



## 面试150

有的标了留着练手

[https://github.com/lyhue1991/eat\\_pytorch\\_in\\_20\\_days](https://github.com/lyhue1991/eat_pytorch_in_20_days)

<https://blog.csdn.net/BlckRiver/article/details/105356991> vector几种初始化方式

## 英文

Bitwise

## 数组与字符串

map使用<https://leetcode.cn/problems/majority-element/solutions/146074/duo-shu-yuan-su-by-leetcode-solution> (python的话学习counter)

拷贝vector `nums.assign(newArr.begin(), newArr.end());`

数组轮转三种方法：<https://leetcode.cn/problems/rotate-array/solutions/551039/xuan-zhuan-shu-zu-by-leetcode-solution-nipk> `reverse()`

跳跃游戏：<https://leetcode.cn/problems/jump-game/solutions/24322/55-by-ikaruga>

<https://leetcode.cn/problems/jump-game-ii/solutions/36035/45-by-ikaruga>

除2可以写移位

## 88. 合并两个有序数组

代码块

```
1  class Solution:
2      def merge(self, nums1: List[int], m: int, nums2: List[int], n: int) ->
    None:
3          """
4          Do not return anything, modify nums1 in-place instead.
5          """
6          nums1[m:] = nums2
7          nums1.sort()
```

代码块

```
1  void merge(vector<int>& nums1, int m, vector<int>& nums2, int n) {
2      int i = nums1.size() - 1;
3      m--;
4      n--;
5      while (n >= 0) {
6          while (m >= 0 && nums1[m] > nums2[n]) {
7              swap(nums1[i--], nums1[m--]);
8          }
9          swap(nums1[i--], nums2[n--]);
10     }
11 }
```

## 80. 删除有序数组中的重复项 II

代码块

```
1  class Solution {
2  public:
3      int removeDuplicates(vector<int>& nums) {
4          return process(nums,2);
5      }
6      int process(vector<int>& nums,int k){
7          int idx = 0;
8          for(auto x : nums){
9              if(idx < k or nums[idx - k] != x){ // 这句好好看看
10                 nums[idx++] = x;
11             }
12         }
13         return idx;
14     }
```

```
15 };;
```

## 169. 多数元素

哈希表

代码块

```
1 class Solution:
2     def majorityElement(self, nums: List[int]) -> int:
3         counts = collections.Counter(nums)
4         print(counts)
5         return max(counts.keys(), key=counts.get)
```

代码块

```
1 class Solution {
2 public:
3     int majorityElement(vector<int>& nums) {
4         unordered_map<int, int> counts;
5         int majority = 0, cnt = 0;
6         for (int num: nums) {
7             ++counts[num];
8             if (counts[num] > cnt) {
9                 majority = num;
10                cnt = counts[num];
11            }
12        }
13        return majority;
14    }
15 };
```

排序 比哈希表更快

代码块

```
1 class Solution:
2     def majorityElement(self, nums: List[int]) -> int:
3         nums.sort()
4         return nums[len(nums) // 2]
```

代码块

```
1 class Solution {
```

```

2 public:
3     int majorityElement(vector<int>& nums) {
4         sort(nums.begin(), nums.end());
5         return nums[nums.size() / 2];
6     }
7 };

```

摩尔投票法：

<https://leetcode.cn/problems/majority-element/solutions/2362000/169-duo-shu-yuan-su-mo-er-tou-piao-qing-ledrh/?envType=study-plan-v2&envId=top-interview-150>

代码块

```

1 class Solution {
2 public:
3     int majorityElement(vector<int>& nums) {
4         int x = 0, votes = 0;
5         for (int num : nums){
6             if (votes == 0) x = num;
7             votes += num == x ? 1 : -1;
8         }
9         return x;
10    }
11 };

```

## 189. 轮转数组

代码块

```

1 用额外数字 学一下assign
2 class Solution {
3 public:
4     void rotate(vector<int>& nums, int k) {
5         int n = nums.size();
6         vector<int> newArr(n);
7         for (int i = 0; i < n; ++i) {
8             newArr[(i + k) % n] = nums[i];
9         }
10        nums.assign(newArr.begin(), newArr.end());
11    }
12 };

```

代码块

```

1  翻转
2  class Solution {
3  public:
4      void reverse(vector<int>& nums, int start, int end) {
5          while (start < end) {
6              swap(nums[start], nums[end]);
7              start += 1;
8              end -= 1;
9          }
10     }
11
12     void rotate(vector<int>& nums, int k) {
13         k %= nums.size();
14         reverse(nums, 0, nums.size() - 1);
15         reverse(nums, 0, k - 1);
16         reverse(nums, k, nums.size() - 1);
17     }
18 };

```

代码块

```

1  python的话reverse要自己写
2  class Solution:
3      def reverse(self, nums: List[int], start: int, end: int):
4          while start < end:
5              nums[start], nums[end] = nums[end], nums[start]
6              start += 1
7              end -= 1
8
9      def rotate(self, nums: List[int], k: int):
10         n = len(nums)
11         k %= n
12         self.reverse(nums, 0, n - 1)
13         self.reverse(nums, 0, k - 1)
14         self.reverse(nums, k, n - 1)

```

## 121. 买卖股票的最佳时机

好好看好好学我擦

代码块

```

1  class Solution:
2      def maxProfit(self, prices: List[int]) -> int:
3          inf = int(1e9)
4          minprice = inf

```

```

5         maxprofit = 0
6         for price in prices:
7             maxprofit = max(price - minprice, maxprofit)
8             minprice = min(price, minprice)
9         return maxprofit

```

## 122. 买卖股票的最佳时机 II

DP

代码块

```

1  public class Solution {
2
3      public int maxProfit(int[] prices) {
4          int len = prices.length;
5          if (len < 2) {
6              return 0;
7          }
8
9          // cash: 持有现金
10         // hold: 持有股票
11         // 状态数组
12         // 状态转移: cash → hold → cash → hold → cash → hold → cash
13         int[] cash = new int[len];
14         int[] hold = new int[len];
15
16         cash[0] = 0;
17         hold[0] = -prices[0];
18
19         for (int i = 1; i < len; i++) {
20             // 这两行调换顺序也是可以的
21             cash[i] = Math.max(cash[i - 1], hold[i - 1] + prices[i]);
22             hold[i] = Math.max(hold[i - 1], cash[i - 1] - prices[i]);
23         }
24         return cash[len - 1];
25     }

```

代码块

```

1  优化版
2  public class Solution {
3
4      public int maxProfit(int[] prices) {
5          int len = prices.length;
6          if (len < 2) {

```

```

7         return 0;
8     }
9
10    // cash: 持有现金
11    // hold: 持有股票
12    // 状态转移: cash → hold → cash → hold → cash → hold → cash
13
14    int cash = 0;
15    int hold = -prices[0];
16
17    int preCash = cash;
18    int preHold = hold;
19    for (int i = 1; i < len; i++) {
20        cash = Math.max(preCash, preHold + prices[i]);
21        hold = Math.max(preHold, preCash - prices[i]);
22
23        preCash = cash;
24        preHold = hold;
25    }
26    return cash;
27 }
28 }

```

## 贪心

代码块

```

1  public class Solution {
2
3      public int maxProfit(int[] prices) {
4          int len = prices.length;
5          if (len < 2) {
6              return 0;
7          }
8
9          int res = 0;
10         for (int i = 1; i < len; i++) {
11             int diff = prices[i] - prices[i - 1];
12             if (diff > 0) {
13                 res += diff;
14             }
15         }
16         return res;
17     }
18 }

```

## 45 跳跃游戏2

<https://leetcode.cn/problems/jump-game-ii/description/?envType=study-plan-v2&envId=top-interview-150>

代码块

```
1 class Solution:
2     def jump(self, nums: List[int]) -> int:
3         steps = [1e9]*len(nums)
4         steps[0] = 0
5         for i in range(len(nums)):
6             for dis in range(1, nums[i]+1): # 这里要+1, 因为前闭后开
7                 if i + dis < len(nums):
8                     steps[i + dis] = min(steps[i]+1, steps[i + dis])
9         return steps[len(nums)-1]
```

上面这个速度很慢

<https://leetcode.cn/problems/jump-game-ii/solutions/36035/45-by-ikaruga>

代码块

```
1 int jump(vector<int>& nums)
2 {
3     int ans = 0;
4     int end = 0;
5     int maxPos = 0;
6     for (int i = 0; i < nums.size() - 1; i++)
7     {
8         maxPos = max(nums[i] + i, maxPos);
9         if (i == end)
10        {
11            end = maxPos;
12            ans++;
13        }
14    }
15    return ans;
```

## 274. H 指数

主要做法没看懂，就记了个排序吧

代码块

```
1 class Solution:
2     def hIndex(self, citations: List[int]) -> int:
```



```

3         sorted_citation = sorted(citations, reverse = True)
4         h = 0; i = 0; n = len(citations)
5         while i < n and sorted_citation[i] > h:
6             h += 1
7             i += 1
8         return h

```

## 275. H 指数 II

这个二分要学会写！！！！

代码块

```

1 class Solution:
2     def hIndex(self, citations: List[int]) -> int:
3         right = len(citations) - 1
4         left = 0
5         while left <= right:
6             mid = (right + left) // 2
7             if citations[mid] >= len(citations) - mid:
8                 right = mid - 1
9             else:
10                 left = mid + 1
11         return len(citations) - left

```

## 380 O1时间插入删除

<https://leetcode.cn/problems/insert-delete-getrandom-o1/description/?envType=study-plan-v2&envId=top-interview-150>

Python字典就当哈希表！

可以不用链表

代码块

```

1 class RandomizedSet:
2     def __init__(self):
3         self.nums = []
4         self.indices = {}
5
6     def insert(self, val: int) -> bool:
7         if val in self.indices:
8             return False

```

```

9         self.indices[val] = len(self.nums)
10        self.nums.append(val)
11        return True
12
13    def remove(self, val: int) -> bool:
14        if val not in self.indices:
15            return False
16        id = self.indices[val]
17        self.nums[id] = self.nums[-1]
18        self.indices[self.nums[id]] = id
19        self.nums.pop()
20        del self.indices[val]
21        return True
22
23    def getRandom(self) -> int:
24        return choice(self.nums)

```

代码块

```

1  class RandomizedSet {
2  public:
3      RandomizedSet() {
4          srand((unsigned)time(NULL));
5      }
6
7      bool insert(int val) {
8          if (indices.count(val)) {
9              return false;
10         }
11         int index = nums.size();
12         nums.emplace_back(val);
13         indices[val] = index;
14         return true;
15     }
16
17     bool remove(int val) {
18         if (!indices.count(val)) {
19             return false;
20         }
21         int index = indices[val];
22         int last = nums.back();
23         nums[index] = last;
24         indices[last] = index;
25         nums.pop_back();
26         indices.erase(val);
27         return true;

```

```

28     }
29
30     int getRandom() {
31         int randomIndex = rand()%nums.size();
32         return nums[randomIndex];
33     }
34 private:
35     vector<int> nums;
36     unordered_map<int, int> indices;
37 };

```

## 238 自身以外数组乘积

<https://leetcode.cn/problems/product-of-array-except-self/?envType=study-plan-v2&envId=top-interview-150>

这个下面处理是n-2!!!

