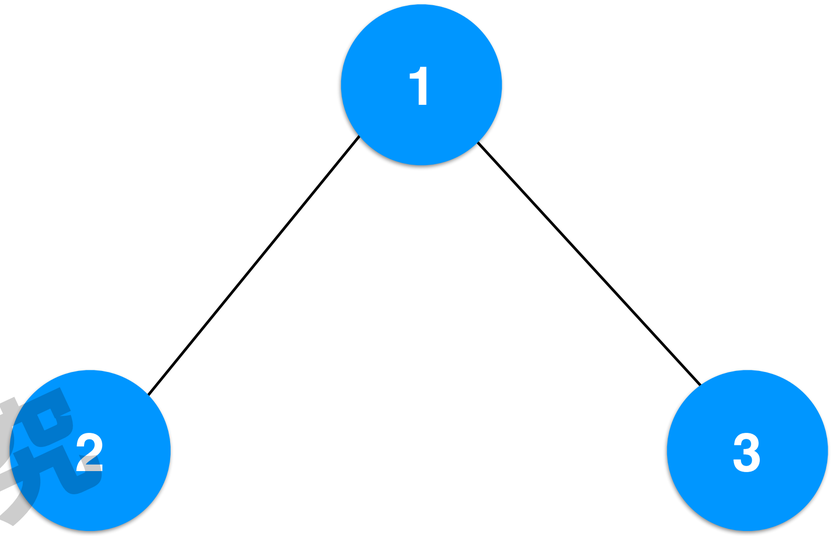


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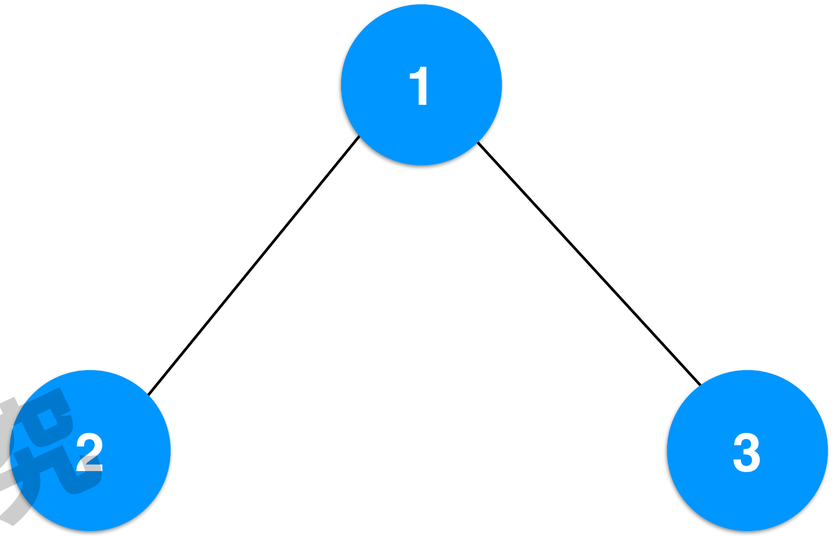


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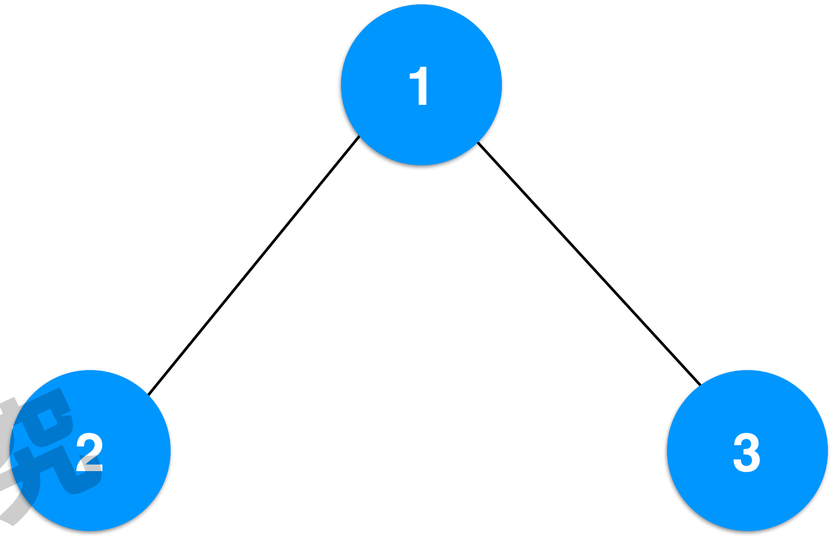

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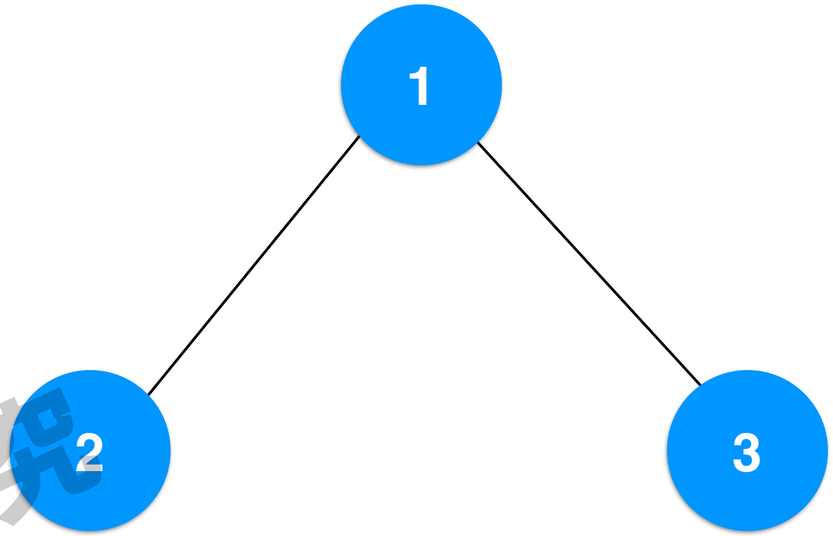

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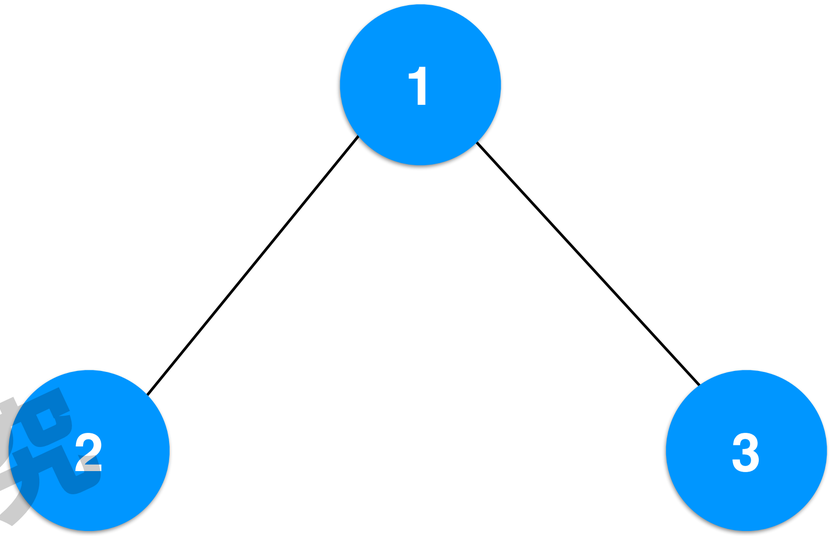

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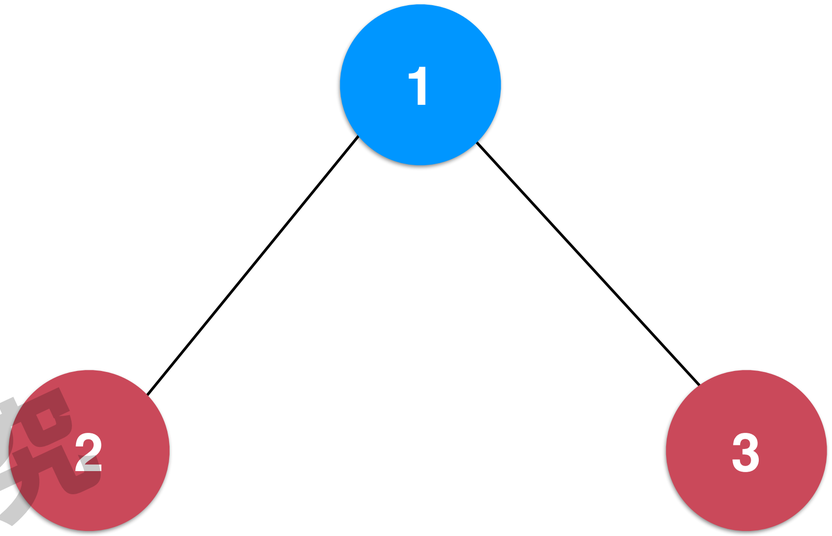

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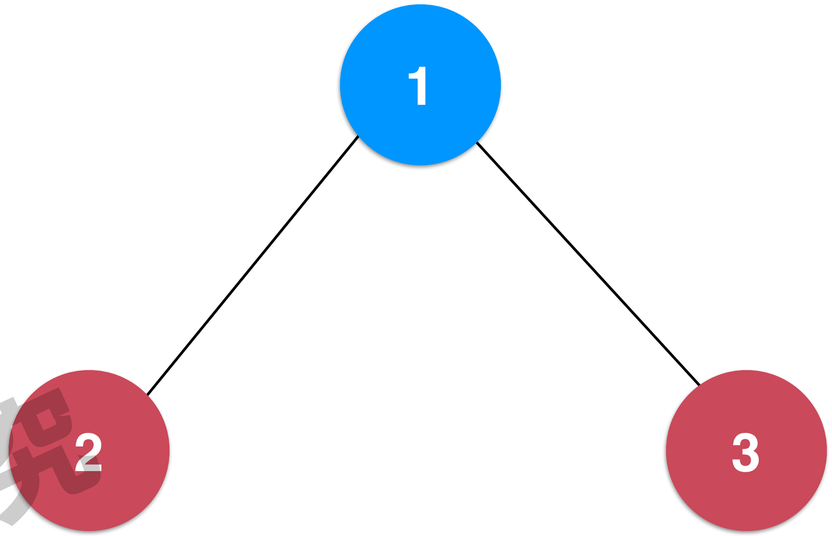

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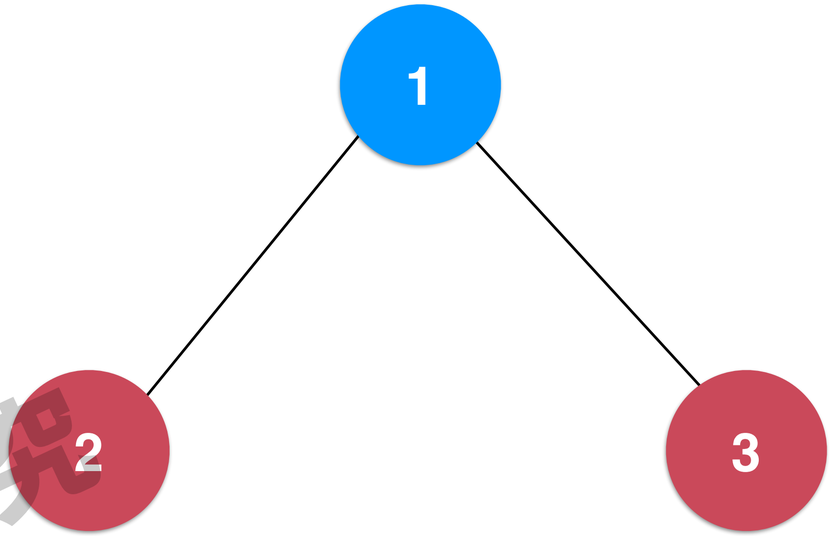

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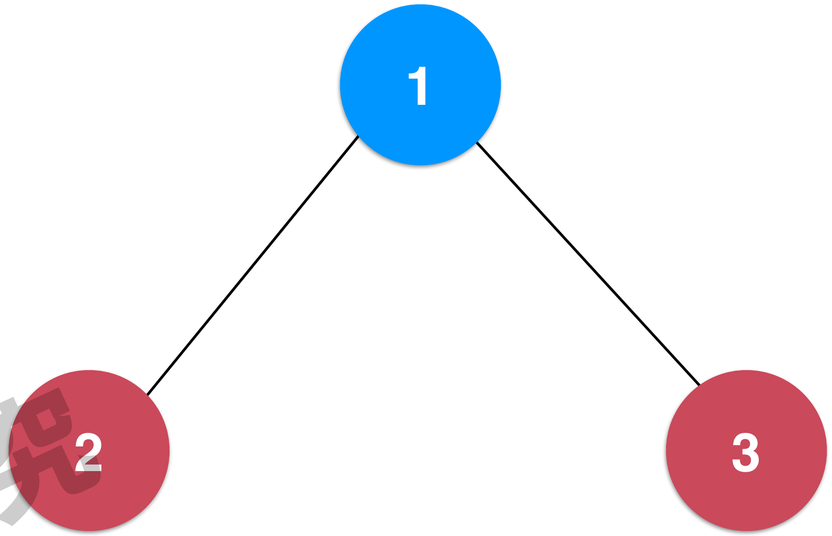
cout 1 | go 1-L | go 1-R

