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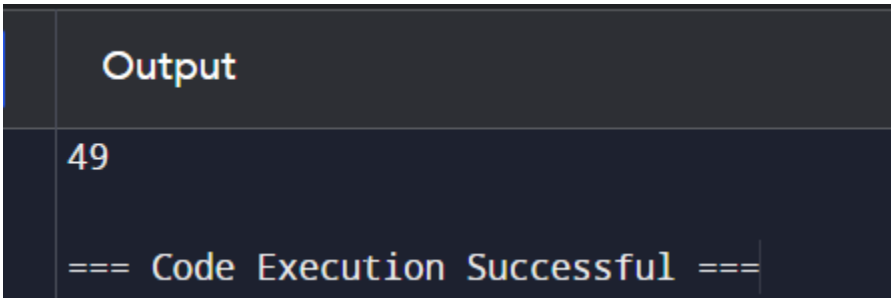
ASSIGNMENT – 2

11.Container With Most Water You are given an integer array height of length n. There are n vertical lines drawn such that the two endpoints of the ith line are (i, 0) and (i, height[i]). Find two lines that together with the x-axis form a container, such that the container contains the most water. Return the maximum amount of water a container can store. Notice that you may not slant the container. Example 1: Input: height = [1,8,6,2,5,4,8,3,7] Output: 49 Explanation: The above vertical lines are represented by array [1,8,6,2,5,4,8,3,7]. In this case, the max area of water (blue section) the container can contain is 49. Example 2: Input: height = [1,1] Output: 1 Constraints: ● n == height.length ● 2 <= n <= 105 ● 0 <= height[i] <= 104

```
def maxArea(height):
    left, right = 0, len(height) - 1
    max_area = 0

    while left < right:

        width = right - left
        min_height = min(height[left], height[right])
        current_area = width * min_height
        max_area = max(max_area, current_area)



        if height[left] < height[right]:
            left += 1
        else:
            right -= 1

    return max_area
```

height = [1,8,6,2,5,4,8,3,7]

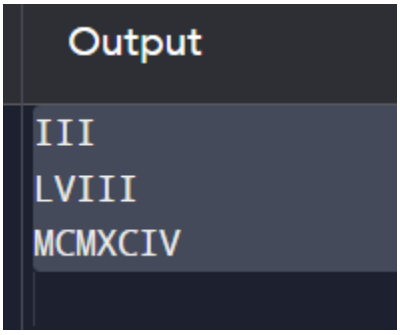
print(maxArea(height))



12. Integer to Roman Roman numerals are represented by seven different symbols: I, V, X, L, C, D and M. Symbol Value I 1 V 5 X 10 L 50 C 100 D 500 M 1000 For example, 2 is written as II in Roman numeral, just two one's added together. 12 is written as XII, which is simply X + II. The number 27 is written as XXVII, which is XX + V + II. Roman numerals are usually written largest to smallest from left to right. However, the numeral for four is not IIII. Instead, the number four is written as IV. Because the one is before the five we subtract it making four. The same principle applies to the number nine, which is written as IX. There are six instances where subtraction is used: ● I can be placed before V (5) and X (10) to make 4 and 9. ● X can be placed before L (50) and C (100) to make 40 and 90. ● C can be placed before D (500) and M (1000) to make 400 and 900. Given an integer, convert it to a roman numeral. Example 1: Input: num = 3 Output: "III" Explanation: 3 is represented as 3 ones. Example 2: Input: num = 58 Output: "LVIII" Explanation: L = 50, V = 5, III = 3. Example 3: Input: num = 1994 Output: "MCMXCIV" Explanation: M = 1000, CM = 900, XC = 90 and IV = 4. Constraints: ● 1 <= num <= 3999

```
def intToRoman(num):
    value_to_roman = [
      (1000, 'M'), (900, 'CM'), (500, 'D'), (400, 'CD'),
      (100, 'C'), (90, 'XC'), (50, 'L'), (40, 'XL'),
      (10, 'X'), (9, 'IX'), (5, 'V'), (4, 'IV'), (1, 'I')
   ]

    roman_numeral = ""

    for value, roman in value_to_roman:
        while num >= value:
            roman_numeral += roman
            num -= value
```

