**3.  Longest Palindromic Substring**

**1. allocate 2dimensions array to store length of palindromic strings**

**2.Consider if length of string == 2 just to compare s[i] == s[j]**

**3. if length of string % 2 == 0 consider poly[i+1][j-1] > 0 and s[i] == s[j] then it’s palindrome.**

**4. Product of Array Except Self**

**1. Use resulting array to safe product of from 1 to I:product[i] = product[i-1]\*nums[i-1]**

**product[0] = 1**

**2. Go from product[i] = product[i]\* right using right as product value from len-1 to I and right = right \* nums[i+1]**

**5.Find the Duplicate Number**

**+ Sort the items and find same adjacent items.**

**6.Intersection of Two Linked Lists**

**class ListNode {**  
 **int val;**  
 **ListNode next;**  
  
 **ListNode(int x) {**  
 **val = x;**  
 **next = null;**  
 **}**  
  
 **ListNode(int x, ListNode n) {**  
 **this(x);**  
 **this.next = n;**  
 **}**  
**}**  
  
**public class IntersectionTwoLinkedLists {**  
 **private int lenOf(ListNode head) {**  
 **int len = 0;**  
 **while (head != null) {**  
 **len += 1;**  
 **head = head.next;**  
 **}**  
 **return len;**  
 **}**  
  
 **public ListNode getIntersectionNode(ListNode headA, ListNode headB) {**  
 **//boundary check**  
 **if (headA == null || headB == null) return null;**  
  
 **ListNode a = headA;**  
 **ListNode b = headB;**  
  
 **//if a & b have different len, then we will stop the loop after second iteration**  
 **while (a != b) {**  
 **//for the end of first iteration, we just reset the pointer to the head of another linkedlist**  
 **a = a == null ? headB : a.next;**  
 **b = b == null ? headA : b.next;**  
 **}**  
 **return a;**  
 **}**  
**}**

**- make while until list1 != list2 list1 = list1.next and list2 = list2.next,**

**If list1 == null list1 = head1 and if list2 == null list2 = head2 Floyd algorithm**????? – fix it!!!

**7.Symmetric Tree**

**Create method for x and y to compare x.left and y.right and x.right and y.left. To pass (root, root) as first parameters to this method.**

**8.Binary Tree Vertical Order Traversal**

**public List<List<Integer>> verticalOrder(TreeNode root) {**

**List<List<Integer>> res = new ArrayList<>();**

**if (root == null) {**

**return res;**

**}**

**Map<Integer, ArrayList<Integer>> map = new HashMap<>();**

**Queue<TreeNode> q = new LinkedList<>();**

**Queue<Integer> cols = new LinkedList<>();**

**q.add(root);**

**cols.add(0);**

**int min = 0;**

**int max = 0;**

**while (!q.isEmpty()) {**

**TreeNode node = q.poll();**

**int col = cols.poll();**

**if (!map.containsKey(col)) {**

**map.put(col, new ArrayList<Integer>());**

**}**

**map.get(col).add(node.val);**

**if (node.left != null) {**

**q.add(node.left);**

**cols.add(col - 1);**

**min = Math.min(min, col - 1);**

**}**

**if (node.right != null) {**

**q.add(node.right);**

**cols.add(col + 1);**

**max = Math.max(max, col + 1);**

**}**

**}**

**for (int i = min; i <= max; i++) {**

**res.add(map.get(i));**

**}**

**return res;**

**Graph Valid Tree:**

**Use union-find algorithm with rank and path-compression**

**9.Alien Language**

**import collections**  
**class Solution:**  
 **def alienOrder(self, words):**  
 **pre = collections.defaultdict(set)**  
 **suc = collections.defaultdict(set)**  
  
 **for pair in zip(words, words[1:]):**  
 **for a, b in zip(\*pair):**  
 **if a != b:**  
 **suc[a].add(b)**  
 **pre[b].add(a)**  
 **break**  
 **chars = set(''.join(words))**  
 ***#get first char without predecesesor***  
**charToProcess = chars - set(pre)**  
 **order = ''**  
 **while charToProcess:**  
 **ch = charToProcess.pop()**  
 **order += ch**  
 **for b in suc[ch]:**  
 **pre[b].discard(ch)**  
 **if not pre[b]: *# if processed all predecesesors let's add curret char to charToProcess***  
**charToProcess.add(b)**  
 **return order \* (set(order) == chars)**

**Kth Largest Element in an Array**

**class Solution:**  
 **def quick\_select(self, arr, l, r, k):**  
 **if 0 < k <= r - l + 1:**  
 **pos = self.partition(arr, l, r)**  
 **if pos - 1 == k - 1:**  
 **return arr[pos]**  
 **if pos - l > k - 1:**  
 **return self.quick\_select(arr, l, pos - 1, k)**  
 **return self.quick\_select(arr, pos + 1, r, k - pos + l - 1)**  
  
 **def partition(self, arr, l, r):**  
 **i = l**  
 **x = arr[r]**  
 **for j in range(l, r):**  
 **if arr[j] > x:**  
 **arr[i],arr[j] = arr[j],arr[i]**  
 **i += 1**  
 **arr[i], arr[r] = arr[r], arr[i]**  
 **return i**  
  
 **def findKthLargest(self, nums, k):**  
 **return self.quick\_select(nums, 0, len(nums) - 1, k)**  
  
**sol = Solution()**  
**print(sol.findKthLargest([3,2,1,5,6,4], 2))**

**11. WordLadder2**

**import scala.collection.mutable.ListBuffer**  
  
**case class WordNode(word: String, numSteps: Int, pre: WordNode = null)**  
  
**object FindLaddersApp extends App {**  
 **private def log(last: WordNode): Unit = {**  
 **val sbf = new StringBuilder()**  
 **var cur = last**  
 **while(cur != null){**  
 **sbf.insert(0, s"${cur.word}(${cur.numSteps})")**  
 **cur = cur.pre**  
 **}**  
 ***println*(sbf.result())**  
 **}**  
  
 **def findLadders(beginWord: String, endWord: String, wordList: List[String]): List[List[String]] = {**  
 **var result = *List*.*empty*[List[String]]**  
 **var queue = *List*.*empty*[WordNode]**  
 **queue = *WordNode*(beginWord,1) :: queue**  
 **var minStep = 0**  
 **var visited = *Set*.empty[String]**  
 **var unvisited = *Set*.empty[String]**  
 **unvisited = unvisited ++ wordList**  
 **var preNumSteps = 0**  
 **while(queue.nonEmpty){**  
 **var top = queue.head**  
 **queue = queue.tail**  
 **val word = top.word**  
 **val currNumSteps = top.numSteps**  
 ***log*(top)**  
 ***println*(s"currNumStep = $currNumSteps")**  
 **var continue = false**  
 **if(word == endWord){**  
 **if(minStep == 0) minStep = top.numSteps**  
 **if(top.numSteps == minStep && minStep !=0) {**  
 **//nothing**  
 **val t = new ListBuffer[String]()**  
 **t += top.word**  
 **while(top.pre !=null){**  
 **t.+=:(top.pre.word)**  
 **top = top.pre**  
 **}**  
 **result = result :+ t.toList**  
 **continue = true**  
 **}**  
 **}**  
 **if(!continue){**  
 **if(preNumSteps < currNumSteps){**  
 **unvisited = unvisited -- visited**  
 **}**  
 ***println*(s"preNumSteps = $preNumSteps")**  
 **preNumSteps = currNumSteps**  
 **val arr = word.toArray**  
  
 **for(i <- 0 until arr.length) {**  
 **for(c <- 'a' to 'z'){**  
 **val temp = arr(i)**  
 **if(arr(i) != c){**  
 **arr(i) = c**  
 **}**  
  
 **val newWord = String.*valueOf*(arr)**  
 **if(unvisited.contains(newWord)) {**  
 **queue = queue :+ *WordNode*(newWord, top.numSteps + 1, top)**  
 **visited = visited + newWord**  
 **}**  
 **arr(i)=temp**  
 **}**  
 **}**  
  
 **}**  
 **}**  
 **result**  
 **}**  
 ***println*(*findLadders*("hit", "cog", *List*("hot","dot","dog","lot","log","cog")))**  
**}**

**12.Best Time Buy Sell Stock**

**def maxProfit(prices: Array[Int]): Int = {**

**if (prices.isEmpty) 0**

**else {**

**var maxprofit = 0**

**var minprice = Int.MaxValue**

**for (i <- 0 to prices.length - 1) {**

**if (minprice > prices(i)) {**

**minprice = prices(i)**

**}**

**else if ((prices(i) - minprice) > 0) {**

**maxprofit = (prices(i) - minprice) max maxprofit**

**}**

**}**

**maxprofit**

**}**

**}**

Design HitCounter

class HitCounter {

private val elapsedPeriod = 300

private val times = Array.ofDim[Int](elapsedPeriod)

private val hits = Array.ofDim[Int](elapsedPeriod)

/\*\* Record a hit.

@param timestamp - The current timestamp (in seconds granularity). \*/

def hit(timestamp: Int) {

val index = timestamp % elapsedPeriod

if(times(index) != timestamp){

times(index) = timestamp

hits(index) = 1

} else hits(index) += 1

}

/\*\* Return the number of hits in the past 5 minutes.

@param timestamp - The current timestamp (in seconds granularity). \*/

def getHits(timestamp: Int): Int = {

times.zip(hits).filter(th => timestamp - th.\_1 < elapsedPeriod).map(\_.\_2).sum

}

}

Binary Search Tree Iterator

public class BSTIterator {

private List<TreeNode> stack = new LinkedList<>();

public BSTIterator(TreeNode root) {

pushAll(root);

}

/\*\*

\* @return whether we have a next smallest number

\*/

public boolean hasNext() {

return !stack.isEmpty();

}

public int next() {

TreeNode tmpNode = stack.remove(stack.size()-1);

pushAll(tmpNode.right);

return tmpNode.val;

}

private void pushAll(TreeNode node) {

for (; node != null; stack.add(node), node = node.left);

}

}

10. Find a celebrity

public int findCelebrity(int n) {  
 int canditate = 0;  
 for(int i = 1; i< n;i++){  
 if(knows(canditate,i)){  
 canditate = i;  
 }  
 }  
 for(int i = 0; i< n;i++){  
 if((i!=canditate) &&(knows(canditate,i) || !knows(i, canditate))) return -1;  
 }  
 return canditate;  
}

Minimum Sliding Window

**public static String minWindow(String s, String t) {**  
 **if(s == null || t == null || s.length() < t.length()) return "";**  
 **int map[] = new int[128];**  
 **for(int i = 0; i< t.length(); i++){**  
 **map[t.charAt(i)] += 1;**  
 **}**  
 **int counter = t.length();**  
 **int begin = 0,end = 0;**  
 **int d = Integer.*MAX\_VALUE*;**  
 **int head = 0;**  
 **while(end < s.length()){**  
 **if(map[s.charAt(end)] > 0) counter -=1;**  
 **map[s.charAt(end)] -= 1;**  
 **end += 1;**  
 **while(counter == 0){**  
 **if(end - begin < d) {**  
 **d = end - begin;**  
 **head = begin;**  
 **}**  
 **if(map[s.charAt(begin)] == 0) counter += 1;**  
 **map[s.charAt(begin)] += 1;**  
 **begin += 1;**  
  
 **}**  
 **}**  
 **return d == Integer.*MAX\_VALUE* ? "": s.substring(head, head + d);**  
**}**

Generate Parentheses

**GenerateParentheses**

**private def generate(s: Array[Char], pos:Int,n: Int,open:Int,close:Int, res:ListBuffer[String]):Unit = {**  
 **if(close == n) {**  
 **res += s.mkString("")**  
 **}**  
 **else {**  
 **if(open > close){**  
 **s(pos) = ')'**  
 ***generate*(s, pos + 1, n, open, close + 1, res)**  
 **}**  
 **if(open < n){**  
 **s(pos) = '('**  
 ***generate*(s, pos + 1, n, open + 1, close, res)**  
 **}**  
 **}**  
**}**  
  
**def generateParenthesis(n: Int): List[String] = {**  
 **val res = new ListBuffer[String]()**  
 ***generate*(Array.*ofDim*[Char](2\* n),0, n, 0, 0,res)**  
 **res.toList**  
**}**

**99. Evaluate Division**

**1. x/y = 2 x → y is edge with weight 2.**

**2. create the graph with x/y and y/x edges.**

**3. Use DFS to find a/c path and calculate the path weight.**

**91. Decode Ways**

**1. Represent num\_Decoding(s) = num\_Decoding(s,1:k) +**

**num\_Decoding(s,k+1,n)**

**2. Use memoization to cache num\_Decoding for a substring**

**3. Take into account to consider 01 and 100… as invalid string**

**621. Task Scheduler**

**1. Sort the tasks by its frequences. Let start from bigger frequencies and run the inner loop by the cooling time taking the pending tasks from 25 — i task and increase the time by 1,**

**2. Again sort the frequences array in the descending order in each cycle iteration.**

**3. Run outer loop until the arr[25] is 0**

**560. Subarray Sum Equals K**

1. **Sum up items. Use the fact sum[0:l] = k + sum[i:j] first sum = 0 has frequency 1.**

**If map contains sum[i:j] then count it as k takes place.**

**2. if sum – k in map then add frequency to result.**

**3. Store current sum to frequency map (sum -> frequency)**

**468. Validate IP Address**

**Use regular expression to extract IP parts:**

**res = re.match(r'^([0-9]{1,3})\.([0-9]{1,3})\.([0-9]{1,3})\.([0-9]{1,3})$', ip)**

**res = re.search('^([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4}):([0-9abcdefABCDEF]{1,4})$', ip)**

**Check that there is no leading zeros in IP4: 001 and Ip address has to start from a > 0.**

**289. Game of Life**

**1. Allocate a buffer for calculating with 2 rows in size.**

**2. Put i-th row in a buffer. If a buffer reached size of 2 rows it would copy 0-row back to original array and append new row from array.**

**46. Permutations**

**1.create the function backtrack(first):**

**- check if first = len of arr then it returns count**

**- iterate from first to end:**

**a) swap i and first and call backtrack recursively**

**b) swap i and first back**

**151. Reverse Words in a String**

**1. copy a string in inverse order.**

**2. iterate through the string and push the char to a stack**

**3. if it meets space then to pop the chars to result list — if the result list is not empty, it appends space before chars.**

**4. join the result**

**127. Word Ladder**

**1. Use BFS for search endWord from beginWord**

**2. Store visited words to a dict to prevent repeated using of it.**

**3. Store in a queue a tuple (word,length)**

**4. When adding new neighbours to a queue it add theirs to visited dict and check if added word is endWord.**

380. [Insert Delete GetRandom O(1)](https://leetcode.com/problems/insert-delete-getrandom-o1)

**1. Declare an array for values and a map for value and its position in the array.**

**2. While inserting new value it has to check if new value already exists. If not exist it will add this value to the end of this array**

**3.While removing a value it swaps last item with the value and remove last item in the array and the value in the map.**

**79. Word Search**

1. Use backtracking to check if a word in list.

2. if backtrack function it checks if word in position equals a character in the matrix. If so it calls this with i+1,i-1,j-1, j+1 characters in matrix by adding the used characters in seen before each recursive call and then it removes it later.