Stack

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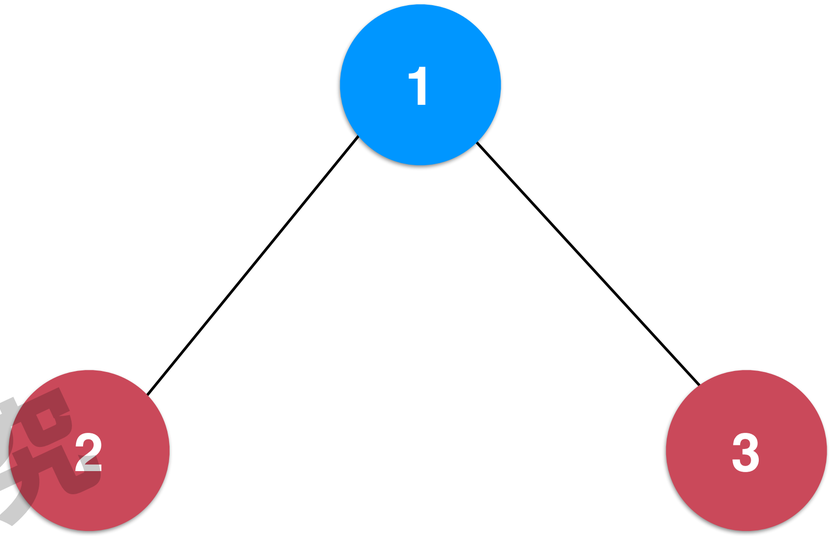


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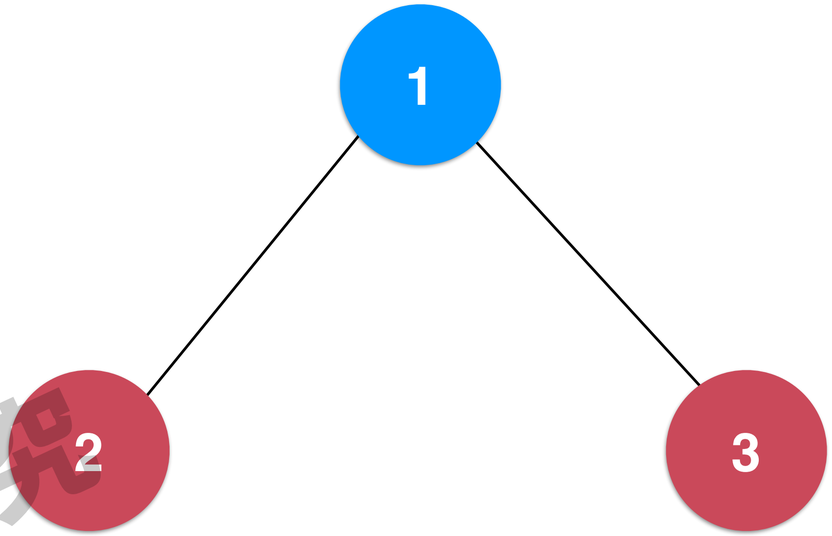
cout 1 | go 1-L | go 1-R

Stack




```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

144. Binary Tree Preorder Traversal

```
void preorder( TreeNode* node ){

    if( node ){
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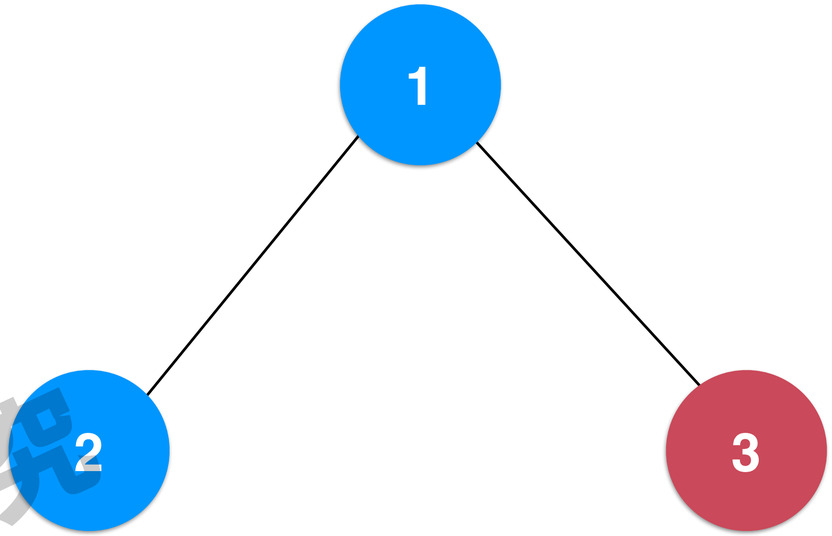
    }
}
```

cout 1 | go 1-L | go 1-R

Stack

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144. Binary Tree Preorder Traversal

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    if( node ){
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    }
}
```

cout 1 | go 1-L | go 1-R

Stack

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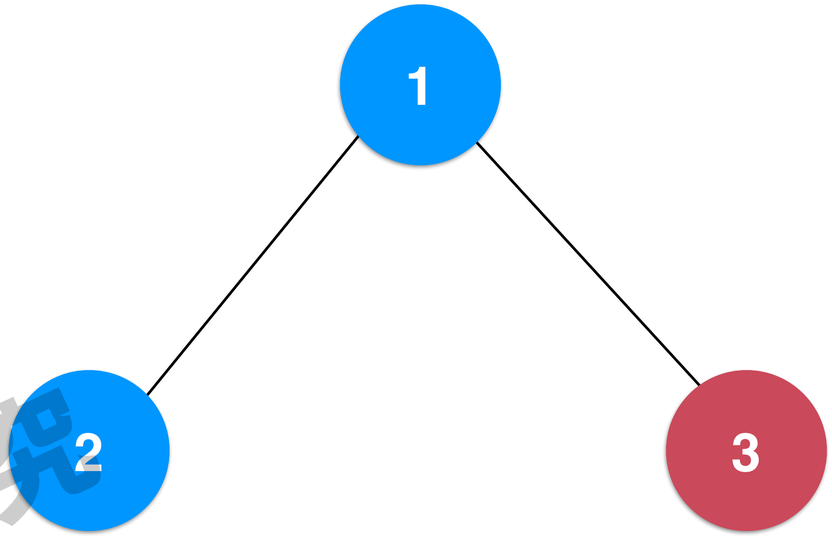

144. Binary Tree Preorder Traversal

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void preorder( TreeNode* node ){

