算法题准备材料

Tyrael.wang

# JAVA常用API

1. 栈Stack类继承Vector类。主要方法：pushpoppeekempty（Java编程思想：Java本身的栈设计欠佳。暴露了很多Vector的方法。）

2. 队列Java 有Queue接口。LinkedList实现了Queue接口。offer插入队尾remove、pollelement、peek3. 字符串相关StringBuffer 线程安全StringBuilder 非线程安全字符串逆转stringBuilder.reverse4. 集合Arrays.binSearch的返回值5. Math算法相关：PriorityQueue 基于堆实现的无界队列，非线程安全的An unbounded priority {@linkplain Queue queue} based on a priority heap.

# 常用数据结构

## 二叉树

### 性质

### 构建

106. Construct Binary Tree from Inorder and Postorder Traversal

### 二叉索引树

https://leetcode.com/problems/unique-binary-search-trees/description/

C(2n,n)/(n+1)

https://leetcode.com/problems/unique-binary-search-trees-ii/description/

## 字典树

**public class** Node {  
 Node[] **children**;  
 String **leaf**;  
  
 */\*\*  
 \*  
 \** ***@param n*** *孩子容量  
 \*/* **public** Node(**int** n) {  
 **children** = **new** Node[n];  
 }  
}

**public class** Trie {  
 Node **root**;  
  
 **public** Node create(){  
 **root** = **new** Node(26);  
 **return root**;  
 }  
  
 **public void** insert(String s){  
 *//逐个查找，找不到则建点* Node node = **root**;  
 **for** (**int** i = 0; i < s.length(); i++) {  
 **int** index = order(s.charAt(0));  
 Node child = node.**children**[index];  
 **if**(child == **null**){  
 child = **new** Node(26);  
 node.**children**[index] = child;  
 node = child;  
 }**else**{  
 node = child;  
 }  
 }  
 node.**leaf** = s;  
 }  
  
 **public boolean** search(String s){  
 Node node = **root**;  
 **for** (**int** i = 0; i < s.length(); i++) {  
 **int** index = order(s.charAt(0));  
 Node child = node.**children**[index];  
 **if**(child == **null**){  
 **return false**;  
 }**else**{  
 node = child;  
 }  
 }  
 *//如果该词是其他词的前缀，也不存在。* **return** node.**leaf** != **null**;  
 }  
  
 **public int** order(**char** a){  
 **return** a - **'a'**;  
 }  
}

211. Add and Search Word - Data structure design

变种：search(word) can search a literal word or a regular expression string containing only letters a-z or .. A . means it can represent any one letter.

红黑树

前缀和

线段树

图

拓扑排序

并查集扩展元素数量集合数量

# 经典算法

排序

计算几何

算法导论33章

字符串匹配

kmp算法ac自动机

## 素数计算

https://leetcode.com/problems/2-keys-keyboard/solution/

## 二分查找

含重复元素、等号、上下界

34. Search for a Range

## 流算法

### 摩尔多数投票算法

查找1/2、1/3水王

### 水库采样

## 下一个排列

O(n);O(1)

**public** **void** **nextPermutation(int[]** nums**)** **{**

**int** i **=** nums**.**length **-** 2**;**

**while** **(**i **>=** 0 **&&** nums**[**i **+** 1**]** **<=** nums**[**i**])** **{ //找到第一个不满足逆序的数**

i**--;**

**}**

**if** **(**i **>=** 0**)** **{**

**int** j **=** nums**.**length **-** 1**;**

**while** **(**j **>=** 0 **&&** nums**[**j**]** **<=** nums**[**i**])** **{ //找到比i位置大一点的数**

j**--;**

**}**

swap**(**nums**,** i**,** j**); //i位置确定好**

**}**

reverse**(**nums**,** i **+** 1**); //余下的按正序排列即可**

**}**

## 二叉搜索树/binary search tree

98. Validate Binary Search Tree

450. Delete Node in a BST

230. Kth Smallest Element in a BST

## 树状数组/binary indexed tree

https://blog.csdn.net/l664675249/article/details/50157669

## 图

133. Clone Graph

Dijkstra

<https://leetcode.com/problems/cheapest-flights-within-k-stops/description/>

单源路径

743. Network Delay Time

带权单源路径

## 01背包问题

只能穷举

NP问题

字符串匹配

318. Maximum Product of Word Lengths

## 扩展

### 马拉车算法

### 格雷码

N位格雷码

for (int i = 0; i < 1<<n; i++)