3. In main function it iterates through all characters and call the backtracking for each character.

FriendCircles

1. Use FindUnion with path compression and rank.
2. If m[i][j] == 1 or m[p1]m[p2] == 1 let’s union friends
3. Filter out the unique parent values. There are circle size

Word Frequencies

cat words.txt | tr -s ' ' '\n' | awk '{nums[$1]++}END{for(word in nums) print word, nums[word]}' | sort -rn -k2

**923. 3Sum With Multiplicity**

**1. Use 2 pointer technic**

**2. Sort array, take i-th item, and look for target – a[i] from i + 1 to len(arr)-1.**

**3. if a[j] + a[k] == target – a[i] it has 2 cases:**

**3.1 if a[j] == a[k] num = (k – j + 1)\*(k-j) / 2**

**3.2 in another case left is count of a[j] and right is count of a[k]:**

**while j + 1 < k and arr[j] == arr[j + 1]:**  
 **left += 1**  
 **j += 1**  
**right = 1**  
**while k - 1 > j and arr[k] == arr[k - 1]:**  
 **right += 1**  
 **k -= 1**  
**num += left \* right**

* 1. **num += left \* right**

**394. Decode String**

**1. recursive decent**

**class Decoded:**  
 **def \_\_init\_\_(self):**  
 **self.pos = 0**  
 **self.res = ''**  
  
  
**class Solution:**  
 **def is\_digit(self, ch):**  
 **return '0' <= ch <= '9'**  
  
 **def is\_char(self, ch):**  
 **return 'a' <= ch <= 'z' or 'A' <= ch <= 'Z'**  
  
 **def str(self, s, decoded):**  
 **if decoded.pos == len(s):**  
 **return ""**  
 **if self.is\_char(s[decoded.pos]):**  
 **j = decoded.pos**  
 **while decoded.pos < len(s) and self.is\_char(s[decoded.pos]):**  
 **decoded.pos += 1**  
 **decoded.res += s[j: decoded.pos]**  
  
 **def rep\_or\_str(self, s, decoded):**  
 **if decoded.pos == len(s):**  
 **return ""**  
 **if self.is\_char(s[decoded.pos]):**  
 **self.str(s, decoded)**  
 **return**  
 **j = decoded.pos**  
 **while decoded.pos < len(s) and self.is\_digit(s[decoded.pos]):**  
 **decoded.pos += 1**  
 **k = int(s[j: decoded.pos])**  
 **decoded.pos += 1**  
 **prev = decoded.pos**  
 **for i in range(k):**  
 **decoded.pos = prev**  
 **while s[decoded.pos] != ']':**  
 **self.str(s, decoded)**  
 **if self.is\_digit(s[decoded.pos]):**  
 **self.rep\_or\_str(s, decoded)**  
 **elif self.is\_char(s[decoded.pos]):**  
 **self.str(s, decoded)**  
 **decoded.pos += 1**  
  
 **def decodeString(self, s: str) -> str:**  
 **if not str:**  
 **return ""**  
 **decoded = Decoded()**  
 **while decoded.pos < len(s):**  
 **self.rep\_or\_str(s, decoded)**  
 **return decoded.res**

**528. Random Pick with Weight**

**1. Consider array of weight sums: w[0], w[0] + w[1],…**

**2. Take random value from the interval [0, total)**

**3. Search least sum > random value using binary search:**

**While lo != hi:**

**If a >= array[mid] lo = mid + 1**

**Else hi = mid – 1**

**Return lo**

**755. Pour Water**

**1. Go to the left to look up the leftmost min:**

**While height[i+d] <= height[i]**

**2. Do the same for the right side.**

**3. in another case to increment height[k]:**

**class Solution:**  
 **def find\_min(self, heights, v, d):**  
 **i = v**  
 **res = -1**  
 ***#look up leftmost/rightmost min***  
**while 0 <= (i + d) < len(heights) and heights[i + d] <= heights[i]:**  
 **if heights[i + d] < heights[i]:**  
 **res = i + d**  
 **i += d**  
 **if res != -1:**  
 **return res**  
 **return -1**  
  
 **def pourWater(self, heights, V: int, K: int):**  
 **if not heights or V == 0:**  
 **return heights**  
 **for v in range(V):**  
 **left = self.find\_min(heights, K, -1)**  
 **if left >= 0:**  
 **heights[left] += 1**  
 **else:**  
 **right = self.find\_min(heights, K, 1)**  
 **if right >= 0:**  
 **heights[right] += 1**  
 **else:**  
 **heights[K] += 1**  
  
 **return heights**

**973. K Closest Points to Origin**

**1. Use quick\_select to find k-th closest point to origin**

**2. partition uses forward and backward iterations**

**3. quick\_select uses mid - r + 1 and check if k < or > mid – l + 1 then choose the part having K. For right part it changes K = K – (mid –l +1) = K –mid + l -1**

**103. Binary Tree Zigzag Level Order Traversal**

**1. Use recursive helper function to traverse tree in order.**

**2. Use map as function parameter and level -> list**

**3. Function calling itself for left child and right child passes map and level + 1.**

**4. If level is even it appends node.val to list looking up in map by level. In other case it inserts node.val at the begging of list.**

**332. Reconstruct Itinerary**

**1. Put a ticket departure as key and list of indexes of tickets to map. Sort a list in lexical order.**

**2. Use dfs to walk around all tickets to find unique path from all tickets so dfs takes one of parameters used\_tickets and other parameters are dep, seen and path.**

**3. Call dfs until use all of tickets for a path**

**4. Reuse path in the same recursive level by reseting the path after calling of dfs.**

**347. Top K Frequent Elements**

**1. Make map element to its frequency**

**2. Create min heap of size k and if it reaches size k then it remove min element if it has less frequency than adding one has.**

**Search in rotated Sorted array**

1. **Use binary search**
2. **If leftmost <= middle and target is out of left half – it returns right half**
3. **If middle <= rightmost and target is out of the right half – it returns left half**
4. **If leftmost <= middle – it returns left half**
5. **If middle <= rightmost – it returns right half**

**947. Most Stones Removed with Same Row or Column**

**1. Use disjoin set union to store each x and y coordinate separately –**

**Let’s y will be in 10000+ y. if maximum coordinate is 10000**

**2. stones may hold in one component**

**3. So union x,y coordinates of stones**

**4. max moves = number of stones – number of components. In each component is left one stone so number of components are number of left stones.**

**341. Flatten Nested List Iterator**

**class NestedIterator:**  
 **def \_\_init\_\_(self, lst):**  
 **self.q = []**  
 **self.flatten(lst)**  
  
 **def flatten(self, lst):**  
 **for ni in lst:**  
 **if ni.isInteger():**  
 **self.q.append(ni.getInteger())**  
 **else:**  
 **self.flatten(ni.getList())**  
  
 **def next(self):**  
 **a = self.q[0]**  
 **self.q.pop(0)**  
 **return a**  
  
 **def hasNext(self):**  
 **return len(self.q)**

**692. Top K Frequent Words**

**1. Count word frequency in map**

**2. Use priority queue to get frequency minimum or lower lexicographical word if frequencies are equal**

**3.Add word to list and reverse list**

**Course Schedule**

1. **Create graph as adjacent list, list visit is with 3 states: 0 is if vertex is not seem,1 is if way is seen, -1 is if vertex in cycle. We can mark the course we seen as visited and use it in the next time.**
2. **Before each traversation we mark vertex as cycle part then as seen.**
3. **Use dfs to traverse graph**
4. **def canFinish(self, numCourses: int, prerequisites):**  
    **if not numCourses:**  
    **return False**  
    **graph = [[] for \_ in range(numCourses)]**  
    **visit = [0 for i in range(numCourses)]**  
    **for i in range(len(prerequisites)):**  
    **graph[prerequisites[i][0]].append(prerequisites[i][1])**  
     
    **def dfs(v, graph, visit):**  
    **if visit[v] == 1:**  
    **return True**  
    **if visit[v] == -1:**  
    **return False**  
    **visit[v] = -1**  
    **for u in graph[v]:**  
    **if not dfs(u, graph, visit):**  
    **return False**  
    **visit[v] = 1**  
    **return True**  
     
    **for v in range(len(graph)):**  
    **if not dfs(v, graph, visit):**  
    **return False**  
    **return True**

**895. Maximum Frequency Stack**

**1. Create map value to frequency, map frequency to stack**

**2. If we push value we will add value to map : a -> (frequency + 1). If frequency > maxFrequency, we will update maxFrequency and put maxFrequency -> stack, push value to stack**

**3. When we pop value, we pop value from stack in second map, and decsrease value frequency in first map.**

1. **ZigZag Conversion**

**def convert(self, s, numRows):**  
 **if not s or not numRows:**  
 **return s**  
 **r = 0**  
 **i = 0**  
 **m = defaultdict(list)**  
 **while i < len(s):**  
 **while r < numRows and i < len(s):**  
 **m[r].append(s[i])**  
 **i += 1**  
 **r += 1**  
 **r -= 2**  
 **while r > 0 and i < len(s):**  
 **m[r].append(s[i])**  
 **i += 1**  
 **r -= 1**  
 **r = 0**  
 **res = ''**  
 **for i in range(numRows):**  
 **for j in range(len(m[i])):**  
 **res += m[i][j]**  
 **return res**

**BasicCalculator||**

**class Solution:**

**def prec(self, op):**

**if op == '+' or op == '-':**

**return 0**

**return 1**

**def eval(self, stack, ops):**

**while len(stack) > 0:**

**zn = stack.pop()**

**a = ops.pop()**

**b = ops.pop()**

**if zn == '+':**

**ops.append(a + b)**

**elif zn == '-':**

**ops.append(b - a)**

**elif zn == '\*':**

**ops.append(a \* b)**

**else:**

**ops.append(b // a)**

**return ops.pop()**

**def postfix(self, s):**

**j = 0**

**stack = []**

**buf = []**

**while j < len(s):**

**if '0' <= s[j] <= '9':**

**i = j**

**while i < len(s) and '0' <= s[i] <= '9':**

**i+= 1**

**buf.append(s[j:i])**

**j = i**

**else:**

**if s[j] in ['+','-','\*','/']:**

**while len(stack) > 0 and self.prec(s[j]) <= self.prec(stack[len(stack) - 1]):**

**buf.append(stack.pop())**

**stack.append(s[j])**

**j += 1**

**while len(stack) > 0:**

**buf.append(stack.pop())**

**return buf**

**def calculate(self, s):**

**if not s:**

**return None**

**stack = []**

**postfix = self.postfix(s)**

**i = 0**

**while i < len(postfix):**

**x = postfix[i]**

**if x.isdecimal():**

**stack.append(int(x))**

**else:**

**a = stack.pop()**

**b = stack.pop()**

**if x == '+':**

**stack.append(a + b)**

**elif x == '-':**

**stack.append(b - a)**

**elif x == '\*':**

**stack.append(a \* b)**

**else:**

**stack.append(b // a)**

**i += 1**

**return stack.pop()**

**974. Subarray Sums Divisible by K**

**Let there be a subarray (i, j) whose sum is divisible by k**

**sum(i, j) = sum(0, j) - sum(0, i-1)**

**Sum for any subarray can be written as q\*k + rem where q**

**is a quotient and rem is remainder**

**Thus,**

**sum(i, j) = (q1 \* k + rem1) - (q2 \* k + rem2)**

**sum(i, j) = (q1 - q2)k + rem1-rem2**

**We see, for sum(i, j) i.e. for sum of any subarray to be**

**divisible by k, the RHS should also be divisible by k.**

**(q1 - q2)k is obviously divisible by k, for (rem1-rem2) to**

**follow the same, rem1 = rem2 where**

**rem1 = Sum of subarray (0, j) % k**

**rem2 = Sum of subarray (0, i-1) % k**

1. **v \* (v - 1) // 2 - (n choose 2) ways to combine 2 subarrays.**
2. **class Solution:**  
    **def subarraysDivByK(self, arr, k):**  
    **if not arr or len(arr) == 0 or k == 0:**  
    **return 0**  
    **p = [0]**  
    **for x in arr:**  
    **p.append((p[-1] + x) % k)**  
     
    **freq = Counter(p)**  
    **return int(sum(v \* (v - 1) // 2 for v in freq.values()))**

**12. Integer to Roman**

1. **Add all roman number to map decimal to roman numbers**
2. **Find greatest minimum number and subtract it from current decimal number by appending roman to result.**
3. **class Solution:**  
    **def find\_greater\_min(self, num):**  
    **if 1 <= num < 4:**  
    **return 1**  
    **if 4 <= num < 5:**  
    **return 4**  
    **if 5 <= num < 9:**  
    **return 5**  
    **if 9 <= num < 10:**  
    **return 9**  
    **if 10 <= num < 40:**  
    **return 10**  
    **if 40 <= num < 50:**  
    **return 40**  
    **if 50 <= num < 90:**  
    **return 50**  
    **if 90 <= num < 100:**  
    **return 90**  
    **if 100 <= num < 400:**  
    **return 100**  
    **if 400 <= num < 500:**  
    **return 400**  
    **if 500 <= num < 900:**  
    **return 500**  
    **if 900 <= num < 1000:**  
    **return 900**  
    **return 1000**  
     
    **def intToRoman(self, num):**  
    **if num <= 0:**  
    **return ''**  
    **roman = {}**  
    **roman[1] = 'I'**  
    **roman[4] = 'IV'**  
    **roman[5] = 'V'**  
    **roman[9] = 'IX'**  
    **roman[10] = 'X'**  
    **roman[40] = 'XL'**  
    **roman[50] = 'L'**  
    **roman[90] = 'XC'**  
    **roman[100] = 'C'**  
    **roman[500] = 'D'**  
    **roman[400] = 'CD'**  
    **roman[900] = 'CM'**  
    **roman[1000] = 'M'**  
    **res = ''**  
    **while num > 0:**  
    **d = self.find\_greater\_min(num)**  
    **res += roman[d]**  
    **num -= d**  
    **return res**

#### Find first and last position of element in sorted array

#### Use binary search :

1. **def find\_least(self, nums, target):**  
    **s = 0**  
    **e = len(nums) - 1**  
    **res = -1**  
    **while s <= e:**  
    **mid = s + (e - s) // 2**  
    **if nums[mid] < target:**  
    **s = mid + 1**  
    **else:**  
    **if nums[mid] == target:**  
    **res = mid**  
    **e = mid - 1**  
    **return res**  
     
   **def find\_greatest(self, nums, target):**  
    **s = 0**  
    **e = len(nums) - 1**  
    **res = -1**  
    **while s <= e:**  
    **mid = s + (e - s) // 2**  
    **if nums[mid] > target:**  
    **e = mid - 1**  
    **else:**  
    **if nums[mid] == target:**  
    **res = mid**  
    **s = mid + 1**  
    **return res**  
     
   **def searchRange(self, nums, target):**  
    **if not nums:**  
    **return [-1, -1]**  
    **return [self.find\_least(nums, target), self.find\_greatest(nums, target)]**

**986. Interval List Intersections**

1.Use merge two sorted lists.

2. If lefts of interval are equal then merge each of them with other list and increment indices by 1

3. If one of interval is less just merge it with other interval list and increment its index by 1

**Validate Binary Search Tree**

1. Traverse tree in-order: left subtree, root, right subtree and add remember last node value and check if invariant is keeping: last value is less than current node value.Also update last variable before running traverse for right subtree.