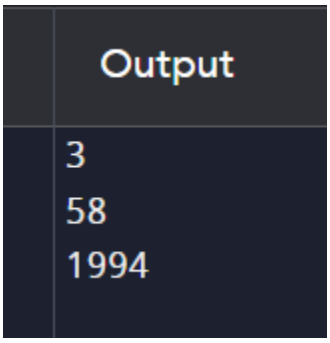
```
    return roman_numeral


 print(intToRoman(3))
print(intToRoman(58))
print(intToRoman(1994))
```



13.Roman to Integer Roman numerals are represented by seven different symbols: I, V, X, L, C, D and M. Symbol Value I 1 V 5 X 10 L 50 C 100 D 500 M 1000 For example, 2 is written as II in Roman numeral, just two ones added together. 12 is written as XII, which is simply X + II. The number 27 is written as XXVII, which is XX + V + II. Roman numerals are usually written largest to smallest from left to right. However, the numeral for four is not IIII. Instead, the number four is written as IV. Because the one is before the five we subtract it making four. The same principle applies to the number nine, which is written as IX. There are six instances where subtraction is used: ● I can be placed before V (5) and X (10) to make 4 and 9. ● X can be placed before L (50) and C (100) to make 40 and 90. ● C can be placed before D (500) and M (1000) to make 400 and 900. Given a roman numeral, convert it to an integer. Example 1: Input: s = "III" Output: 3 Explanation: III = 3. Example 2: Input: s = "LVIII" Output: 58 Explanation: L = 50, V= 5, III = 3. Example 3: Input: s = "MCMXCIV" Output: 1994 Explanation: M = 1000, CM = 900, XC = 90 and IV = 4. Constraints: ● 1 <= s.length <= 15 ● s contains only the characters ('I', 'V', 'X', 'L', 'C', 'D', 'M'). ● It is guaranteed that s is a valid roman numeral in the range [1, 3999].

```
def romanToInt(s: str) -> int:
    roman_to_int = {
       'I': 1, 'V': 5, 'X': 10, 'L': 50,
       'C': 100, 'D': 500, 'M': 1000
   }


   total = 0
   i = 0
```

```
    n = len(s)

    while i < n:
        if i + 1 < n and roman_to_int[s[i]] < roman_to_int[s[i + 1]]:
            total -= roman_to_int[s[i]]
        else:
            total += roman_to_int[s[i]]
        i += 1

    return total


print(romanToInt("III"))
print(romanToInt("LVIII"))
print(romanToInt("MCMXCIV"))
```



14. Longest Common Prefix Write a function to find the longest common prefix string amongst an array of strings. If there is no common prefix, return an empty string "". Example 1: Input: strs = ["flower","flow","flight"] Output: "fl" Example 2: Input: strs = ["dog","racecar","car"] Output: "" Explanation: There is no common prefix among the input strings. Constraints: ● 1 <= strs.length <= 200 ● 0 <= strs[i].length <= 200 ● strs[i] consists of only lowercase English letters.

```
def longestCommonPrefix(strs):
    if not strs:
        return ""

    prefix = strs[0]
```

```
    for string in strs[1:]:
        while string[:len(prefix)] != prefix:
            prefix = prefix[:-1]
            if not prefix:
                return ""

    return prefix

print(longestCommonPrefix(["flower", "flow", "flight"]))
print(longestCommonPrefix(["dog", "racecar", "car"]))
```