result.add(i ^ i>>1);

## 简单

### 逆波兰表达式

150. Evaluate Reverse Polish Notation

# 从形式到思路

## 广义表

341. Flatten Nested List Iterator

385. Mini Parser

394. Decode String

借助栈实现

## 数字

402. Remove K Digits

解法一：

删除数字-》保留数字-》高位重要

解法二：

one can simply scan from left to right, and remove the first "peak" digit; the peak digit is larger than its right neighbor.

使用栈

738. Monotone Increasing Digits

when the number is 123454321, we could have a candidate of 123449999. It seems like a decent strategy is to take a monotone increasing prefix of N, then decrease the number before the "cliff" (the index where adjacent digits decrease for the first time) if it exists, and replace the rest of the characters with 9s.

### 位操作

397. Integer Replacement

//more

海明距离

477. Total Hamming Distance

421. Maximum XOR of Two Numbers in an Array

338. Counting Bits

## 从回溯到dp

https://leetcode.com/problems/target-sum/description/

## 数组/矩阵区间和/积

https://leetcode.com/problems/range-sum-query-2d-immutable/description/

## 四则运算

https://leetcode.com/problems/different-ways-to-add-parentheses/description/

## 无序数组/字符串

### 排列/组合

60. Permutation Sequence

46. Permutations

不同元素

47. Permutations II

重复的下一个排列

77. Combinations

### 元素和

<https://leetcode.com/problems/combination-sum-iv/description/>

回溯-》dp

### 回文

字串

<https://leetcode.com/problems/palindromic-substrings/description/>

131. Palindrome Partitioning

回溯

子序列（中漏）

https://leetcode.com/problems/longest-palindromic-subsequence/description/

dp[i][j]: the longest palindromic subsequence's length of substring(i, j)

State transition:

dp[i][j] = dp[i+1][j-1] + 2 if s.charAt(i) == s.charAt(j)

otherwise, dp[i][j] = Math.max(dp[i+1][j], dp[i][j-1])

Initialization: dp[i][i] = 1

### 背包问题/选或不选

416. Partition Equal Subset Sum

698. Partition to K Equal Sum Subsets

背包问题

https://leetcode.com/problems/ones-and-zeroes/description/

39. Combination Sum

选用多次

40. Combination Sum II

集合中有重复元素，选用一次

216. Combination Sum III

元素不可重复

377. Combination Sum IV

### 推进

<https://leetcode.com/problems/house-robber-ii/description/>

DP

### 两个字符串的关系

缩小规模-》DP

https://leetcode.com/problems/minimum-swaps-to-make-sequences-increasing/description/

722. Remove Comments

line comments, and block comments.

注意嵌套情况

“”字符串嵌套，转义字符

//可以在一行的任意位置

/\*/不完整

https://leetcode.com/problems/unique-substrings-in-wraparound-string/description/

https://leetcode.com/problems/unique-substrings-in-wraparound-string/discuss/95439/Concise-Java-solution-using-DP

712. Minimum ASCII Delete Sum for Two Strings

## 单词列表

查找：字典树

212. Word Search II

318. Maximum Product of Word Lengths

## 有序数组

### 排序

324. Wiggle Sort II

快排的应用。

大小元素的摆放

### 前K

373. Find K Pairs with Smallest Sums

215. Kth Largest Element in an Array、

快排

692. Top K Frequent Words

### 波形

股票

https://leetcode.com/problems/best-time-to-buy-and-sell-stock-with-cooldown/description/

