ASSIGNMENT-2

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11. Container With Most Water

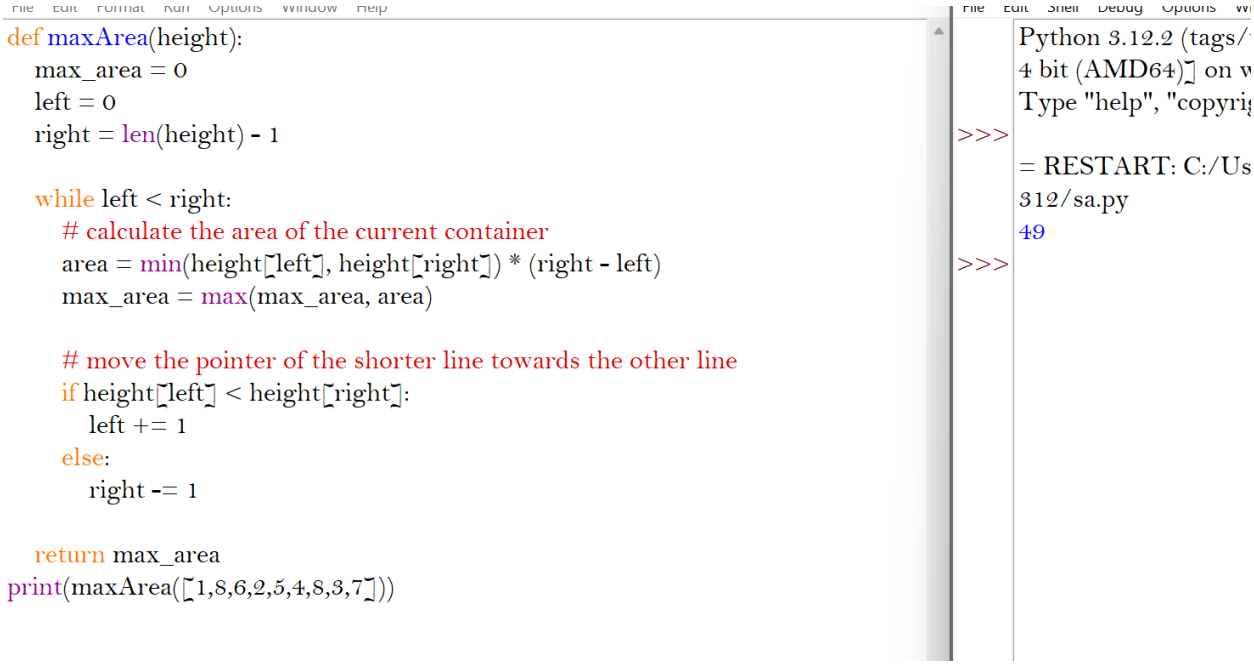
Container With Most Water You are given an integer array height of length n. There are n vertical lines drawn such that the two endpoints of the ith line are (i, 0) and (i, height[i]). Find two lines that together with the x-axis form a container, such that the container contains the most water. Return 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

PROGRAM:



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

    while left < right:
        # calculate the area of the current container
        area = min(height[left], height[right]) * (right - left)
        max_area = max(max_area, area)

        # move the pointer of the shorter line towards the other line
        if height[left] < height[right]:
            left += 1
        else:
            right -= 1

    return max_area
print(maxArea([1,8,6,2,5,4,8,3,7]))
```

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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.

PROGRAM:

```
def int_to_roman(num):
    val = [
        1000, 900, 500, 400,
        100, 90, 50, 40,
        10, 9, 5, 4,
        1
        ]
    syb = [
        "M", "CM", "D", "CD",
        "C", "XC", "L", "XL",
        "X", "IX", "V", "IV",
        "I"
        ]
    roman_num = ''
    i = 0
    while  num > 0:
        for _ in range(num // val[i]):
            roman_num += syb[i]
            num -= val[i]
        i += 1
    return roman_num
print(int_to_roman(3))
```

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```

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.

PROGRAM:

```python
def romanToInt(s: str) -> int:
    roman_dict = {'I': 1, 'V': 5, 'X': 10, 'L': 50, 'C': 100, 'D': 500, 'M': 1000}
    total = 0
    for i in range(len(s) - 1):
        if roman_dict[s[i]] < roman_dict[s[i + 1]]:
            total -= roman_dict[s[i]]
        else:
            total += roman_dict[s[i]]
    return total + roman_dict[s[-1]]
print(romanToInt("III"))
```

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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"

PROGRAM:

```python
def longest_common_prefix(strs):
    if not strs:
        return ""
    prefix = strs[0]
    for s in strs[1:]:
        while not s.startswith(prefix):
            prefix = prefix[:-1]
            if not prefix:
                return ""
    return prefix
example1 = ["flower", "flow", "flight"]
print(longest_common_prefix(example1))
```

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5. 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.

PROGRAM:

```
def threeSum(nums):
    nums.sort()
    result = []
    for i in range(len(nums) - 2):
        if i > 0 and nums[i] == nums[i - 1]:
            continue
        l, r = i + 1, len(nums) - 1
        while l < r:
            s = nums[i] + nums[l] + nums[r]
            if s < 0:
                l += 1
            elif s > 0:
                r -= 1
            else:
                result.append([nums[i], nums[l], nums[r]])
                while l < r and nums[l] == nums[l + 1]:
                    l += 1
                while l < r and nums[r] == nums[r - 1]:
                    r -= 1
                l += 1
                r -= 1
    return result
nums = [-1, 0, 1, 2, -1, -4]
result = threeSum(nums)
print(result)
```

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

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).

PROGRAM:

```
def threeSumClosest(nums, target):
    nums.sort()
    closest_sum = float('inf')
    for i in range(len(nums) - 2):
        left, right = i + 1, len(nums) - 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
nums = [-1,2,1,-4]
target = 1
closest_sum = threeSumClosest(nums, target)
print(closest_sum)
```

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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"]

PROGRAM:

```
def letterCombinations(digits):
    if not digits:
        return []
    phone = {
        '2': ['a', 'b', 'c'],
        '3': ['d', 'e', 'f'],
        '4': ['g', 'h', 'i'],
        '5': ['j', 'k', 'l'],
        '6': ['m', 'n', 'o'],
        '7': ['p', 'q', 'r', 's'],
        '8': ['t', 'u', 'v'],
        '9': ['w', 'x', 'y', 'z']
    }
    def backtrack(combination, next_digits):
        if len(next_digits) == 0:
            output.append(combination)
        else:
            for letter in phone[next_digits[0]]:
                backtrack(combination + letter, next_digits[1:])

    output = []
    backtrack("", digits)
    return output
print(letterCombinations("23"))
```

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312/sa.py
['ad', 'ae', 'af', 'bd', 'be', 'bf', 'cd', 'ce', 'cf']
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```

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]]

PROGRAM:

```
def fourSum(nums, target):
    nums.sort()
    result = []
    for i in range(len(nums) - 3):
        if i > 0 and nums[i] == nums[i - 1]:
            continue
        for j in range(i + 1, len(nums) - 2):
            if j > i + 1 and nums[j] == nums[j - 1]:
                continue
            left, right = j + 1, len(nums) - 1
            while left < right:
                total = nums[i] + nums[j] + nums[left] + nums[right]
                if total < target:
                    left += 1
                elif total > target:
                    right -= 1
                else:
                    result.append([nums[i], nums[j], nums[left], nums[right]])
                    while left < right and nums[left] == nums[left + 1]:
                        left += 1
                    while left < right and nums[right] == nums[right - 1]:
                        right -= 1
                    left += 1
                    right -= 1
    return result
print(fourSum([1, 0, -1, 0, -2, 2], 0))
```

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

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]

PROGRAM:

```python
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next
def removeNthFromEnd(head: ListNode, n: int) -> ListNode:
    dummy = ListNode(0, head)
    first = dummy
    second = dummy
    for _ in range(n + 1):
        first = first.next
    while first is not None:
        first = first.next
        second = second.next
    second.next = second.next.next
    return dummy.next
def list_to_linkedlist(arr):
    if not arr:
        return None
    head = ListNode(arr[0])
    current = head
    for val in arr[1:]:
        current.next = ListNode(val)
        current = current.next
    return head
def linkedlist_to_list(node):
    arr = []
    while node:
        arr.append(node.val)
        node = node.next
    return arr
head = list_to_linkedlist([1, 2, 3, 4, 5])
n = 2
new_head = removeNthFromEnd(head, n)
print(linkedlist_to_list(new_head))
```

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[1, 2, 3, 5]
>>>
```

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

PROGRAM:

```
def isValid(s: str) -> bool:
    stack = []
    mapping = {")": "(", "}": "{", "]": "["}

    for char in s:
        if char in mapping.values():  # open bracket
            stack.append(char)
        elif char in mapping:  # close bracket
            if not stack or mapping[char] != stack.pop():
                return False
    return not stack
print(isValid("()"))
```

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312/sa.py
True
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