代码块

```

1  class Solution:
2      def productExceptSelf(self, nums: List[int]) -> List[int]:
3          forward = [nums[0]]
4          backward = [nums[-1]]
5          n = len(nums)
6          for i in range(1, n):
7              forward.append(forward[i-1] * nums[i])
8              backward.append(backward[i-1] * nums[n-i-1])
9          answer = [backward[n-2]]
10         for i in range(1, n-1):
11             answer.append(forward[i-1] * backward[n-i-2])
12         answer.append(forward[n-2])
13         return answer

```

## 134. 加油站

代码块

```

1  class Solution:
2      def canCompleteCircuit(self, gas: List[int], cost: List[int]) -> int:
3          n = len(gas)
4          spare = 0
5          min_spare = float('inf')
6          min_index = 0

```

```

7
8     for i in range(n):
9         spare += gas[i] - cost[i]
10        if spare < min_spare:
11            min_spare = spare
12            min_index = i
13
14        return ((min_index + 1) % n) if spare >= 0 else -1
15
16 允许油量为负，但是总剩余油量应该大于等于0，否则不存在解的。存在解的情况下，利用贪心法的思想，找到最低点，它的下一个点出发的话，可以保证前期得到剩余油量最大，所以可以跑完全程。
17

```

## 135 发糖果

<https://leetcode.cn/problems/candy/solutions/533150/fen-fa-tang-guo-by-leetcode-solution-f01p/?envType=study-plan-v2&envId=top-interview-150>

从左到右再从右到左

代码块

```

1  class Solution:
2      def candy(self, ratings: List[int]) -> int:
3          n = len(ratings)
4          left = [0] * n
5          for i in range(n):
6              if i > 0 and ratings[i] > ratings[i - 1]:
7                  left[i] = left[i - 1] + 1
8              else:
9                  left[i] = 1
10
11         right = ret = 0
12         for i in range(n - 1, -1, -1):
13             if i < n - 1 and ratings[i] > ratings[i + 1]:
14                 right += 1
15             else:
16                 right = 1
17             ret += max(left[i], right)
18
19         return ret

```

这个有点抽象

代码块

```

1  class Solution:
2      def candy(self, ratings: List[int]) -> int:
3          n = len(ratings)
4          ret = 1
5          inc, dec, pre = 1, 0, 1
6
7          for i in range(1, n):
8              if ratings[i] >= ratings[i - 1]:
9                  dec = 0
10                 pre = (1 if ratings[i] == ratings[i - 1] else pre + 1)
11                 ret += pre
12                 inc = pre
13             else:
14                 dec += 1
15                 if dec == inc:
16                     dec += 1
17                 ret += dec
18                 pre = 1
19
20         return ret

```

依据前面总结的规律，我们可以提出本题的解法。我们从左到右枚举每一个同学，记前一个同学分得的糖果数量为 `pre`：

如果当前同学比上一个同学评分高，说明我们就在最近的递增序列中，直接分配给该同学 `pre+1` 个糖果即可。

否则我们就在一个递减序列中，我们直接分配给当前同学一个糖果，并把该同学所在的递减序列中所有的同学都再多分配一个糖果，以保证糖果数量还是满足条件。

我们无需显式地额外分配糖果，只需要记录当前的递减序列长度，即可知道需要额外分配的糖果数量。

同时注意当当前的递减序列长度和上一个递增序列等长时，需要把最近的递增序列的最后一个同学也并进递减序列中。

这样，我们只要记录当前递减序列的长度 `dec`，最近的递增序列的长度 `inc` 和前一个同学分得的糖果数量 `pre` 即可。

## 42. 接雨水

这个思路有点骚操作 可以再看看代码自己写能不能写对

```

1  class Solution {
2      public int trap(int[] height) {
3          int n = height.length;
4          int res = 0;
5          // 左右指针：分别指向左右边界的列

```

```

6         int left = 0, right = n - 1;
7         // 左指针的左边最大高度、右指针的右边最大高度
8         int leftMax = height[left], rightMax = height[right];
9         // 最两边的列存不了水
10        left++;
11        right--;
12        // 向中间靠拢
13        while(left <= right){
14            leftMax = Math.max(leftMax, height[left]);
15            rightMax = Math.max(rightMax, height[right]);
16            if(leftMax < rightMax){
17                // 左指针的leftMax比右指针的rightMax矮
18                // 说明：左指针的右边至少有一个板子 > 左指针左边所有板子
19                // 根据水桶效应，保证了左指针当前列的水量决定权在左边
20                // 那么可以计算左指针当前列的水量：左边最大高度-当前列高度
21                res += leftMax - height[left];
22                left++;
23            }else{
24                // 右边同理
25                res += rightMax - height[right];
26                right--;
27            }
28        }
29        return res;
30    }
31 }

```

一层一层扫描 应该是对的但是会超时

代码块

```

1  class Solution:
2      def trap(self, height: List[int]) -> int:
3          highest = max(height)
4          water = 0
5          for h in range(1, highest+1):
6              left_index = -1
7              right_index = len(height)
8              wall = 0
9              for index in range(len(height)-1, -1, -1):
10                 if height[index] >= h:
11                     right_index = index
12                     break
13             for index in range(0, len(height)):
14                 if height[index] >= h:
15                     left_index = index

```

```

16             break
17         if right_index == left_index or right_index == left_index + 1:
18             continue
19         for index in range(left_index+1, right_index):
20             if height[index] >= h:
21                 wall += 1
22         water += right_index - left_index - wall - 1
23     return water

```

## 12. 整数转罗马数字

用符号表

罗马转整数往后看一个来确定加还是减

整数转罗马就把6个特殊情况也编入符号表

## 58 最后一个单词长度

<https://leetcode.cn/problems/length-of-last-word/description/?envType=study-plan-v2&envId=top-interview-150>

反向遍历

代码块

```

1  class Solution {
2  public:
3      int lengthOfLastWord(string s) {
4          int index = s.size() - 1;
5
6          while (s[index] == ' ') {
7              index--;
8          }
9          int wordLength = 0;
10         while (index >= 0 && s[index] != ' ') {
11             wordLength++;
12             index--;
13         }
14
15         return wordLength;
16     }
17 };

```

## 14. 最长公共前缀

横扫一遍就够 拿第一个单词当最长前缀 然后不断减少

也可以竖向扫描，同时扫所有字符串第i位

这个可以留着练手

## 151. 反转字符串中的单词

字符串操作复习一下 string可以直接+char

留着练手

```
1  class Solution {
2  public:
3      string reverseWords(string s) {
4          int left = 0, right = s.size() - 1;
5          // 去掉字符串开头的空白字符
6          while (left <= right && s[left] == ' ') ++left;
7
8          // 去掉字符串末尾的空白字符
9          while (left <= right && s[right] == ' ') --right;
10
11         deque<string> d;
12         string word;
13
14         while (left <= right) {
15             char c = s[left];
16             if (word.size() && c == ' ') {
17                 // 将单词 push 到队列的头部
18                 d.push_front(move(word));
19                 word = "";
20             }
21             else if (c != ' ') {
22                 word += c;
23             }
24             ++left;
25         }
26         d.push_front(move(word));
27
28         string ans;
29         while (!d.empty()) {
30             ans += d.front();
31             d.pop_front();
32             if (!d.empty()) ans += ' ';
33         }
34         return ans;
35     }
36 };
```



class Solution:

def reverseWords(self, s: str) -> str:

return " ".join(reversed(s.split()))

## 6. Z 字形变换

可以构造二维 也可以直接这样

```
1  class Solution {
2  public:
3      string convert(string s, int numRows) {
4          if (numRows < 2)
5              return s;
6          vector<string> rows(numRows);
7          int i = 0, flag = -1;
8          for (char c : s) {
9              rows[i].push_back(c);
10             if (i == 0 || i == numRows - 1)
11                 flag = - flag;
12             i += flag;
13         }
14         string res;
15         for (const string &row : rows)
16             res += row;
17         return res;
18     }
19 };
```

## 28. 找出字符串中第一个匹配项的下标

KMP算法

<https://zhuanlan.zhihu.com/p/83334559> 实际上next数组在构建状态转移图啊!

## 68 文本左右对齐

<https://leetcode.cn/problems/text-justification/description/?envType=study-plan-v2&envId=top-interview-150>

没啥技术含量，主要是折磨？

## 239. 滑动窗口最大值

很精髓啊 priority\_queue用法学习一下

3个方法都挺有意思的

## 各个数据结构的时间开销

## 各个数据结构的操作原理和使用方法

# 双指针

### 283. 移动零

发现自己是弱智

### 167. 两数之和 II - 输入有序数组

这个双指针看起来不对但实际是对的

### 11. 盛最多水的容器

也是一个看起来不对实际上对 每次就是把短板往中间移

双指针代表的是 可以作为容器边界的所有位置的范围。在一开始，双指针指向数组的左右边界，表示数组中所有的位置都可以作为容器的边界，因为我们还没有进行过任何尝试。在这之后，我们每次将对应的数字较小的那个指针 往 另一个指针 的方向移动一个位置，就表示我们认为 这个指针不可能再作为容器的边界了。

# 滑动数组

### 209. 长度最小的子数组

#### 方法二：前缀和 + 二分查找

方法一的时间复杂度是  $O(n^2)$ ，因为在确定每个子数组的开始下标后，找到长度最小的子数组需要  $O(n)$  的时间。如果使用二分查找，则可以将时间优化到  $O(\log n)$ 。

为了使用二分查找，需要额外创建一个数组 `sums` 用于存储数组 `nums` 的前缀和，其中 `sums[i]` 表示从 `nums[0]` 到 `nums[i - 1]` 的元素和。得到前缀和之后，对于每个开始下标 `i`，可通过二分查找得到大于或等于 `i` 的最小下标 `bound`，使得 `sums[bound] - sums[i - 1] ≥ s`，并更新子数组的最小长度（此时子数组的长度是 `bound - (i - 1)`）。

```
1  class Solution {
2  public:
3      int minSubArrayLen(int s, vector<int>& nums) {
4          int n = nums.size();
5          if (n == 0) {
6              return 0;
```

```

7      }
8      int ans = INT_MAX;
9      vector<int> sums(n + 1, 0);
10     // 为了方便计算, 令 size = n + 1
11     // sums[0] = 0 意味着前 0 个元素的前缀和为 0
12     // sums[1] = A[0] 前 1 个元素的前缀和为 A[0]
13     // 以此类推
14     for (int i = 1; i <= n; i++) {
15         sums[i] = sums[i - 1] + nums[i - 1];
16     }
17     for (int i = 1; i <= n; i++) {
18         int target = s + sums[i - 1];
19         auto bound = lower_bound(sums.begin(), sums.end(), target);
20         if (bound != sums.end()) {
21             ans = min(ans, static_cast<int>((bound - sums.begin()) - (i -
12         1)));
22     }
23 }
24 return ans == INT_MAX ? 0 : ans;
25 }
26 };

```

## 滑动窗口

先扩大到足够大 然后右边往右移 超了就缩左边 再右边往右移

```

1  class Solution {
2  public:
3      int minSubArrayLen(int s, vector<int>& nums) {
4          int n = nums.size();
5          if (n == 0) {
6              return 0;
7          }
8          int ans = INT_MAX;
9          int start = 0, end = 0;
10         int sum = 0;
11         while (end < n) {
12             sum += nums[end];
13             while (sum >= s) {
14                 ans = min(ans, end - start + 1);
15                 sum -= nums[start];
16                 start++;
17             }
18             end++;
19         }
20         return ans == INT_MAX ? 0 : ans;

```

```
21     }
22     };
```

### 30. 串联所有单词的子串

好难 这个勉强看懂<https://leetcode.cn/problems/substring-with-concatenation-of-all-words/solutions/3825/chuan-lian-suo-you-dan-ci-de-zi-chuan-by-powcai>

```
1  class Solution:
2      def findSubstring(self, s: str, words: List[str]) -> List[int]:
3          from collections import Counter
4          if not s or not words: return []
5          one_word = len(words[0])
6          all_len = len(words) * one_word
7          n = len(s)
8          words = Counter(words)
9          res = []
10         for i in range(0, n - all_len + 1):
11             tmp = s[i:i+all_len]
12             c_tmp = []
13             for j in range(0, all_len, one_word):
14                 c_tmp.append(tmp[j:j+one_word])
15             if Counter(c_tmp) == words:
16                 res.append(i)
17         return res
```

## 矩阵

### 54. 螺旋矩阵

这个这么简洁太离谱了啊

```
1  class Solution {
2  public:
3      vector<int> spiralOrder(vector<vector<int>>& matrix) {
4          vector<int> ans;
5          if(matrix.empty()) return ans; //若数组为空, 直接返回答案
6          int u = 0; //赋值上下左右边界
7          int d = matrix.size() - 1;
8          int l = 0;
9          int r = matrix[0].size() - 1;
10         while(true)
11         {
```

```

12         for(int i = l; i <= r; ++i) ans.push_back(matrix[u][i]); //向右移动
    直到最右
13         if(++ u > d) break; //重新设定上边界，若上边界大于下边界，则遍历遍历完
    成，下同
14         for(int i = u; i <= d; ++i) ans.push_back(matrix[i][r]); //向下
15         if(-- r < l) break; //重新设定有边界
16         for(int i = r; i >= l; --i) ans.push_back(matrix[d][i]); //向左
17         if(-- d < u) break; //重新设定下边界
18         for(int i = d; i >= u; --i) ans.push_back(matrix[i][l]); //向上
19         if(++ l > r) break; //重新设定左边界
20     }
21     return ans;
22 }
23 };

```

## 48. 旋转图像

找到逻辑

<https://leetcode.cn/problems/rotate-image/solutions/526980/xuan-zhuan-tu-xiang-by-leetcode-solution-vu3m/>

题解有点六

## 289. 生命游戏

生命游戏原地算法：用一个新的状态标记

# 哈希表

## 205. 同构字符串

基本操作

但是不要用来计数，直接用这个方法更简单

```

1     class Solution {
2     public:
3         bool isIsomorphic(string s, string t) {
4             unordered_map<char, char> s2t;
5             unordered_map<char, char> t2s;
6             int len = s.length();
7             for (int i = 0; i < len; ++i) {
8                 char x = s[i], y = t[i];

```

```

9         if ((s2t.count(x) && s2t[x] != y) || (t2s.count(y) && t2s[y] !=
    x)) {
10             return false;
11         }
12         s2t[x] = y;
13         t2s[y] = x;
14     }
15     return true;
16 }
17 };