状态思想

https://leetcode.com/problems/best-time-to-buy-and-sell-stock-with-cooldown/discuss/75928/Share-my-DP-solution-(By-State-Machine-Thinking)

https://leetcode.com/problems/best-time-to-buy-and-sell-stock-with-transaction-fee/description/

456. 132 Pattern

区间中的值

//more

### 划分

813. Largest Sum of Averages

1. 回溯 + memo

2. 二维dp

### 子序列长度

n!个子序列

https://leetcode.com/problems/wiggle-subsequence/description/

https://leetcode.com/problems/is-subsequence/description/

public boolean isSubsequence(String s, String t) {

if (s.length() == 0) return true;

int indexS = 0, indexT = 0;

while (indexT < t.length()) {

if (t.charAt(indexT) == s.charAt(indexS)) {

indexS++;

if (indexS == s.length()) return true;

}

indexT++;

}

return false;

}

### 丑数

质因子只含235的数

https://leetcode.com/problems/ugly-number-ii/description/

三个队列

313. Super Ugly Number

### 递增子串

https://leetcode.com/problems/number-of-longest-increasing-subsequence/description/

### 排序数组查找

二分查找变种

### 逆序

775. Global and Local Inversions

To check if #global inversion=#local inversion, we just need to ensure that there are no such inversion:i>j+1, a[i]<a[j]

### 两个数的关系

2/3/4 Sum （smaller、closet）

暂定一个值，排序查找另一个值

注意平均值关系，运用两个指针单向滑动

### 小区间

思路：计数排序、二分查找

例：

825. Friends Of Appropriate Ages

### 区间和/积

log(∏​*i*​​*x*​*i*​​)=∑​*i*​​log*x*​*i*​​

前缀和

累积和：累积和特点：对于单一元素，单调递增。

209. Minimum Size Subarray Sum

713. Subarray Product Less Than K

明显：列举所有：O(n3)

累积和：O(n2)

累积和：注意脑中有一个递增序列：二分查找(nlogn)

两个指针：某一个index，有条件提前结束查找：（n）

238. Product of Array Except Self

空间利用，

利用输出数组

Dp空间的优化

### 利用索引

769. Max Chunks To Make Sorted

768. Max Chunks To Make Sorted II

565. Array Nesting

442. Find All Duplicates in an Array

映射空间大的话，最终可以恢复数组

274. H-Index

275. H-Index II

利用索引+计数排序+DP

二分搜索

526. Beautiful Arrangement

### 环/并查集

565. Array Nesting

### 其他

数组实际上是一个map可以在原数组操作

https://leetcode.com/problems/delete-and-earn/description/

## 矩阵

解题思路：回溯、dfs、bfs、dp

路径搜索，一般只依赖邻居，通常可以用dp解决

最简单的空间占用是n2

有些可以优化到n，如2向路径。跟依赖多少方向有关系。

有些可以优化到1

### 矩阵2向路径

62 Unique Paths排列组合问题哦：DRRRDRRR（m\*n）!/(m!\*n!)

63. Unique Paths II

DP

### 矩阵4向路径

矩阵邻居搜索

79. Word Search

212. Word Search II

出界

https://leetcode.com/problems/out-of-boundary-paths/description/

### 矩阵搜索

74. Search a 2D Matrix

二分搜索，mid的计算比较复杂

### 三角形

120. Triangle

坐标变换、dp

### 区域面积

拆分维度，分别dp，再综合计算

https://leetcode.com/problems/maximal-square/description/

764. Largest Plus Sign

If we knew the longest possible arm length L\_u, L\_l, L\_d, L\_r*L*​*u*​​,*L*​*l*​​,*L*​*d*​​,*L*​*r*​​ in each direction from a center, we could know the order \min(L\_u, L\_l, L\_d, L\_r)min(*L*​*u*​​,*L*​*l*​​,*L*​*d*​​,*L*​*r*​​) of a plus sign at that center. We could find these lengths separately using dynamic programming.