**Add Two Numbers**

1. Sum digest from left to right. If sum is greater 10 to set up the variable carry to 1.

**535. Encode and Decode TinyURL**

class Codec:

def \_\_init\_\_(self):

self.key = [0] \* 6

self.encodedToUrl = {}

def next(self):

arr = [0] \* len(self.key)

for i in range(len(self.key)):

arr[i] = self.key[i] + 65

for i in range(len(self.key)):

if arr[i] < 63:

arr[i] += 1

return ''.join(map(chr, arr))

def encode(self, longUrl):

*"""Encodes a URL to a shortened URL.*

***:type*** *longUrl: str*

***:rtype****: str*

*"""*

if not longUrl:

return ''

key = self.next()

self.encodedToUrl[key] = longUrl

return 'http://tinyurl.com/{}'.format(key)

def decode(self, shortUrl):

*"""Decodes a shortened URL to its original URL.*

***:type*** *shortUrl: str*

***:rtype****: str*

*"""*

if not shortUrl:

return None

parts = shortUrl.split('/')

encoded = parts[len(parts) - 1]

if encoded in self.encodedToUrl:

return self.encodedToUrl[encoded]

return None

codec = Codec()

print(codec.encode('https://leetcode.com/problems/design-tinyurl'))

print(codec.decode(codec.encode('https://leetcode.com/problems/design-tinyurl')))

**Convert Binary Search Tree to Sorted Doubly Linked List**

1. Use in-order to convert tree to double-linked list.

2. Declare first and last, when it traverse left subtree let's assign to last current node.

If last == None let’s assign first to current node. If we have last we update last.right = node and node.left to last

class Solution(object):

def treeToDoublyList(self, root):

def traverse(node):

nonlocal first, last

if node:

traverse(node.left)

if last:

node.left = last

last.right = node.left

else:

first = node

last = node

traverse(node.right)

first, last = None, None

traverse(root)

last.right = first

first.left = last

return first

**177. Nth Highest Salary**

**CREATE FUNCTION getNthHighestSalary(N INT) RETURNS INT**

**BEGIN**

**DECLARE X INT;**

**SET X = (SELECT MAX(salary) FROM employee);**

**WHILE N > 1 DO**

**SET X = (SELECT MAX(salary) FROM employee WHERE salary < X);**

**SET N = N - 1;**

**END WHILE;**

**RETURN (X);**

**END**

CloneGraph

1. Use DFS to clone graph
2. If we meet node again then take it from map

class Solution:

def cloneGraph(self, node):

if not node:

return node

def clone(node, nodes):

if not node:

return None

if node.val in nodes:

return nodes[node.val]

cloned = Node(node.val, [])

nodes[cloned.val] = cloned

for x in node.neighbors:

new\_x = clone(x, nodes)

cloned.neighbors.append(new\_x)

return cloned

return clone(node, {})

**Minesweeper**

class Solution:

def mines(self, board, row, col):

mines = 0

if row - 1 >= 0 and board[row - 1][col] in 'MX':

mines += 1

if row + 1 < len(board) and board[row + 1][col] in 'MX':

mines += 1

if col - 1 >= 0 and board[row][col - 1] in 'MX':

mines += 1

if col + 1 < len(board[0]) and board[row][col + 1] in 'MX':

mines += 1

if row - 1 >= 0 and col - 1 >= 0 and board[row - 1][col - 1] in 'MX':

mines += 1

if row - 1 >= 0 and col + 1 < len(board[0]) and board[row - 1][col + 1] in 'MX':

mines += 1

if row + 1 < len(board) and col - 1 >= 0 and board[row+1][col-1] in 'MX':

mines += 1

if row + 1 < len(board) and col + 1 < len(board[0]) and board[row + 1][col + 1] in 'MX':

mines += 1

return mines

def updateBoard(self, board, click):

if not board or not click:

return

def reveal(board, row, col):

if board[row][col] == 'M':

board[row][col] = 'X'

if board[row][col] == 'E':

mines = self.mines(board, row, col)

if mines > 0:

board[row][col] = chr(ord('0') + mines)

else:

board[row][col] = 'B'

if mines > 0:

return

if row - 1 >= 0:

reveal(board, row - 1, col)

if row + 1 < len(board):

reveal(board, row + 1, col)

if col - 1 >= 0:

reveal(board, row, col - 1)

if col + 1 < len(board[0]):

reveal(board, row, col + 1)

if row - 1 >= 0 and col - 1 >= 0:

reveal(board, row - 1, col - 1)

if row - 1 >= 0 and col + 1 < len(board[0]):

reveal(board, row - 1, col + 1)

if row + 1 < len(board) and col - 1 >= 0:

reveal(board, row + 1, col - 1)

if row + 1 < len(board) and col + 1 < len(board[0]):

reveal(board, row + 1, col + 1)

reveal(board, click[0], click[1])

return board

**Restore IP Addresses**

Use backtracking.

Time complexity is O(27). 3 dots give 27 permutations.

Memory complexity is O(19).

class Solution:

def restoreIpAddresses(self, s):

if not s:

return s

def generate\_ip(part, i, ip, res):

if part == 4:

ip\_len = len(ip[0]) + len(ip[1]) + len(ip[2]) + len(ip[3])

if ip\_len >= len(s):

ip\_str = '.'.join(ip)

if len(res) > 0:

if res[-1] != ip\_str:

res.append(ip\_str)

else:

res.append(ip\_str)

return

for j in range(1, 4):

if (i + j) > len(s):

break

a = int(s[i: i + j])

if a <= 255:

ip[part] = repr(a)

generate\_ip(part + 1, i + j, ip, res)

res = []

ip = [0] \* 4

generate\_ip(0, 0, ip, res)

return res

Maximal Square

1. Use DP
2. dp[i][j] is length of square matrix with lower right corner

class Solution:

def maximalSquare(self, matrix):

if not matrix:

return 0

dp = [0] \* (len(matrix) + 1)

for i in range(len(dp)):

dp[i] = [0] \* (len(matrix[0]) + 1)

max\_len = 0

for i in range(1, len(dp)):

for j in range(1, len(dp[0])):

if matrix[i - 1][j - 1] == '1':

dp[i][j] = min(dp[i-1][j], dp[i][j-1], dp[i-1][j-1]) + 1

max\_len = max(max\_len, dp[i][j])

return max\_len \* max\_len

Longest Increasing Subsequence

1. Use DP. Try to add nums[i+1] to each subsequence [0, k] where k = [1, i]:

[0,1], [0,2],[0, k]

2. Allocate the array dp to store maximum subsequence length.

def lengthOfLIS(self, nums):

if not nums:

return 0

lis = [1] \* len(nums)

for i in range(1, len(nums)):

for j in range(0, i):

if nums[i] > nums[j] and lis[i] < lis[j] + 1:

lis[i] = lis[j] + 1

return max(lis)

**Increasing Triplet Subsequence**

1. **Find first and second in triplet.**

class Solution:

def increasingTriplet(self, nums):

if not nums or len(nums) < 3:

return False

small = sys.maxsize

large = sys.maxsize

for i in range(len(nums)):

if nums[i] <= small:

small = nums[i]

elif nums[i] <= large:

large = nums[i]

else:

return True

return False

**Maximum Length of Pair Chain**

1.Sort pairs by first item

2. Use algorithm as for LIS.

**Knight Dialer**

**1.Use DP to solve it.**

**2. Make map where key is digit and value at which digit I can go.**

**3. Allocate array 10 x N where N is step number.**

4. Num[i][j] = Num[i-1][k1] + Num[i-1][k2] + … where Nym

Design Log Storage System

1. Store log entry in tree map by converting timestamp to seconds
2. Set up all fields to 0 if them are not considered.
3. Increment granularity field for end value.
4. Use tailMap to get timestamp is greater or equal to start.

import java.util.\*;

public class LogSystem {

ArrayList < long[] > list;

public LogSystem() {

list = new ArrayList < long[] > ();

}

public void put(int id, String timestamp) {

int[] st = Arrays.*stream*(timestamp.split(":")).mapToInt(Integer::*parseInt*).toArray();

list.add(new long[] {convert(st), id});

}

public long convert(int[] st) {

st[1] = st[1] - (st[1] == 0 ? 0 : 1);

st[2] = st[2] - (st[2] == 0 ? 0 : 1);

return (st[0] - 1999L) \* (31 \* 12) \* 24 \* 60 \* 60 + st[1] \* 31 \* 24 \* 60 \* 60 + st[2] \* 24 \* 60 \* 60 + st[3] \* 60 \* 60 + st[4] \* 60 + st[5];

}

public List < Integer > retrieve(String s, String e, String gra) {

ArrayList < Integer > res = new ArrayList();

long start = granularity(s, gra, false);

long end = granularity(e, gra, true);

for (int i = 0; i < list.size(); i++) {

if (list.get(i)[0] >= start && list.get(i)[0] < end)

res.add((int) list.get(i)[1]);

}

return res;

}

public long granularity(String s, String gra, boolean end) {

HashMap < String, Integer > h = new HashMap();

h.put("Year", 0);

h.put("Month", 1);

h.put("Day", 2);

h.put("Hour", 3);

h.put("Minute", 4);

h.put("Second", 5);

String[] res = new String[] {"1999", "00", "00", "00", "00", "00"};

String[] st = s.split(":");

for (int i = 0; i <= h.get(gra); i++) {

res[i] = st[i];

}

int[] t = Arrays.*stream*(res).mapToInt(Integer::*parseInt*).toArray();

if (end)

t[h.get(gra)]++;

return convert(t);

}

}

**Count Complete Tree Nodes**

1. **Solve it with recursion: go to right subtree and go to the left subtree:**

**Def countNodes(tree):**

**Return 1 + countNodes(tree.right) + countNodes(tree.left) if root else 0**

**Find Minimum in Rotated Sorted Array**

1. **If first element is less than mid then it takes right part in other case it takes left part.**
2. **If elm[mid] > elm[mid+1] return mid+1. If elm[mid-1] > elm[mid] return mid**

class Solution:

def findMin(self, nums):

if not nums:

return

if len(nums) == 1:

return nums[0]

if nums[0] < nums[len(nums) - 1]:

return nums[0]

def find\_inflection\_index(s, e):

if s > e:

return s

mid = s + (e - s) // 2

if mid + 1 < len(nums) and nums[mid + 1] < nums[mid]:

return mid + 1

if nums[mid - 1] > nums[mid]:

return mid

if nums[0] < nums[mid]:

s = mid + 1

else:

e = mid - 1

return find\_inflection\_index(s, e)

ind = find\_inflection\_index(0, len(nums) - 1)

return nums[ind]

RotateList

1.Add items to stack

2.Pop from stack and insert in existent list. If length is odd to pop length/2+1 items and in other case to pop lenght/2 ones.

3.When popping new node then set up next to None.

class Solution:

def reorderList(self, head):

if not head or not head.next:

return

p = head

q = []

while p:

q.append(p)

p = p.next

p = head

count = len(q) // 2

if len(q) % 2 == 1:

count += 1

while count > 0:

last = q.pop()

last.next = None

t = p.next

p.next = last

last.next = t

p = t

count -= 1

if p:

p.next = None

**Binary Tree Right Side View**

1. **Traverse right subtree, then a left subtree.**
2. **Store depth as key and value in map if it doesn’t have such key yet.**

class Solution:

def rightSideView(self, root):

if not root:

return []

max\_depth = 0

def traverse(node, level, m):

nonlocal max\_depth

if not node:

return

max\_depth = max(max\_depth, level)

traverse(node.right, level + 1, m)

traverse(node.left, level + 1, m)

if level not in m:

m[level] = node.val

m = {}

traverse(root, 0, m)

return [m[depth] for depth in range(max\_depth+1)]

Custom Sort String:

1.All chars in S should be in T in the same order

2.

from collections import Counter

class Solution:

def customSortString(self, S, T):

if not S or not T:

return

chars = Counter(T)

res = []

for ch in S:

res.append(ch \* chars[ch])

chars[ch] = 0

for ch,count in chars.items():

res.append(ch \* count)

return ''.join(res)

**Partition Labels**

1. **Calculate rightmost char position in a string.**
2. **Let’s set start, end are current string**
3. **If last[char] < end then this char is inside current string, in other case**

**If last[char] == I then the current string is finished, let’s start new string and append size to result array.**

class Solution:

def partitionLabels(self, S):

if not S:

return []

last = {c: i for i,c in enumerate(S)}

j,start = 0,0

res = []

for i in range(len(S)):

j = max(j, last[S[i]])

if i == j:

res.append(i - start + 1)

start = i + 1

return res

Partition List

1. Use 2 lists one is for < x and another is >= x

class Solution:

def partition(self, head, x):

if not head:

return

min\_p = None

e1 = None

max\_p = None

e2 = None

cur = head

while cur:

if cur.val < x:

if not min\_p:

min\_p = cur

e1 = min\_p

cur = cur.next

e1.next = None

else:

e1.next = cur

e1 = e1.next

cur = cur.next

e1.next = None

else:

if not max\_p:

max\_p = cur

e2 = max\_p

cur = cur.next

e2.next = None

else:

e2.next = cur

e2 = e2.next

cur = cur.next

e2.next = None

if min\_p and max\_p:

e1.next = max\_p

return min\_p

if min\_p:

return min\_p

return max\_p

Car Pooling

1. Iterate with step 1 and and check which trips starts and which one finishes to add or subtract people.
2. Check if we don’t exceed capacity

class Solution:

def carPooling(self, trips, capacity):

if not trips or capacity == 0:

return False

start = {}

end = {}

max\_end = 0

for people,s,e in trips:

if s not in start:

start[s] = []

start[s].append(people)

if e not in end:

end[e] = []

end[e].append(people)

max\_end = max(e, max\_end)

occupied = 0

for i in range(max\_end + 1):

if i in end:

for num in end[i]:

occupied -= num

if i in start:

for num in start[i]:

occupied += num

if occupied > capacity:

return False

return True

**Squares of a Sorted Array**

1. **Find last negative element**
2. **Use merge to compare squares of negative or positive numbers**

**class Solution:**

**def sortedSquares(self, arr):**

**if not arr:**

**return []**

**j = 0**

**while j < len(arr) and arr[j] < 0:**

**j += 1**

**i = j - 1**

**res = []**

**while i >= 0 and j < len(arr):**

**a = arr[i] \*\* 2**

**b = arr[j] \*\* 2**

**if a < b:**

**res.append(a)**

**i -= 1**

**else:**

**res.append(b)**

**j += 1**

**while i >= 0:**

**res.append(arr[i] \*\* 2)**

**i -= 1**

**while j < len(arr):**

**res.append(arr[j] \*\* 2)**

**j += 1**

**return res**

**4Sum:**

**1.Use one by one 3Sum, 2Sum.**

2. 2Sum: sort an array, use 2 pointers and go from start and from tail until they meet.