    if( node ){
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    }
}
```

cout 1 | go 1-L | go 1-R

Stack

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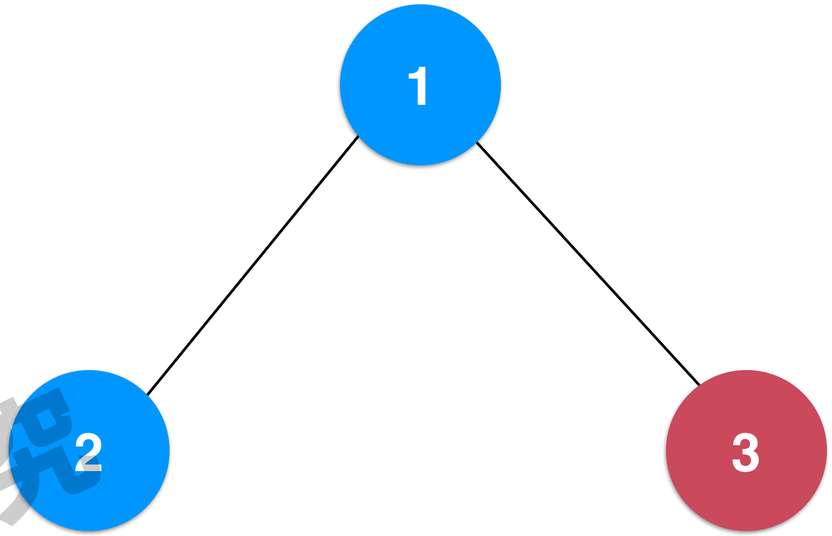
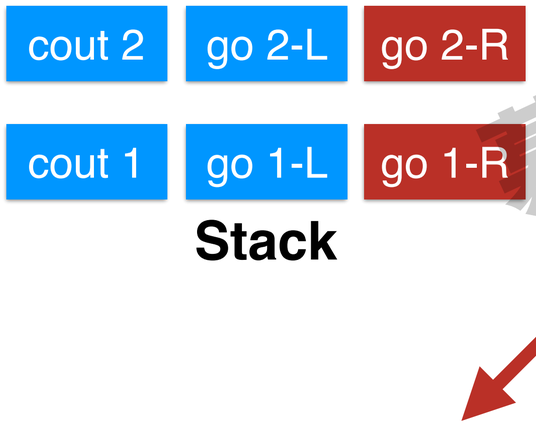


144. Binary Tree Preorder Traversal

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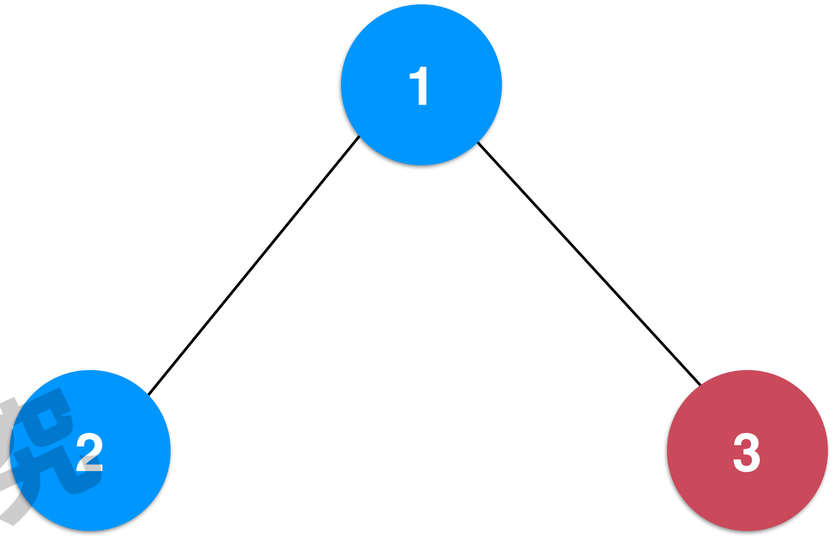

144. Binary Tree Preorder Traversal

cout 2 | go 2-L | go 2-R

cout 1 | go 1-L | go 1-R

Stack

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
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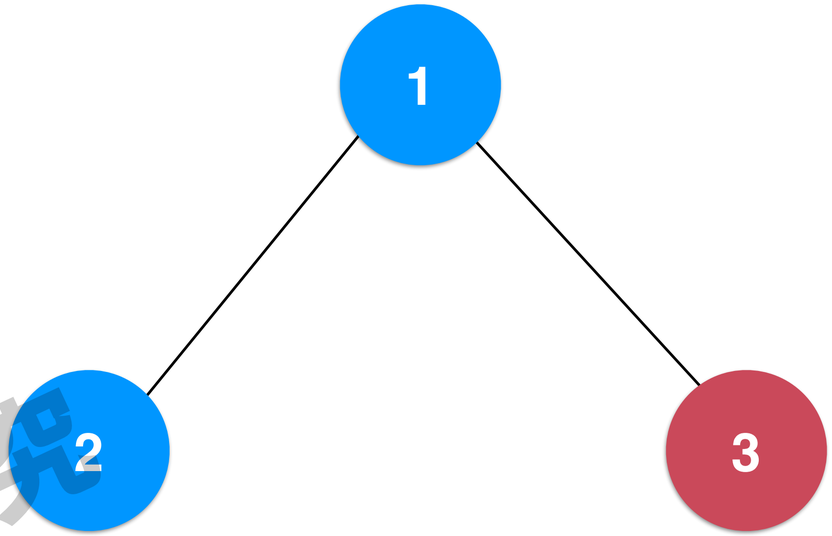

144. Binary Tree Preorder Traversal

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

cout 1 | go 1-L | go 1-R

Stack

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
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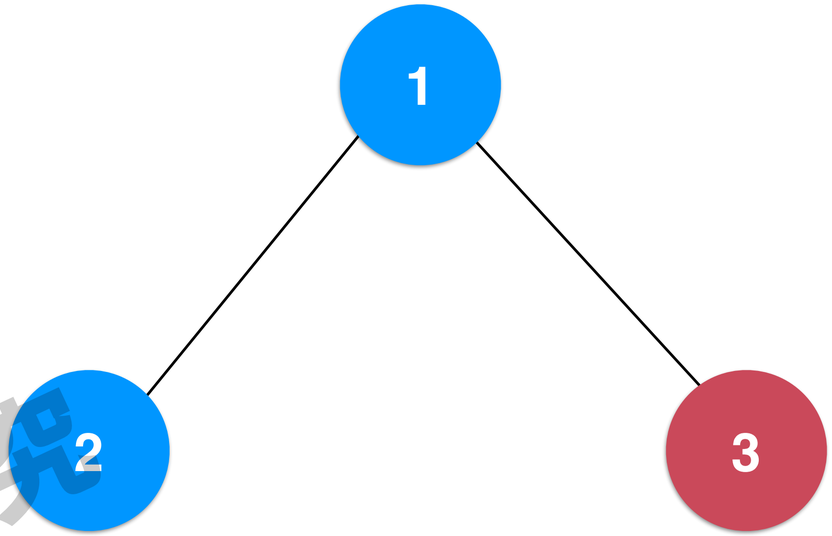

144. Binary Tree Preorder Traversal


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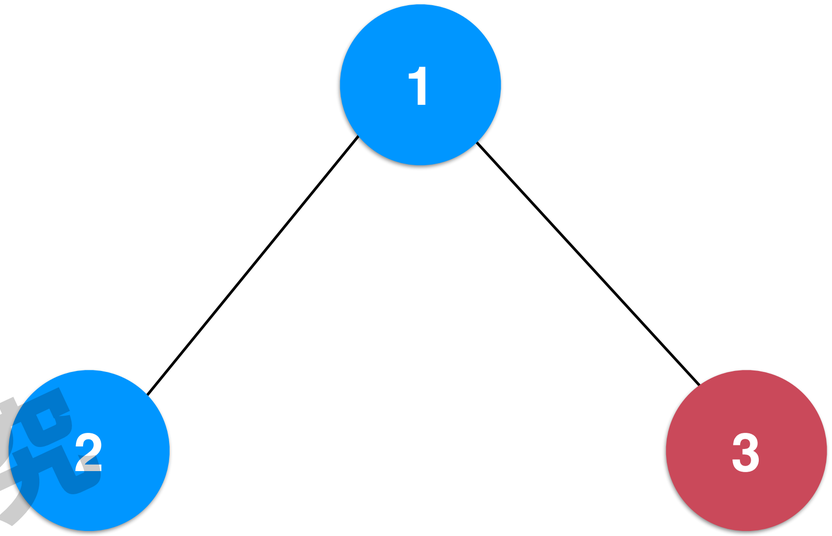
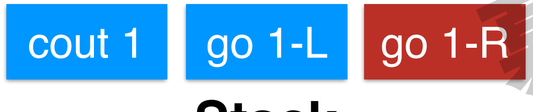


144. Binary Tree Preorder Traversal



Stack

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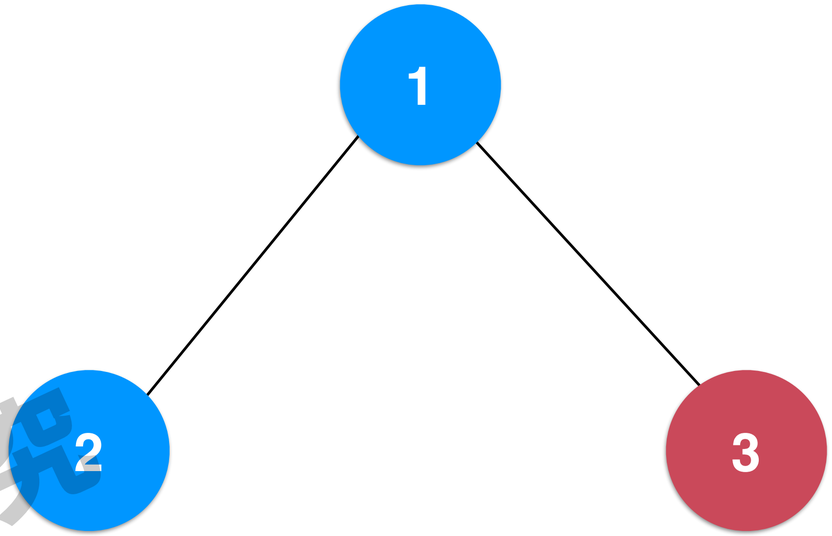

144. Binary Tree Preorder Traversal

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

cout 1 | go 1-L | go 1-R

Stack

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void preorder( TreeNode* node ){

    if( node ){
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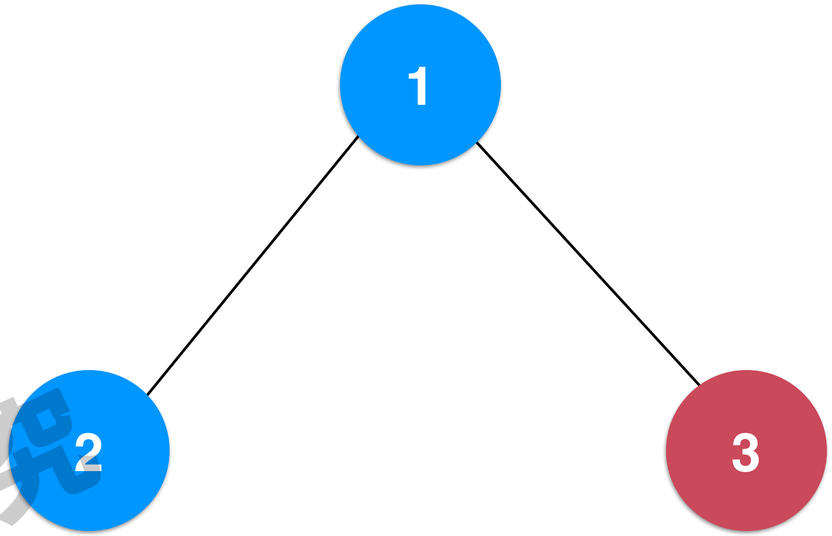

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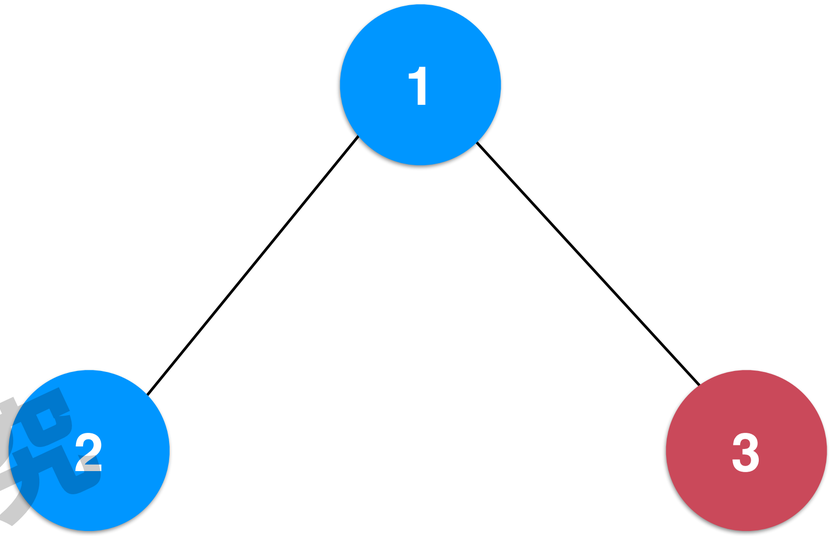

144. Binary Tree Preorder Traversal

cout 1 | go 1-L | go 1-R

Stack

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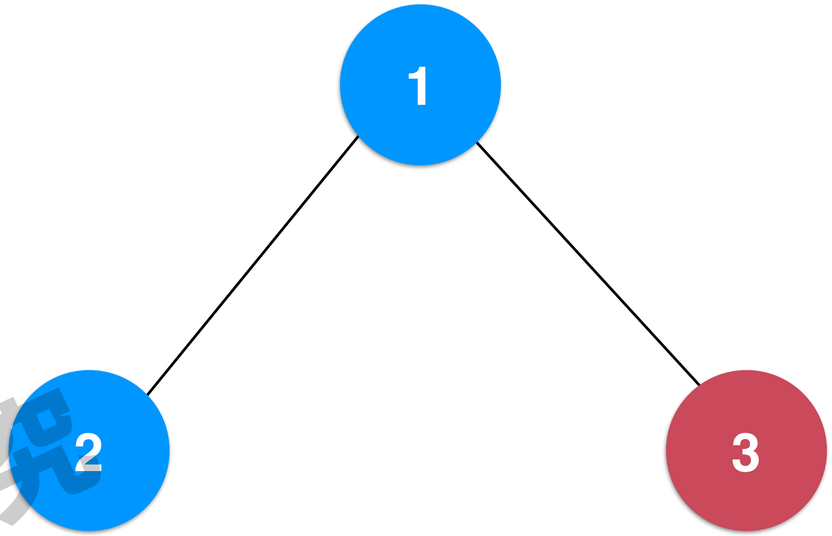

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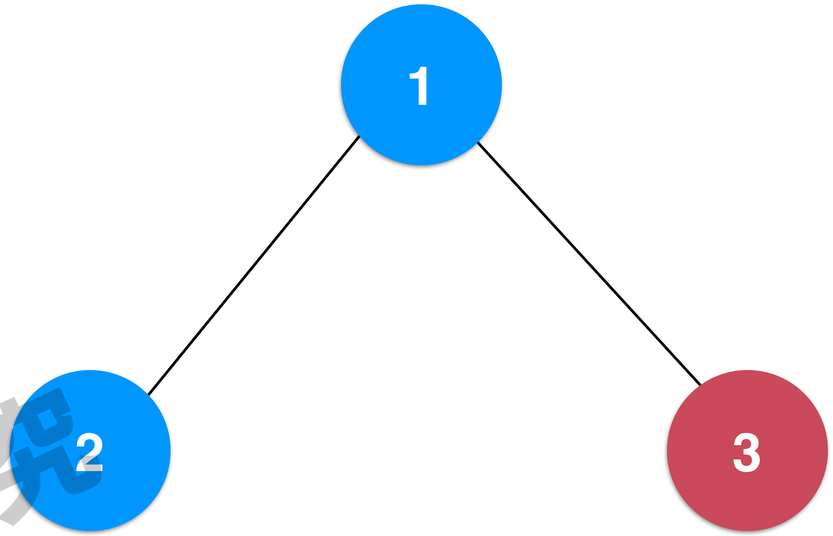

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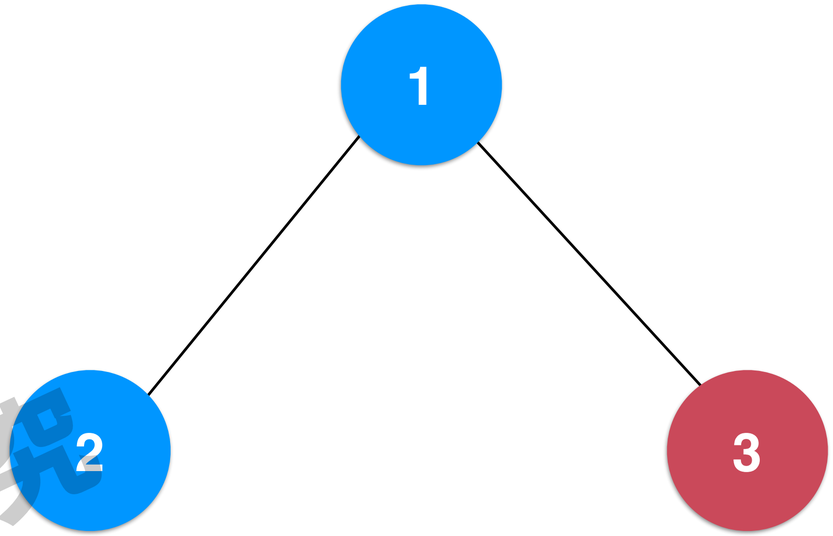


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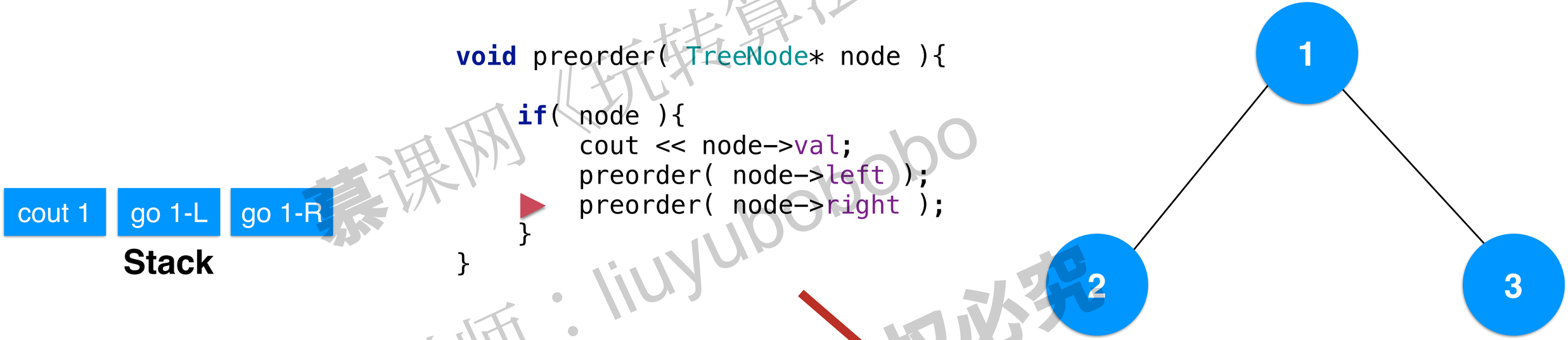
144. Binary Tree Preorder Traversal



cout 1 | go 1-L | go 1-R

Stack

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void preorder( TreeNode* node ){

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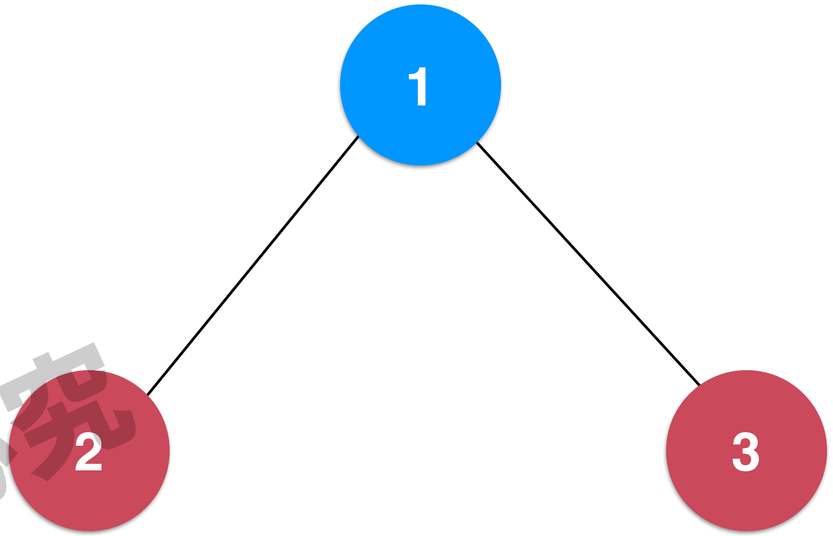
```