15. 3Sum Given an integer array nums, return all the triplets [nums[i], nums[j], nums[k]] such that i != j, i != k, and j != k, and nums[i] + nums[j] + nums[k] == 0. Notice that the solution set must not contain duplicate triplets. Example 1: Input: nums = [-1,0,1,2,-1,-4] Output: [[-1,-1,2],[-1,0,1]] Explanation: nums[0] + nums[1] + nums[2] = (-1) + 0 + 1 = 0. nums[1] + nums[2] + nums[4] = 0 + 1 + (-1) = 0. nums[0] + nums[3] + nums[4] = (-1) + 2 + (-1) = 0. The distinct triplets are [-1,0,1] and [-1,-1,2]. Notice that the order of the output and the order of the triplets does not matter. Example 2: Input: nums = [0,1,1] Output: [] Explanation: The only possible triplet does not sum up to 0. Example 3: Input: nums = [0,0,0] Output: [[0,0,0]] Explanation: The only possible triplet sums up to 0. Constraints: ● 3 <= nums.length <= 3000 ● -105 <= nums[i] <= 105

```
def threeSum(nums):
    nums.sort()
    result = []
    n = len(nums)

    for i in range(n - 2):
        if i > 0 and nums[i] == nums[i - 1]:
            continue
```

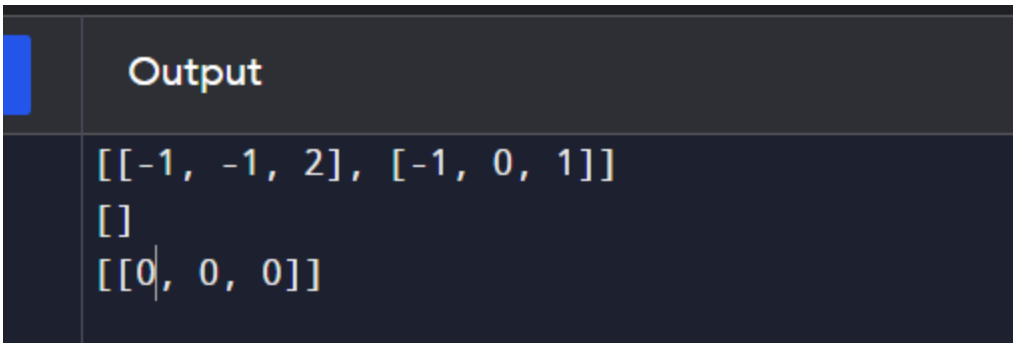
```
        left, right = i + 1, n - 1
        while left < right:
            s = nums[i] + nums[left] + nums[right]
            if s == 0:
                result.append([nums[i], nums[left], nums[right]])
                left += 1
                right -= 1
                 while left < right and nums[left] == nums[left - 1]:
                    left += 1
                while left < right and nums[right] == nums[right + 1]:
                    right -= 1
            elif s < 0:
                left += 1
            else:
                right -= 1


    return result


 print(threeSum([-1, 0, 1, 2, -1, -4]))
print(threeSum([0, 1, 1]))
print(threeSum([0, 0, 0]))
```

```
Output
[[-1, -1, 2], [-1, 0, 1]]
[]
[[0, 0, 0]]
```

16. 3Sum Closest Given an integer array nums of length n and an integer target, find three integers in nums such that the sum is closest to target. Return the sum of the three integers. You may assume that

each input would have exactly one solution. Example 1: Input: nums = [-1,2,1,-4], target = 1 Output: 2 Explanation: The sum that is closest to the target is 2. (-1 + 2 + 1 = 2). Example 2: Input: nums = [0,0,0], target = 1 Output: 0 Explanation: The sum that is closest to the target is 0. (0 + 0 + 0 = 0). Constraints: ● 3 <= nums.length <= 500 ● -1000 <= nums[i] <= 1000 ● -104 <= target <= 104