**3.**

class Solution:

def twoSum(self, nums, target, start, end):

res = []

i = start

j = end

while i < j:

sum\_of\_two = nums[i] + nums[j]

if sum\_of\_two > target:

j -= 1

elif sum\_of\_two < target:

i += 1

else:

res.append([nums[i], nums[j]])

i += 1

j -= 1

while i < j and nums[i] == nums[i - 1]:

i += 1

while i < j and nums[j] == nums[j + 1]:

j -= 1

return res

def threeSum(self, nums, target, start, end):

res = []

for j in range(start, end - 1):

rest = target - nums[j]

candidates = self.twoSum(nums, rest, j + 1, len(nums) - 1)

if len(candidates) > 0:

# [[a,b],[c,d]]

# flatten it

for a,b in candidates:

res.append([nums[j], a, b])

return res

def hash(self, list\_of\_nums):

h = 11 \* list\_of\_nums[0]

for i in range(1, len(list\_of\_nums)):

h += list\_of\_nums[i]

return h

def has\_dup(self, nums, list\_of\_nums):

for num in nums:

if num == list\_of\_nums:

return True

return False

def fourSum(self, nums, target):

nums.sort()

res = {}

neg\_res = set()

for i in range(len(nums) - 3):

rest = target - nums[i]

if rest in neg\_res:

continue

candidates = self.threeSum(nums, rest, i + 1, len(nums) - 1)

if len(candidates) > 0:

#[[a,b,c],[e,f,g]]

for a,b,c in candidates:

hash = self.hash([a, b, c])

if hash in res:

if self.has\_dup(res[hash], [nums[i], a,b,c]):

continue

if hash not in res:

res[hash] = []

res[hash].append([nums[i], a,b,c])

else:

neg\_res.add(rest)

return list([item for k,items in res.items() for item in items])

Find All Duplicates in Array

1. Go though array and mark value as negative
2. If we meet negative value it means we find duplicate and we can add it to result array

class Solution:

def findDuplicates(self, nums):

if not nums:

return []

res = []

for z in nums:

i = abs(z) - 1

if nums[i] < 0:

res.append(i + 1)

else:

nums[i] = -nums[i]

return res

Max chunks to make sorted

1. Look for item in own position with and is greater then last maximum

class Solution:

def maxChunksToSorted(self, arr):

if not arr:

return 0

ans = 0

max\_val = 0

for i in range(len(arr)):

max\_val = max(max\_val, arr[i])

if max\_val == i:

ans += 1

return ans

Spiral Matrix II

1.Calculate min and max row and column.

class Solution:

def generateMatrix(self, n):

if n == 0:

return [[]]

if n == 1:

return [[n]]

new\_size = n \*\* 2

mat = [0] \* n

for i in range(len(mat)):

mat[i] = [0] \* n

num = 1

# to the left

r1 = 0

c1 = 0

while num <= new\_size:

r2 = r1 + n - 1

c2 = c1 + n - 1

if num == new\_size:

mat[r1][c1] = num

num += 1

break

#to the left

for j in range(c1, c2 + 1):

mat[r1][j] = num

num += 1

#to the bottom

for i in range(r1 + 1, r2 + 1):

mat[i][c2] = num

num += 1

#to the left

a = num + n - 2

for j in range(c1, c2):

mat[r2][j] = a

a -= 1

num = mat[r2][c1] + 1

#to the top

for i in range(r2 - 1, r1, -1):

mat[i][c1] = num

num += 1

r1 += 1

c1 += 1

n -= 2

return mat

**Construct Binary Tree from Preorder and Inorder Traversal**

**1.Use preorder as new root of building tree**

**2. Create 2 pointers there are start and end that represent an interval where is located current root from preorder.**

**3. On each recursive call find index in order for node from preorder and split the inorder into start:index for left subtree and index+1:end is for right subtree.**

class Solution:

def buildTree(self, preorder, inorder):

if not preorder or not inorder:

return None

in\_idx = {x: i for i, x in enumerate(inorder)}

def build(in\_idx, in\_s, in\_e):

nonlocal pre\_idx

if in\_s == in\_e:

return None

x = preorder[pre\_idx]

root = TreeNode(x)

index = in\_idx[x]

pre\_idx += 1

root.left = build(in\_idx, in\_s, index)

root.right = build(in\_idx, index + 1, in\_e)

return root

pre\_idx = 0

root = build(in\_idx, 0, len(inorder))

return root

Maximum Product Subarray

1. Allocate dp\_max and dp\_min arrays.
2. Set up dp\_max[0] = arr[0] and dp\_min[0] = arr[0]
3. Go through the rest items let’s calculate dp\_max[i] = max(dp\_mmdp\_max[i-1]\* arr[i],dp\_min[i]=dp\_min[i-1]\*arr[i] and arr[i] and dp\_min[i]=min(dp\_min[i-1]\*arr[i],dp\_max[i-1]\*arr[i] and arr[i])
4. max\_prod = max(max\_prod, dp\_max[i])

Maximum subarray

1.Go through array.Sum up items, if sum is less 0 then set up sum to 0

2. Memorize maximum contigues sum

class Solution:

def maxSubArray(self, nums):

if not nums:

return []

max\_so\_far = 0

max\_sum = float('-inf')

i = 0

while i < len(nums):

max\_so\_far += nums[i]

max\_sum = max(max\_sum, max\_so\_far)

if max\_so\_far < 0:

max\_so\_far = 0

i += 1

return max\_sum

House Rober

1.Allocate array by length + 1. We save loot for i-th home

2. loot[i] = max(loot[i-1], loot[i-2] \* money[i-1]) We select to rob home or don’t

3. Answer is at last item.

def rob(nums: Array[Int]): Int = {

if(nums.isEmpty) 0

else if(nums.length == 1) nums(0)

else if (nums.length == 2) nums.max

else {

val money = Array.ofDim[Int](nums.length + 1)

money(1) = nums(0)

for (i <- 2 to nums.length) {

val loot = money(i - 1) max (money(i - 2) + nums(i - 1))

money(i) = loot

}

money(nums.length)

}

}

**Number of Equivalent Domino Pairs**

1.Allocate new array where is each item is another array from 0 till 9.

2. Go through input array and update global count by value from arr[\_.\_1][\_.\_2] use \_.\_1 as key

3. Update second array by 1 to mark count of dominoes with (a,b)

4.

from collections import defaultdict

class Solution:

def numEquivDominoPairs(self, dominoes):

if not dominoes:

return 0

mem = defaultdict(lambda: [0] \* 10)

pairs = 0

for i in range(len(dominoes)):

c, d = dominoes[i]

arr = mem[c]

pairs += arr[d]

if c != d:

arr = mem[d]

pairs += arr[c]

mem[c][d] += 1

return pairs

**Maximum Product of Three Numbers**

1. **Sort array.**
2. **If first item is less 0 and last one is positive then to consider 2 variants: last \* item[0] \* item[1] or item[last] \* item[last-1] \* item[last-2]**
3. **In other case to return product of last three items.**

**Subarray Product Less Than K**

**1.consider array where each item is index of smallest number in the given array for the j: nums[i] \* nums[i+1] \*.. nums[j] < k**

**class Solution:**

**def numSubarrayProductLessThanK(self, nums, k):**

**if not nums or k <= 1:**

**return 0**

**prod = 1**

**left = 0**

**sub\_arr\_count = 0**

**for i in range(len(nums)):**

**prod \*= nums[i]**

**while prod >= k:**

**prod /= nums[left]**

**left += 1**

**sub\_arr\_count += i - left + 1**

**return sub\_arr\_count**

**Kill Process**

**1.Use BFS to process children of process.**

**2. Create map where the key is pid and value is children list.**

from collections import defaultdict

class Solution:

def killProcess(self, pid, ppid, kill):

if not pid or not ppid or not kill:

return

queue = [kill]

res = []

parent\_to\_child = defaultdict(lambda :[])

for i in range(len(ppid)):

parent\_to\_child[ppid[i]].append(pid[i])

while len(queue) > 0:

proc = queue.pop()

res.append(proc)

for child in parent\_to\_child[proc]:

queue.append(child)

return res

Smallest String Starting From Leaf

1. go from root to leaf by append node char to buffer. If node is a leaf let’s reverse the buffer and compare the result with earlier storing minimal lexographical string

O(N\*lg(N)) where N – node number and Log N is heigh of complete tree.

class Solution:  
 def \_\_init\_\_(self):  
 self.min\_str = None  
  
 def to\_char(self, code):  
 return chr(ord('a') + code)  
  
 def min\_string(self, s1, s2):  
 if not s1:  
 return s2  
 if not s2:  
 return s1  
 return min(s1, s2)  
  
 def smallestFromLeaf(self, root):  
 if not root:  
 return root  
 def traverse(node, str=''):  
 if node and not node.left and not node.right:  
 ch = self.to\_char(node.val)  
 s = ch + str[::-1]  
 self.min\_str = self.min\_string(s, self.min\_str)  
 return  
 if not node:  
 return  
 ch = self.to\_char(node.val)  
 traverse(node.left, str + ch)  
 traverse(node.right, str + ch)  
 self.min\_str = None  
 traverse(root)  
 return self.min\_str

Keys and rooms

1. Use DFS to visit all rooms if first room we visit is 0

2. If we visited this room we skip it.

3. allocate set to store all visited rooms.

class Solution:  
 def canVisitAllRooms(self, rooms):  
 if not rooms or len(rooms) == 0:  
 return False  
 def dfs(room, visited):  
 visited.add(room)  
 for key in rooms[room]:  
 if key in visited:  
 continue  
 dfs(key, visited)  
 visited = set()  
 dfs(0, visited)  
 return len(visited) == len(rooms)

Increasing Order Search Tree:

1. Use in-order to place nodes in such order and connect right subtree.

2. Left subtree is new root.

class Solution:  
 def increasingBST(self, root):  
 if not root:  
 return root  
  
 def rearrange(node):  
 if not node:  
 return None  
 if not node.left and not node.right:  
 return TreeNode(node.val)  
 left\_subtree = rearrange(node.left)  
 #left\_subtree is new root  
 #find the rightmost node  
 rightmost\_leave = left\_subtree  
 while rightmost\_leave and rightmost\_leave.right:  
 rightmost\_leave = rightmost\_leave.right  
 new\_node = TreeNode(node.val)  
 if rightmost\_leave:  
 rightmost\_leave.right = new\_node  
 new\_node.right = rearrange(node.right)  
 return left\_subtree if left\_subtree else new\_node  
  
 return rearrange(root)

Path In Zigzag Labelled Binary Tree

1. Traverse through the complete tree using for left subtree index is 2 \* index + 1 and for right subtree is 2 \* index + 2. Start traversing from label and go to the root. Let’s distinguish node label and node position: label is position + 1.

from math import log  
  
class Solution:  
 def pathInZigZagTree(self, label):  
 if label < 0:  
 return []  
 row = int(log(label, 2)) + 1  
 #start label  
 s = 2 \*\* (row - 1)  
 #end label  
 e = 2 \* s - 1  
 res = []  
 #find pos  
 pos = label - 1  
 #pos is label - 1  
 if row % 2 == 0:  
 off = e - label  
 pos = s - 1 + off  
 while pos >= 0:  
 label = pos + 1  
 if row % 2 == 0:  
 #numbers are from right to left  
 #fix label  
 off = label - s  
 label = e - off  
 if pos % 2 == 0:  
 pos -= 2  
 else:  
 pos -= 1  
 res.insert(0, label)  
 pos //= 2  
 row -= 1  
 s //= 2  
 e = s \* 2 - 1  
 return res

3 Sum Closest

**1. Sort number array**

**2. Take item and take subarray from next item to the end**

**3. Use two pointers technic to find diff = abs(target – sum of 3 items) then compare it to the previous diff**

class Solution:  
 def threeSumClosest(self, nums, target):  
 if not nums or len(nums) < 3:  
 return None  
 nums.sort()  
 closest = sum(nums[:3])  
 for i in range(len(nums) - 2):  
 s = i + 1  
 e = len(nums) - 1  
 while s < e:  
 candidate = nums[i] + nums[s] + nums[e]  
 if abs(target - candidate) < abs(target - closest):  
 closest = candidate  
  
 if candidate > target:  
 e -= 1  
 elif candidate < target:  
 s += 1  
 else:  
 return target  
 return closest

Can Make Palindrome from Substring

***1.Use array of all prefix frequencies; assume to use only 26 latin charecters.***

***2. R[i+1] – L[j[] is substring frequencies.***

***3. If half of odds frequencies is less or equal then the allowed changes let’s add true in result array in other case to add false.***

class Solution:  
 def canMakePaliQueries(self, s, queries):  
 if not s or not queries:  
 return []  
 dp = [[0] \* 26]  
 for i in range(1, len(s) + 1):  
 new\_dp = dp[i-1][:]  
 new\_dp[ord(s[i - 1]) - ord('a')] += 1  
 dp.append(new\_dp)  
 answer = []  
 for start,end,may\_change in queries:  
 R = dp[end + 1]  
 L = dp[start]  
 odds = sum((R[i] - L[i]) & 1 for i in range(26))  
 if odds // 2 <= may\_change:  
 answer.append(True)  
 else:  
 answer.append(False)  
 return answer

**Sort colors:**

1. Use 2 pointers: rightmost one is for 0, leftmost one is for 2

class Solution:  
 def sortColors(self, nums):  
 if not nums:  
 return nums  
 p0 = 0  
 p2 = len(nums) - 1  
 cur = 0  
 while cur <= p2:  
 if nums[cur] == 0:  
 nums[p0], nums[cur] = nums[cur], nums[p0]  
 cur += 1  
 p0 += 1  
 elif nums[cur] == 2:  
 nums[p2], nums[cur] = nums[cur], nums[p2]  
 p2 -= 1  
 else:  
 cur += 1

**Minimum Time Difference**

1. Convert string to hours extracting hours and minutes and convert them to hours.

I hours is less 12 then let’s add hours + 24 \* 60 because time may be time in the next day.

1. Sort new array and find difference between adjacent items.
2. class Solution:  
    def findMinDifference(self, timePoints):  
    if not timePoints:  
    return None  
    min\_diff = 24 \* 60 + 1  
    times = []  
    for timePoint in timePoints:  
    hours,mins = timePoint.split(':')  
    mins = int(mins)  
    hours = int(hours)  
    time = hours \* 60 + mins  
    times.append(time)  
    if hours < 12:  
    times.append(time + 24 \* 60)  
    times.sort()  
    for i in range(1, len(times)):  
    min\_diff = min(times[i] - times[i - 1], min\_diff)  
    return min\_diff

Search a 2D Matrix ||

1. Use approaches if target > item in matrix then go to the left, if target < item in matrix then go to the up

2. Start from bottom-left.

class Solution:  
 def searchMatrix(self, matrix, target):  
 if not matrix:  
 return False  
 col = 0  
 row = len(matrix) - 1  
 while row >=0 and col < len(matrix[0]):  
 if matrix[row][col] > target:  
 row -= 1  
 elif matrix[row][col] < target:  
 col += 1  
 else:  
 return True  
 return False

**Sort List**

1. Compare and merge sublists by length 1, 2, 4, .. log(list len)

class Solution:  
 def copy\_list(self, head):  
 p = head  
 new\_head = None  
 new\_p = None  
 while p:  
 if not new\_head:  
 new\_head = ListNode(p.val)  
 new\_p = new\_head  
 else:  
 new\_p.next = ListNode(p.val)  
 new\_p = new\_p.next  
 p = p.next  
 return new\_head  
  
 def go(self, head, step):  
 p1 = head  
 while p1 and step > 0:  
 p1 = p1.next  
 step -= 1  
 return p1  
  
 def merge\_sort(self, head, list\_len, size):  
 p0 = head  
 p1 = self.go(p0, size)  
 new\_head = None  
 pn = None  
 while p0 or p1:  
 if p0 and p1:  
 #merge both sublists in ascending order  
 sz0 = size  
 sz1 = size if list\_len >= 2 \* size else list\_len - size  
 while p0 and p1 and sz0 > 0 and sz1 > 0:  
 if p0.val > p1.val:  
 new\_node = ListNode(p1.val)  
 if not new\_head:  
 new\_head = new\_node  
 pn = new\_head  
 else:  
 pn.next = new\_node  
 pn = pn.next  
 sz1 -= 1  
 p1 = p1.next  
 else:  
 new\_node = ListNode(p0.val)  
 if not new\_head:  
 new\_head = new\_node  
 pn = new\_head  
 else:  
 pn.next = new\_node  
 pn = pn.next  
 sz0 -= 1  
 p0 = p0.next  
 if sz0 > 0:  
 while sz0 and p0:  
 pn.next = ListNode(p0.val)  
 pn = pn.next  
 p0 = p0.next  
 sz0 -= 1  
 if sz1 > 0:  
 while sz1 and p1:  
 pn.next = ListNode(p1.val)  
 pn = pn.next  
 p1 = p1.next  
 sz1 -= 1  
 elif p0 or p1:  
 if not new\_head:  
 new\_head = self.copy\_list(p0) if p0 else self.copy\_list(p1)  
 pn = new\_head  
 else:  
 pn.next = self.copy\_list(p0)  
 pn = pn.next  
 p0 = p1  
 p1 = self.go(p0, size)  
 return new\_head  
  
 def sortList(self, head):  
 if not head:  
 return  
 list\_len = 0  
 p0 = head  
 while p0:  
 list\_len += 1  
 p0 = p0.next  
 size = 1  
 while size <= list\_len:  
 head = self.merge\_sort(head, list\_len, size)  
 size \*= 2  
 return head

**Insert Sort List**

1. Use insertion sort to order single list items. Account for the if first item is greater then new inserted, store last minimum item to insert new one after.

class Solution:  
 def insertionSortList(self, head):  
 if not head:  
 return None  
 new\_head = None  
 p0 = head  
 while p0:  
 if not new\_head:  
 new\_head = ListNode(p0.val)  
 else:  
 p1 = new\_head  
 prev = None  
 while p1 and p1.val <= p0.val:  
 prev = p1  
 p1 = p1.next  
 if not prev:  
 t = new\_head  
 new\_head = ListNode(p0.val)  
 new\_head.next = t  
 else:  
 t = prev.next  
 prev.next = ListNode(p0.val)  
 prev.next.next = t  
 p0 = p0.next  
 return new\_head

**Longest string chain**

1.Consider each string is succ string without one character.