希望大家自己完成后续模拟

希望大家对前，中，后序遍历，都使用类似的模拟

使用栈模拟系统栈，写出非递归程序

144. Binary Tree Preorder Traversal

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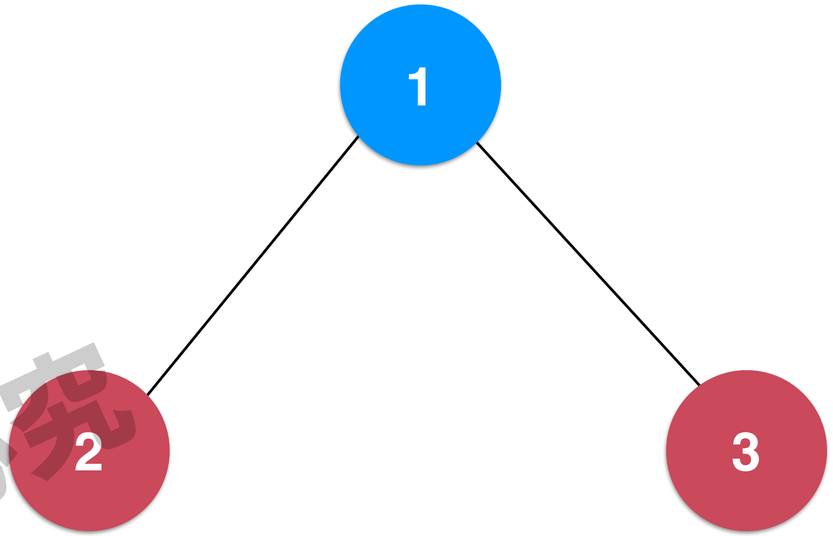
}
```

cout 1 | go 1-L | go 1-R

Stack

144. Binary Tree Preorder Traversal



cout 1

go 1-L

go 1-R

Stack

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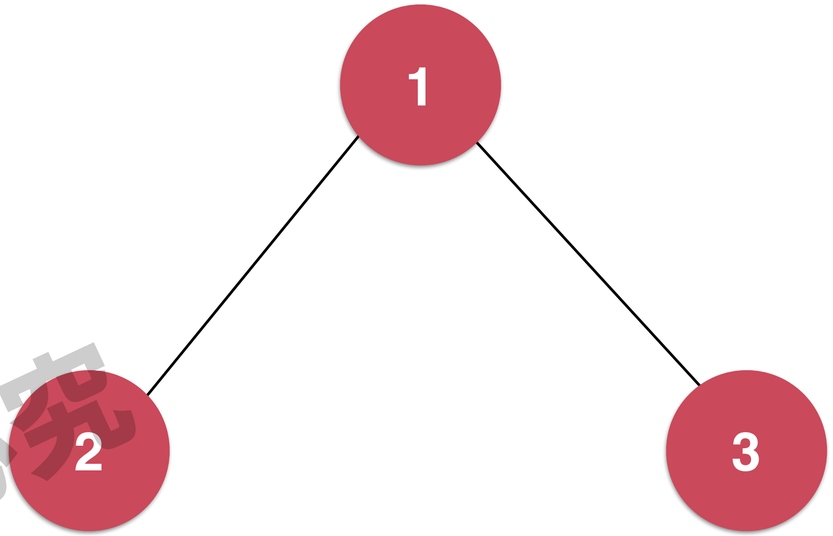
144. Binary Tree Preorder Traversal

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    if( node ){
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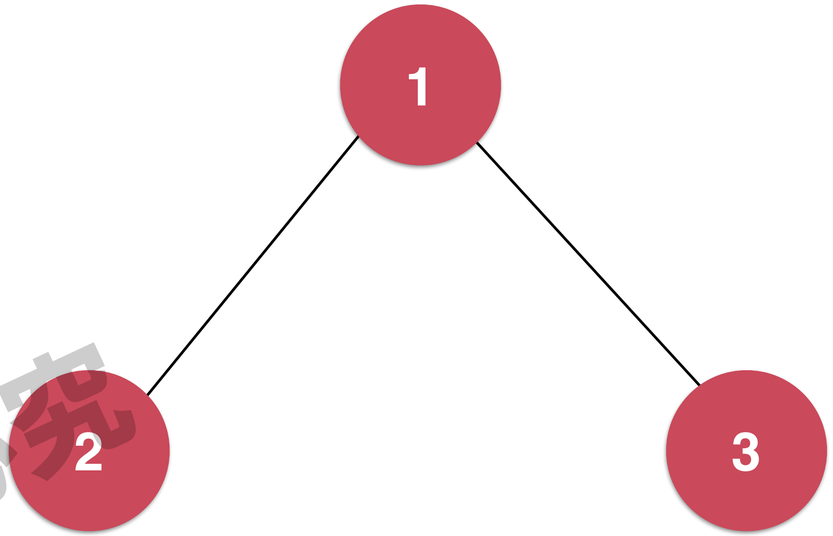
    }
}
```

go 1

Stack

144. Binary Tree Preorder Traversal

go 1

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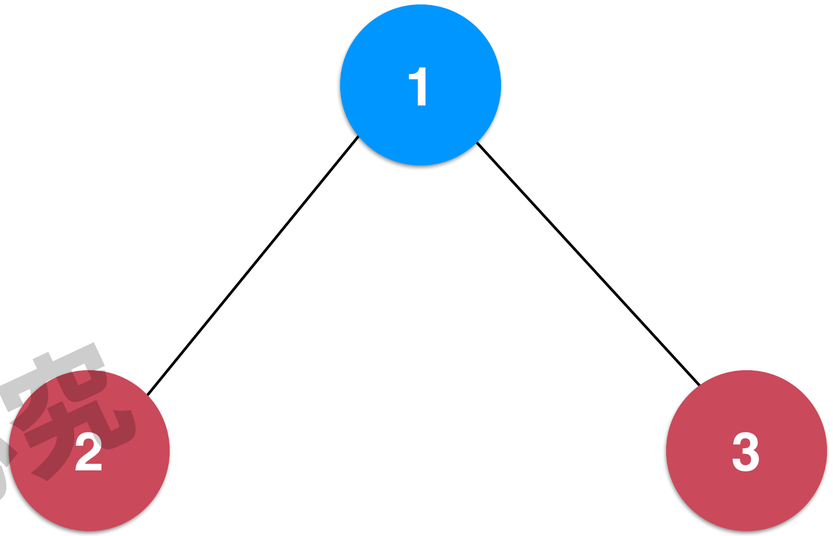
Stack

144. Binary Tree Preorder Traversal



cout 1

go 1-L

go 1-R

Stack

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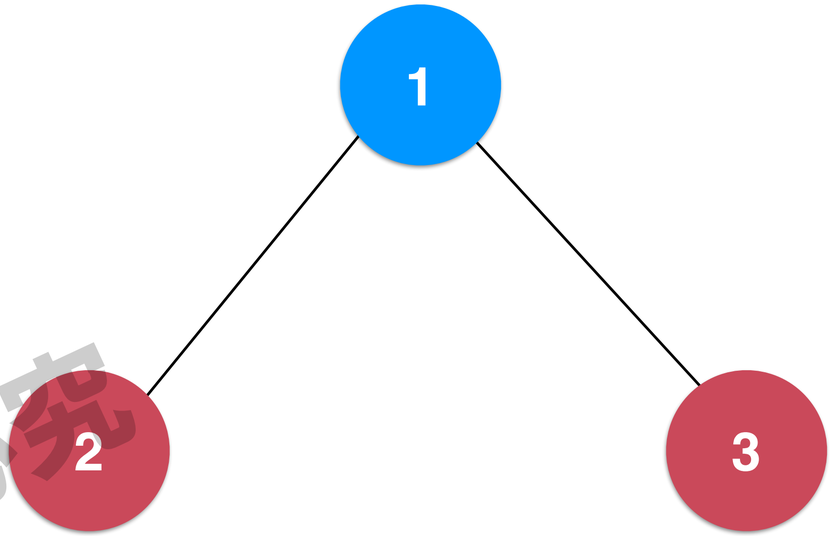
144. Binary Tree Preorder Traversal

cout 1

go 1-L

go 1-R

Stack

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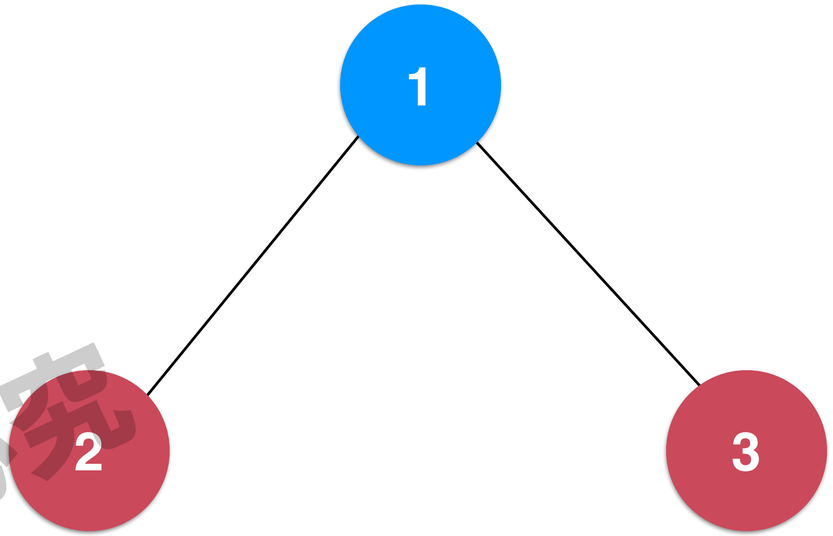

go 1-L

go 1-R

Stack

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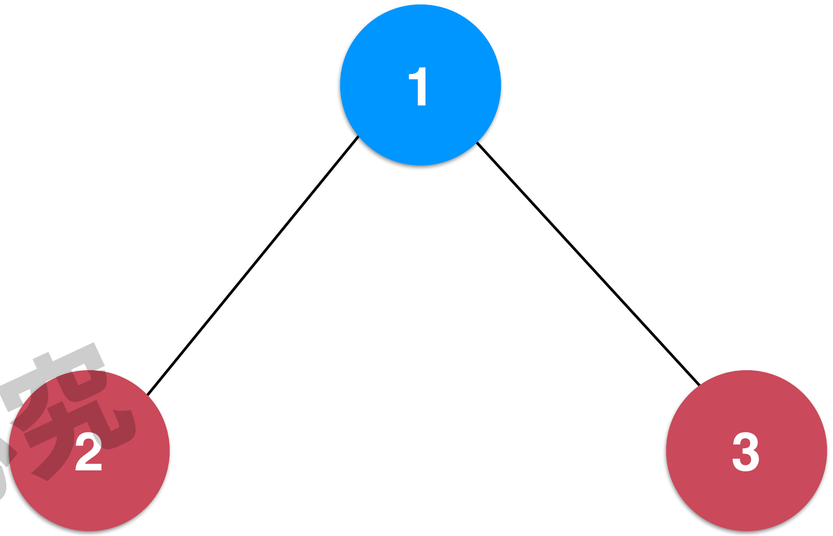
144. Binary Tree Preorder Traversal

go 1-L

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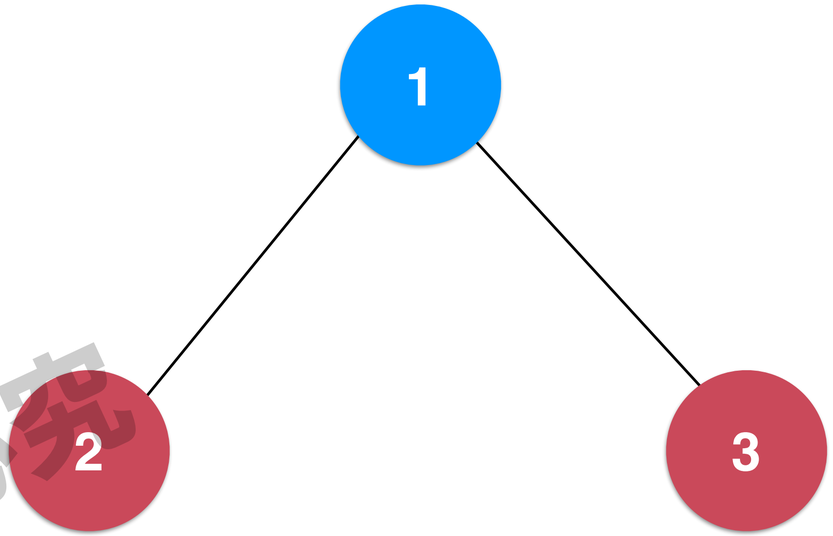
```

go 1-R

Stack

144. Binary Tree Preorder Traversal



cout 2

go 2-L

go 2-R

go 1-R

Stack

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
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        preorder( node->right );
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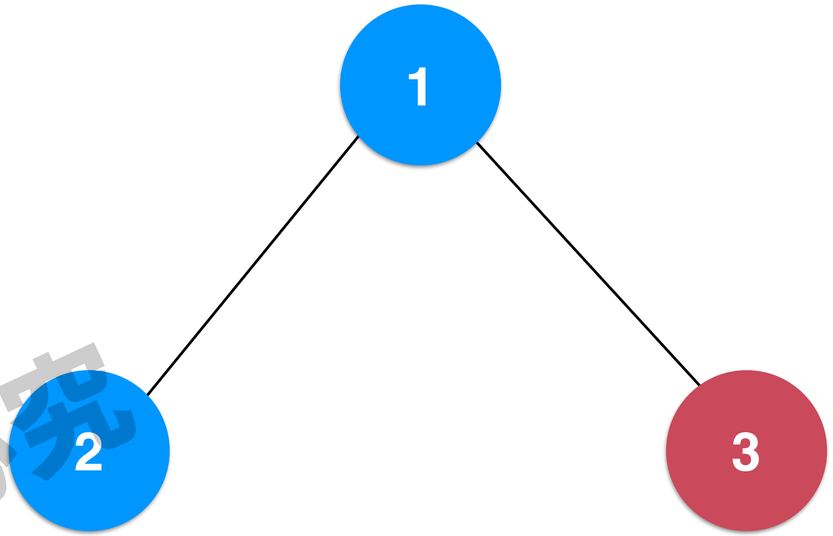
```