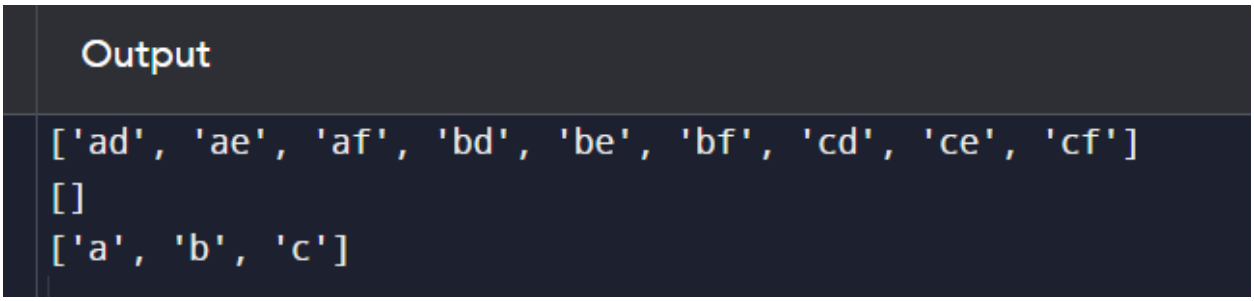
```
def threeSumClosest(nums, target):
    nums.sort()
    closest_sum = float('inf')
    n = len(nums)

    for i in range(n - 2):
        left, right = i + 1, n - 1
        while left < right:
            current_sum = nums[i] + nums[left] + nums[right]
            if current_sum == target:
                return current_sum

            if abs(current_sum - target) < abs(closest_sum - target):
                closest_sum = current_sum

            if current_sum < target:
                left += 1
            else:
                right -= 1

    return closest_sum




print(threeSumClosest([-1, 2, 1, -4], 1))
print(threeSumClosest([0, 0, 0], 1))
```



17. Letter Combinations of a Phone Number Given a string containing digits from 2-9 inclusive, return all possible letter combinations that the number could represent. Return the answer in any order. A mapping of digits to letters (just like on the telephone buttons) is given below. Note that 1 does not map to any letters. Example 1: Input: digits = "23" Output: ["ad","ae","af","bd","be","bf","cd","ce","cf"] Example 2: Input: digits = "" Output: [] Example 3: Input: digits = "2" Output: ["a","b","c"] Constraints: ● 0 <= digits.length <= 4 ● digits[i] is a digit in the range ['2', '9'].

```
def letterCombinations(digits):
    if not digits:
        return []

    digit_to_char = {
        '2': 'abc', '3': 'def', '4': 'ghi', '5': 'jkl', '6': 'mno',
        '7': 'pqrs', '8': 'tuv', '9': 'wxyz'
    }

    def backtrack(index, path):
        if index == len(digits):
            result.append("".join(path))
            return

        current_digit = digits[index]
        for char in digit_to_char[current_digit]:
            path.append(char)
            backtrack(index + 1, path)
```

```
        path.pop()


    result = []
    backtrack(0, [])
    return result


 print(letterCombinations("23"))
print(letterCombinations(""))
print(letterCombinations("2"))
```



18. 4Sum Given an array nums of n integers, return an array of all the unique quadruplets [nums[a], nums[b], nums[c], nums[d]] such that: ● 0 <= a, b, c, d < n ● a, b, c, and d are distinct. ● nums[a] + nums[b] + nums[c] + nums[d] == target You may return the answer in any order. Example 1: Input: nums = [1,0,-1,0,-2,2], target = 0 Output: [[-2,-1,1,2],[-2,0,0,2],[-1,0,0,1]] Example 2: Input: nums = [2,2,2,2,2], target = 8 Output: [[2,2,2,2]] Constraints: ● 1 <= nums.length <= 200 ● -109 <= nums[i] <= 109 ● -109 <= target <= 109

```
def fourSum(nums, target):
    nums.sort()
    result = []
    n = len(nums)


    for i in range(n - 3):
        if i > 0 and nums[i] == nums[i - 1]:
            continue
        for j in range(i + 1, n - 2):
            if j > i + 1 and nums[j] == nums[j - 1]:
```

```
            continue
        left, right = j + 1, n - 1
        while left < right:
            sum_ = nums[i] + nums[j] + nums[left] + nums[right]
            if sum_ == target:
                result.append([nums[i], nums[j], nums[left], nums[right]])
                left += 1
                right -= 1
                while left < right and nums[left] == nums[left - 1]:
                    left += 1
                while left < right and nums[right] == nums[right + 1]:
                    right -= 1
            elif sum_ < target:
                left += 1
            else:
                right -= 1

    return result


print(fourSum([1, 0, -1, 0, -2, 2], 0))
print(fourSum([2, 2, 2, 2, 2], 8))
```