## 数学

3.2.4. 数组积

29 Divides1：位操作，变大除数s2：长除法

326 PowerOfThree// 1162261467 is 3^19, 3^20 is bigger than int return ( n>0 && 1162261467%n==0);

概率

https://leetcode.com/problems/soup-servings/description/

丑数

https://leetcode.com/problems/integer-break/description/

all factors should be 2 or 3 (N > 4)

3 \* 3 > 2 \* 2 \* 2.

## 链表

19. Remove Nth Node From End两个指针O(n)

138. Copy List with Random Pointer利用原链表指针相对位置关系=》指针关系

## 区间维护

56 Merge Intervals排序以后按顺序合并

228. Summary Ranges

646. Maximum Length of Pair Chain

452. Minimum Number of Arrows to Burst Balloons

435. Non-overlapping Intervals

课程时间安排

https://en.wikipedia.org/wiki/Interval\_scheduling#Interval\_Scheduling\_Maximization

## 二叉树

236. Lowest Common Ancestor of a Binary Tree

层次遍历

117. Populating Next Right Pointers in Each Node II

114. Flatten Binary Tree to Linked List

652. Find Duplicate Subtrees

标志id的思想。

623. Add One Row to Tree

### 路径

路径dfs

113. Path Sum II

根到叶

437. Path Sum III

任意点

优化算法：每个路径构建前缀和

124. Binary Tree Maximum Path Sum

129. Sum Root to Leaf Numbers

### Level

129. Sum Root to Leaf Numbers

## 树

<https://leetcode.com/problems/house-robber-iii/description/>

遍历

https://leetcode.com/problems/binary-tree-zigzag-level-order-traversal/description/

## 图

207 Course Schedule依赖问题：拓扑排序（需要手写）时间问题：贪心算法

缔结斯科拉

https://leetcode.com/problems/cheapest-flights-within-k-stops/description/

## 猜大小

https://leetcode.com/problems/guess-number-higher-or-lower-ii/description/

## 极大极小

486. Predict the Winner

https://leetcode.com/problems/predict-the-winner/solution/

649. Dota2 Senate

## 拾遗

621. Task Scheduler

Input: tasks = ["A","A","A","B","B","B"], n = 2

Output: 8

Explanation: A -> B -> idle -> A -> B -> idle -> A -> B.

406. Queue Reconstruction by Height

一个人的位置，由比他高的人决定。

从高到低确定位置。

393. UTF-8 Validation

A character in UTF8 can be from 1 to 4 bytes long, subjected to the following rules:

For 1-byte character, the first bit is a 0, followed by its unicode code.

For n-bytes character, the first n-bits are all one's, the n+1 bit is 0, followed by n-1 bytes with most significant 2 bits being 10.

This is how the UTF-8 encoding would work:

Char. number range | UTF-8 octet sequence

(hexadecimal) | (binary)

--------------------+---------------------------------------------

0000 0000-0000 007F | 0xxxxxxx

0000 0080-0000 07FF | 110xxxxx 10xxxxxx

0000 0800-0000 FFFF | 1110xxxx 10xxxxxx 10xxxxxx

0001 0000-0010 FFFF | 11110xxx 10xxxxxx 10xxxxxx 10xxxxxx

捞针

260. Single Number III

全部两次+两个一次

//more

# 常用解题思路

## DP

能够应用DP的问题，通常有两种可能

1. 可以构建无后效性递归式
2. 可以应用回溯算法，并且有大量重复。

表面上是TopDown算法，一般可以转化为bottomUp算法。

DP的空间，

思考时，可以用较大的空间。

最终的优化，看递归式，到底依赖了多少上一步的结果。

https://leetcode.com/problems/2-keys-keyboard/discuss/105932/Java-solutions-from-naive-DP-to-optimized-DP-to-non-DP