144. Binary Tree Preorder Traversal

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144. Binary Tree Preorder Traversal

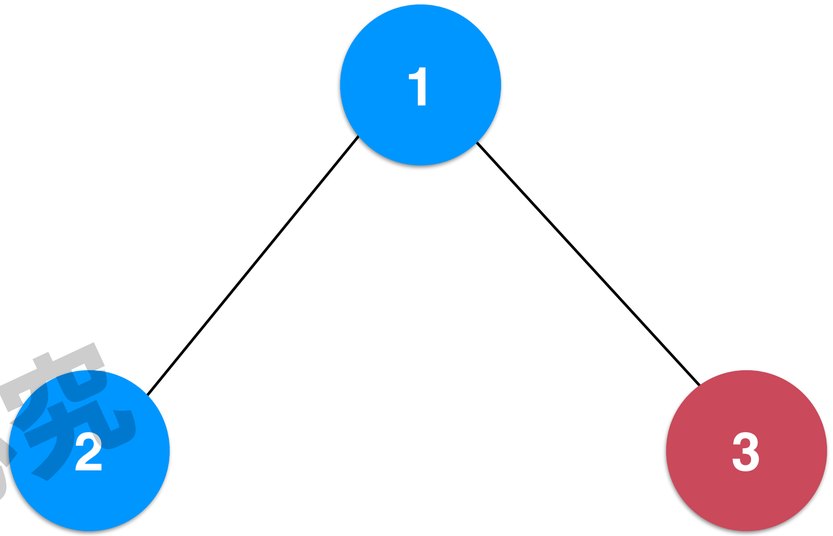
cout 2

go 2-L

go 2-R

go 1-R

Stack

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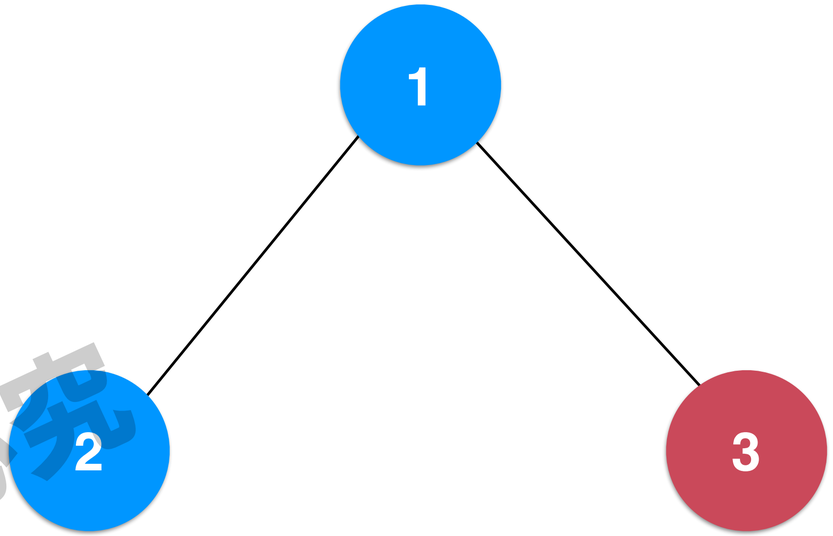

go 2-L

go 2-R

go 1-R

Stack

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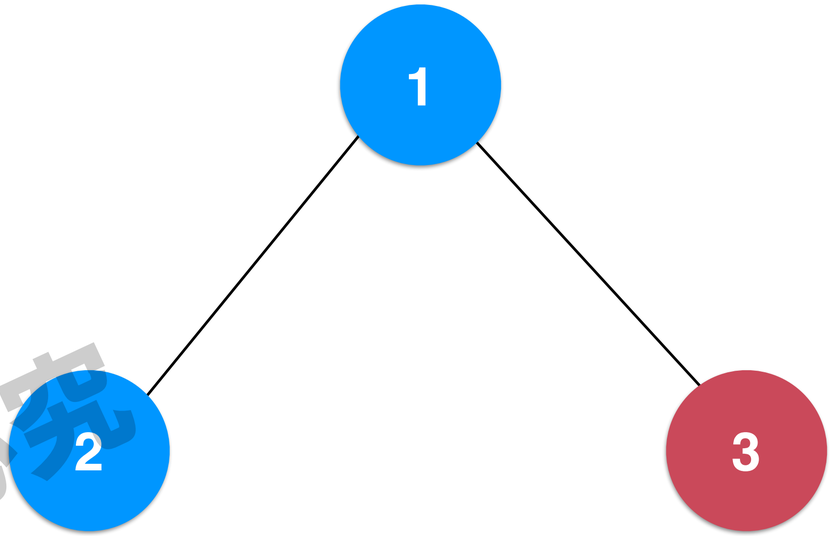
144. Binary Tree Preorder Traversal

go 2-L



go 2-R

go 1-R

Stack

```
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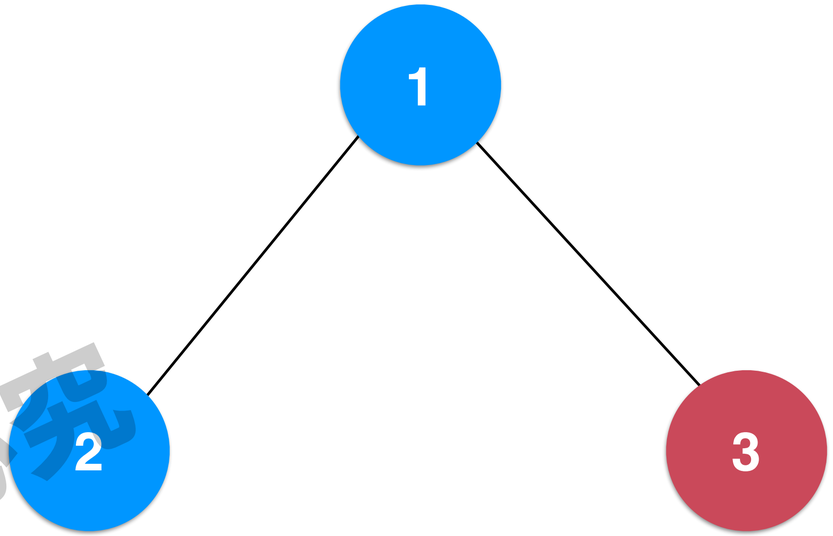
144. Binary Tree Preorder Traversal



go 2-R

go 1-R

Stack

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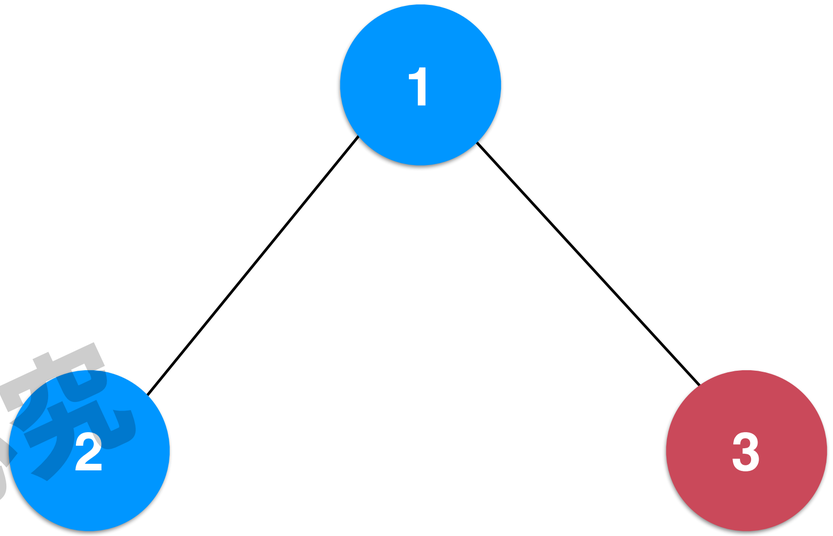
144. Binary Tree Preorder Traversal

go 2-R

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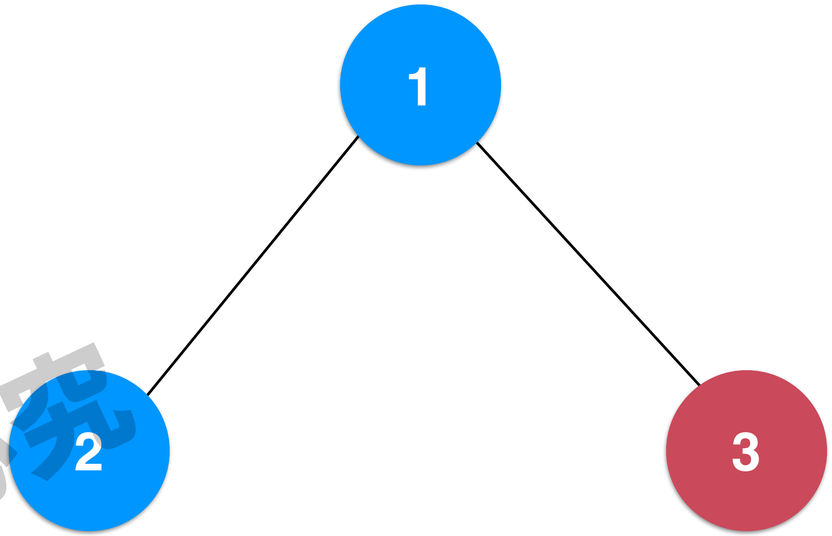
go 1-R

Stack

144. Binary Tree Preorder Traversal



go 1-R

Stack

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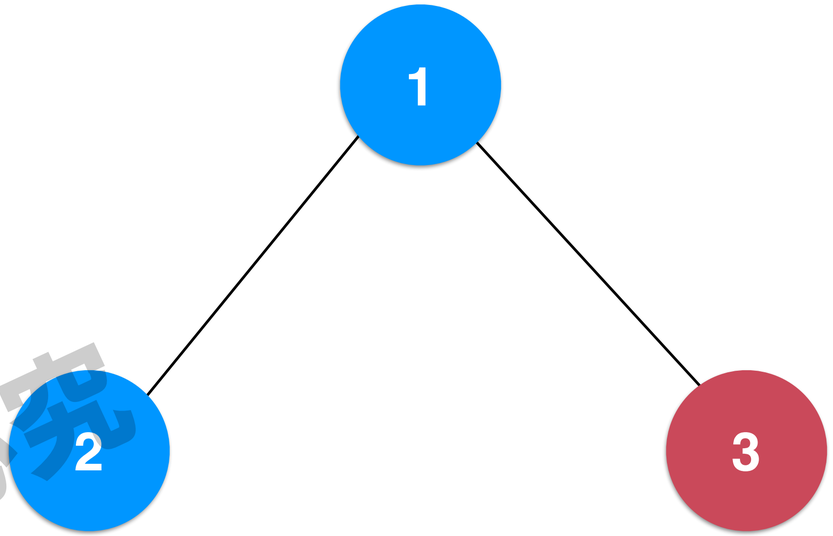
```

144. Binary Tree Preorder Traversal

go 1-R

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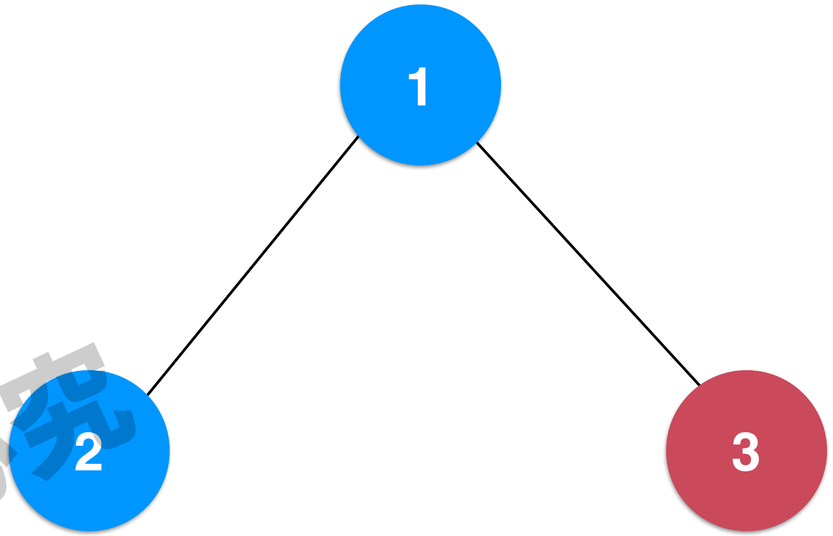
144. Binary Tree Preorder Traversal