```

## 290. 单词规律

切字符串怎么切

```

1  class Solution {
2  public:
3      bool wordPattern(string pattern, string str) {
4          unordered_map<string, char> str2ch;
5          unordered_map<char, string> ch2str;
6          int m = str.length();
7          int i = 0;
8          for (auto ch : pattern) {
9              if (i >= m) {
10                 return false;
11             }
12             int j = i;
13             while (j < m && str[j] != ' ') j++;
14             const string &tmp = str.substr(i, j - i);
15             if (str2ch.count(tmp) && str2ch[tmp] != ch) {
16                 return false;
17             }
18             if (ch2str.count(ch) && ch2str[ch] != tmp) {
19                 return false;
20             }
21             str2ch[tmp] = ch;
22             ch2str[ch] = tmp;
23             i = j + 1;
24         }
25         return i >= m;
26     }
27 };

```

## 49. 字母异位词分组

先给string排序 绝了

```
1  class Solution {
2  public:
3      vector<vector<string>> groupAnagrams(vector<string>& strs) {
4          unordered_map<string, vector<string>> mp;
5          for (string& str: strs) {
6              string key = str;
7              sort(key.begin(), key.end());
8              mp[key].emplace_back(str);
9          }
10         vector<vector<string>> ans;
11         for (auto it = mp.begin(); it != mp.end(); ++it) {
12             ans.emplace_back(it->second);
13         }
14         return ans;
15     }
16 };
```

### 1. 两数之和

太妙了！哈希表就行。但是有坑 如果要输出多个的时候 先插入在匹配就会出现2+3 然后3+2  
要先匹配再插入，不然会自己和自己匹配！！

```
1  class Solution {
2  public:
3      vector<int> twoSum(vector<int>& nums, int target) {
4          unordered_map<int, int> hashtable;
5          for (int i = 0; i < nums.size(); ++i) {
6              auto it = hashtable.find(target - nums[i]);
7              if (it != hashtable.end()) {
8                  return {it->second, i};
9              }
10             hashtable[nums[i]] = i;
11         }
12         return {};
13     }
14 };
```

### 560. 和为 K 的子数组\*

两数之和的升级版 用前缀和+哈希表

## 128. 最长连续序列\*

一个很神奇的题目 很神奇的做法 只从最小号记上升序列

```
1  class Solution {
2  public:
3      int longestConsecutive(vector<int>& nums) {
4          unordered_set<int> num_set;
5          for (const int& num : nums) {
6              num_set.insert(num);
7          }
8
9          int longestStreak = 0;
10
11         for (const int& num : num_set) {
12             if (!num_set.count(num - 1)) {
13                 int currentNum = num;
14                 int currentStreak = 1;
15
16                 while (num_set.count(currentNum + 1)) {
17                     currentNum += 1;
18                     currentStreak += 1;
19                 }
20
21                 longestStreak = max(longestStreak, currentStreak);
22             }
23         }
24
25         return longestStreak;
26     }
27 };
```

## 快慢指针

### 202. 快乐数

判断重复循环时，可以不用哈希表，用快慢指针

<https://leetcode.cn/problems/happy-number/solutions/21454/shi-yong-kuai-man-zhi-zhen-si-xiang-zhao-chu-xun-h>



```

1  class Solution {
2  public:
3      int bitSquareSum(int n) {
4          int sum = 0;
5          while(n > 0)
6          {
7              int bit = n % 10;
8              sum += bit * bit;
9              n = n / 10;
10         }
11         return sum;
12     }
13
14     bool isHappy(int n) {
15         int slow = n, fast = n;
16         do{
17             slow = bitSquareSum(slow);
18             fast = bitSquareSum(fast);
19             fast = bitSquareSum(fast);
20         }while(slow != fast);
21
22         return slow == 1;
23     }
24 };

```

## 区间

### 228. 汇总区间

<https://leetcode.cn/problems/summary-ranges/description/?envType=study-plan-v2&envId=top-interview-150>

这么做神奇地不需要对结尾额外处理

而且nums[i] == nums[i - 1] + 1不会产生整数溢出

```

1  class Solution {
2  public:
3      vector<string> summaryRanges(vector<int>& nums) {
4          vector<string> result;
5          string res;
6          int i = 0, n = nums.size();
7          while(i < n)
8          {
9              int low = i;

```

```

10         ++i;
11         while( i < n && nums[i] == nums[i - 1] + 1)
12         {
13             ++i;
14         }
15         int high = i - 1;
16         string temp = to_string(nums[low]);
17         if(low < high)
18         {
19             temp.append("<->");
20             temp.append(to_string(nums[high]));
21         }
22         result.push_back(move(temp));
23     }
24     return result;
25 }
26 };

```

## 56. 合并区间\*

用sort函数排序

<https://leetcode.cn/problems/merge-intervals/?envType=study-plan-v2&envId=top-interview-150>

```

1
2 class Solution {
3 public:
4     vector<vector<int>> merge(vector<vector<int>>& intervals) {
5         sort(intervals.begin(), intervals.end());
6         vector<vector<int>> res;
7         res.push_back(intervals[0]);
8         for (auto &kv : intervals) {
9             if (kv[0] <= res.back()[1]) {
10                 res.back()[1] = max(res.back()[1], kv[1]);
11             } else if (kv[0] > res.back()[1]) {
12                 res.push_back(kv);
13             }
14         }
15         return res;
16     }
17 };

```

## 452. 用最少数量的箭引爆气球

<https://leetcode.cn/problems/minimum-number-of-arrows-to-burst-balloons/description/?envType=study-plan-v2&envId=top-interview-150>

排序加贪心 需要思考一下贪心是正确的

sort里用lambda表达式重写的comp方法

```
6 //重写排序方法
7 bool comp(const node &a, const node &b)
8 {
9     //常引用const T &xxx
10    return a.first < b.first || a.first == b.first && a.second <= b.second;
11    //<代表升序, >代表降序
12 }
13
14 int main()
15 {
16     node a[] = {{1, 2}, {2, 3}, {2, 1}};
17     int length = sizeof(a) / sizeof(node);
18
19     sort(a, a + length, comp);
```

```
1 class Solution {
2 public:
3     int findMinArrowShots(vector<vector<int>>& points) {
4         if (points.empty()) {
5             return 0;
6         }
7         sort(points.begin(), points.end(), [](const vector<int>& u, const
vector<int>& v) {
8             return u[1] < v[1];
9         });
10        int pos = points[0][1];
11        int ans = 1;
12        for (const vector<int>& balloon: points) {
13            if (balloon[0] > pos) {
14                pos = balloon[1];
15                ++ans;
16            }
17        }
18        return ans;
19    }
20 };
```

# 栈

## 20. 有效的括号

学习一下智能指针和栈，map的用法

unordered\_map <https://blog.csdn.net/shouhu010/article/details/129795413>

map: <http://www.noobyard.com/article/p-vqktwxq-hp.html>

判断字符串长度: <https://www.codenong.com/5-different-methods-to-find-the-length-of-a-string-in-cplusplus/>

```
1  class Solution {
2  public:
3      bool isValid(string s) {
4          int n = s.size();
5          if (n % 2 == 1) {
6              return false;
7          }
8
9          unordered_map<char, char> pairs = {
10             {'}', '('},
11             {']', '['},
12             {'}', '{'}
13         };
14         stack<char> stk;
15         for (char ch: s) {
16             if (pairs.count(ch)) {
17                 if (stk.empty() || stk.top() != pairs[ch]) {
18                     return false;
19                 }
20                 stk.pop();
21             }
22             else {
23                 stk.push(ch);
24             }
25         }
26         return stk.empty();
27     }
28 };
```

## 71. 简化路径

<https://leetcode.cn/problems/simplify-path/description/?envType=study-plan-v2&envId=top-interview-150>

```
1  class Solution {
2  public:
3      string simplifyPath(string path) {
4          int beg = 1, end = 1;
5          vector<string> names;
6          stack<string> ans;
7          while(beg < path.size())
8          {
9              end = path.find('/', beg);
10             string s = path.substr(beg, end - beg);
11             beg = end + 1;
12             names.push_back(s);
13         }
14         for(string name : names)
15         {
16             if(!name.empty() && name != ".")
17                 ans.push_back(name);
18             else if(name == "..")
19             {
20                 ans.pop();
21             }
22         }
23         string res;
24         if(ans.empty())
25             res = "/";
26         else
27         {
28             for(string s : ans)
29             {
30                 res += "/" + s;
31             }
32         }
33         return res;
34     }
35 };
```

## 150. 逆波兰表达式求值

<https://leetcode.cn/problems/evaluate-reverse-polish-notation/description/?envType=study-plan-v2&envId=top-interview-150>

遇到括号啥也不干就行……

atoi(token.c\_str())

```
1  class Solution {
2  public:
3      int evalRPN(vector<string>& tokens) {
4          stack<int> stk;
5          int n=tokens.size();
6          for(int i=0;i<n;i++){
7              string& token = tokens[i];
8              if(isNumber(token)){
9                  stk.push(atoi(token.c_str()));
10             }
11             else{
12                 int num2=stk.top();
13                 stk.pop();
14                 int num1=stk.top();
15                 stk.pop();
16                 switch(token[0]){
17                     case '+':
18                         stk.push(num1+num2);
19                         break;
20                     case '-':
21                         stk.push(num1-num2);
22                         break;
23                     case '*':
24                         stk.push(num1*num2);
25                         break;
26                     case '/':
27                         stk.push(num1/num2);
28                         break;
29                 }
30             }
31         }
32     }
33     return stk.top();
34 }
35 bool isNumber(string& token) {
36     return !(token == "+" || token == "-" || token == "*" || token ==
37     "/"");
38 }
39 };
```

## 224. 基本计算器\*

224是简单版，只有加减，思路在于展开所有括号，搞一个东西记下括号前的符号，如果是-就把括号里符号都反。这个用于记录的东西要用栈，因为括号可能嵌套。每次离开括号就弹出

下面这个应该是完整计算器，还没看

<https://leetcode.cn/problems/basic-calculator/?envType=study-plan-v2&envId=top-interview-150>

```
1  class Solution {
2  public:
3      struct Data {
4          bool is_number {false};
5          long long number {0};
6          char op {'\0'};
7          Data(bool set_is_number, long long set_number, char set_op) :
            is_number(set_is_number), number(set_number), op(set_op) {};
8      };
9
10     int calculate(string s) {
11         // 去除所有空格
12         std::string new_s1;
13         for (char c : s) {
14             if (c != ' ') {
15                 new_s1 += c;
16             }
17         }
18
19         // (-n) -> (0-n)
20         // (+n) -> (0+n) (本题没有, 忽略)
21         // 开头的-n -> 0-n
22         // 开头的+n -> 0+n (本题没有, 忽略)
23         std::string new_s2;
24         int n = new_s1.length();
25         for (int i = 0; i < n; ++i) {
26             if (new_s1[i] == '-' && (i == 0 || new_s1[i - 1] == '(')) {
27                 new_s2 += "0-";
28             } else {
29                 new_s2 += new_s1[i];
30             }
31         }
32
33         // 中缀表达式 -> 后缀表达式
34         // 操作符优先级: ^ (本题没有, 忽略) > *, / (本题没有, 忽略) > +, -
35         // 左括号、右括号的优先级单独计算, 因为无论定义左括号优先级最高, 右括号优先级最低, 还是左括号优先级最低, 右括号优先级最高, 在具体计算的不同逻辑中都无法统一处理
```

```

36         // 相同优先级条件下, 先出现的优先级更高(即, 均是+、-, 则先出现的比后出现的优先
    级级高, 即相同优先级的运算符, 先出现的先计算)
37         // 转换过程:
38         // 中缀表达式从前向后遍历过程中, 保证op_stack的栈顶是当前操作符优先级最高的
39         // 即, 如果栈为空, 或者当前操作符比栈顶操作符优先级高, 则入栈
40         // 遇到(, 则认为优先级最高, 无脑入栈
41         // 遇到), 则认为优先级最低, 不断弹栈到后缀表达式结果datas中, 直到遇到(, 操作
    符)不会入栈
42         // 如果栈不为空, 且当前操作符比栈顶操作符优先级低或相同(优先级相同时, 先出现的
    优先级更高, 需要先进行计算), 则不断弹栈到后缀表达式结果datas中, 直到弹到栈为空, 或当前操
    作符优先级比栈顶操作符元素的优先级高, 或遇到(, 弹栈后, 将当前操作符压栈, 即, 该操作符入栈
    前, 一定要保证所有优先级大于等于该操作符(实际等于时, 先出现的优先级也要更高, 要先计算)的
    操作符, 都要先输出到后缀表达式结果datas中
43
44         // 存储后缀表达式
45         std::vector<Data> datas;
46         // 存储操作符op的栈
47         std::stack<char> op_stack;
48
49         // 中缀表达式 -> 后缀表达式
50         // has_number是为了知道最后是否还有数字元素没有加入到datas中, 因为每次遇到操
    作符才将cur_number写入, 但是最后结尾有可能是数字, 有可能是操作符), 而且数字可能为0, 可
    能非0, 无法判断, 所以只能引入额外变量标记
51         bool has_number = false;
52         long long cur_number = 0;
53         for (char c : new_s2) {
54             if (c >= '0' && c <= '9') {
55                 // 数字
56                 has_number = true;
57                 cur_number = cur_number * 10 + c - '0';
58             } else {
59                 // 操作符
60                 if (has_number) {
61                     // 将上一个数字输出到后缀表达式结果datas中
62                     datas.emplace_back(true, cur_number, '\\0');
63                     cur_number = 0;
64                     has_number = false;
65                 }
66
67                 if (c == '(') {
68                     // 遇到(, 无脑入栈
69                     op_stack.emplace(c);
70                 } else if (c == ')') {
71                     // 遇到), 不断弹栈到后缀表达式结果datas中, 直到遇到(, 操作符)不会
    入栈
72                     while (!op_stack.empty() && op_stack.top() != '(') {
73                         char op = op_stack.top();