常用解决方案：分治、二分、DP哈希、双指针、排序

双向bfs

贪心算法专题

关键是需要证明为什么贪心是对的。

狭义贪心算法是动态规划的特例。贪心算法代码看起来比动态规划简单，实际上思维上要复杂一点。算法导论有介绍321 Create Maximum Number广义贪心算法

回溯

心中一颗答案空间搜索树

两种搜索：dfs、bfs

Dfs用递归、栈实现

Bfs队列实现

# 常用正则表达式

# 测试细节

解题流程

确认算法、复杂度

确认输入边界，说明分支处理。

大于还是大于等于？

编写常规流程

代码走查

完善测试用例，确认测试通过。

Comparator注意越界

测试用例总结整数、小数、科学计数法1. 前后空格2. 前0，多个03. 负04. 小数，后多个05. 小数，小数点前后没有06. 指数，指数为07. 字母、空格，中间夹杂8. 空值Pattern.matches("(\\+|-)?(\\d+(\\.\\d\*)?|\\.\\d+)(e(\\+|-)?\\d+)?", s);test(1, "123", true);test(2, " 123 ", true);test(3, "0", true);test(4, "0123", true); //Cannot agreetest(5, "00", true); //Cannot agreetest(6, "-10", true);test(7, "-0", true);test(8, "123.5", true);test(9, "123.000000", true);test(10, "-500.777", true);test(11, "0.0000001", true);test(12, "0.00000", true);test(13, "0.", true); //Cannot be more disagree!!!test(14, "00.5", true); /ly cannot agreetest(15, "123e1", true);test(16, "1.23e10", true);test(17, "0.5e-10", true);test(18, "1.0e4.5", false);test(19, "0.5e04", true);test(20, "12 3", false);test(21, "1a3", false);test(22, "", false);test(23, " ", false);test(24, null, false);test(25, ".1", true); //Ok, if you say sotest(26, ".", false);test(27, "2e0", true); //Really?!test(28, "+.8", true); (29, " 005047e+6", true); //Damn = =|||Here is the final Regex I got based on their definitionPattern.matches("(\\+|-)?(\\d+(\\.\\d\*)?|\\.\\d+)(e(\\+|-)?\\d+)?", s);But I thought my original one should be more rigorous!Pattern.matches("-?(([1-9]{1}+\\d\*|0)(\\.\\d+)?|\\.\\d+)(e-?[1-9]{1}+\\d\*)?", s);

3. Longest Substring Without Repeating Characters

滑动窗口

If a substring s\_{ij}s

​ij

​​ from index ii to j - 1j−1 is already checked to have no duplicate characters. We only need to check if s[j]s[j] is already in the substring s\_{ij}s

​ij

​​ .

355. Design Twitter

字符串匹配

Rolling hash

187. Repeated DNA Sequences

//TODO

凡是单调的列表，就要考虑下二分搜索。

或者存在有个有限空间。

Anagram

性质

字母数相等

与位置无关

注意结果集，或者任何集比较小的情况，

可以在此做文章。

二分、以结果为key作map

676. Implement Magic Dictionary

Trie

排序

快排

链表快排

插入法

两个指针法

链表归并排序

快慢指针划分

非递归归并排序

写循环注意参照for循环，不要忘了推进

链表环检测

环入口

142. Linked List Cycle II

my solution is like this: using two pointers, one of them one step at a time. another pointer each take two steps. Suppose the first meet at step k,the length of the Cycle is r. so..2k-k=nr,k=nr

Now, the distance between the start node of list and the start node of cycle is s. the distance between the start of list and the first meeting node is k(the pointer which wake one step at a time waked k steps).the distance between the start node of cycle and the first meeting node is m, so...s=k-m,

s=nr-m=(n-1)r+(r-m),here we takes n = 1..so, using one pointer start from the start node of list, another pointer start from the first meeting node, all of them wake one step at a time, the first time they meeting each other is the start of the cycle.

