**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