```



```

74         op_stack.pop();
75         datas.emplace_back(false, 0, op);
76     }
77
78     // 将 '(' 弹栈
79     op_stack.pop();
80 } else if (c == '+' || c == '-') {
81     if (op_stack.empty() || op_stack.top() == '(') {
82         // 如果栈为空, 或者当前操作符比栈顶操作符优先级高, 则入栈
83         op_stack.emplace(c);
84     } else {
85         // 如果栈不为空, 且当前操作符比栈顶操作符优先级低或相同 (优先
            级相同时, 先出现的优先级更高, 需要先进行计算), 则不断弹栈到后缀表达式结果datas中, 直到弹
            到栈为空, 或当前操作符优先级比栈顶操作符元素的优先级高, 或遇到(, 弹栈后, 将当前操作符压
            栈, 即, 该操作符入栈前, 一定要保证所有优先级大于等于该操作符 (实际等于时, 先出现的优先级也
            要更高, 要先计算)的操作符, 都要先输出到后缀表达式结果datas中
86         while (!op_stack.empty() && (op_stack.top() == '+' ||
op_stack.top() == '-')) {
87             // 这里如果遇到(就不要再弹了, 说明这些都是在 一组()内处理
            的部分
88             char op = op_stack.top();
89             op_stack.pop();
90             datas.emplace_back(false, 0, op);
91         }
92
93         // 将当前操作符压栈
94         op_stack.emplace(c);
95     }
96 }
97 }
98 }
99 if (has_number) {
100     // 如果原中缀表达式最后一个字符不是), 则最后一个数字还没有输出到后缀表达式
    结果datas中
101     datas.emplace_back(true, cur_number, '\0');
102 }
103 while (!op_stack.empty()) {
104     // 将栈中剩余操作符依次弹栈到后缀表达式结果datas中
105     char op = op_stack.top();
106     op_stack.pop();
107     datas.emplace_back(false, 0, op);
108 }
109
110 // 计算后缀表达式
111 // 此时后缀表达式结果datas中, 只包括数字、+、-, 不会再存在括号
112
113 // 存储操作数num的栈

```

```

114         std::stack<long long> num_stack;
115
116         for (const Data& data : datas) {
117             if (data.is_number) {
118                 // 如果是数字，就压栈
119                 num_stack.emplace(data.number);
120             } else {
121                 // 如果是操作符，就进行相应计算
122                 // 先弹栈的是右操作数，后弹栈的是左操作数
123                 long long a = num_stack.top();
124                 num_stack.pop();
125                 long long b = num_stack.top();
126                 num_stack.pop();
127                 if (data.op == '+') {
128                     num_stack.emplace(b + a);
129                 } else if (data.op == '-') {
130                     num_stack.emplace(b - a);
131                 }
132             }
133         }
134
135
136
137         return num_stack.top();
138     }
139 };

```

## 链表

是否有环：快慢指针，一个移2一个移1，有环的话必定相遇

### 141. 环形链表

快慢指针，快能到底部就说明没环

代码块

```

1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, x):
4  #         self.val = x
5  #         self.next = None
6
7  class Solution:

```

```

8     def hasCycle(self, head: ListNode) -> bool:
9         if not head or not head.next:
10             return False
11
12         slow = head
13         fast = head.next
14
15         while slow != fast:
16             if not fast or not fast.next:
17                 return False
18             slow = slow.next
19             fast = fast.next.next
20
21         return True

```

然后哈希表存seen也可以

代码块

```

1     class Solution:
2         def hasCycle(self, head: ListNode) -> bool:
3             seen = set()
4             while head:
5                 if head in seen:
6                     return True
7                 seen.add(head)
8                 head = head.next
9             return False

```

## 2 两数相加

<https://leetcode.cn/problems/add-two-numbers/description/?envType=study-plan-v2&envId=top-interview-150>

代码块

```

1  /**
2   * Definition for singly-linked list.
3   * public class ListNode {
4   *     int val;
5   *     ListNode next;
6   *     ListNode() {}
7   *     ListNode(int val) { this.val = val; }
8   *     ListNode(int val, ListNode next) { this.val = val; this.next = next; }
9   * }
10 */

```

```

11  class Solution {
12
13
14      public ListNode addTwoNumbers(ListNode l1, ListNode l2) {
15          // 创建一个虚拟头节点【不要动他】
16          ListNode dummy = new ListNode(0);
17          // 创建一个指针指向头节点【动他】
18          ListNode cur = dummy;
19          // 定义一个变量表示进位
20          int carry = 0;
21
22          // 遍历两个链表，直到都为空
23          while (l1 != null || l2 != null) {
24              // 取出两个链表的当前值，如果为空则为0【① 取出加数 被加数】
25              int x = l1 == null ? 0 : l1.val;
26              int y = l2 == null ? 0 : l2.val;
27              // 计算两个值的和，加上进位【② 先求和：加数+被加数+进位】
28              int sum = x + y + carry;
29
30              // 更新进位，如果和大于等于10，则进位为1，否则为0【③ 再更新进位carry，只有
              // 两个取值1,0】
31              carry = sum >= 10 ? 1 : 0;
32              // 创建一个新的节点，存储和的个位数【④ 最后节点存入结果（链表）sum的个位】
33              cur.next = new ListNode(sum % 10);
34
35              //          ===== 循环指针更新          =====
36              // 移动指针到下一个节点
37              cur = cur.next;
38              // 如果链表不为空，则移动到下一个节点
39              if (l1 != null) l1 = l1.next;
40              if (l2 != null) l2 = l2.next;
41          }
42          // 如果最后还有进位，则在末尾添加一个节点【把多的那个进位 存上】
43          if (carry > 0) {
44              cur.next = new ListNode(carry);
45          }
46          // 返回虚拟头节点的下一个节点，即真正的头节点
47          return dummy.next;
48      }
49  }

```

## 21 合并两个有序链表

错误示范：head = list1会把前一个节点指向这里的给搞没了

```

1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, val=0, next=None):
4  #         self.val = val
5  #         self.next = next
6  class Solution:
7      def mergeTwoLists(self, list1: Optional[ListNode], list2:
Optional[ListNode]) -> Optional[ListNode]:
8          head = ListNode()
9          real_head = head
10         while list1 and list2:
11             if list1.val < list2.val:
12                 head.val = list1.val
13                 list1 = list1.next
14             else:
15                 head.val = list2.val
16                 list2 = list2.next
17             head.next = ListNode()
18             head = head.next
19         if list1:
20             head = list1
21         else:
22             head = list2
23         return real_head

```

应该这样：

代码块

```

1  class Solution:
2      def mergeTwoLists(self, l1: ListNode, l2: ListNode) -> ListNode:
3          prehead = ListNode(-1)
4
5          prev = prehead
6          while l1 and l2:
7              if l1.val <= l2.val:
8                  prev.next = l1
9                  l1 = l1.next
10             else:
11                 prev.next = l2
12                 l2 = l2.next
13             prev = prev.next
14
15             # 合并后 l1 和 l2 最多只有一个还未被合并完，我们直接将链表末尾指向未合并完的链表
即可
16         prev.next = l1 if l1 is not None else l2

```

```
17
18         return prehead.next
```

### 138. 随机链表的复制\*

<https://leetcode.cn/problems/copy-list-with-random-pointer/description/?envType=study-plan-v2&envId=top-interview-150>

0 不用回溯

代码块

```
1  class Solution {
2      public Node copyRandomList(Node head) {
3          if (head == null)
4              return null;
5          Map<Node, Node> map = new HashMap<>(); // 原节点 -> 新节点映射
6          Node curr = head;
7          // 第一次遍历: 创建新节点并建立映射
8          while (curr != null) {
9              map.put(curr, new Node(curr.val));
10             curr = curr.next;
11         }
12         // 第二次遍历: 设置next和random指针
13         curr = head;
14         while (curr != null) {
15             Node clone = map.get(curr);
16             clone.next = map.get(curr.next);
17             clone.random = map.get(curr.random);
18             curr = curr.next;
19         }
20         return map.get(head);
21     }
22 }
```

#### 1. 回溯加哈希字典

```
1  class Solution {
2      public:
3          unordered_map<Node*, Node*> cachedNode;
4
5          Node* copyRandomList(Node* head) {
6              if (head == nullptr) {
7                  return nullptr;
8              }
9          }
```

```

9         if (!cachedNode.count(head)) {
10             Node* headNew = new Node(head->val);
11             cachedNode[head] = headNew;
12             headNew->next = copyRandomList(head->next);
13             headNew->random = copyRandomList(head->random);
14         }
15         return cachedNode[head];
16     }
17 };

```

2. 可以一个拆两个，复制再拼回

## 206 链表反转

<https://leetcode.cn/problems/reverse-linked-list/description/>

最后要return的pre!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

代码块

```

1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, val=0, next=None):
4  #         self.val = val
5  #         self.next = next
6  class Solution:
7      def reverseList(self, head: Optional[ListNode]) -> Optional[ListNode]:
8          pre = None
9          cur = head
10         while cur:
11             save_next = cur.next
12             cur.next = pre
13             pre = cur
14             cur = save_next
15         return pre

```

## 92. 反转链表 II\*

<https://leetcode.cn/problems/reverse-linked-list-ii/solutions/634701/fan-zhuan-lian-biao-ii-by-leetcode-solut-teyq/?envType=study-plan-v2&envId=top-interview-150>

反转一个区间，就是取出一段来反转

```

1  class Solution {
2  private:

```

```

3      void reverseLinkedList(ListNode *head) {
4          // 也可以使用递归反转一个链表
5          ListNode *pre = nullptr;
6          ListNode *cur = head;
7
8          while (cur != nullptr) {
9              ListNode *next = cur->next;
10             cur->next = pre;
11             pre = cur;
12             cur = next;
13         }
14     }
15
16     public:
17         ListNode *reverseBetween(ListNode *head, int left, int right) {
18             // 因为头节点有可能发生变化，使用虚拟头节点可以避免复杂的分类讨论
19             ListNode *dummyNode = new ListNode(-1);
20             dummyNode->next = head;
21
22             ListNode *pre = dummyNode;
23             // 第 1 步：从虚拟头节点走 left - 1 步，来到 left 节点的前一个节点
24             // 建议写在 for 循环里，语义清晰
25             for (int i = 0; i < left - 1; i++) {
26                 pre = pre->next;
27             }
28
29             // 第 2 步：从 pre 再走 right - left + 1 步，来到 right 节点
30             ListNode *rightNode = pre;
31             for (int i = 0; i < right - left + 1; i++) {
32                 rightNode = rightNode->next;
33             }
34
35             // 第 3 步：切断出一个子链表（截取链表）
36             ListNode *leftNode = pre->next;
37             ListNode *curr = rightNode->next;
38
39             // 注意：切断链接
40             pre->next = nullptr;
41             rightNode->next = nullptr;
42
43             // 第 4 步：同第 206 题，反转链表的子区间
44             reverseLinkedList(leftNode);
45
46             // 第 5 步：接回到原来的链表中
47             pre->next = rightNode;
48             leftNode->next = curr;
49             return dummyNode->next;

```



```
50     }
51 };
```

## 25 K 个一组翻转链表#

<https://leetcode.cn/problems/reverse-nodes-in-k-group/solutions/248591/k-ge-yi-zu-fan-zhuan-lian-biao-by-leetcode-solutio/?envType=study-plan-v2&envId=top-interview-150>

这个留着练手。很折磨

代码块

1

## 19. 删除链表的倒数第 N 个结点\*

<https://leetcode.cn/problems/remove-nth-node-from-end-of-list/description/?envType=study-plan-v2&envId=top-interview-150>