高度平衡二叉树构建

Power（x，n）

数学

https://leetcode.com/problems/reach-a-number/solution/

公约数

裴蜀定理

https://leetcode.com/problems/water-and-jug-problem/discuss/83715/Math-solution-Java-solution

四则运算的原始算法

https://leetcode.com/problems/multiply-strings/description/

排列

60. Permutation Sequence

https://leetcode.com/problems/permutation-sequence/discuss/22507/%22Explain-like-I'm-five%22-Java-Solution-in-O(n)

https://leetcode.com/problems/next-greater-element-iii/description/

https://leetcode.com/problems/integer-replacement/description/

https://leetcode.com/problems/ugly-number/description/

<https://leetcode.com/problems/ugly-number-ii/description/>

<https://leetcode.com/problems/ugly-number-ii/discuss/69362/O(n)-Java-solution>

https://leetcode.com/problems/super-ugly-number/description/

https://leetcode.com/problems/rotate-function/discuss/87853/Java-O(n)-solution-with-explanation

F(k) = F(k-1) + sum - nBk[0]

旋转函数，注意前后的数之间的关系

368. Largest Divisible Subset

取模运算

https://baike.baidu.com/item/%E5%8F%96%E6%A8%A1%E8%BF%90%E7%AE%97/10739384?fr=aladdin

算法道路数论章节

<https://leetcode.com/problems/super-pow/description/>

四平方定理

<https://leetcode.com/problems/perfect-squares/description/>

平方数、奇数偶数

<https://leetcode.com/problems/bulb-switcher/description/>

<https://leetcode.com/problems/bulb-switcher-ii/solution/>

答案空间很小，无限循环

数字单词

The **even** digits all have a unique letter while the **odd** digits all don't:

zero: Only digit with z  
two: Only digit with w  
four: Only digit with u  
six: Only digit with x  
eight: Only digit with g

The odd ones for easy looking, each one's letters all also appear in other digit words:  
one, three, five, seven, nine

<https://leetcode.com/problems/count-numbers-with-unique-digits/discuss/>

<https://leetcode.com/problems/integer-break/description/>

https://leetcode.com/problems/escape-the-ghosts/discuss/116678/Why-interception-in-the-middle-is-not-a-good-idea-for-ghosts.

https://leetcode.com/problems/minimum-moves-to-equal-array-elements-ii/description/

子串

<https://leetcode.com/problems/longest-word-in-dictionary-through-deleting/description/>

回文

https://leetcode.com/problems/longest-palindromic-substring/description/

https://leetcode.com/problems/longest-palindromic-substring/solution/

https://leetcode.com/problems/shortest-palindrome/description/

https://leetcode.com/problems/palindrome-pairs/description/

<https://leetcode.com/problems/longest-palindromic-subsequence/description/>

<https://leetcode.com/problems/palindromic-substrings/description/>

测试

https://leetcode.com/problems/simplify-path/description/

* Did you consider the case where **path** = "/../"?  
  In this case, you should return "/".
* Another corner case is the path might contain multiple slashes '/' together, such as "/home//foo/".  
  In this case, you should ignore redundant slashes and return "/home/foo".

子串

https://leetcode.com/problems/longest-uncommon-subsequence-ii/description/

https://leetcode.com/problems/delete-operation-for-two-strings/solution/

<https://leetcode.com/problems/expressive-words/solution/>

https://leetcode.com/problems/reorganize-string/description/

排序

<https://leetcode.com/problems/custom-sort-string/description/>

bst

https://leetcode.com/problems/kth-smallest-element-in-a-bst/discuss/

https://leetcode.com/problems/kth-smallest-element-in-a-bst/discuss/63659/What-if-you-could-modify-the-BST-node's-structure

# End