cout 3

go 3-L

go 3-R

Stack

```
void preorder( TreeNode* node ){

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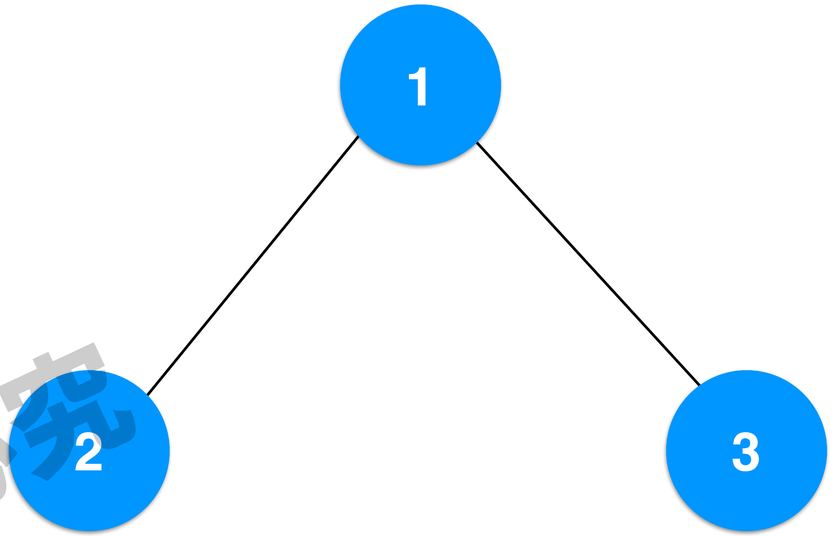
144. Binary Tree Preorder Traversal



cout 3

go 3-L

go 3-R

Stack

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

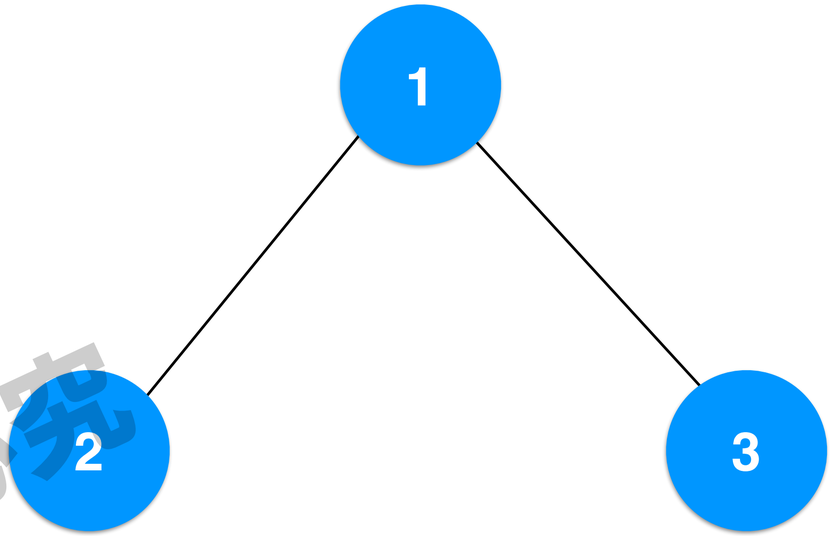
144. Binary Tree Preorder Traversal

cout 3

go 3-L

go 3-R

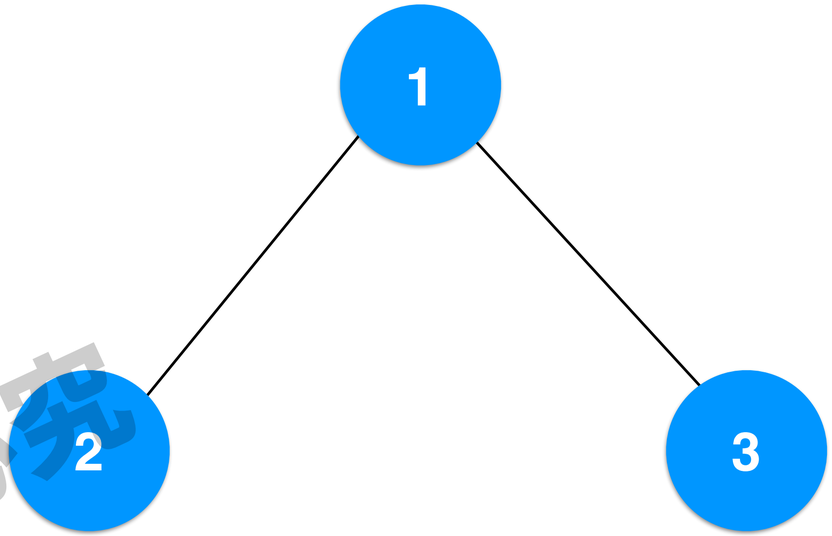
Stack




```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

144. Binary Tree Preorder Traversal



go 3-L

go 3-R

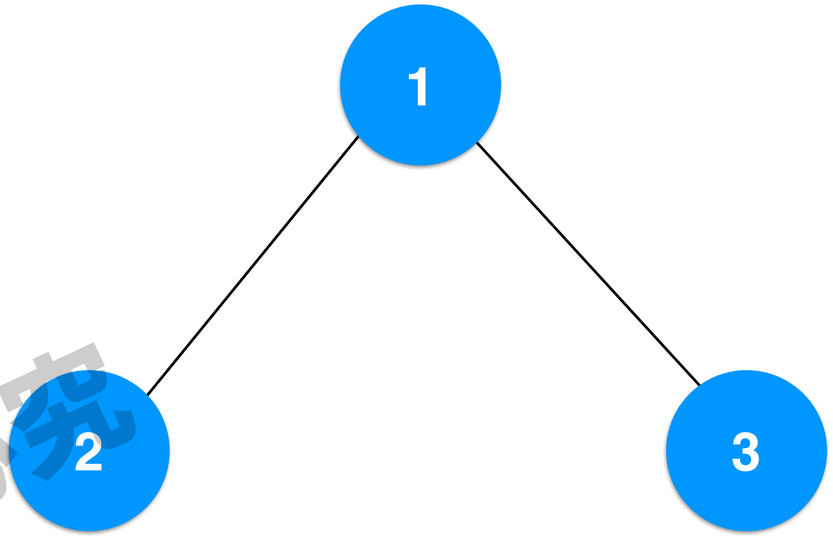
Stack

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

144. Binary Tree Preorder Traversal

go 3-L



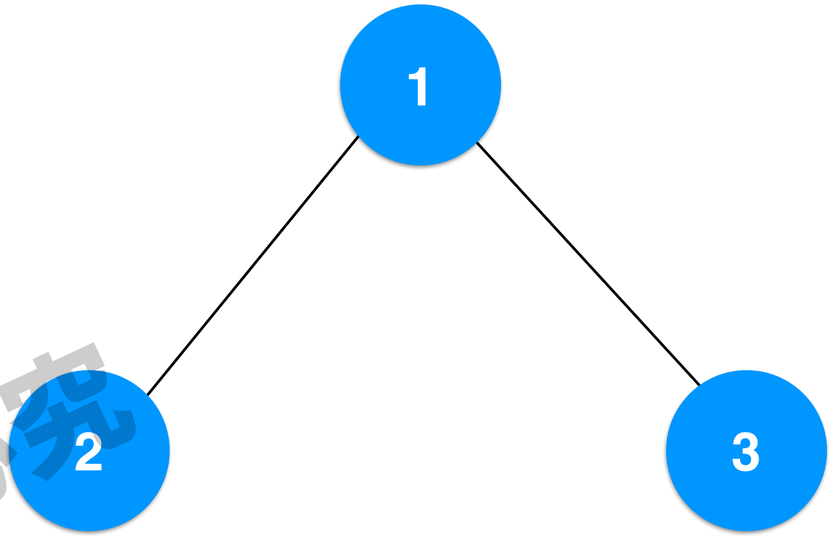

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

go 3-R

Stack

144. Binary Tree Preorder Traversal



go 3-R

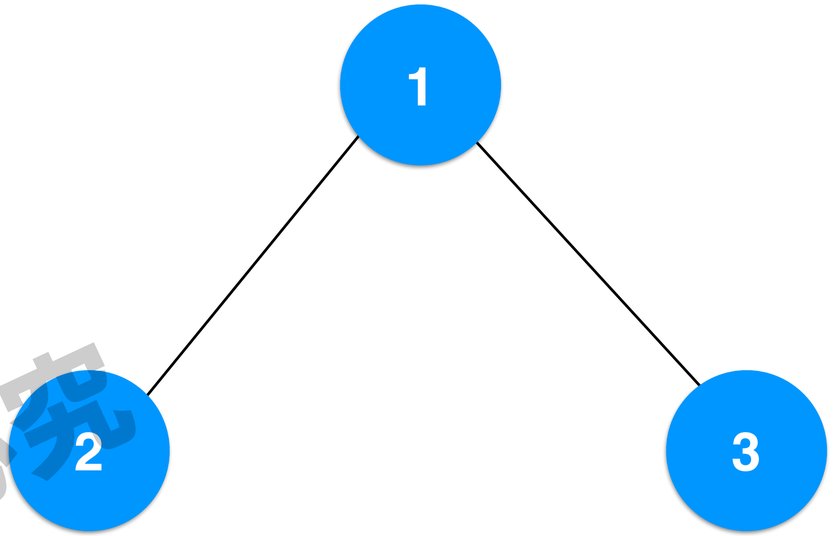
Stack

```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

144. Binary Tree Preorder Traversal

go 3-R

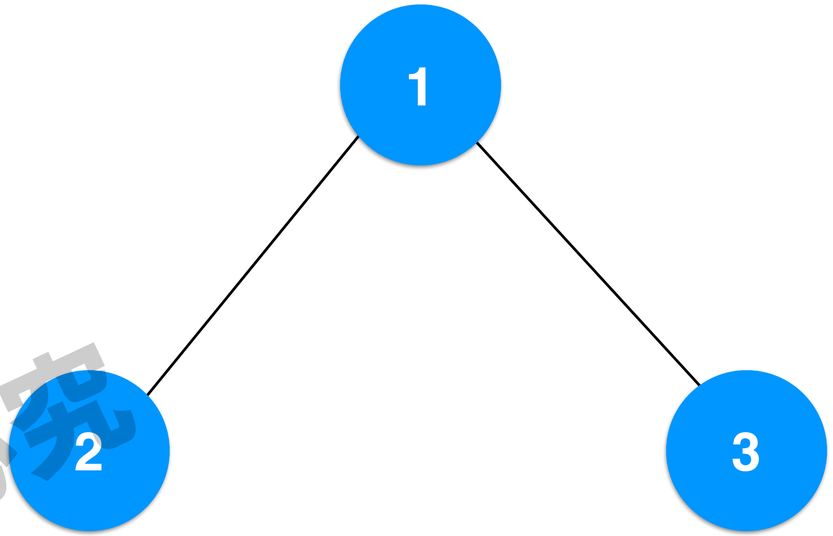



```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

Stack

144. Binary Tree Preorder Traversal




```
void preorder( TreeNode* node ){

    if( node ){
        cout << node->val;
        preorder( node->left );
        preorder( node->right );
    }
}
```

Stack

实践：非递归完成前序遍历

实践：修改非递归完成中序遍历

实践：修改非递归完成后序遍历

教科书上的经典非递归方法

341. Flatten Nested List Iterator



给出一个嵌套的整型列表。列表中的项或者为一个整数，或者是另一个列表。设计一个迭代器，遍历这个整型列表中的所有整数。

- 如 [[1 , 1] , 2 , [1 , 1]]
- 如 [1 , [4 , [6]]]

341. Flatten Nested List Iterator

```
class NestedInteger {
    public:
    bool isInteger() const;
    int getInteger() const;
    const vector<NestedInteger> &getList() const;
};

class NestedIterator {
public:
    NestedIterator(vector<NestedInteger> &nestedList) { }

    int next() { }

    bool hasNext() { }
};
```

341. Flatten Nested List Iterator

```
class NestedIterator {
public:
    NestedIterator(vector<NestedInteger> &nestedList) {}

    int next() {}

    bool hasNext() {}
};
```

对于 [[1 , 1] , 2 , [1 , 1]]，在hasNext()为true的情况下

不断调用next()，依次获得 1 1 2 1 1

341. Flatten Nested List Iterator

```
class NestedIterator {
public:
    NestedIterator(vector<NestedInteger> &nestedList) {}

    int next() {}

    bool hasNext() {}
};
```

对于 [1 , [4 , [6]]]，在hasNext()为true的情况下

不断调用next()，依次获得 1 4 6

队列 Queue

队列 Queue

- 队列的基本应用 - 广度优先遍历
  - 树； 层序遍历
  - 图； 无权图的最短路径

102. Binary Tree Level Order Traversal

对一个二叉树进行层序遍历

102. Binary Tree Level Order Traversal

对一个二叉树进行层序遍历


```
[
  [3],
  [9,20],
  [15,7]
]
```

实践：实现102

107. Binary Tree Level Order Traversal II

对一个二叉树进行层序遍历，返回从底层到上层每层的节点。

103. Binary Tree Zigzag Level Order Traversal

LinkedIn Bloomberg Microsoft

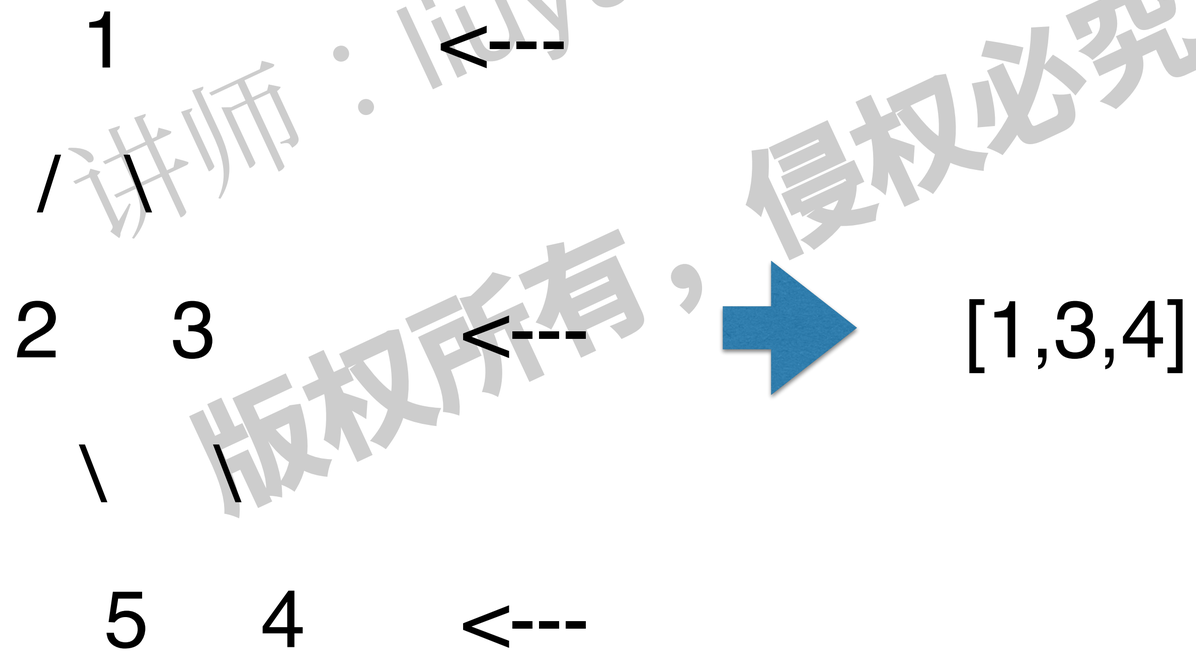
对一个二叉树进行层序遍历，按照“之”字形的顺序返回所有节点


```
[
  [3],
  [20,9],
  [15,7]
]
```

199. Binary Tree Right Side View

amazon

想象你站在一棵二叉树的右侧，返回所有你能看见的节点。



BFS和图的最短路径

279. Perfect Squares

给出一个正整数n，寻找最少的完全平方数，使他们的和为n。

- 完全平方数：1, 4, 9, 16...
- 12 = 4 + 4 + 4
- 13 = 4 + 9

279. Perfect Squares

给出一个正整数n，寻找最少的完全平方数，使他们的和为n。

- 没有解怎么办?
- 是否可能没有解?