倒数第N个，所以搞一个快指针快N。否则从第一个开始还要先获取链表长度

就是双指正

## 82. 删除排序链表中的重复元素 II

一个错误的结果

代码块

```
1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, val=0, next=None):
4  #         self.val = val
5  #         self.next = next
6  class Solution:
7      def deleteDuplicates(self, head: Optional[ListNode]) -> Optional[ListNode]:
8          if not head:
9              return None
10         prev = ListNode
11         new_head = prev
12         prev.next = head
13         curr = head
14         while curr and curr.next:
15             if curr.next.val == curr.val:
16                 while curr.next.val == curr.val:
17                     curr = curr.next
18                 prev.next = curr.next # 但是这个也可能是重复的
19                 prev = curr.next
```

```

20         curr = curr.next.next
21     else:
22         prev = curr
23         curr = curr.next
24     return new_head.next

```

## 正确示范

核心是设置了标志确定有没有重复 然后curr每次循环都要跳 设置prev.next然后prev没重复才跳到自己next

代码块

```

1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, val=0, next=None):
4  #         self.val = val
5  #         self.next = next
6
7  class Solution:
8      def deleteDuplicates(self, head: Optional[ListNode]) -> Optional[ListNode]:
9          dummy = ListNode(0) # 虚拟头节点
10         dummy.next = head
11         prev = dummy # 指向最后一个不重复的节点
12         curr = head
13
14         while curr:
15             duplicate = False
16             # 如果当前节点有重复值, 跳过它们
17             while curr.next and curr.val == curr.next.val:
18                 curr = curr.next
19                 duplicate = True
20             if duplicate:
21                 # 跳过所有重复节点
22                 prev.next = curr.next
23             else:
24                 # 当前节点无重复, 移动 prev
25                 prev = prev.next
26             curr = curr.next
27
28
29         return dummy.next
30

```

## 61. 旋转链表

题目不难 但是有很多要提前返回的条件 少了一个就不对

代码块

```
1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, val=0, next=None):
4  #         self.val = val
5  #         self.next = next
6  class Solution:
7      def rotateRight(self, head: Optional[ListNode], k: int) ->
Optional[ListNode]:
8          if not head:
9              return None
10         if k == 0:
11             return head
12         lens = 0
13         curr = head
14         while curr:
15             lens += 1
16             tail = curr
17             curr = curr.next
18         if lens == 1:
19             return head
20         ak = k % lens
21         if ak == 0:
22             return head
23         curr = head
24         for i in range(lens - ak - 1):
25             curr = curr.next
26         new_head = curr.next
27         curr.next = None
28         tail.next = head
29         return new_head
```

## 86. 分隔链表\*

<https://leetcode.cn/problems/partition-list/?envType=study-plan-v2&envId=top-interview-150>

直接把前一半里不符合条件的接到末尾去

```
1  class Solution {
2  public:
3      ListNode* partition(ListNode* head, int x) {
```

```

4         if(head==nullptr)
5             return nullptr;
6         ListNode* dump=new ListNode(-1,head);
7         auto pre=dump,tail=head;
8         int size=0;
9         while(tail->next)
10        {
11            tail=tail->next;
12            size++;
13        }
14        for(int i=0;i<=size;i++){
15            if(pre->next->val>=x)
16            {
17                tail->next=pre->next;
18                pre->next=pre->next->next;
19                tail=tail->next;
20                tail->next=nullptr;
21            }
22            else
23                pre=pre->next;
24        }
25        return dump->next;
26    }
27 };

```

上面有点乱

直接搞一个新列表比较好使

代码块

```

1  # Definition for singly-linked list.
2  # class ListNode:
3  #     def __init__(self, val=0, next=None):
4  #         self.val = val
5  #         self.next = next
6  class Solution:
7      def partition(self, head: Optional[ListNode], x: int) ->
Optional[ListNode]:
8          before_head = ListNode(0)
9          after_head = ListNode(0)
10
11         before = before_head
12         after = after_head
13         current = head
14
15         while current:

```

```

16         if current.val < x:
17             before.next = current
18             before = before.next
19         else:
20             after.next = current
21             after = after.next
22             current = current.next
23
24         # 结束时需断开 after 链表尾部, 防止形成环
25         after.next = None
26         before.next = after_head.next
27
28         return before_head.next
29

```

## 146. LRU 缓存 #

一个链表一个哈希表。移到头 = 删掉+添加到头

<https://leetcode.cn/problems/lru-cache/description/?envType=study-plan-v2&envId=top-interview-150>

```

1  struct DLinkedNode {
2      int key, value;
3      DLinkedNode* prev;
4      DLinkedNode* next;
5      DLinkedNode(): key(0), value(0), prev(nullptr), next(nullptr) {}
6      DLinkedNode(int _key, int _value): key(_key), value(_value),
prev(nullptr), next(nullptr) {}
7  };
8
9  class LRUCache {
10 private:
11     unordered_map<int, DLinkedNode*> cache;
12     DLinkedNode* head;
13     DLinkedNode* tail;
14     int size;
15     int capacity;
16
17 public:
18     LRUCache(int _capacity): capacity(_capacity), size(0) {
19         // 使用伪头部和伪尾部节点
20         head = new DLinkedNode();
21         tail = new DLinkedNode();
22         head->next = tail;
23         tail->prev = head;

```

```

24     }
25
26     int get(int key) {
27         if (!cache.count(key)) {
28             return -1;
29         }
30         // 如果 key 存在，先通过哈希表定位，再移到头部
31         DLinkedNode* node = cache[key];
32         moveToHead(node);
33         return node->value;
34     }
35
36     void put(int key, int value) {
37         if (!cache.count(key)) {
38             // 如果 key 不存在，创建一个新的节点
39             DLinkedNode* node = new DLinkedNode(key, value);
40             // 添加进哈希表
41             cache[key] = node;
42             // 添加至双向链表的头部
43             addToHead(node);
44             ++size;
45             if (size > capacity) {
46                 // 如果超出容量，删除双向链表的尾部节点
47                 DLinkedNode* removed = removeTail();
48                 // 删除哈希表中对应的项
49                 cache.erase(removed->key);
50                 // 防止内存泄漏
51                 delete removed;
52                 --size;
53             }
54         }
55         else {
56             // 如果 key 存在，先通过哈希表定位，再修改 value，并移到头部
57             DLinkedNode* node = cache[key];
58             node->value = value;
59             moveToHead(node);
60         }
61     }
62
63     void addToHead(DLinkedNode* node) {
64         node->prev = head;
65         node->next = head->next;
66         head->next->prev = node;
67         head->next = node;
68     }
69
70     void removeNode(DLinkedNode* node) {

```

```

71         node->prev->next = node->next;
72         node->next->prev = node->prev;
73     }
74
75     void moveToHead(DLinkedNode* node) {
76         removeNode(node);
77         addToHead(node);
78     }
79
80     DLinkedNode* removeTail() {
81         DLinkedNode* node = tail->prev;
82         removeNode(node);
83         return node;
84     }
85 };

```

Python的话写法要会写，尤其是定义Node

## 二叉树

### 104. 二叉树的最大深度

代码块

```

1  class Solution:
2      def maxDepth(self, root):
3          if root is None:
4              return 0
5          else:
6              left_height = self.maxDepth(root.left)
7              right_height = self.maxDepth(root.right)
8              return max(left_height, right_height) + 1

```

### 100. 相同的树

代码块

```

1  class Solution:
2      def isSameTree(self, p: TreeNode, q: TreeNode) -> bool:
3          if not p and not q:
4              return True
5          elif not p or not q:
6              return False

```

```

7         elif p.val != q.val:
8             return False
9         else:
10            return self.isSameTree(p.left, q.left) and
                self.isSameTree(p.right, q.right)

```

## 226. 翻转二叉树

<https://leetcode.cn/problems/invert-binary-tree/description/?envType=study-plan-v2&envId=top-interview-150>

要多搞一个额外变量来存变化后的左右，否则会出现冲突

```

1  class Solution {
2  public:
3      TreeNode* invertTree(TreeNode* root) {
4          if(root==nullptr)
5              return nullptr;
6          auto left=invertTree(root->left);
7          auto right=invertTree(root->right);
8          root->right=left;
9          root->left=right;
10         return root;
11     }
12 };

```

## 101. 对称二叉树

<https://leetcode.cn/problems/symmetric-tree/description/?envType=study-plan-v2&envId=top-interview-150>

可以递归，也可以用队列，每次放进去两个拿出来两个

代码块

```

1  # Definition for a binary tree node.
2  # class TreeNode:
3  #     def __init__(self, val=0, left=None, right=None):
4  #         self.val = val
5  #         self.left = left
6  #         self.right = right
7  class Solution:
8      def check(self, left, right):
9          if not left and not right:
10             return True
11             elif not left or not right:

```



```

12         return False
13         return left.val == right.val and self.check(left.right, right.left) and
self.check(left.left, right.right)
14
15     def isSymmetric(self, root: Optional[TreeNode]) -> bool:
16         return self.check(root.left, root.right)

```

## 105. 从前序与中序遍历序列构造二叉树

<https://leetcode.cn/problems/construct-binary-tree-from-preorder-and-inorder-traversal/description/?envType=study-plan-v2&envId=top-interview-150>

看官方题解

## 114. 二叉树展开为链表

<https://leetcode.cn/problems/flatten-binary-tree-to-linked-list/description/?envType=study-plan-v2&envId=top-interview-150>

不用新建，直接递归去变形

```

1  class Solution {
2  public:
3      void flatten(TreeNode* root) {
4          if(root==nullptr)
5              return;
6          flatten(root->left);
7          flatten(root->right);
8          auto left=root->left;
9          auto right=root->right;
10         root->left=nullptr;
11         root->right=left;
12         auto temp=root;
13         while(temp->right)
14             temp=temp->right;
15         temp->right=right;
16     }
17 };

```

## 112. 路径总和

<https://leetcode.cn/problems/path-sum/description/?envType=study-plan-v2&envId=top-interview-150>

路径总和的四种解法：DFS、回溯、BFS、栈

## 129. 求根节点到叶节点数字之和

<https://leetcode.cn/problems/sum-root-to-leaf-numbers/description/?envType=study-plan-v2&envId=top-interview-150>

这个简单的递归写法一定要熟练

```
1  class Solution {
2  public:
3      int dfs(TreeNode* root, int prevSum) {
4          if (root == nullptr) {
5              return 0;
6          }
7          int sum = prevSum * 10 + root->val;
8          if (root->left == nullptr && root->right == nullptr) {
9              return sum;
10         } else {
11             return dfs(root->left, sum) + dfs(root->right, sum);
12         }
13     }
14     int sumNumbers(TreeNode* root) {
15         return dfs(root, 0);
16     }
17 };
```

## 124. 二叉树中的最大路径和

<https://leetcode.cn/problems/binary-tree-maximum-path-sum/description/?envType=study-plan-v2&envId=top-interview-150>

这个递归里的逻辑也是

```
1  class Solution {
2  private:
3      int maxSum = INT_MIN;
4
5  public:
6      int maxGain(TreeNode* node) {
7          if (node == nullptr) {
8              return 0;
9          }
10
11         // 递归计算左右子节点的最大贡献值
12         // 只有在最大贡献值大于 0 时，才会选取对应子节点
13         int leftGain = max(maxGain(node->left), 0);
```

```

14         int rightGain = max(maxGain(node->right), 0);
15
16         // 节点的最大路径和取决于该节点的值与该节点的左右子节点的最大贡献值
17         int priceNewpath = node->val + leftGain + rightGain;
18
19         // 更新答案
20         maxSum = max(maxSum, priceNewpath);
21
22         // 返回节点的最大贡献值
23         return node->val + max(leftGain, rightGain);
24     }
25
26     int maxPathSum(TreeNode* root) {
27         maxGain(root);
28         return maxSum;
29     }
30 };

```

## 173. 二叉搜索树迭代器

<https://leetcode.cn/problems/binary-search-tree-iterator/description/?envType=study-plan-v2&envId=top-interview-150>

复习一下中序遍历怎么写。就是递归时候先左，再自己，再右

```

1     void inorder(TreeNode* root, vector<int>& res) {
2         if (!root) {
3             return;
4         }
5         inorder(root->left, res);
6         res.push_back(root->val);
7         inorder(root->right, res);
8     }
9     vector<int> inorderTraversal(TreeNode* root) {
10        vector<int> res;
11        inorder(root, res);
12        return res;
13    }

```

## 222. 完全二叉树的节点个数

<https://leetcode.cn/problems/count-complete-tree-nodes/description/?envType=study-plan-v2&envId=top-interview-150>

这个二分的方法去判断有没有那个节点有点精髓 要好好学

```

1  class Solution {
2  public:
3      int countNodes(TreeNode* root) {
4          if (root == nullptr) {
5              return 0;
6          }
7          int level = 0;
8          TreeNode* node = root;
9          while (node->left != nullptr) {
10             level++;
11             node = node->left;
12         }
13         int low = 1 << level, high = (1 << (level + 1)) - 1;
14         while (low < high) {
15             int mid = (high - low + 1) / 2 + low;
16             if (exists(root, level, mid)) {
17                 low = mid;
18             } else {
19                 high = mid - 1;
20             }
21         }
22         return low;
23     }
24
25     bool exists(TreeNode* root, int level, int k) {
26         int bits = 1 << (level - 1);
27         TreeNode* node = root;
28         while (node != nullptr && bits > 0) {
29             if (!(bits & k)) {
30                 node = node->left;
31             } else {
32                 node = node->right;
33             }
34             bits >>= 1;
35         }
36         return node != nullptr;
37     }
38 };