2. allocate 1 dimensional array length, sort words by length and length[word[i]] = max(length(word[i], word[j] + 1)) where j < i

class Solution:  
 def longestStrChain(self, words):  
 if not words:  
 return False  
  
 def is\_pred(pred, succ):  
 chars = [0] \* 26  
 for ch in words[pred]:  
 chars[ord(ch) - ord('a')] += 1  
 for ch in words[succ]:  
 pos = ord(ch) - ord('a')  
 chars[pos] -= 1  
 if chars[pos] < -1:  
 return False  
 zeros = 0  
 ones = 0  
 for a in chars:  
 if a == -1:  
 ones += 1  
 if a == 0:  
 zeros += 1  
 if ones > 1:  
 return False  
 return zeros == len(chars) - 1  
  
 #sort by length  
 words.sort(key=lambda s: len(s))  
 dp = [1] \* len(words)  
 max\_len = 1  
 for i in range(len(words) - 1):  
 for j in range(i + 1, len(words)):  
 if len(words[j]) > len(words[i]) + 1:  
 break  
 if len(words[i]) < len(words[j]) and is\_pred(i, j):  
 dp[j] = max(dp[j], dp[i] + 1)  
 max\_len = max(max\_len, dp[j])  
 return max\_len

**Triangle**

1. Go from bottom to up and allocate 1-dimensional array.

2. dp[i] = min(dp[i], dp[i+1]) + triangle[k][i]

3. In inner cycle we have the upper bound by triangle[k]

class Solution:  
 def minimumTotal(self, triangle):  
 if not triangle:  
 return 0  
 dp = [tri for tri in triangle[-1]]  
 for row in range(len(triangle) - 2, -1, -1):  
 for j in range(len(triangle[row])):  
 dp[j] = min(dp[j], dp[j + 1]) + triangle[row][j]  
 return dp[0]

**Ugly number**

1. Count number using binary search and the function F(A) = A/a + A/b + A/c – A/ac – A/ab – A/bc + A/abc. Where ab, ac, bc, abc is multiple of respective numbers and they are calculate with lcm = a\*b / gcd

2. Use the binary search to found out number of F(A) and compare it to the given n

class Solution:  
 def nthUglyNumber(self, n, a, b, c):  
 def gcd(a, b):  
 if b == 0:  
 return a  
 return gcd(b, a % b)  
  
 def lcm(a, b):  
 return a \* b // gcd(a, b)  
  
 ab, bc, ac = lcm(a, b),lcm(b, c), lcm(a, c)  
 abc = lcm(a, bc)  
 lo = 1  
 hi = 2 \* 10 \*\* 9  
 while lo < hi:  
 mid = lo + (hi - lo) // 2  
 cnt = mid // a + mid // b + mid // c - mid // ab - mid // ac - mid // bc + mid // abc  
 if cnt < n:  
 lo = mid + 1  
 else:  
 hi = mid  
 return lo

**Smallest string with swaps**

1. use union find to collect all indices in pair.

2. sort chars in one connected component(pairs)

from collections import defaultdict  
  
class Solution:  
 def smallestStringWithSwaps(self, s, pairs):  
 if not s:  
 return None  
 if len(pairs) == 0:  
 return s  
 def find(parent, i):  
 if parent[i] != i:  
 p = find(parent, parent[i])  
 parent[i] = p  
 return parent[i]  
  
 def union(parent, i, j):  
 p1 = find(parent, i)  
 p2 = find(parent, j)  
 if p1 != p2:  
 parent[p1] = p2  
  
 parent = [i for i in range(len(s))]  
 for i,j in pairs:  
 union(parent, i, j)  
  
 chars = defaultdict(list)  
 for i in range(len(s)):  
 chars[find(parent, i)].append(s[i])  
 for k in chars:  
 chars[k].sort()  
  
 res = []  
 for i in range(len(s)):  
 res.append(chars[find(parent, i)].pop(0))  
 return ''.join(res)

**Large Divisible Set**

1. Sort nums, allocate the array dp to store max length of subset from [X1,….Xi]

2. If X[i] % X[j] == 0 i > j in a subset it means X[i] is divided by other members of the current subset

class Solution:  
 def largestDivisibleSubset(self, nums):  
 if not nums:  
 return []  
 nums.sort()  
 dp = [1] \* len(nums)  
 for i in range(1, len(nums)):  
 for j in range(0, i):  
 if nums[i] % nums[j] == 0:  
 dp[i] = max(dp[i], dp[j] + 1)  
 #look up max by first item in tuple  
 max\_len,max\_index = max([(v, i) for i,v in enumerate(dp)])  
 cur\_tail,cur\_size = nums[max\_index],max\_len  
 res = []  
 for i in range(max\_index, -1, -1):  
 if dp[i] == cur\_size and cur\_tail % nums[i] == 0:  
 res.insert(0, nums[i])  
 cur\_size -= 1  
 cur\_tail = nums[i]  
 return res

**Sum target**

1. Use recursion to find if we can reach the given S.

2. Memoized the solution for position and sum and return it.

class Solution:

def findTargetSumWays(self, nums, S):

if not nums:

return 0

dp = [0] \* len(nums)

for i in range(len(dp)):

dp[i] = [0] \* 2001

dp[0][nums[0] + 1000] = 1

dp[0][-nums[0] + 1000] += 1

for i in range(1, len(nums)):

for s in range(-1000, 1001):

if dp[i - 1][1000 + s] > 0:

dp[i][s + nums[i] + 1000] += dp[i-1][1000 + s]

dp[i][s - nums[i] + 1000] += dp[i-1][1000 + s]

return dp[len(nums) - 1][S + 1000] if S <= 1000 else 0

Time complexity(L \*n() where L is range of sum

Memory is O(n)

Longest Substring with At Most K Distinct Characters

1.Use 2 pointers to go through chars in a string and move the left pointer.

from collections import defaultdict  
  
class Solution:  
 def lengthOfLongestSubstringKDistinct(self, s, k):  
 if not s or k == 0:  
 return 0  
 chars = defaultdict(lambda: 0)  
 i = 0  
 j = 0  
 max\_len = 0  
 while i <= j:  
 if j < len(s):  
 chars[s[j]] += 1  
 j += 1  
 while len(chars.keys()) > k and i < len(s) and i <= j:  
 chars[s[i]] -= 1  
 if chars[s[i]] == 0:  
 del chars[s[i]]  
 i += 1  
 max\_len = max(max\_len, j - i)  
 else:  
 break  
 return max\_len

Longest Arithmetic Subsequence of Given Difference

1.Use DP but use number as dp index and for each number to check if number – difference exists in dp and it it’s so let’s dp[arr[i]] = dp[arr[i] – difference] + 1

2. if arr[i] may be less 0 then add prefix as 10000

class Solution:  
 def longestSubsequence(self, arr, difference):  
 if not arr:  
 return 0  
 dp = [-1] \* (3 \* (10 \*\* 4) + 1)  
 max\_len = 1  
 dp[10000 + arr[0]] = 1  
 for i in range(1, len(arr)):  
 a = arr[i]  
 if dp[10000 + a - difference] > - 1:  
 dp[10000 + a] = dp[10000 + a - difference] + 1  
 else:  
 dp[10000 + a] = 1  
 max\_len = max(max\_len, dp[10000 + a])  
 return max\_len

 Play with Chips

1. count odd chips and compare it to even one. If number of odds are greater then find first odd position and calculate cost others. In other case it uses even position.

class Solution:  
 def calc\_cost(self, chips, pos):  
 cost = 0  
 for chip in chips:  
 cost += abs(pos - chip) % 2  
 return cost  
  
 def minCostToMoveChips(self, chips):  
 if not chips:  
 return 0  
 odds = sum(map(lambda x: 1 if x % 2 == 1 else 0, chips))  
 evens = len(chips) - odds  
 for pos,\_ in enumerate(chips):  
 if odds > evens:  
 if pos % 2 == 1:  
 return self.calc\_cost(chips, pos)  
 else:  
 if pos % 2 == 0:  
 return self.calc\_cost(chips, pos)  
 return self.calc\_cost(chips, chips[0])

Count Vowels Permutation

1.Consider some string with length j: we create table where dp rows are ending chars and columns are length from 0 to n. So dp[i][j] contains number of strings ending by char i and having length j. From char i we can move to specific chars so we know possible strings for strings[k][j+1] but where k is char which we can add to j. So dp[k][j+1] is increased by dp[i][j] because dp[i][j] is number strings ending by i.

class Solution:  
 def countVowelPermutation(self, n):  
 if n == 0:  
 return 0  
 chars = ['a', 'e', 'i', 'o', 'u']  
 moves = {0: [1], 1: [0, 2], 3: [2, 4], 4: [0], 2: [1, 0, 3, 4]}  
 dp = [0] \* len(chars)  
 for i in range(len(dp)):  
 dp[i] = [0] \* (n + 1)  
  
 for i in range(len(dp)):  
 dp[i][1] = 1  
 for j in range(2, len(dp[0])):  
 for i in range(len(chars)):  
 to\_chars = moves[i]  
 for char in to\_chars:  
 dp[char][j] += dp[i][j-1]  
 count = 0  
 base = 10 \*\* 9 + 7  
 for j in range(len(dp)):  
 count += (dp[j][n] % base)  
 return count % base

Verifying an Alien Dictionary

1.Map char to integer to define new char ordering

2. Convert word to array number respecting to order.  
3. Compare all words

class Solution:

def isAlienSorted(self, words, order):

if not words or not order:

return False

map = {char: i for i,char in enumerate(order)}

new\_words = []

for word in words:

new\_word = [map[ch] for ch in word]

new\_words.append(new\_word)

for i in range(1, len(new\_words)):

if new\_words[i-1] > new\_words[i]:

return False

return True

 Binary Tree Right Side View

1.Use stack to store node with depth where first node is root with 0.

2. Pop up node and if it’s not None add it to map where depth is key and node value is value if this depth is not in map.

class Solution:  
 def rightSideView(self, root):  
 if not root:  
 return []  
 max\_depth = 0  
 rightmost\_node = {}  
 stack = [(root, 0)]  
 while stack:  
 node,depth = stack.pop()  
  
 if node is not None:  
 max\_depth = max(max\_depth, depth)  
 if depth not in rightmost\_node:  
 rightmost\_node[depth] = node.val  
 stack.append((node.left, depth + 1))  
 stack.append((node.right, depth + 1))  
 return [rightmost\_node[depth] for depth in range(max\_depth + 1)]

Permutation in String

1.Use sliding window: add new chars to frequency map and remove leftmost one.

2 .if 2 maps are the same then it returns true

class Solution:  
 def rightSideView(self, root):  
 if not root:  
 return []  
 max\_depth = 0  
 rightmost\_node = {}  
 stack = [(root, 0)]  
 while stack:  
 node,depth = stack.pop()  
  
 if node is not None:  
 max\_depth = max(max\_depth, depth)  
 if depth not in rightmost\_node:  
 rightmost\_node[depth] = node.val  
 stack.append((node.left, depth + 1))  
 stack.append((node.right, depth + 1))  
 return [rightmost\_node[depth] for depth in range(max\_depth + 1)]

**Capacity to ship packages within D days**

1. Use binary search from 0 to max sum of weights.

2. go through all weights to check if it’s enough capacity conveyer belt.

class Solution:  
 def enough\_belt\_capacity(self, weights, max\_w, d):  
 days = 0  
 capacity = max\_w  
 for weight in weights:  
 if weight > max\_w:  
 return False  
 if weight > capacity:  
 #move to the next day to carry the left packages  
 days += 1  
 capacity = max\_w - weight  
 else:  
 capacity -= weight  
 days += 1  
 return days <= d  
  
 def shipWithinDays(self, weights, D):  
 if not weights or D == 0:  
 return 0  
 lo = 0  
 hi = 50000 \* 500  
 while lo < hi:  
 max\_w = lo + (hi - lo) // 2  
 if self.enough\_belt\_capacity(weights, max\_w, D):  
 hi = max\_w  
 else:  
 lo = max\_w + 1  
 return lo

**Split Array Largest Sum**

1. Use binary search to look up the min max sum of a subarray.

2. Count subarray number that are less the given sum

3. If that numbers is less the then hi = mid – 1and in other case it has to be lo = mid + 1

class Solution:  
 def splitArray(self, nums, m):  
 if not nums or m == 0:  
 return 0  
 lo = 0  
 hi = 0  
 for i in range(len(nums)):  
 hi += nums[i]  
 if nums[i] > lo:  
 lo = nums[i]  
 res = hi  
 while lo <= hi:  
 f = lo + (hi - lo) // 2  
 sum\_nums = 0  
 cnt = 1  
 for i in range(len(nums)):  
 if sum\_nums + nums[i] > f:  
 cnt += 1  
 sum\_nums = nums[i]  
 else:  
 sum\_nums += nums[i]  
 if cnt <= m:  
 res = min(res, f)  
 hi = f - 1  
 else:  
 lo = f + 1  
 return res

Koko Eating Bananas

class Solution:  
 def minEatingSpeed(self, piles, H):  
 if not piles or H == 0:  
 return 0  
 k = max(piles)  
 lo = 1  
 hi = sum(piles)  
 while lo <= hi:  
 speed = lo + (hi - lo) // 2  
 hours = 0  
 for i in range(len(piles)):  
 if piles[i] <= speed:  
 hours += 1  
 else:  
 #eating piles  
 hours += (piles[i] // speed)  
 if piles[i] % speed != 0:  
 hours += 1  
 if hours <= H:  
 k = min(speed, k)  
 hi = speed - 1  
 else:  
 lo = speed + 1  
 return k

Subsets II

1.Sort input array

2. Use combination recursive function

3. Sort result array by length and append items to new array while appending new item the last one is not the same.

class Solution:  
 def subsetsWithDup(self, nums):  
 if not nums:  
 return []  
 nums.sort()  
 res = []  
 def subsets(i, cur):  
 if i == len(nums):  
 res.append(cur)  
 return  
 subsets(i + 1, cur)  
 new\_cur = cur[:]  
 new\_cur.append(nums[i])  
 subsets(i + 1, new\_cur)  
 subsets(0, [])  
 res.sort(key=lambda x:[x, len(x)])  
 new\_res = []  
 for a in res:  
 if len(new\_res) == 0 or new\_res[-1] != a:  
 new\_res.append(a)  
 return new\_res

#### [Sort Items by Groups Respecting Dependencies](https://leetcode.com/problems/sort-items-by-groups-respecting-dependencies/)