279. Perfect Squares

直觉解法？贪心？

12 = 9 + 1 + 1 + 1

12 = 4 + 4 + 4

279. Perfect Squares

对问题建模：

整个问题转化为一个图论问题。

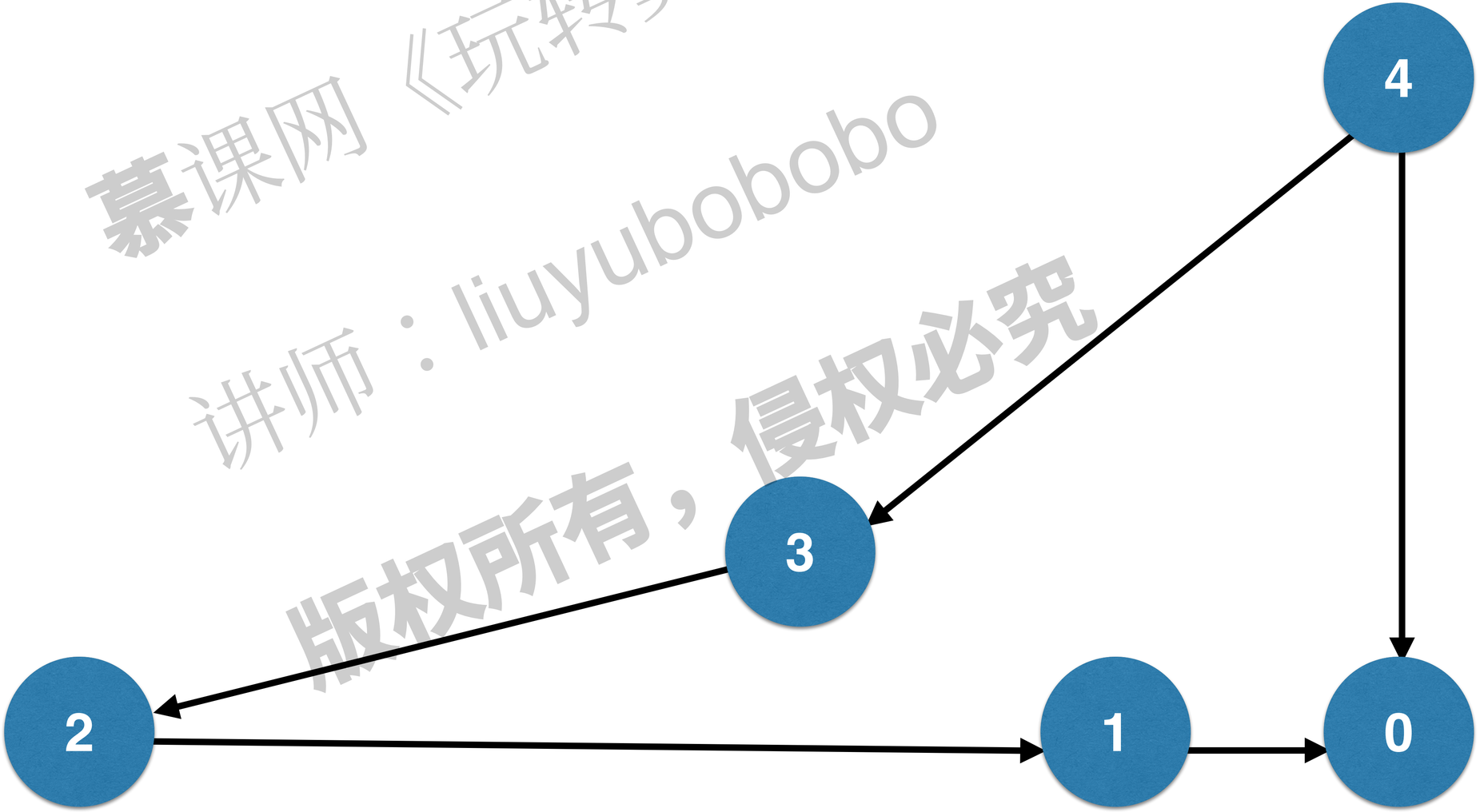
从n到0，每个数字表示一个节点；

如果两个数字x到y相差一个完全平方数，则连接一条边。

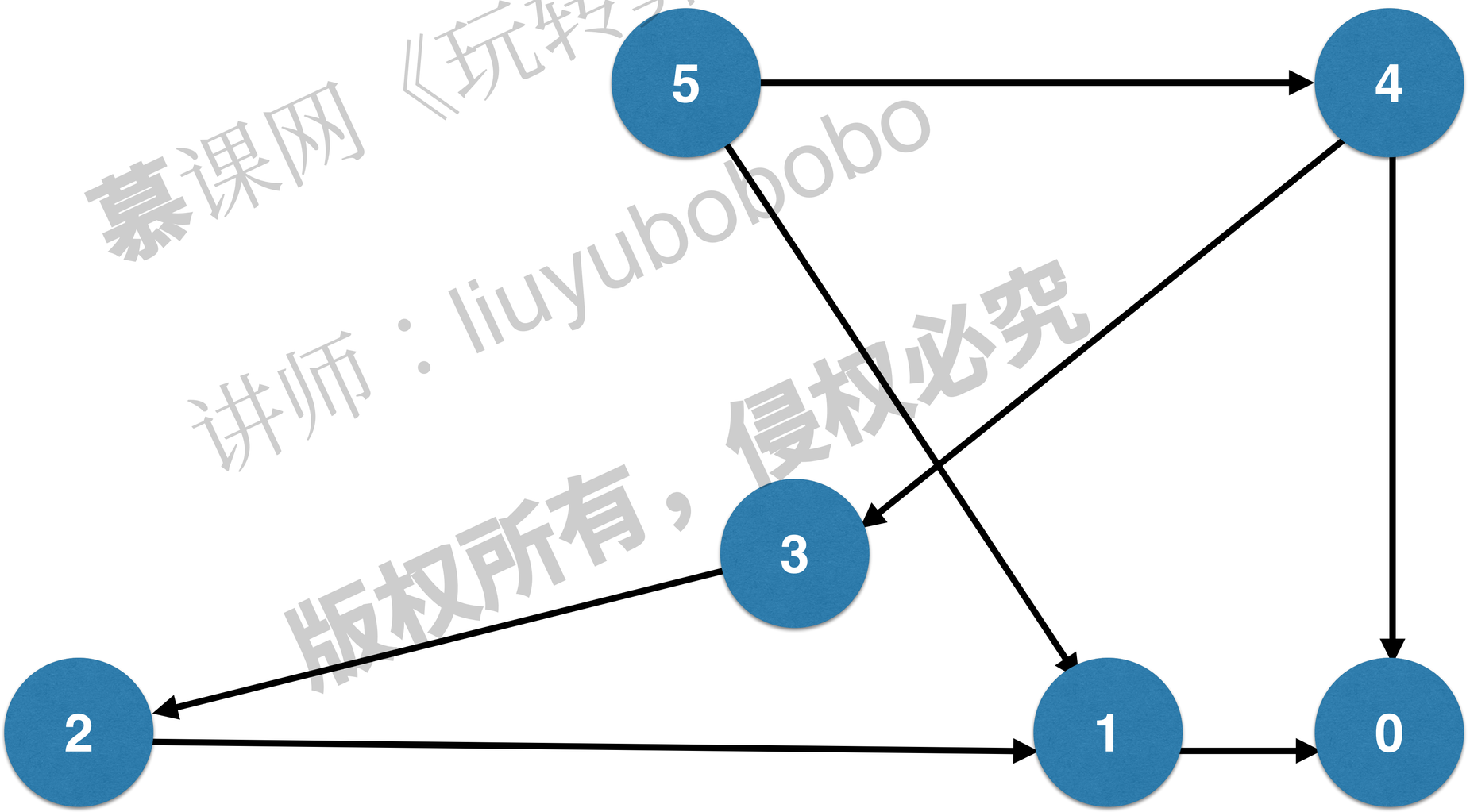
我们得到了一个无权图。

原问题转化成，求这个无权图中从n到0的最短路径。

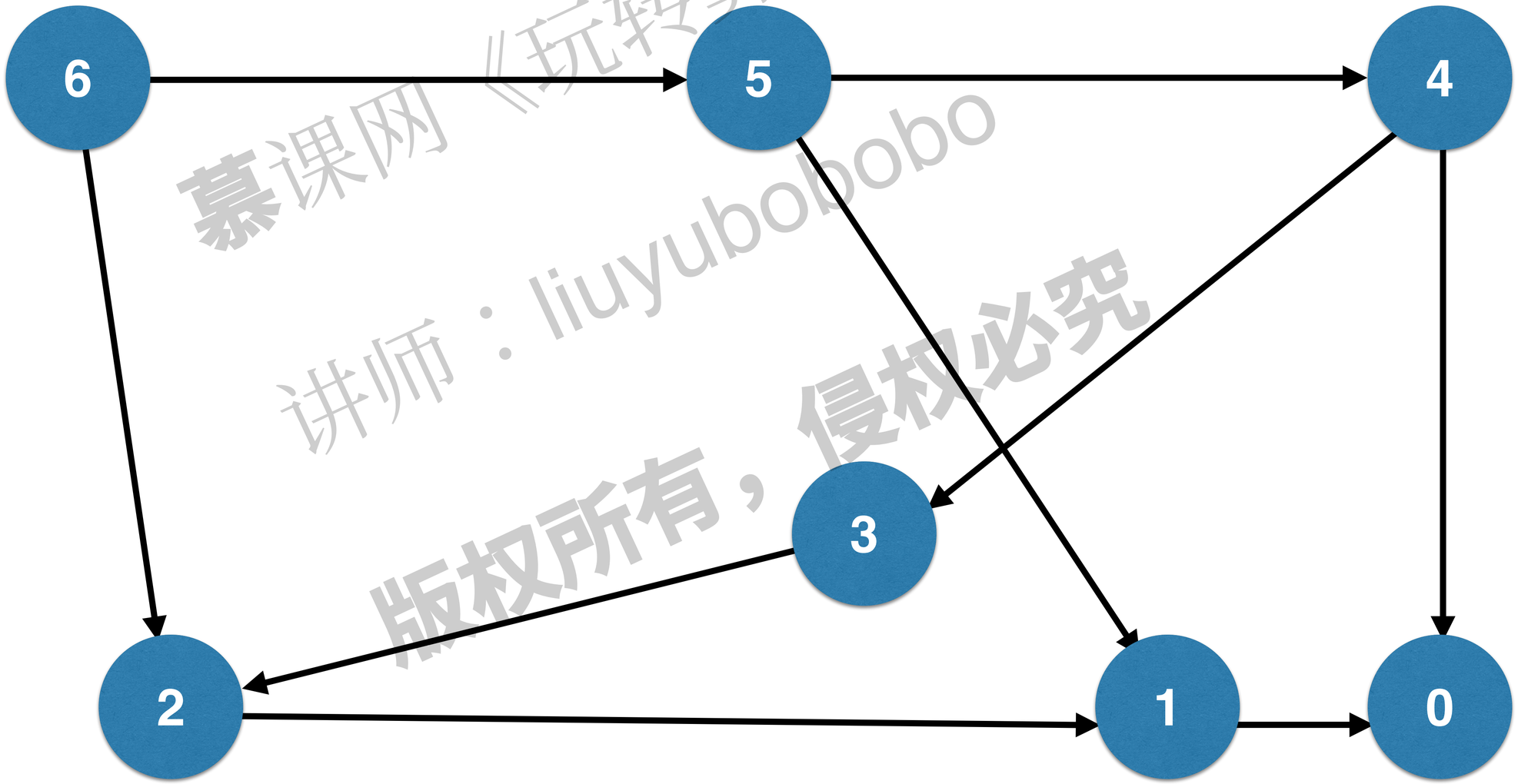
279. Perfect Squares



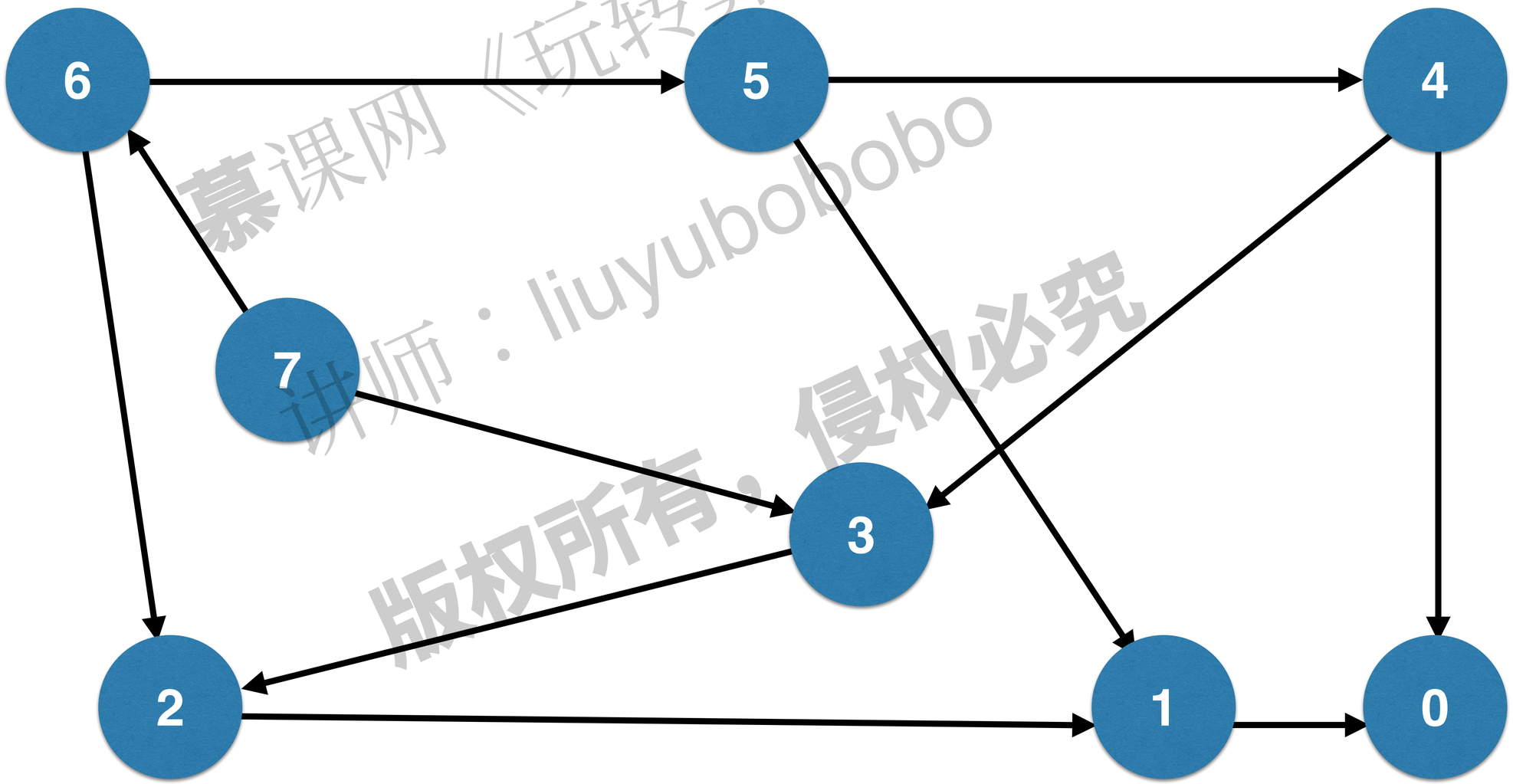
279. Perfect Squares



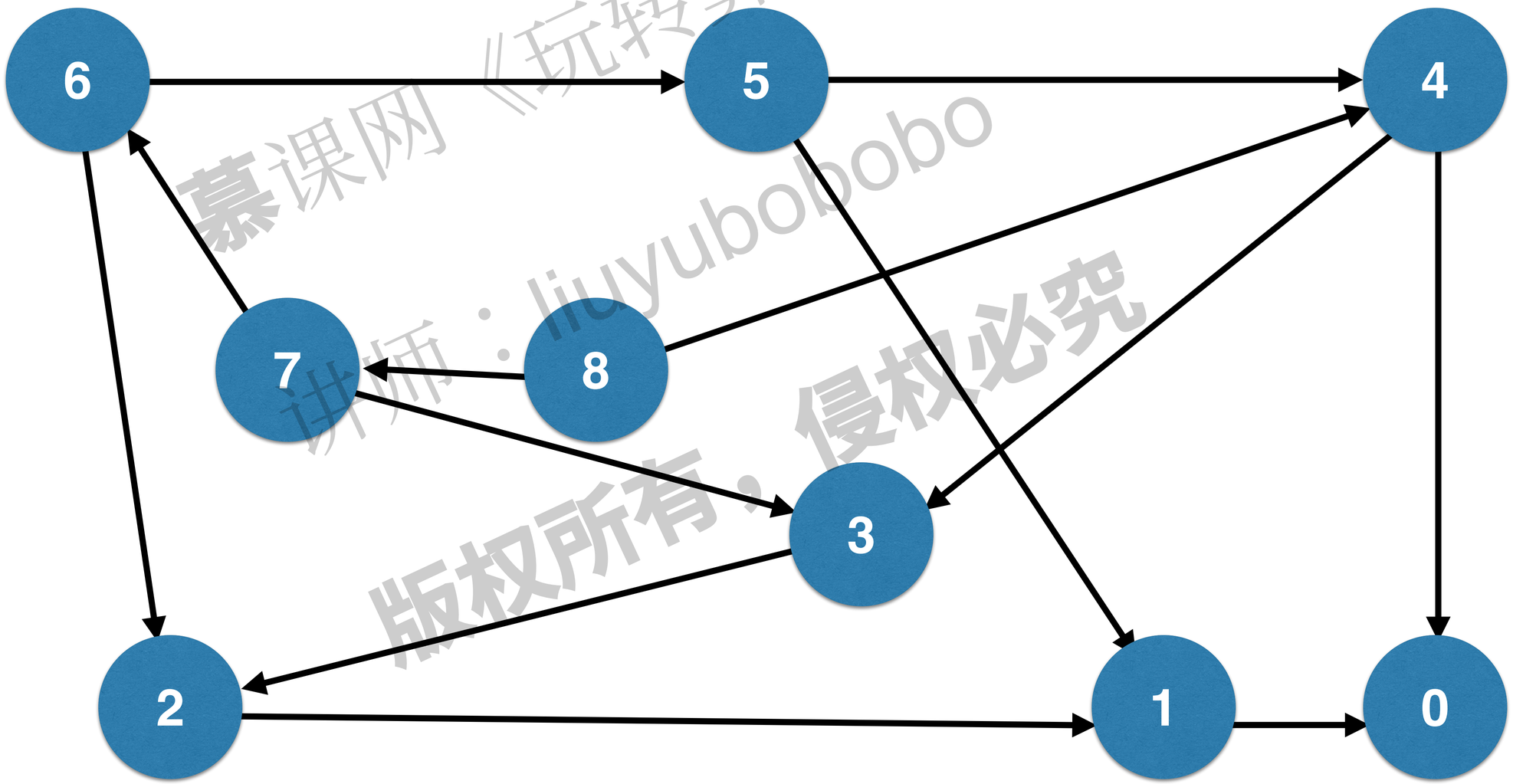
279. Perfect Squares



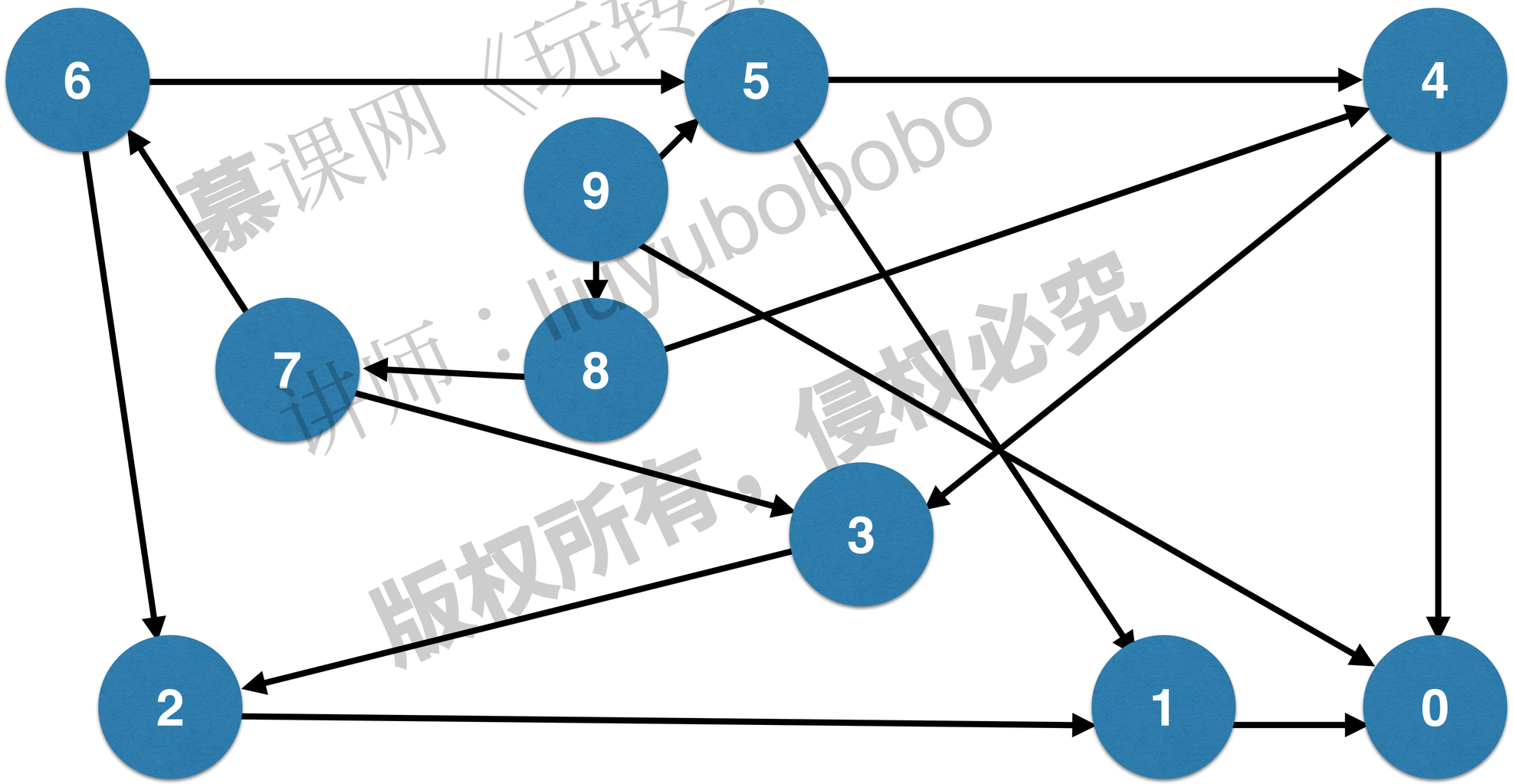
279. Perfect Squares



279. Perfect Squares



279. Perfect Squares



实践：解决279

127. Word Ladder

给出两个单词 (beginWord 和 endWord), 以及一个单词列表, 寻找一条从 beginWord 到 endWord 的最短变换路径。每次变换只能修改单词的一个字母。

127. Word Ladder





- beginWord = “hit" , endWord = "cog"
- 单词列表是 ["hot","dot","dog","lot","log","cog"]
- 我们可以找到的最短的变换路径为：

  "hit" -> "hot" -> "dot" -> "dog" -> "cog",

- 结果为5

126. Word Ladder II

amazon yelp

给出两个单词 (beginWord 和 endWord), 以及一个单词列表, 寻找所有从 beginWord 到 endWord 的最短变换路径。每次变换只能修改单词的一个字母。