```

## 236. 二叉树的最近公共祖先

<https://leetcode.cn/problems/lowest-common-ancestor-of-a-binary-tree/description/?envType=study-plan-v2&envId=top-interview-150>

其实不是很懂这个递归……

```

1  class Solution {
2      public TreeNode lowestCommonAncestor(TreeNode root, TreeNode p, TreeNode
q) {
3          if (root == null || root == p || root == q) {
4              //只要当前根节点是p和q中的任意一个，就返回（因为不能比这个更深了，再深p和q
中的一个就没了）
5              return root;
6          }
7          //根节点不是p和q中的任意一个，那么就继续分别往左子树和右子树找p和q
8          TreeNode left = lowestCommonAncestor(root.left, p, q);
9          TreeNode right = lowestCommonAncestor(root.right, p, q);
10         //p和q都没找到，那就没有
11         if(left == null && right == null) {
12             return null;
13         }
14         //左子树没有p也没有q，就返回右子树的结果
15         if (left == null) {
16             return right;
17         }
18         //右子树没有p也没有q就返回左子树的结果
19         if (right == null) {
20             return left;
21         }
22         //左右子树都找到p和q了，那就说明p和q分别在左右两个子树上，所以此时的最近公共祖
先就是root
23         return root;
24     }
25 }

```

## 二叉搜索树

### 230. 二叉搜索树中第K小的元素

<https://leetcode.cn/problems/kth-smallest-element-in-a-bst/description/?envType=study-plan-v2&envId=top-interview-150>

感觉这个有点精髓的

### 98. 验证二叉搜索树

<https://leetcode.cn/problems/validate-binary-search-tree/description/?envType=study-plan-v2&envId=top-interview-150>

虽然简单，但是递归要写得优雅

```

1  class Solution {
2  public:
3      bool helper(TreeNode* root, long long lower, long long upper) {
4          if (root == nullptr) {
5              return true;
6          }
7          if (root -> val <= lower || root -> val >= upper) {
8              return false;
9          }
10         return helper(root -> left, lower, root -> val) && helper(root ->
            right, root -> val, upper);
11     }
12     bool isValidBST(TreeNode* root) {
13         return helper(root, LONG_MIN, LONG_MAX);
14     }
15 };

```



所有岛屿问题<https://leetcode.cn/problems/number-of-islands/solutions/211211/dao-yu-lei-wen-ti-de-tong-yong-jie-fa-dfs-bian-li->

可以看到，二叉树的 DFS 有两个要素：「访问相邻结点」和「判断 base case」。

网格结构是「四叉」的。

其次，网格 DFS 中的 base case 是什么？从二叉树的 base case 对应过来，应该是网格中不需要继续遍历、grid[r][c] 会出现数组下标越界异常的格子，也就是那些超出网格范围的格子。

如何避免这样的重复遍历呢？答案是标记已经遍历过的格子。以岛屿问题为例，我们需要在所有值为 1 的陆地格子上做 DFS 遍历。每走过一个陆地格子，就把格子的值改为 2，这样当我们遇到 2 的时候，就知道这是遍历过的格子了。

## 200. 岛屿数量

<https://leetcode.cn/problems/number-of-islands/description/?envType=study-plan-v2&envId=top-interview-150>

```

1  class Solution {
2  private:
3      void dfs(vector<vector<char>>& grid, int r, int c) {
4          int nr = grid.size();
5          int nc = grid[0].size();
6
7          grid[r][c] = '0';
8          if (r - 1 >= 0 && grid[r-1][c] == '1') dfs(grid, r - 1, c);

```

```

9         if (r + 1 < nr && grid[r+1][c] == '1') dfs(grid, r + 1, c);
10        if (c - 1 >= 0 && grid[r][c-1] == '1') dfs(grid, r, c - 1);
11        if (c + 1 < nc && grid[r][c+1] == '1') dfs(grid, r, c + 1);
12    }
13
14    public:
15        int numIslands(vector<vector<char>>& grid) {
16            int nr = grid.size();
17            if (!nr) return 0;
18            int nc = grid[0].size();
19
20            int num_islands = 0;
21            for (int r = 0; r < nr; ++r) {
22                for (int c = 0; c < nc; ++c) {
23                    if (grid[r][c] == '1') {
24                        ++num_islands;
25                        dfs(grid, r, c);
26                    }
27                }
28            }
29
30            return num_islands;
31        }
32    };

```

## 130. 被围绕的区域

代码块

```

1    class Solution:
2        def solve(self, board: List[List[str]]) -> None:
3            if not board:
4                return
5
6            m, n = len(board), len(board[0])
7
8            def dfs(x, y):
9                if not 0 <= x < m or not 0 <= y < n or board[x][y] != 'O':
10                    return
11
12                board[x][y] = "A"
13                dfs(x + 1, y)
14                dfs(x - 1, y)
15                dfs(x, y + 1)
16                dfs(x, y - 1)
17

```

```

18         for i in range(m):
19             dfs(i, 0)
20             dfs(i, n - 1)
21
22         for i in range(n - 1):
23             dfs(0, i)
24             dfs(m - 1, i)
25
26         for i in range(m):
27             for j in range(n):
28                 if board[i][j] == "A":
29                     board[i][j] = "O"
30                 elif board[i][j] == "O":
31                     board[i][j] = "X"

```

### 133. 克隆图

<https://leetcode.cn/problems/clone-graph/description/?envType=study-plan-v2&envId=top-interview-150>

这个DFS非常精髓，好好学

代码块

```

1  """
2  # Definition for a Node.
3  class Node:
4      def __init__(self, val = 0, neighbors = None):
5          self.val = val
6          self.neighbors = neighbors if neighbors is not None else []
7  """
8
9  from typing import Optional
10 class Solution(object):
11
12     def __init__(self):
13         self.visited = {}
14
15     def cloneGraph(self, node):
16         """
17         :type node: Node
18         :rtype: Node
19         """
20         if not node:
21             return node
22
23         # 如果该节点已经被访问过了，则直接从哈希表中取出对应的克隆节点返回

```



```

24         if node in self.visited:
25             return self.visited[node]
26
27         # 克隆节点，注意到为了深拷贝我们不会克隆它的邻居的列表
28         clone_node = Node(node.val, [])
29
30         # 哈希表存储
31         self.visited[node] = clone_node
32
33         # 遍历该节点的邻居并更新克隆节点的邻居列表
34         if node.neighbors:
35             clone_node.neighbors = [self.cloneGraph(n) for n in node.neighbors]
36
37         return clone_node

```

```

1  class Solution {
2  public:
3      unordered_map<Node*, Node*> visited;
4      Node* cloneGraph(Node* node) {
5          if (node == nullptr) {
6              return node;
7          }
8
9          // 如果该节点已经被访问过了，则直接从哈希表中取出对应的克隆节点返回
10         if (visited.find(node) != visited.end()) {
11             return visited[node];
12         }
13
14         // 克隆节点，注意到为了深拷贝我们不会克隆它的邻居的列表
15         Node* cloneNode = new Node(node->val);
16         // 哈希表存储
17         visited[node] = cloneNode;
18
19         // 遍历该节点的邻居并更新克隆节点的邻居列表
20         for (auto& neighbor: node->neighbors) {
21             cloneNode->neighbors.emplace_back(cloneGraph(neighbor));
22         }
23         return cloneNode;
24     }
25 };

```

## 399. 除法求值

巨难

<https://leetcode.cn/problems/evaluate-division/description/?envType=study-plan-v2&envId=top-interview-150>

官方解法可以用并查集 超级难啊

然后另一种做法就是建立图 然后每次查询用搜索路径

这个建立图是动态规划 可以好好学学

## 207. 课程表

建立有向图，每次删掉In-degree为0的节点

也可以深度优先，每次把没有edge往外指的点入栈

代码块

```
1  from collections import deque
2
3  class Solution:
4      def canFinish(self, numCourses: int, prerequisites: List[List[int]]) ->
        bool:
5          indegrees = [0 for _ in range(numCourses)]
6          adjacency = [[] for _ in range(numCourses)]
7          queue = deque()
8          # Get the indegree and adjacency of every course.
9          for cur, pre in prerequisites:
10             indegrees[cur] += 1
11             adjacency[pre].append(cur)
12             # Get all the courses with the indegree of 0.
13             for i in range(len(indegrees)):
14                 if not indegrees[i]: queue.append(i)
15             # BFS TopSort.
16             while queue:
17                 pre = queue.popleft()
18                 numCourses -= 1
19                 for cur in adjacency[pre]:
20                     indegrees[cur] -= 1
21                     if not indegrees[cur]: queue.append(cur)
22             return not numCourses
```

## 909. 蛇梯棋

<https://leetcode.cn/problems/snakes-and-ladders/description/?envType=study-plan-v2&envId=top-interview-150>

一个很奇怪的BFS

好好看看题解

## 433. 最小基因变化

<https://leetcode.cn/problems/minimum-genetic-mutation/description/?envType=study-plan-v2&envId=top-interview-150>

## 127. 单词接龙

<https://leetcode.cn/problems/word-ladder/solutions/473600/dan-ci-jie-long-by-leetcode-solution/?envType=study-plan-v2&envId=top-interview-150>

同样是奇怪的BFS 可以先建立图 然后双向广度优先

# 字典树/前缀树

## 208. 实现 Trie (前缀树)

<https://leetcode.cn/problems/implement-trie-prefix-tree/description/?envType=study-plan-v2&envId=top-interview-150>

```
1  class Trie {
2  private:
3      bool isEnd;
4      Trie* next[26];
5  public:
6      Trie() {
7          isEnd = false;
8          memset(next, 0, sizeof(next));
9      }
10
11     void insert(string word) {
12         Trie* node = this;
13         for (char c : word) {
14             if (node->next[c-'a'] == NULL) {
15                 node->next[c-'a'] = new Trie();
16             }
17             node = node->next[c-'a'];
18         }
19         node->isEnd = true;
20     }
21
22     bool search(string word) {
23         Trie* node = this;
24         for (char c : word) {
25             node = node->next[c - 'a'];
26             if (node == NULL) {
```

```

27         return false;
28     }
29 }
30 return node->isEnd;
31 }
32
33 bool startsWith(string prefix) {
34     Trie* node = this;
35     for (char c : prefix) {
36         node = node->next[c-'a'];
37         if (node == NULL) {
38             return false;
39         }
40     }
41     return true;
42 }
43 };

```

## 212. 单词搜索 II

<https://leetcode.cn/problems/word-search-ii/description/?envType=study-plan-v2&envId=top-interview-150>

困难 把要搜的单词建立前缀树 然后去挨个位置DFS（而不是对棋盘建立前缀） 其中标记防止循环 删除已匹配的单词

大厂经典必考题

<https://leetcode.cn/problems/word-search-ii/solutions/1000172/dan-ci-sou-suo-ii-by-leetcode-solution-7494>

## 回溯

### 17. 电话号码的字母组合

<https://leetcode.cn/problems/letter-combinations-of-a-phone-number/description/?envType=study-plan-v2&envId=top-interview-150>

官方解析好好学 什么是回溯

```

1  class Solution {
2  public:
3      vector<string> letterCombinations(string digits) {
4          vector<string> combinations;
5          if (digits.empty()) {
6              return combinations;

```

```

7         }
8         unordered_map<char, string> phoneMap{
9             {'2', "abc"},
10            {'3', "def"},
11            {'4', "ghi"},
12            {'5', "jkl"},
13            {'6', "mno"},
14            {'7', "pqrs"},
15            {'8', "tuv"},
16            {'9', "wxyz"}
17        };
18        string combination;
19        backtrack(combinations, phoneMap, digits, 0, combination);
20        return combinations;
21    }
22
23    void backtrack(vector<string>& combinations, const unordered_map<char,
string>& phoneMap, const string& digits, int index, string& combination) {
24        if (index == digits.length()) {
25            combinations.push_back(combination);
26        } else {
27            char digit = digits[index];
28            const string& letters = phoneMap.at(digit);
29            for (const char& letter: letters) {
30                combination.push_back(letter);
31                backtrack(combinations, phoneMap, digits, index + 1,
combination);
32                combination.pop_back();
33            }
34        }
35    }
36 };

```

## 77. 组合

<https://leetcode.cn/problems/combinations/description/?envType=study-plan-v2&envId=top-interview-150>

官方解析有一个很离谱的 反向的二进制枚举

## 39. 组合总和

<https://leetcode.cn/problems/comination-sum/?envType=study-plan-v2&envId=top-interview-150>