1. Build graph for items and groups using beforeItems

2. Order group graph with topological sort

3. for every group in group graph sort group’s items with topological sort

4. Check if all items in result follow the beforeItems.

from collections import defaultdict  
  
class Solution:  
 def sortItems(self, n, m, group, beforeItems):  
 if not group or not beforeItems:  
 return []  
 node\_graph = defaultdict(list)  
 group\_graph = defaultdict(list)  
 group\_to\_node = defaultdict(list)  
  
 for node in range(n):  
 group\_to\_node[group[node]].append(node)  
  
 for node,before\_items in enumerate(beforeItems):  
 for before\_item in before\_items:  
 node\_graph[before\_item].append(node)  
 if group[before\_item] != group[node]:  
 group\_graph[group[before\_item]].append(group[node])  
  
 visited\_group = [False] \* (m + 1)  
  
 def group\_top\_sort(g, visited, adj\_list, res):  
 visited[g + 1] = True  
 for neighbour in adj\_list[g]:  
 if not visited[neighbour + 1]:  
 group\_top\_sort(neighbour, visited, adj\_list, res)  
 res.insert(0, g)  
  
 def item\_top\_sort(node, g, visited, adj\_list, res):  
 visited[node] = True  
 if group[node] == g:  
 for neighbour in adj\_list[node]:  
 if group[neighbour] != g:  
 continue  
 if not visited[neighbour]:  
 item\_top\_sort(neighbour, g, visited, adj\_list, res)  
 res.insert(0, node)  
  
 res\_group = []  
 for g in range(-1, m):  
 if not visited\_group[g + 1]:  
 group\_top\_sort(g, visited\_group, group\_graph, res\_group)  
 res = []  
 visited\_item = [False] \* n  
 for i in range(len(res\_group) - 1, -1, -1):  
 g = res\_group[i]  
 for node in group\_to\_node[g]:  
 if not visited\_item[node]:  
 item\_top\_sort(node, g, visited\_item, node\_graph, res)  
 pos\_to\_node = {node:i for i,node in enumerate(res)}  
 #check if all nodes follow to restrictions  
 for i,node in enumerate(res):  
 for before\_item in beforeItems[node]:  
 if pos\_to\_node[before\_item] > i:  
 return []  
 return res

 Smallest Subtree with all the Deepest Nodes

1. Calculate max depth and then if node has such depth let consider such cases:

- left subtree and right subtree return nodes then return parent of them

- return non empty subtree.

class Solution:  
 def subtreeWithAllDeepest(self, root):  
 if not root:  
 return []  
  
 def depth(node):  
 if not node:  
 return 0  
 left\_depth = 1 + depth(node.left)  
 right\_depth = 1 + depth(node.right)  
 return max(left\_depth, right\_depth)  
  
 def is\_leaf(node):  
 return node and node.right is None and node.left is None  
  
 def sub\_tree(node, d):  
 if d == 0:  
 return node  
 if not node:  
 return None  
 left\_tree = sub\_tree(node.left, d - 1)  
 right\_tree = sub\_tree(node.right, d - 1)  
 if left\_tree and right\_tree:  
 return node  
 if left\_tree:  
 return left\_tree  
 return right\_tree  
  
 if is\_leaf(root):  
 return root  
  
 d = depth(root) - 1 # number of nodes  
 return sub\_tree(root, d)

 Minimum Domino Rotations For Equal Row

1. At least if one A[i] or B[i] is absent in A or B it returns -1

class Solution(object):  
 def minDominoRotations(self, A, B):  
 if not A or not B:  
 return -1  
  
 def check(x):  
 flip\_a = 0  
 flip\_b = 0  
 for i in range(len(A)):  
 if A[i] != x and B[i] != x:  
 return -1  
 if A[i] == x and B[i] != x:  
 flip\_b += 1  
 elif B[i] == x and A[i] != x:  
 flip\_a += 1  
 return min(flip\_a, flip\_b)  
 flip = check(A[0])  
 if flip == -1:  
 return check(B[0])  
 return flip

**Asteroid collision**

1. Use stack to put there asteroid

class Solution(object):  
 def asteroidCollision(self, asteroids):  
 if not asteroids:  
 return []  
 res = [asteroids[0]]  
 i = 1  
 while i < len(asteroids):  
 while res and asteroids[i] < 0 < res[-1]:  
 if res[-1] < -asteroids[i]:#  
 res.pop()  
 continue  
 elif res[-1] == -asteroids[i]: # =  
 res.pop()  
 break  
 else:  
 res.append(asteroids[i])  
 i += 1  
 return res

Longest Arithmetic Sequence

1. Use longest arithemetic sequence array only 2 dimensional with row as difference A[i] – A[j]

i > j

class Solution(object):

def longestArithSeqLength(self, A):

if not A:

return 0

las = [1] \* 20001

for i in range(len(las)):

las[i] = [1] \* len(A)

max\_len = 0

for i in range(len(A)):

for j in range(i):

d = A[i] - A[j]

las[2001 + d][i] = max(las[2001 + d][i], las[2001 + d][j] + 1)

max\_len = max(max\_len, las[2001 + d][i])

return max\_len

Check Completeness of a Binary Tree

1. Use BFS until a node is None.

2. Go to the right by evicting the None

3. If nodes is empty a tree is complete.

class Solution(object):  
 def isCompleteTree(self, root):  
 if not root:  
 return False  
 nodes = [root]  
 while nodes[0] is not None:  
 node = nodes.pop(0)  
 nodes.append(node.left)  
 nodes.append(node.right)  
 while len(nodes) > 0 and nodes[0] is None:  
 nodes.pop(0)  
 return len(nodes) == 0

**Split a String in Balanced Strings**

1. Use counter for L and for R.
2. When both of them are equal let’s increment split counter.

class Solution(object):

def balancedStringSplit(self, s):

if not s:

return 0

l = 0

r = 0

splits = 0

for i in range(len(s)):

if s[i] == 'L':

l += 1

elif s[i] == 'R':

r += 1

if l == r:

l = 0

r = 0

splits += 1

return splits

**Dice Roll Simulation**

1.Use DP to store combination number at i-th dice roll if last number was j. dp[i][j] = dp[i-1][1…6]. If number j has restriction we add todp[i][j] the combinations with dp[i - x][1,,6(no j)] i - x >= 0

class Solution(object):

def dieSimulator(self, n, rollMax):

if n == 0 or not rollMax:

return 0

dp = [[0 for \_ in range(6)] for \_ in range(n)]

for i in range(n):

for j in range(6):

for x in range(1, rollMax[j] + 1):

if i - x >= 0:

for v in range(6):

if v != j:

dp[i][j] = dp[i][j] + dp[i - x][v]

else:

dp[i][j] += 1

break

return sum(dp[n-1])

**Fraction to Recurring Decimal**

1. Use long division to get result.
2. Divide numerator by denumerator to get integer part.
3. Divide numerator % denumerator to get remainder and if it’s equal zero to return result without fractional part.
4. Until remainder is zero let’s add digits to fractional part: multiply remainder by 10 and

save remainder to map to check out if it’s met earlier. If so then we have recuring result and embrace it in curly braces.

class Solution(object):

def fractionToDecimal(self, numerator, denominator):

if denominator == 0:

return Exception('denominator is 0')

if numerator == 0:

return '0'

res = []

if (denominator < 0) ^ (numerator < 0):

res.append('-')

a = abs(numerator)

b = abs(denominator)

res.append(str(a // b))

a = a % b

if a == 0:

return ''.join(res)

res.append('.')

remainders = {}

while a != 0:

if a in remainders:

p = remainders[a]

res.insert(p, '(')

res.append(')')

break

remainders[a] = len(res)

a \*= 10

res.append(str(a // b))

a = a % b

return ‘'.join(res)

**Expression Add Operators**

1. Use recursion to solve it.
2. Create recursive function (pos, prev\_operand, cur\_operand, value, buf)
3. If we calculate multiplication we will subtract value - prev\_operand + prev\_operand \* cur\_operand

class Solution(object):

def addOperators(self, num, target):

if not num:

return []

res = []

def calc\_exp(pos, prev\_operand, cur\_operand, value, buf):

if pos == len(num):

if value == target and cur\_operand == 0:

res.append(''.join(buf[1:]))

return

cur\_operand = cur\_operand \* 10 + int(num[pos])

if cur\_operand > 0:

calc\_exp(pos + 1, prev\_operand, cur\_operand, value, buf)

str\_oper = str(cur\_operand)

# +

buf.append('+')

buf.append(str\_oper)

calc\_exp(pos + 1, cur\_operand, 0, value + cur\_operand, buf)

buf.pop()

buf.pop()

if buf:

# -

buf.append('-')

buf.append(str\_oper)

calc\_exp(pos + 1, -cur\_operand, 0, value - cur\_operand, buf)

buf.pop()

buf.pop()

# \*

buf.append('\*')

buf.append(str\_oper)

calc\_exp(pos + 1, prev\_operand \* cur\_operand, 0, value - prev\_operand + prev\_operand \* cur\_operand, buf)

buf.pop()

buf.pop()

calc\_exp(0, 0, 0, 0, [])

return res

**Before and After Puzzle**

1. Use map to store last word and phrase indices which contain the given word

from collections import defaultdict

class Solution(object):

def beforeAndAfterPuzzles(self, phrases):

if not phrases:

return []

res = set()

start\_word = defaultdict(list)

for i,phrase in enumerate(phrases):

words = phrase.split()

start\_word[words[0]].append(i)

for i,phrase in enumerate(phrases):

words = phrase.split()

last\_word = words[-1]

# act as before phrase

if last\_word in start\_word:

for j in start\_word[last\_word]:

if i == j:

continue

new\_phrase = words + phrases[j].split()[1:]

string = ' '.join(new\_phrase)

res.add(string)

new\_list = list(res)

new\_list.sort()

return new\_list

**Minimum Cost Tree From Leaf Values**

1. Use DP to solve it. Outer loop for length and inner loop is from I to i+lenth and third loop I <= k < j to

dp[i][j] = min(dp[i][j], max(arr[i:k + 1]) \* max(arr[k + 1: j + 1]) + dp[i][k] + dp[k+1][j])

class Solution(object):

def mctFromLeafValues(self, arr):

if not arr:

return float('inf')

dp = [[float('inf')] \* len(arr) for \_ in range(len(arr))]

for i in range(len(arr)):

dp[i][i] = 0

for l in range(1, len(arr)):

for i in range(len(arr)):

j = i + l

if j >= len(arr):

break

for k in range(i, j):

dp[i][j] = min(dp[i][j], max(arr[i:k + 1]) \* max(arr[k + 1: j + 1]) + dp[i][k] + dp[k+1][j])

return dp[0][-1]

**3Sum**

1. Use 2 pointers technic. If a+b == target - we just change 2 pointers.

2. For triplet uniqueness we store only tuple2.

class Solution(object):

def threeSum(self, nums):

if len(nums) < 3:

return []

res = []

nums.sort()

seen = set()

for i in range(len(nums) - 2):

target = -nums[i]

j = i + 1

k = len(nums) - 1

while j < k:

sum\_of\_two = nums[j] + nums[k]

if sum\_of\_two == target:

if (nums[i], nums[j]) not in seen:

res.append([nums[i], nums[j], nums[k]])

seen.add((nums[i], nums[j]))

j += 1

k -= 1

elif sum\_of\_two > target:

k -= 1

else:

j += 1

return res

**Flatten a Multilevel Doubly Linked List**

1. Use recursion to traverse a list
2. If we meet a node with child let call the node.child recursively and then call the function with node.next

class Solution(object):

def flatten(self, head):

if not head:

return None

first = None

last = None

def add(node, last):

if last:

last.next = Node(node.val, last, None, None)

return last.next

return Node(node.val, None, None, None)

def make\_flat(node):

nonlocal last, first

if not node:

return

last = add(node, last)

if not first:

first = last

if node.child:

make\_flat(node.child)

make\_flat(node.next)

make\_flat(head)

return first

**Number of Longest Increasing Subsequence**

1. Allocate new array count where we store count of Lis ending at position I
2. If j < I and dp[i] <= dp[j](length is less) it means we have the same number LIS at I as at j so count[i] = count[j]
3. If dp[i] == dp[j] + 1 let’s increase count[i] by count[j]

class Solution(object):

def findNumberOfLIS(self, nums):

if not nums:

return 0

dp = [0] \* len(nums)

count = [1] \* len(nums)

for i in range(len(nums)):

for j in range(0, i):

if nums[i] > nums[j]:

if dp[j] >= dp[i]:

dp[i] = dp[j] + 1

count[i] = count[j]

elif dp[j] + 1 == dp[i]:

count[i] += count[j]

max\_len = max(dp)

return sum([c for i,c in enumerate(count) if dp[i] == max\_len])

**Next Permutation**

1. Find the a[i] < a[i+1] in decreasing subsequence
2. Find the least item that is bigger then a[i], swap them
3. Reverse all a[j] from I + 1

class Solution(object):

def nextPermutation(self, nums):

if not nums:

return

i = len(nums) - 2

# find first decreasing item

while i >= 0 and nums[i + 1] <= nums[i]:

i -= 1

if i >= 0:

# find the least bigger item

j = len(nums) - 1

while j >= 0 and nums[j] <= nums[i]:

j -= 1

nums[i],nums[j] = nums[j], nums[i]

# reverse

i += 1

j = len(nums) - 1

while i < j:

nums[i],nums[j] = nums[j],nums[i]

i += 1

j -= 1

**Letter Combinations of a Phone Number**

1. Use recursive solution where is digit on which we are working on.
2. Go through letter of digits:

2.1 If res is empty add new list with one char

2.2 If last res list has length less than I + 1 we copy by taking [0:i ] and add new char

If I == len(digits) then we return result

‘

class Solution(object):

def letterCombinations(self, digits):

if not digits:

return []

num\_to\_chars = {"0": " ", "1": "", "2": "abc", "3": "def", "4": "ghi", "5": "jkl", "6": "mno", "7": "pqrs", "8": "tuv", "9": "wxyz"}

def comb(i, res):

if i == len(digits):

return

for ch in num\_to\_chars[digits[i]]:

if not res:

res.append([ch])

else:

if len(res[-1]) < (i + 1):

res[-1].append(ch)

else:

seq = res[-1][:i]

seq.append(ch)

res.append(seq)

comb(i + 1, res)

res = []

comb(0, res)

return [''.join(arr) for arr in res]

**Palindromic Substrings**

1. We have 2\*n - 1 positions for centre of polindrom
2. We calculate left and right and changes it to get number of palindromic substrings

class Solution(object):

def countSubstrings(self, s):

if not s:

return 0

res = 0

for center in range(2\*len(s) - 1):

left = center // 2

right = left + center % 2

while left >= 0 and right < len(s) and s[left] == s[right]:

res += 1

left -= 1

right += 1

return res

**Bulb Switcher**

1. Count factors for every bulb. If I bulb has odd number of factors it will be on in other case it will be off. Numbers that have squares have odd numbers of factors.