126. Word Ladder II

amazon yelp

- beginWord = “hit" , endWord = "cog"
- 单词列表是 ["hot","dot","dog","lot","log","cog"]
- [
  ["hit","hot","dot","dog","cog"],
  ["hit","hot","lot","log","cog"]
]

优先队列

优先队列也是队列

优先队列的底层实现：堆

对于堆的底层实现，白板编程

使用优先队列解决算法问题

学习使用语言中的优先队列容器

C++语言： priority_queue

实践：使用C++中的优先队列

使用优先队列解决算法问题

347. Top K Frequent Elements

给定一个非空数组，返回前k个出现频率最高的元素。

- 如给定 [1,1,1,2,2,3], k = 2
- 返回 [1,2]
- 注意k的合法性问题

347. Top K Frequent Elements

给定一个非空数组，返回前k个出现频率最高的元素。

最简单的思路：扫描一遍统计频率；排序找到前k个出现频率最高的元素。O(nlogn)

347. Top K Frequent Elements

给定一个非空数组，返回前k个出现频率最高的元素。

维护一个含有k个元素的优先队列。如果遍历到的元素比队列中的最小频率元素的频率高，则取出队列中最小频率的元素，将新元素入队。最终，队列中剩下的，就是前k个出现频率最高的元素。

347. Top K Frequent Elements

给定一个非空数组，返回前k个出现频率最高的元素。

思路2：维护优先队列，时间复杂度：O(nlogk)

实践：解决347

347. Top K Frequent Elements

给定一个非空数组，返回前k个出现频率最高的元素。

思路3：维护优先队列，时间复杂度：O(nlog(n-k))

23. Merge k Sorted Lists

有k个有序数组，将他们归并为一个有序数组

其他

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玩儿转算法面试

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