非常艰难地用left偷到了一点点边界

```

1  class Solution {
2  public:
3      vector<vector<int>> res;
4      vector<vector<int>> combinationSum(vector<int>& candidates, int target) {
5          sort(candidates.begin(), candidates.end());
6          vector<int> path;
7          backtrack(path, target, candidates, 0);
8          return res;
9      }
10     void backtrack(vector<int>& path, int cur, vector<int>& candidates, int
left) {
11         if (cur == 0){
12             res.push_back(path);
13         }
14         for (int i =left;i<candidates.size();i++) {
15             if (cur - candidates[i] <0) break;
16             path.push_back(candidates[i]);
17             backtrack(path, cur - candidates[i],candidates, i);
18             path.pop_back();
19         }
20     }
21 };

```

## 52. N 皇后 II

<https://leetcode.cn/problems/n-queens-ii/description/?envType=study-plan-v2&envId=top-interview-150>

按行，每行放一个，每次检查有没有冲突

可以用位运算来优化空间复杂度

```

1  class Solution {
2  public:
3      int totalNQueens(int n) {
4          unordered_set<int> columns, diagonals1, diagonals2;
5          return backtrack(n, 0, columns, diagonals1, diagonals2);
6      }
7
8      int backtrack(int n, int row, unordered_set<int>& columns,
unordered_set<int>& diagonals1, unordered_set<int>& diagonals2) {
9          if (row == n) {
10             return 1;
11         } else {
12             int count = 0;

```

```

13         for (int i = 0; i < n; i++) {
14             if (columns.find(i) != columns.end()) {
15                 continue;
16             }
17             int diagonal1 = row - i;
18             if (diagonals1.find(diagonal1) != diagonals1.end()) {
19                 continue;
20             }
21             int diagonal2 = row + i;
22             if (diagonals2.find(diagonal2) != diagonals2.end()) {
23                 continue;
24             }
25             columns.insert(i);
26             diagonals1.insert(diagonal1);
27             diagonals2.insert(diagonal2);
28             count += backtrack(n, row + 1, columns, diagonals1,
diagonals2);
29             columns.erase(i);
30             diagonals1.erase(diagonal1);
31             diagonals2.erase(diagonal2);
32         }
33         return count;
34     }
35 }
36 };

```

## 22. 括号生成

<https://leetcode.cn/problems/generate-parentheses/description/?envType=study-plan-v2&envId=top-interview-150>

```

1  class Solution:
2      @lru_cache(None)
3      def generateParenthesis(self, n: int) -> List[str]:
4          if n == 0:
5              return ['']
6          ans = []
7          for c in range(n):
8              for left in self.generateParenthesis(c):
9                  for right in self.generateParenthesis(n-1-c):
10                     ans.append('({}){}'.format(left, right))
11         return ans
12

```

```

1  class Solution {
2      shared_ptr<vector<string>> cache[100] = {nullptr};
3  public:
4      shared_ptr<vector<string>> generate(int n) {
5          if (cache[n] != nullptr)
6              return cache[n]; //已经有了的话就不要重复生成了
7          if (n == 0) {
8              cache[0] = shared_ptr<vector<string>>(new vector<string>{" "});
9          } else {
10             auto result = shared_ptr<vector<string>>(new vector<string>);
11             for (int i = 0; i != n; ++i) {
12                 auto lefts = generate(i);
13                 auto rights = generate(n - i - 1);
14                 for (const string& left : *lefts)
15                     for (const string& right : *rights)
16                         result->push_back("(" + left + ")" + right);
17             }
18             cache[n] = result;
19         }
20         return cache[n];
21     }
22     vector<string> generateParenthesis(int n) {
23         return *generate(n);
24     }
25 };

```

```

1  class Solution {
2      List<String> res = new ArrayList<>();
3      public List<String> generateParenthesis(int n) {
4          if(n <= 0){
5              return res;
6          }
7          getParenthesis("",n,n);
8          return res;
9      }
10
11     private void getParenthesis(String str,int left, int right) {
12         if(left == 0 && right == 0 ){
13             res.add(str);
14             return;
15         }
16         if(left == right){
17             //剩余左右括号数相等，下一个只能用左括号
18             getParenthesis(str+"(",left-1,right);
19         }else if(left < right){

```



```

20          //剩余左括号小于右括号，下一个可以用左括号也可以用右括号
21          if(left > 0){
22              getParthesis(str+"(",left-1,right);
23          }
24          getParthesis(str+")",left,right-1);
25      }
26  }
27  }

```

## 79. 单词搜索

<https://leetcode.cn/problems/word-search/description/?envType=study-plan-v2&envId=top-interview-150>

可以自己写一下当练手

## 分治

### 148. 排序链表

<https://leetcode.cn/problems/sort-list/description/?envType=study-plan-v2&envId=top-interview-150>

自顶向下递归会产生 $n\log n$ 的空间复杂度，这是因为递归会消耗栈上空间造成的

两种写法可以好好看看题解<https://leetcode.cn/problems/sort-list/solutions/492301/pai-xu-lian-biao-by-leetcode-solution>

### 427. 建立四叉树

<https://leetcode.cn/problems/construct-quad-tree/?envType=study-plan-v2&envId=top-interview-150>

没看懂

## Kadane

### 53. 最大子数组和

最大连续子数组 顶级题目解析<https://leetcode.cn/problems/maximum-subarray/solutions/9058/dong-tai-gui-hua-fen-zhi-fa-python-dai-ma-java-dai>

两种动态规划和分治

官方题解很奇怪没懂

### 918. 环形子数组的最大和

<https://leetcode.cn/problems/maximum-sum-circular-subarray/description/?envType=study-plan-v2&envId=top-interview-150>

题解里有骚操作

## 二分查找

### 35. 搜索插入位置

<https://leetcode.cn/problems/search-insert-position/description/?envType=study-plan-v2&envId=top-interview-150>

要输出插入的位置似乎并不简单

```
1  class Solution {
2  public:
3      int searchInsert(vector<int>& nums, int target) {
4          int left = 0;
5          int right = nums.size()-1;
6          int mid = nums.size();
7          int ans;
8          while(left <= right){
9              mid = (left+right)/2;
10             if(nums[mid] == target) return mid;
11             if(nums[mid] < target){
12                 left = mid + 1;
13                 ans = left;
14             }
15             else{
16                 right = mid - 1;
17             }
18         }
19         return max(ans, 0);
20     }
21 };
```

### 33. 搜索旋转排序数组

<https://leetcode.cn/problems/search-in-rotated-sorted-array/description/?envType=study-plan-v2&envId=top-interview-150>

还是可以二分 因为还是会有有序的区域

```
1  class Solution {
2  public:
```

```

3      int search(vector<int>& nums, int target) {
4          int n = (int)nums.size();
5          if (!n) {
6              return -1;
7          }
8          if (n == 1) {
9              return nums[0] == target ? 0 : -1;
10         }
11         int l = 0, r = n - 1;
12         while (l <= r) {
13             int mid = (l + r) / 2;
14             if (nums[mid] == target) return mid;
15             if (nums[0] <= nums[mid]) {
16                 if (nums[0] <= target && target < nums[mid]) {
17                     r = mid - 1;
18                 } else {
19                     l = mid + 1;
20                 }
21             } else {
22                 if (nums[mid] < target && target <= nums[n - 1]) {
23                     l = mid + 1;
24                 } else {
25                     r = mid - 1;
26                 }
27             }
28         }
29         return -1;
30     }
31 };

```

### 34. 在排序数组中查找元素的第一个和最后一个位置

<https://leetcode.cn/problems/find-first-and-last-position-of-element-in-sorted-array/description/?envType=study-plan-v2&envId=top-interview-150>

二分到最左边界

```

1      class Solution {
2      public:
3          int binarySearch(vector<int>& nums, int target, bool lower) {
4              int left = 0, right = (int)nums.size() - 1, ans = (int)nums.size();
5              while (left <= right) {
6                  int mid = (left + right) / 2;
7                  if (nums[mid] > target || (lower && nums[mid] >= target)) {
8                      right = mid - 1;
9                  }
10             }
11             return ans;
12         }
13     };

```

```

10         } else {
11             left = mid + 1;
12         }
13     }
14     return ans;
15 }
16
17 vector<int> searchRange(vector<int>& nums, int target) {
18     int leftIdx = binarySearch(nums, target, true);
19     int rightIdx = binarySearch(nums, target, false) - 1;
20     if (leftIdx <= rightIdx && rightIdx < nums.size() && nums[leftIdx] ==
target && nums[rightIdx] == target) {
21         return vector<int>{leftIdx, rightIdx};
22     }
23     return vector<int>{-1, -1};
24 }
25 };

```

### 153. 寻找旋转排序数组中的最小值

<https://leetcode.cn/problems/find-minimum-in-rotated-sorted-array/description/?envType=study-plan-v2&envId=top-interview-150>

一个很特别的二分

```

1  public static int findMin(int[] nums) {
2      int len = nums.length;
3      int low = 0;
4      int high = len-1;
5
6      //      二分查找
7      while(low < high){
8          //          取中间值
9          int mid = (high+low)/2;
10         //          如果中间值小于最大值，则最大值减小
11         //          疑问: 为什么 high = mid;而不是 high = mid-1;
12         //          解答: {4,5,1,2,3}, 如果high=mid-1, 则丢失了最小值1
13         if (nums[mid] < nums[high]) {
14             high = mid;
15         } else {
16             //          如果中间值大于最大值，则最小值变大
17             //          疑问: 为什么 low = mid+1;而不是 low = mid;
18             //          解答: {4,5,6,1,2,3}, nums[mid]=6, low=mid+1,刚好nums[low]=1
19             //          继续疑问: 上边的解释太牵强了，难道没有可能low=mid+1,正好错过了最小
            值

```

```

20 //          继续解答：不会错过!!! 如果nums[mid]是最小值的话，则其一定小于
    nums[high],走if, 就不会走else了
21         low = mid+1;
22     }
23 }
24 //          疑问：为什么while的条件是low<high,而不是low<=high呢
25 //          解答：low<high, 假如最后循环到{*,10,1,*}的这种情况时，
    nums[low]=10,nums[high]=1,nums[mid]=10,low=mid+1,
26 //          直接可以跳出循环了,所以low<high,此时low指向的就是最小值的下标；
27 //          如果low<=high的话，low=high，还会再不必要的循环一次，此时最后一次循环
    的时候会发生low==high==mid,
28 //          则nums[mid]==nums[high]，则会走一次else语句，则low=mid+1,此时low指
    向的是最小值的下一个下标，
29 //          则需要return[low-1]
30     return nums[low];
31 }

```

## 4. 寻找两个正序数组的中位数

<https://leetcode.cn/problems/median-of-two-sorted-arrays/description/?envType=study-plan-v2&envId=top-interview-150>

非常难的一个二分 看题解吧

## 堆

### 215. 数组中的第K个最大元素

<https://leetcode.cn/problems/kth-largest-element-in-an-array/solutions/307351/shu-zu-zhong-de-di-kge-zui-da-yuan-su-by-leetcode-/?envType=study-plan-v2&envId=top-interview-150>

1 quick select 2 堆排序

### 373. 查找和最小的 K 对数字

<https://leetcode.cn/problems/find-k-pairs-with-smallest-sums/description/?envType=study-plan-v2&envId=top-interview-150>

先放进去一批，然后每次拿一个就往堆里加下一个

### 295. 数据流的中位数

<https://leetcode.cn/problems/find-median-from-data-stream/description/?envType=study-plan-v2&envId=top-interview-150>

<https://leetcode.cn/problems/find-median-from-data-stream/solutions/2361972/295-shu-ju-liu-de-zhong-wei-shu-dui-qing-gmdo> 看这个题解

非常神奇 搞两个堆一大一小 往A堆加就先加到B再把B顶拿给A 这样确保两边堆顶是中间的

## 23. 合并 K 个升序链表

# 位运算/二进制

## 67. 二进制求和

<https://leetcode.cn/problems/add-binary/description/?envType=study-plan-v2&envId=top-interview-150>

字符串操作复习一下：

```
1  class Solution {
2  public:
3      string addBinary(string a, string b) {
4          string ans;
5          reverse(a.begin(), a.end());
6          reverse(b.begin(), b.end());
7
8          int n = max(a.size(), b.size()), carry = 0;
9          for (size_t i = 0; i < n; ++i) {
10             carry += i < a.size() ? (a.at(i) == '1') : 0;
11             carry += i < b.size() ? (b.at(i) == '1') : 0;
12             ans.push_back((carry % 2) ? '1' : '0');
13             carry /= 2;
14         }
15
16         if (carry) {
17             ans.push_back('1');
18         }
19         reverse(ans.begin(), ans.end());
20
21         return ans;
22     }
23 };
```

也可以位运算 但是这个好像很抽象

```
1  class Solution:
2      def addBinary(self, a, b) -> str:
3          x, y = int(a, 2), int(b, 2)
4          while y:
5              answer = x ^ y
```

```

6         carry = (x & y) << 1
7         x, y = answer, carry
8         return bin(x)[2:]