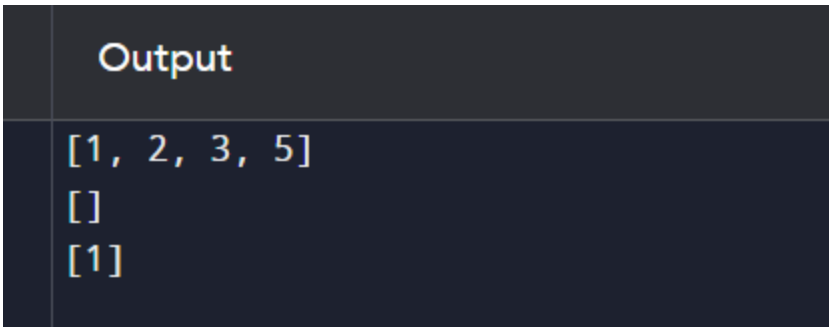
```
Output
[[-2, -1, 1, 2], [-2, 0, 0, 2], [-1, 0, 0, 1]]
[[2, 2, 2, 2]]
```

19. Remove Nth Node From End of List Given the head of a linked list, remove the nth node from the end of the list and return its head. Example 1: Input: head = [1,2,3,4,5], n = 2 Output: [1,2,3,5] Example 2:

Input: head = [1], n = 1 Output: [] Example 3: Input: head = [1,2], n = 1 Output: [1] Constraints: ● The number of nodes in the list is sz. ● 1 <= sz <= 30 ● 0 <= Node.val <= 100 ● 1 <= n <= sz

```
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next


def removeNthFromEnd(head, n):
     dummy = ListNode(0, head)
    first = dummy
    second = dummy


     for _ in range(n + 1):
        first = first.next


     while first:
        first = first.next
        second = second.next


     second.next = second.next.next


     return dummy.next


 def create_linked_list(lst):
    dummy = ListNode(0)
    current = dummy
    for val in lst:
        current.next = ListNode(val)
        current = current.next
```

```
    return dummy.next

def print_linked_list(head):
    current = head
    result = []
    while current:
        result.append(current.val)
        current = current.next
    return result

 head = create_linked_list([1, 2, 3, 4, 5])
n = 2
new_head = removeNthFromEnd(head, n)
print(print_linked_list(new_head))

head = create_linked_list([1])
n = 1
new_head = removeNthFromEnd(head, n)
print(print_linked_list(new_head))

head = create_linked_list([1, 2])
n = 1
new_head = removeNthFromEnd(head, n)
print(print_linked_list(new_head))
```



20. Valid Parentheses Given a string s containing just the characters '(', ')', '{', '}', '[' and ']', determine if the input string is valid. An input string is valid if: 1. Open brackets must be closed by the same type of brackets. 2. Open brackets must be closed in the correct order. 3. Every close bracket has a corresponding open bracket of the same type. Example 1: Input: s = "()" Output: true Example 2: Input: s = "()[]{}" Output: true Example 3: Input: s = "(]" Output: false Constraints: ● 1 <= s.length <= 104 ● s consists of parentheses only '()[]{}

```
def isValid(s):
    stack = []
    mapping = {')': '(', ']': '[', '}': '{'}

    for char in s:
        if char in mapping.values():
            stack.append(char)
        elif char in mapping.keys():
            if not stack or stack.pop() != mapping[char]:
                return False
        else:
            return False

    return not stack

 print(isValid("()"))
print(isValid("()[]{}"))
print(isValid("(]"))
```

Output

```
True
True
False
```