If number is not -square it has even number of factors:

If num % a == 0:

Factors +=1

If num % a != a:

Factors += 1

2. So we can just found all squared number till N.

3. Of just calculate sqrt of N.

from math import sqrt

class Solution(object):

def bulbSwitch(self, n):

if n <= 0:

return 0

bulb\_on = int(sqrt(n))

return bulb\_on

**Range Sum Query 2D - Immutable**

1.Use additional matrix to store sum of [0,0]-[i,j]

2. To store sum to additional matrix it needs to set up 1 line as original matrix and sum[i][j] = matrix[i][j] + sum[i-1][j], then sum[i][j] += sum[i][j-1]

class NumMatrix(object):

def \_\_init\_\_(self, matrix):

self.aux = [0] \* len(matrix)

for i in range(len(matrix)):

self.aux[i] = [0] \* len(matrix[0])

for j in range(len(matrix[0])):

self.aux[0][j] = matrix[0][j]

for i in range(1, len(self.aux)):

for j in range(len(self.aux[i])):

self.aux[i][j] = matrix[i][j] + self.aux[i-1][j]

for i in range(len(self.aux)):

for j in range(1, len(self.aux[i])):

self.aux[i][j] += self.aux[i][j - 1]

def sumRegion(self, row1, col1, row2, col2):

if 0 == len(self.aux) or 0 == len(self.aux[0]):

return 0

sum\_reg = self.aux[row2][col2]

if row1 - 1 >= 0:

sum\_reg -= self.aux[row1-1][col2]

if col1 - 1 >= 0:

sum\_reg -= self.aux[row2][col1 - 1]

if row1 - 1 >= 0 and col1 - 1 >= 0:

sum\_reg += self.aux[row1-1][col1-1]

return sum\_reg

**Contiguous Array**

1. Use counter that decreased if we meet 0 and increase if we meet 1.
2. Use map to store count-> index. If we meet such count in map we get the equal number of zeros and ones.

class Solution(object):

def findMaxLength(self, nums):

if not nums:

return 0

m = {0: -1}

count = 0

max\_len = 0

for i in range(len(nums)):

if nums[i] == 0:

count += -1

else:

count += 1

if count in m:

max\_len = max(max\_len, i - m[count])

else:

m[count] = i

return max\_len

**Campus Bikes**

1. **Use bucket sort where bucket is distance between worker and bike.**
2. **Appending new item to buckets is order in which it needs to get result for workers and bikes.**

class Solution(object):

def assignBikes(self, workers, bikes):

if not workers or not bikes:

return []

buckets = [[] for \_ in range(2001)]

for i in range(len(workers)):

for j in range(len(bikes)):

d = abs(workers[i][0] - bikes[j][0]) + abs(workers[i][1] - bikes[j][1])

buckets[d].append((i,j))

res = [-1 for i in range(len(workers))]

used\_bikes = set()

for bucket in buckets:

for worker,bike in bucket:

if res[worker] == -1 and bike not in used\_bikes:

res[worker] = bike

used\_bikes.add(bike)

return res

**Diagonal Traverse**

1. Declare 2 steps to change row and column
2. If row + d1 < 0 or row+d1 > len(matrix) then change col += 1 if col+1 < len(matrix[0]) or row += 1
3. If col + d2 < 0 or col + d2 > len(matrix[0]) then change row += 1 if row+1 < len(matrix) or col += 1

4. In other case we change row += d1 and col += d2

class Solution(object):

def findDiagonalOrder(self, matrix):

if not matrix or not matrix[0]:

return []

res = []

r = 0

c = 0

d1 = -1

d2 = 1

count = len(matrix) \* len(matrix[0])

while count > 0:

res.append(matrix[r][c])

if r + d1 < 0 or r + d1 == len(matrix):

if c + 1 == len(matrix[0]):

r += 1

else:

c += 1

d1 = -d1

d2 = -d2

elif c + d2 < 0 or c + d2 == len(matrix[0]):

if r + 1 == len(matrix):

c += 1

else:

r += 1

d1 = -d1

d2 = -d2

else:

r += d1

c += d2

count -= 1

return res

**Summary Range.**

1. Use 2 pointers technic

class Solution(object):

def summaryRanges(self, nums):

if not nums:

return []

left = 0

right = 0

res = []

for i in range(1, len(nums)):

if nums[right] + 1 == nums[i]:

right += 1

else:

if left < right:

res.append('{}->{}'.format(nums[left], nums[right]))

else:

res.append(nums[left])

left = i

right = i

if left < right:

res.append('{}->{}'.format(nums[left], nums[right]))

else:

res.append(nums[left])

return res

**Boundary of Binary Tree**

1. Use distinct functions for traverse left, right, leaves boundaries.
2. If we traverse left and right boundaries we start from root.left and root.right
3. Add root as first element in result list
4. Use set to put node in to set
5. Reverse right list

6. In left boundaries to go to the left subtree and go the right one if node doesn’t have the left one. The same works for the right boundaries only with left subtree.

class Solution(object):

def boundaryOfBinaryTree(self, root):

if not root:

return []

def left\_boundary(node, seen, res):

if not node:

return

if node not in seen:

res.append(node.val)

seen.add(node)

left\_boundary(node.left, seen, res)

if not node.left:

left\_boundary(node.right, seen, res)

def right\_boundary(node, seen, res):

if not node:

return

if node not in seen:

res.append(node.val)

seen.add(node)

right\_boundary(node.right, seen, res)

if not node.right:

#probably it will be included to leaf

right\_boundary(node.left, seen, res)

def leaves(node, seen, res):

if not node:

return

leaves(node.left, seen, res)

if not node.left and not node.right and node not in seen:

res.append(node.val)

seen.add(node)

leaves(node.right, seen, res)

seen = set()

lefts = []

leave\_list = []

rights = []

left\_boundary(root.left, seen, lefts)

leaves(root, seen, leave\_list)

right\_boundary(root.right, seen, rights)

rights.reverse()

return [root.val] + lefts + leave\_list + rights

**Daily Temperatures**

1. Use stack to store index of T[i]. If we add new value and we pop up all T[i] <= value and update resulting array.

class Solution(object):

def dailyTemperatures(self, t):

if not t:

return []

res = [0] \* len(t)

wait = []

for i in range(len(t)):

while wait and t[wait[-1]] < t[i]:

res[wait[-1]] = i - wait[-1]

wait.pop()

wait.append(i)

return res

**All Nodes Distance K in Binary Tree**

1. Add the field par to every node with dis
2. Use BFS starting from target and add left,right and parent to queue thus go to bottom and top from target at the same time. Add node we’ve seen to set.
3. If we meet the node with the given distance in queue it means that all nodes in queue are our result.

class Solution(object):

def distanceK(self, root, target, K):

if not root or not target:

return None

def dfs(node, par = None):

if node:

node.par = par

dfs(node.left, node)

dfs(node.right, node)

dfs(root)

q = [(target, 0)]

seen = {target.val}

while q:

if q[0][1] == K:

return [n.val for n,d in q]

node,dist = q.pop(0)

for n in (node.left, node.right, node.par):

if n and n.val not in seen:

q.append((n, dist + 1))

return []

**Course Schedule II**

1. Use topological sort and use additional rec\_stack to recognise a cycle in a graph.

class Solution(object):

def findOrder(self, numCourses, prerequisites):

if numCourses == 0:

return []

adj\_list = [[] for i in range(numCourses)]

# [a,b] b goes first, a -> b

for a,b in prerequisites:

adj\_list[b].append(a)

def top\_sort\_if\_no\_cycle(node, rec\_stack, seen, res):

seen.add(node)

rec\_stack[node] = True

for child in adj\_list[node]:

if child not in seen:

if top\_sort\_if\_no\_cycle(child, rec\_stack, seen, res):

return True

elif rec\_stack[child]:

return True

res.append(node)

rec\_stack[node] = False

return False

rec\_stack = [False] \* numCourses

res = []

seen = set()

for n in range(numCourses):

if n not in seen:

if top\_sort\_if\_no\_cycle(n, rec\_stack, seen, res):

return []

return res[::-1]

**Populating Next Right Pointers in Each Node**

1. Use 2 connections: node.left.next = node.right
2. Node.right.next = node.next.left where node is on level upper

class Solution(object):

def connect(self, root):

if not root:

return root

leftmost = root

while leftmost.left:

head = leftmost

while head:

head.left.next = head.right

if head.next:

head.right.next = head.next.left

head = head.next

leftmost = leftmost.left

return root

Rectangle Overlap

1. Consider cases when 2 rectangle can’t overlap: if one is above other or one is left then other

class Solution:

def isRectangleOverlap(self, rec1, rec2):

if not rec1 or not rec2:

return False

x1,y1,x2,y2 = rec1

x3,y3,x4,y4 = rec2

# one rect is upper then other

if y2 <= y3 or y4 <= y1:

return False

if x2 <= x3 or x4 <= x1:

return False

return True

**Partition Labels**

1. Save to map rightmost position of every char in input string
2. Declare max\_i to save the current rightmost position
3. In the loop: calculate max\_i = max(max\_i, m[char])
4. If current position equals to the rightmost position then append new part length
5. In other case continue

class Solution:

def partitionLabels(self, s):

if not s:

return []

m = {c:i for i,c in enumerate(s)}

parts = []

j = 0

max\_i = 0

last = 0

while j < len(s):

max\_i = max(max\_i, m[s[j]])

if j == max\_i:

parts.append(j - last + 1)

last = j + 1

j += 1

return parts

**Minimum Size Subarray Sum**

1. Use 2 pointers: add right number and while sum >= s let’s calculate min\_len = min(min\_len, j - I + 1)

class Solution:

def minSubArrayLen(self, s, nums):

if not s or not nums:

return 0

cur\_sum = 0

min\_len = float('inf')

j = 0

for i in range(len(nums)):

cur\_sum += nums[i]

while cur\_sum >= s:

min\_len = min(min\_len, i - j + 1)

cur\_sum -= nums[j]

j += 1

return min\_len

**Convert Sorted List to Binary Search Tree**

1. Copy increasing list to array
2. Use recursion to build tree to find middle of the range[l,r]
3. Continue this for [l,mid-1] and [mid+1, r]

class Solution:

def sortedListToBST(self, head):

if not head:

return None

arr = []

node = head

while node:

arr.append(node.val)

node = node.next

def build\_tree(arr, s, e):

if s > e:

return None

# find middle

m = (s + e) // 2

new\_node = TreeNode(arr[m])

if s == e:

return new\_node

new\_node.left = build\_tree(arr,s, m - 1)

new\_node.right = build\_tree(arr,m + 1, e)

return new\_node

return build\_tree(arr, 0, len(arr) - 1)

**132 Pattern**

1.Find all min element for the position I

2. Declare stack where we store third items.

3. Go from the end: if a item is in the stack is greater then min[i] - we will pop up the stack until it’s less min[i], then if min[i] < item[i] < stack[-1] returns true in other case push item[i] to the stack.

class Solution:

def find132pattern(self, nums):

if not nums:

return False

min\_arr = [0] \* len(nums)

min\_arr[0] = nums[0]

for i in range(1, len(min\_arr)):

min\_arr[i] = min(min\_arr[i - 1], nums[i])#decreasing order

stack = [] # for third element

for i in range(len(nums) - 1,-1, -1):

if nums[i] > min\_arr[i]:

while stack and stack[-1] <= min\_arr[i]:

stack.pop()

if stack and stack[-1] < nums[i]:

return True

stack.append(nums[i])# nums[i] <= stack[-1]

return False

Cheapest flights within stops K

1. Use Dejkstra algorithm searching minimal node with min weight.
2. Use BFS adding the (weigh, step, node) to min binary heap and pull min item.
3. If node== dest return weight, in other case if we have step > 0 add new adjacent nodes of this node.

from collections import defaultdict

from heapq import heappop,heappush

class Solution:

def findCheapestPrice(self, n, flights, src, dst, K):

if n == 0 or not flights:

return -1

adj\_list = defaultdict(list)

for s,e,w in flights:

adj\_list[s].append((w, e))

q = [(0,K+1,src)]

#seen = set()

while q:

w,step,u = heappop(q)

if u == dst:

return w

if step > 0:

for w1,v in adj\_list[u]:

heappush(q, (w + w1, step - 1, v))

return -1

**Greatest Common Divisor of Strings**

1. Use smaller string as first gcd and further to try smallest substring.

class Solution:

def has\_gcd(self, str1, gcd):

if len(str1) < len(gcd) or len(str1) % len(gcd) != 0:

return False

i = 0

while i < len(str1):

for j in range(len(gcd)):

if str1[i + j] != gcd[j]:

return False

i += len(gcd)

return True

def gcdOfStrings(self, str1, str2):

if not str1 or not str2:

return ""

if len(str1) < len(str2):

t = str1

str1 = str2

str2 = t

for i in range((len(str1) // 2 + 1), 0, -1):

gcd = str1[0: i]

if self.has\_gcd(str1, gcd) and self.has\_gcd(str2, gcd):

return gcd

return “”

**Buddy Strings**

1. If A == B we search 2 equal chars to swap them.
2. If A != B we just find all different chars and if its count != 2 it returns False

class Solution:

def buddyStrings(self, A, B):

if not A and not B:

return False

if not A or not B:

return False

A = list(A)

B = list(B)

if A == B:

chars = set()

for char in A:

if char in chars:

return True

chars.add(char)

return False

else:

res = []

for i in range(len(A)):

if A[i] != B[i]:

res.append(i)

if len(res) != 2:

return False

i,j = res[0],res[1]

return A[i] == B[j] and A[j] == B[i]

Check valid string

1. Store index of ( and \* to 2 array.
2. If it meets ) it checks if either left parenthesis or star array is not empty and pop it, otherwise it returns False

class Solution:

def checkValidString(self, s):

if not s:

return True

left = []

star = []

for i in range(len(s)):

if s[i] == '(':

left.append(i)

elif s[i] == ')':

if left:

left.pop()

elif star:

star.pop()

else:

return False

else:

star.append(i)

while len(left) > 0 and len(star) > 0:

if star[-1] > left[-1]:

left.pop()

star.pop()

else:

break

return len(left) == 0

**Remove Outermost Parentheses**

1. Use counter if encounter ( let increment ,otherwise decrement it.
2. If counter == 0 to memorise first outer parenthesise, if counter == 1 and letter is ) then save new pair of indices of outer ()

class Solution:

def removeOuterParentheses(self, S):

if not S:

return S

parn = 0

outers = []

left = None

for i in range(len(S)):

if S[i] == ')':

if parn == 1:

outers.append([left, i])

parn -= 1

else:

if parn == 0:

left = i

parn += 1

res = []

for a,b in outers:

res.append(S[a:b+1])

return ‘'.join(res)

**Remove Duplicate Letters**

1. Use stack to store them leftmost char. If current char > top of stack we try to pop up it.

from collections import Counter

class Solution:

def removeDuplicateLetters(self, s):

if not s:

return s

cnt = Counter(s)

used = set()

stack = []

for i in range(len(s)):

cnt[s[i]] -= 1

if s[i] in used:

continue

while stack and s[i] < stack[-1] and cnt[stack[-1]] > 0:

used.discard(stack[-1]) # to allow to add at second time

stack.pop()

stack.append(s[i])

used.add(s[i])

return ‘'.join(stack)

**Rotting Oranges**

1.Use BFS by append rotting fruits

class Solution:

def orangesRotting(self, grid):

if not grid:

return -1

rotten = []

cnt = 0

for i in range(len(grid)):

for j in range(len(grid[0])):

if grid[i][j] == 2:

rotten.append((i, j, 0))

elif grid[i][j] == 1:

cnt += 1

elapsed = 0

while rotten:

r, c, minutes = rotten.pop(0)

elapsed = minutes

if r + 1 < len(grid) and grid[r + 1][c] == 1:

grid[r + 1][c] = 2

cnt -= 1

rotten.append((r + 1, c, minutes + 1))

if r - 1 >= 0 and grid[r - 1][c] == 1:

grid[r - 1][c] = 2

cnt -= 1

rotten.append((r - 1, c, minutes + 1))

if c + 1 < len(grid[0]) and grid[r][c + 1] == 1:

grid[r][c + 1] = 2

cnt -= 1

rotten.append((r, c + 1, minutes + 1))

if c - 1 >= 0 and grid[r][c - 1] == 1:

grid[r][c - 1] = 2

cnt -= 1

rotten.append((r, c - 1, minutes + 1))

if cnt == 0:

return elapsed

return -1

**Accounts Merge**

1. Use DSU to map email to parent by encoding every email as integer
2. Use first email as to connect it with the rest email in account
3. Use map to collect result: key is parent and value is email list.