```

python还可以转换为10进制来做

代码块

```

1 class Solution:
2     def addBinary(self, a, b) -> str:
3         return '{0:b}'.format(int(a, 2) + int(b, 2))

```

## 190. 颠倒二进制位

<https://leetcode.cn/problems/reverse-bits/description/?envType=study-plan-v2&envId=top-interview-150>

逐位颠倒

```

1 class Solution {
2 public:
3     uint32_t reverseBits(uint32_t n) {
4         uint32_t rev = 0;
5         for (int i = 0; i < 32 && n > 0; ++i) {
6             rev |= (n & 1) << (31 - i);
7             n >>= 1;
8         }
9         return rev;
10    }
11 };

```

python的位运算也是一样的

代码块

```

1 class Solution:
2     def reverseBits(self, n: int) -> int:
3         rev = 0
4         for i in range(32):
5             rev |= (n & 1) << (31 - i)
6             n >>= 1
7         return rev

```

## 位运算分治

若要翻转一个二进制串，可以将其均分成左右两部分，对每部分递归执行翻转操作，然后将左半部分拼在右半部分的后面，即完成了翻转。

```
1  class Solution {
2  private:
3      const uint32_t M1 = 0x55555555; // 01010101010101010101010101010101
4      const uint32_t M2 = 0x33333333; // 00110011001100110011001100110011
5      const uint32_t M4 = 0x0f0f0f0f; // 00001111000011110000111100001111
6      const uint32_t M8 = 0x00ff00ff; // 00000000111111110000000011111111
7
8  public:
9      uint32_t reverseBits(uint32_t n) {
10         n = n >> 1 & M1 | (n & M1) << 1; //把 n 的所有奇数位移到偶数位，偶数位移到
            奇数位，完成 1 位组内反转。
11         n = n >> 2 & M2 | (n & M2) << 2;
12         n = n >> 4 & M4 | (n & M4) << 4;
13         n = n >> 8 & M8 | (n & M8) << 8;
14         return n >> 16 | n << 16; //交换高 16 位和低 16 位。
15     }
16 };
```

## 191. 位1的个数

复习一下

这个1左移i位是这么写的!!!!!!!!!!!!!!

```
1  class Solution {
2  public:
3      int hammingWeight(uint32_t n) {
4          int ret = 0;
5          for (int i = 0; i < 32; i++) {
6              if (n & (1 << i)) {
7                  ret++;
8              }
9          }
10         return ret;
11     }
12 };
```

## 136. 只出现一次的数字

哈希表或者异或



```

1  class Solution {
2  public:
3      int singleNumber(vector<int>& nums) {
4          int ans = nums[0];
5          if (nums.size() > 1) {
6              for (int i = 1; i < nums.size(); i++) {
7                  ans = ans ^ nums[i];
8              }
9          }
10         return ans;
11     }
12 };

```

## 137. 只出现一次的数字 II

看题解吧 出现三次的过滤 就是每一位对3取余

## 201. 数字范围按位与

因为有0的话与出来都是0，所以只要找到最小和最大的公共前缀1

```

1  class Solution {
2  public:
3      int rangeBitwiseAnd(int m, int n) {
4          int shift = 0;
5          // 找到公共前缀
6          while (m < n) {
7              m >>= 1;
8              n >>= 1;
9              ++shift;
10         }
11         return m << shift;
12     }
13 };

```

另一种方法就是  $n \& n-1$  把大的数右边1不断消 消到小于小的数就是公共前缀

```

1  class Solution {
2  public:
3      int rangeBitwiseAnd(int m, int n) {
4          while (m < n) {
5              // 抹去最右边的 1
6              n = n & (n - 1);

```

```

7         }
8         return n;
9     }
10 };

```

# 数学

## 9. 回文数

转成字符串后双指针，很简单

或者：

反转一半的数字即可！

```

1  class Solution {
2  public:
3      bool isPalindrome(int x) {
4          // 特殊情况：
5          // 如上所述，当  $x < 0$  时， $x$  不是回文数。
6          // 同样地，如果数字的最后一位是 0，为了使该数字为回文，
7          // 则其第一位数字也应该是 0
8          // 只有 0 满足这一属性
9          if ( $x < 0$  || ( $x \% 10 == 0$  &&  $x != 0$ )) {
10             return false;
11         }
12
13         int revertedNumber = 0;
14         while ( $x > revertedNumber$ ) {
15             revertedNumber = revertedNumber * 10 +  $x \% 10$ ;
16              $x /= 10$ ;
17         }
18
19         // 当数字长度为奇数时，我们可以通过  $revertedNumber/10$  去除处于中位的数字。
20         // 例如，当输入为 12321 时，在 while 循环的末尾我们可以得到  $x = 12$ ，
21         // 由于处于中位的数字不影响回文（它总是与自己相等），所以我们可以简单地将其去
22         // 除。
23         return  $x == revertedNumber$  ||  $x == revertedNumber / 10$ ;
24     }
25 };

```

## 66. 加一

找出第一个不为 999 的元素，将其加一并将后续所有元素置零即可。如果 `digits` 中所有的元素均为 999，那么对应着「思路」部分的第三种情况，我们需要返回一个新的数组

代码块

```
1  class Solution {
2      public int[] plusOne(int[] digits) {
3          for (int i = digits.length - 1; i >= 0; i--) {
4              digits[i]++;
5              digits[i] = digits[i] % 10;
6              if (digits[i] != 0) return digits;
7          }
8          digits = new int[digits.length + 1];
9          digits[0] = 1;
10         return digits;
11     }
12 }
```

## 172. 阶乘后的零

太离谱了

<https://leetcode.cn/problems/factorial-trailing-zeroes/solutions/1360892/jie-cheng-hou-de-ling-by-leetcode-soluti-1egk>

只要找5的个数就行

代码块

```
1  class Solution:
2      def trailingZeroes(self, n: int) -> int:
3          ans = 0
4          while n:
5              n //= 5
6              ans += n
7          return ans
```

## 69. x 的平方根

二分查找/对数换底/牛顿迭代

代码块

```
1  class Solution(object):
2      def mySqrt(self, x):
3          """
4          :type x: int
```

```

5         :rtype: int
6         """
7         low = 0
8         high = x
9         while low<=high:
10             mid =(low+high)//2
11             if mid**2<=x:
12                 ans = mid
13                 low= mid+1
14             else:
15                 high = mid-1
16         return ans

```

## 50. Pow(x, n)

利用二进制进行快速幂乘法 可以每次除2来递归

结尾还要注意一下幂为负数的情况

代码块

```

1  class Solution:
2      def myPow(self, x: float, n: int) -> float:
3          def quickMul(N):
4              if N == 0:
5                  return 1.0
6              y = quickMul(N // 2)
7              return y * y if N % 2 == 0 else y * y * x
8
9          return quickMul(n) if n >= 0 else 1.0 / quickMul(-n)

```

也可以下面这样直接迭代

```

1  class Solution {
2  public:
3      double quickMul(double x, long long N) {
4          double ans = 1.0;
5          // 贡献的初始值为 x
6          double x_contribute = x;
7          // 在对 N 进行二进制拆分的同时计算答案
8          while (N > 0) {
9              if (N % 2 == 1) {
10                 // 如果 N 二进制表示的最低位为 1，那么需要计入贡献
11                 ans *= x_contribute;
12             }

```

```

13         // 将贡献不断地平方
14         x_contribute *= x_contribute;
15         // 舍弃 N 二进制表示的最低位，这样我们每次只要判断最低位即可
16         N /= 2;
17     }
18     return ans;
19 }
20
21 double myPow(double x, int n) {
22     long long N = n;
23     return N >= 0 ? quickMul(x, N) : 1.0 / quickMul(x, -N);
24 }
25 };

```

## 49. 直线上最多的点数

看题解吧

枚举斜率 需要处理除法精度问题 可以用转化为乘法，或者字符串+哈希表，或者？

代码块

```

1  class Solution:
2      def maxPoints(self, points: List[List[int]]) -> int:
3          n, ans = len(points), 1
4          for i, x in enumerate(points):
5              for j in range(i + 1, n):
6                  y = points[j]
7                  # 枚举点对 (i,j) 并统计有多少点在该线上，起始 cnt = 2 代表只有 i 和
                  # j 两个点在此线上
8                  cnt = 2
9                  for k in range(j + 1, n):
10                     p = points[k]
11                     s1 = (y[1] - x[1]) * (p[0] - y[0])
12                     s2 = (p[1] - y[1]) * (y[0] - x[0])
13                     if s1 == s2: cnt += 1
14                 ans = max(ans, cnt)
15         return ans

```

除法结果转字符串来用哈希表

代码块

```

1  class Solution:
2      def maxPoints(self, points):
3          def gcd(a, b):
4              return a if b == 0 else gcd(b, a % b)

```

```

5
6     n, ans = len(points), 1
7     for i in range(n):
8         mapping = {}
9         maxv = 0
10        for j in range(i + 1, n):
11            x1, y1 = points[i]
12            x2, y2 = points[j]
13            a, b = x1 - x2, y1 - y2
14            k = gcd(a, b)
15            key = str(a // k) + "_" + str(b // k)
16            mapping[key] = mapping.get(key, 0) + 1 #处理key不存在的情况!!!!
17            maxv = max(maxv, mapping[key])
18        ans = max(ans, maxv + 1)
19    return ans

```

## 一维动态规划

### 70. 爬楼梯

斐波那契->矩阵快速幂->解数列通项

### 198. 打家劫舍

写的非常好的动态规划思路 <https://leetcode.cn/problems/house-robber/solutions/138131/dong-tai-gui-hua-jie-ti-si-bu-zou-xiang-jie-cjavap>

### 139. 单词拆分

这个动态规划思路值得学习

### 300. 最长递增子序列

这个状态转移方程要学习

```

1  class Solution {
2  public:
3      int lengthOfLIS(vector<int>& nums) {
4          int n = (int)nums.size();
5          if (n == 0) {
6              return 0;
7          }
8          vector<int> dp(n, 0);
9          for (int i = 0; i < n; ++i) {
10             dp[i] = 1;
11             for (int j = 0; j < i; ++j) {

```

```

12         if (nums[j] < nums[i]) {
13             dp[i] = max(dp[i], dp[j] + 1);
14         }
15     }
16 }
17 return *max_element(dp.begin(), dp.end());
18 }
19 };

```

## 多维动态规划

### 120. 三角形最小路径和

可以把空间优化到 $2n$ ，再优化到 $n$

### 63. 不同路径 II

有障碍的话，直接障碍当0即可。这样不会走过

另外就是降维空间，但是这题感觉做不到啊？

### 5. 最长回文子串



#### 5. 最长回文子串

字符	b	a	b	a	b
下标	0	1	2	3	4

子串右边界 \ 子串左边界	0	1	2	3	4
0	TRUE	FALSE	TRUE	FALSE	
1		TRUE	FALSE	TRUE	
2			TRUE	FALSE	
3				TRUE	

状态转移方程:  $dp[i][j] = (s[i] == s[j])$   
 $and (j - i < 3 or dp[i + 1][j - 1])$

由于  $dp[i][j]$  参考它左下方的值:

- (1) 先升序填列;
- (2) 再升序填行。

### 97. 交错字符串

类似双指正的DP 使用滚动数组优化空间

### 72. 编辑距离

非常逆天

<https://leetcode.cn/problems/edit-distance/solutions/6455/zi-di-xiang-shang-he-zi-ding-xiang-xia-by-powcai-3>

123. 买卖股票的最佳时机 III

188. 买卖股票的最佳时机 IV

多次交易的通解 逆天

关键就是看官方题解，学会表达状态

```
1  class Solution {
2  public:
3      int maxProfit(vector<int& prices) {
4          vector buy(3, INT_MIN), sel(3, 0);
5          for (int i : prices) {
6              for (int j = 1; j < 3; j++) {
7                  buy[j] = max(buy[j], sel[j - 1] - i);
8                  sel[j] = max(sel[j], buy[j] + i);
9              }
10         }
11         return sel[2];
12     }
13 };
```

221. 最大正方形

原始矩阵

	0	1	2	3	4
0	0	1	1	1	0
1	1	1	1	1	0
2	0	1	1	1	1
3	0	1	1	1	1
4	0	0	1	1	1

dp

	0	1	2	3	4
0	0	1	1	1	0
1	1	1	2	2	0
2	0	1	2	3	1
3	0	1	2	3	2
4	0	0	1	2	3

3 × 3

表示 dp[2][3]

2 × 2

表示 dp[3][4]

1 × 1

表示 dp[4][2]

dp(2, 3) = min(dp(1, 3), dp(1, 2), dp(2, 2)) + 1 = 3

dp(3, 4) = min(dp(2, 4), dp(2, 3), dp(3, 3)) + 1 = 2

dp(4, 2) = min(dp(3, 2), dp(3, 1), dp(4, 1)) + 1 = 1