from collections import defaultdict

class Dsu:

def \_\_init\_\_(self, n):

self.parent = [i for i in range(n)]

def find(self, x):

if self.parent[x] != x:

p = self.find(self.parent[x])

self.parent[x] = p

return p

return self.parent[x]

def union(self, x1, x2):

p1 = self.find(x1)

p2 = self.find(x2)

self.parent[p1] = p2

class Solution:

def accountsMerge(self, accounts):

if not accounts:

return []

dsu = Dsu(1001)

em\_to\_id = {}

em\_to\_name = {}

i = 0

for acc in accounts:

name = acc[0]

for email in acc[1:]:

em\_to\_name[email] = name

if email not in em\_to\_id:

em\_to\_id[email] = i

i += 1

dsu.union(em\_to\_id[acc[1]], em\_to\_id[email])

res = defaultdict(list)

for email in em\_to\_name:

res[dsu.find(em\_to\_id[email])].append(email)

return [[em\_to\_name[v[0]]] + sorted(v) for v in res.values()]

**Redundant Connection**

1. Use disjoint union set storing the edges,
2. If add new edges to DSU and this edges have the same parent this edge is redundant.

class DSU:

def \_\_init\_\_(self, n):

self.parent = [i for i in range(n)]

def find(self, x):

if self.parent[x] != x:

p = self.find(self.parent[x])

self.parent[x] = p

return p

return self.parent[x]

def union(self, x1, x2):

p1 = self.find(x1)

p2 = self.find(x2)

self.parent[p1] = p2

class Solution:

def findRedundantConnection(self, edges):

if not edges:

return []

dsu = DSU(len(edges) \* 2 + 1)

for x,y in edges:

if dsu.find(x) == dsu.find(y):

return [x,y]

dsu.union(x, y)

return []

Two elements in array without duplicates

1. Xor all numbers from array
2. If xor contain 1 there is 2 numbers have differ so find rightmost 1 and sort number by this criteria.  
   class Solution:

def array\_two\_elements(self, arr):

if not arr:

return []

xor = 0

for a in arr:

xor = xor ^ a

# get rigtmost bit

xor = xor & -xor

rets = [0, 0]

for a in arr:

# look up the num with this bit is 1

if a & xor:

rets[0] = rets[0] ^ a

else:

rets[1] = rets[1] ^ a

return rets

**Cut Off Trees for Golf Event**

1. **Use BFS to resolve this problem.**
2. **When add new row,colum it’s important to add it to seen so avoid to consider it further.**

from collections import deque

class Solution(object):

def dist(self, forest, sr, sc, dr, dc):

R, C = len(forest), len(forest[0])

q = deque([(sr, sc, 0)])

seen = {(sr, sc)}

while q:

r, c, d = q.popleft()

if r == dr and c == dc:

return d

seen.add((r, c))

for r1, c1 in [(r + 1, c), (r - 1, c), (r, c + 1), (r, c - 1)]:

if 0 <= r1 < R and 0 <= c1 < C and (r1, c1) not in seen and forest[r1][c1]:

q.append((r1, c1, d + 1))

#seen.add((r1, c1))

return -1

def cutOffTree(self, forest):

if not forest:

return []

heights = sorted((v, r, c) for r, row in enumerate(forest) for c, v in enumerate(row) if v > 1)

sr, sc = 0, 0

total = 0

for v, r, c in heights:

d = self.dist(forest, sr, sc, r, c)

if d < 0:

return -1

total += d

sr = r

sc = c

return total

**Number of Dice Rolls With Target Sum**

1. Use DP to solve it. Allocate 2-dimensinal table dp[d][target]
2. For I = 1 dp[0][j] = 1, if j>f dp[0][j]=0
3. dp[i][j] = sum of dp[i-1][j-1] + d[i-1][j-2’… + dp[i-1][j-1] if j < f otherwise j = f

class Solution:

def numRollsToTarget(self, d, f, target):

if not d or not target or not f:

return 0

dp = [[0] \* (target + 1) for i in range(d)]

for j in range(target+1):

for i in range(d):

if i == 0:

if 0 < j <= f:

dp[i][j] = 1

else:

ways = 0

for k in range(1, min(j, f + 1)):

ways += dp[i-1][j-k]

dp[i][j] = ways

return dp[d-1][target] % (10 \*\* 9 + 7)

**Sentence Similarity**

1. Add all pair in set
2. Check if word1 == word2 or (word1,word2) or (word2.word1) contained in set

**Sentence Similarity II**

1. Use DSU to union pairs and encode word as integer

2. Go through words in words1 and word2: if they are equal or they have the same parent it returns true otherwise it returns false

**Bus Routes**

1. We use BSF to create bus graph.
2. A bus may connect another bus with bus stop.

from collections import defaultdict

class Solution:

def numBusesToDestination(self, routes, S, T):

if not routes:

return -1

stop\_to\_bus = defaultdict(set)

g = defaultdict(list)

for bus,route in enumerate(routes):

for bs in route:

if bus not in stop\_to\_bus[bs]:

for n in list(stop\_to\_bus[bs]):

g[n].append(bus)

g[bus].append(n)

stop\_to\_bus[bs].add(bus)

# set up 1 if we go by this bus but if S==T we don't ride by bus.

q = [[b,1] for b in list(stop\_to\_bus[S])]

seen = set(stop\_to\_bus[S])

dest = stop\_to\_bus[T]

while q:

bus,count = q.pop(0)

if bus in dest:

if S == T:

return 0

return count

for nei in g[bus]:

if nei not in seen:

seen.add(nei)

q.append([nei, count + 1])

return -1

**Longest Common Subsequence**

1. Use dynamic programming: dp[i][j] = max(dp[i-1][j],dp[i][j-1],1+dp[i-1][j-1])

class Solution:

def longestCommonSubsequence(self, text1, text2):

if not text1 or not text2:

return 0

dp = [[0] \* len(text1) for \_ in range(len(text2))]

for i in range(len(text2)):

for j in range(len(text1)):

if text1[j] == text2[i]:

dp[i][j] = 1

if i > 0 and j > 0:

dp[i][j] += dp[i-1][j - 1]

if i > 0:

dp[i][j] = max(dp[i-1][j], dp[i][j])

if j > 0:

dp[i][j] = max(dp[i][j-1], dp[i][j])

return dp[len(text2) - 1][len(text1) - 1]

**Number of Digit One**

1. Use such algorithm:

class Solution:

def countDigitOne(self, n):

if n <= 0:

return 0

i = 1

count = 0

while i <= n:

divider = i \* 10

count += (n // divider) \* i

count += min(max(n % divider - i + 1, 0), i)

i \*= 10

return count

**Digit Count in Range**

1. Use f(hi) - f(low-1)

class Solution:

def count\_digit(self, d, n):

if n < 0 and n < d:

return 0

count = 0

i = 1

while i <= n:

divider = i \* 10

count += (n // divider) \* i

if d > 0:

count += min(max(n % divider - d \* i + 1, 0), i)

else:

if n // divider > 0:

if i > 1:

count -= i

count += min(n % divider + 1, i)

i \*= 10

return count

**Minimum Time to Build Blocks**

1. Use Huffman code algorithm to build tree but with cost for every split: more frequently using code have shorter encoding in Huffman tree and here most weight block tase shorter path.
2. Join tow nodes with function = split + max(blocks[i-1],blocks[i])

from heapq import heappop,heapify,heappush

class Solution:

def minBuildTime(self, blocks, split):

heapify(blocks)

while len(blocks) > 1:

bl1 = heappop(blocks)

bl2 = heappop(blocks)

new\_bl = split + bl2

heappush(blocks, new\_bl)

return blocks[0]

**Maximum Sum of Two Non-Overlapping Subarrays**

1.Consider 2 options: sum L+M or M+L

2. Save Lmax before I and Mmax before, res is sum[L+M]

3. User prefix sum

4. For every I calculate max(Lmax+ sum[i-M,i], Mmax+sum[i-L,i],max\_sum)

class Solution:

def maxSumTwoNoOverlap2(self, A, L, M):

prefix = [0] \* len(A)

prefix[0] = A[0]

for i in range(1, len(A)):

prefix[i] = prefix[i - 1] + A[i]

l\_max = prefix[L - 1]

m\_max = prefix[M - 1]

max\_sum = prefix[L + M - 1]

for i in range(L + M, len(A)):

# L,M

l\_max = max(l\_max, prefix[i - M] - prefix[i - L - M])

# M,L

m\_max = max(m\_max, prefix[i - L] - prefix[i - L - M])

max\_sum = max(max\_sum, l\_max + prefix[i] - prefix[i - M], m\_max + prefix[i] - prefix[i - L])

return max\_sum

**Set Matrix Zeroes**

1. Use m+n memory to mark row or col should be zeros.

class Solution:

def setZeroes(self, matrix):

if not matrix:

return

rows = [0] \* len(matrix)

cols = [0] \* len(matrix[0])

for i in range(len(matrix)):

for j in range(len(matrix[0])):

if matrix[i][j] == 0:

rows[i] = 1

cols[j] = 1

for i in range(len(matrix)):

for j in range(len(matrix[0])):

if rows[i] == 1 or cols[j] == 1:

matrix[i][j] = 0

**Corporate Flight Bookings**

1. Allocate array in length n. Add w for bookings[i][0] and subtract w for bookings[i][1].

2. Through result array and sum up all number from previous item: item[i] -= item[i-1]

class Solution:

def corpFlightBookings(self, bookings, n):

res = [0] \* n

for a, b, w in bookings:

res[a - 1] += w

if b < n:

res[b] -= w

for i in range(1, n):

res[i] += res[i-1]

return res

Single number II

1. Use 2 numbers:
2. Seen1 = ~seen2 & (seen1 ^num)
3. Seen2 = ~ seen1 & (seen2 ^ num)
4. In seen1 will be result

class Solution:

def singleNumber(self, nums):

if not nums:

return None

seen1 = 0

seen2 = 0

for num in nums:

seen1 = ~seen2 & (seen1 ^ num)

seen2 = ~seen1 & (seen2 ^ num)

return seen1

Single Number III

1. Use bit mask to store diff of 2 number don’t have duplicate.
2. Find rightmost bit 1 diff = bitmask & (-bitmask)
3. Go through array and xor number with 1 in righmost position
4. Result is xor result and result xor bitmask

class Solution:

def singleNumber(self, nums):

if not nums:

return []

bitmask = 0

for num in nums:

bitmask ^= num

#get rightmost bit

bitmask = bitmask & (-bitmask)

x = 0

for num in nums:

if x & bitmask:

x = x ^ num

return [x, x ^ bitmask]

**Grumpy Bookstore Owner**

1. Use window size by X to count unsatisfied members.
2. Count all satisfied members and keep up max of unsatisfied in window

3. Deduct from window the left part grumpy[i-X] \* customer[i-X]

class Solution:

def maxSatisfied(self, customers, grumpy, X):

win = 0

max\_satisfied = 0

satisfied = 0

for i,x in enumerate(customers):

if grumpy[i] == 0:

satisfied += customers[i]

else:

win += customers[i]

if i >= X:

win -= grumpy[i - X] \* customers[i - X]

max\_satisfied = max(max\_satisfied, win)

return satisfied + max\_satisfied

**Candy Crush**

1. Check 3 cols to right and 3 rows to the bottom if they are the same and if so it sets up their values to negative ones.
2. Go by column and starts from bottom row:

Having 2 pointers to crush equal candles.

class Solution:

def candyCrush(self, board):

if not board:

return board

rows = len(board)

cols = len(board[0])

changes = 0

for j in range(cols):

for i in range(rows):

a = abs(board[i][j])

if a == 0:

continue

if j + 2 < cols:

if abs(board[i][j + 1]) == a and abs(board[i][j + 2]) == a:

board[i][j + 1] = -abs(board[i][j + 1])

board[i][j + 2] = -abs(board[i][j + 2])

changes += 1

if board[i][j] > 0:

board[i][j] = -board[i][j]

if i + 2 < rows:

if abs(board[i + 1][j]) == a and abs(board[i + 2][j]) == a:

changes += 1

board[i + 1][j] = -abs(board[i + 1][j])

board[i + 2][j] = -abs(board[i + 2][j])

if board[i][j] > 0:

board[i][j] = -board[i][j]

if changes == 0:

return board

for j in range(cols):

l = rows - 1

i = rows - 1

while i >= 0:

while l >= 0 and board[l][j] < 0:

l -= 1

if l >= 0:

board[i][j] = board[l][j]

l -= 1

else:

board[i][j] = 0

i -= 1

return self.candyCrush(board)

**Minimum Increment to Make Array Unique**

1. Sort array
2. Store max\_so\_far value, if we met equal values we would increase max\_so\_far and increase move by different max\_so\_far+1 - value

class Solution:

def minIncrementForUnique(self, A):

if not A or len(set(A)) == len(A):

return 0

A = sorted(A)

moves = 0

max\_so\_far = A[0]

for i in range(1, len(A)):

if A[i] <= max\_so\_far:

moves += (max\_so\_far + 1 - A[i])

A[i] = max\_so\_far + 1

max\_so\_far = max(max\_so\_far, A[i])

return moves

**Valid Triangle Number**

1. This can be solver as 3Dsum, but we use binary search by looking up the righmost K

a[i] + a[j] > a[K]

import bisect

class Solution:

def triangleNumber(self, nums):

if not nums:

return 0

nums.sort()

res = 0

for i in range(len(nums) - 2):

k = i + 2

for j in range(i+1, len(nums) - 1):

p = bisect.bisect\_left(nums, nums[i] + nums[j], k, len(nums))

if p > j:

res += p - j - 1

k = p

return res

**Critical Connections in a Network**

1.Use Tarjan SCC to find bridge in graph: low[v] > disc[u], where u is parent of v

from collections import defaultdict

class Solution:

def criticalConnections(self, n: int, connections):

low = [-1] \* n

disc = [-1] \* n

time = 1

adj\_list = defaultdict(list)

for s,e in connections:

adj\_list[s].append(e)

adj\_list[e].append(s)

def dfs(u, low, disc, pre, res):

nonlocal time

low[u] = time

disc[u] = time

time += 1

for v in adj\_list[u]:

if pre == v:

continue

if disc[v] == -1:

dfs(v,low, disc, u, res)

low[u] = min(low[u], low[v])

if low[v] > disc[u]:

res.append([u,v])

else:

low[u] = min(low[u], disc[v])

res = []

for i in range(n):

if disc[i] == -1:

dfs(i,low, disc,i,res)

return res

**Unique Paths**

1. Use dynamic programming: dp[i][j] = dp[i-1][j] + dp[i][j-1]

class Solution:

def uniquePaths(self, m: int, n: int):

#m is column number

dp = [[0] \* m for \_ in range(n)]

for i in range(m):

dp[0][i] = 1

for i in range(n):

dp[i][0] = 1

for i in range(1, n):

for j in range(1, m):

dp[i][j] = dp[i][j-1] + dp[i-1][j]

return dp[-1][-1]

**Find Peak Element**

**1 Use unequality nums[i] > nums[i+1] then nums[i] is peak**

**2. Can use binary seach**

class Solution:

def findPeakElement(self, nums):

if not nums:

return None

for i in range(len(nums)):

if nums[i] > nums[i+1]:

return i

return len(nums) - 1