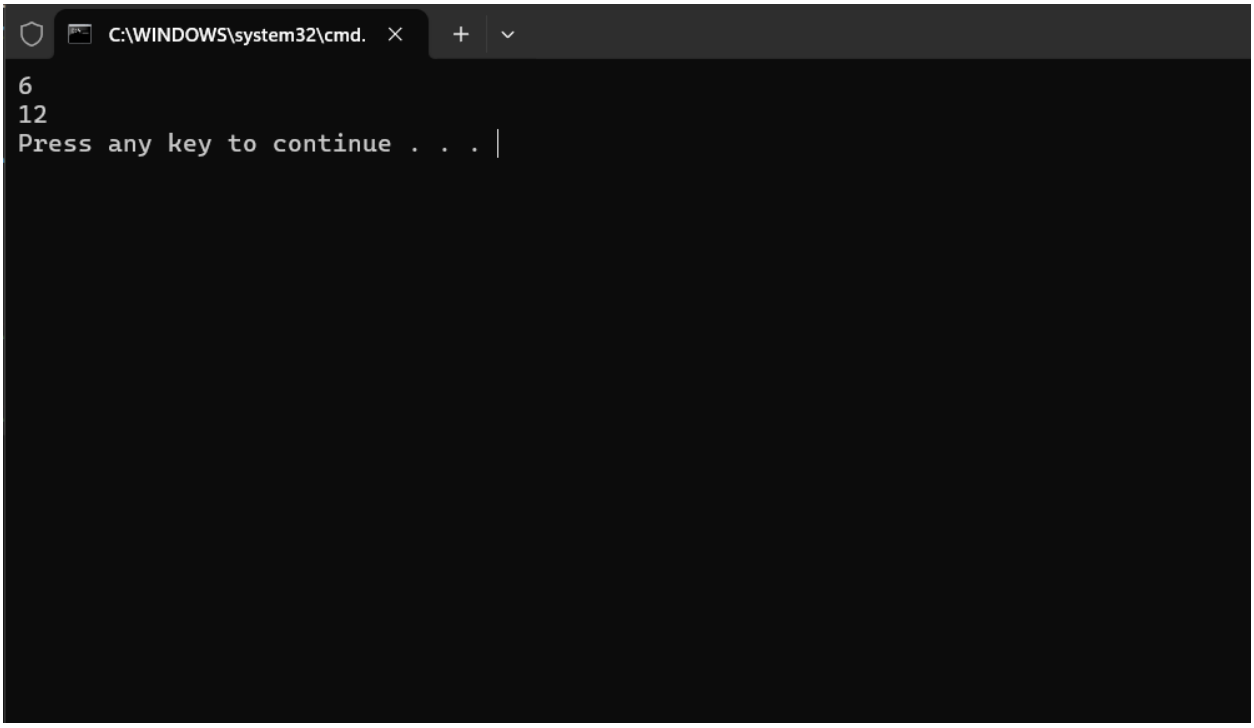
ASSIGNMENT 2:

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.

CODE:

```
def maxArea(A, Len) :
    area = 0
    for i in range(Len) :
        for j in range(i + 1, Len) :
             area = max(area, min(A[j], A[i]) * (j - i))
    return area
a = [ 1, 5, 4, 3 ]
b = [ 3, 1, 2, 4, 5 ]
len1 = len(a)
print(maxArea(a, len1))
len2 = len(b)
print(maxArea(b, len2))
```

OUTPUT:



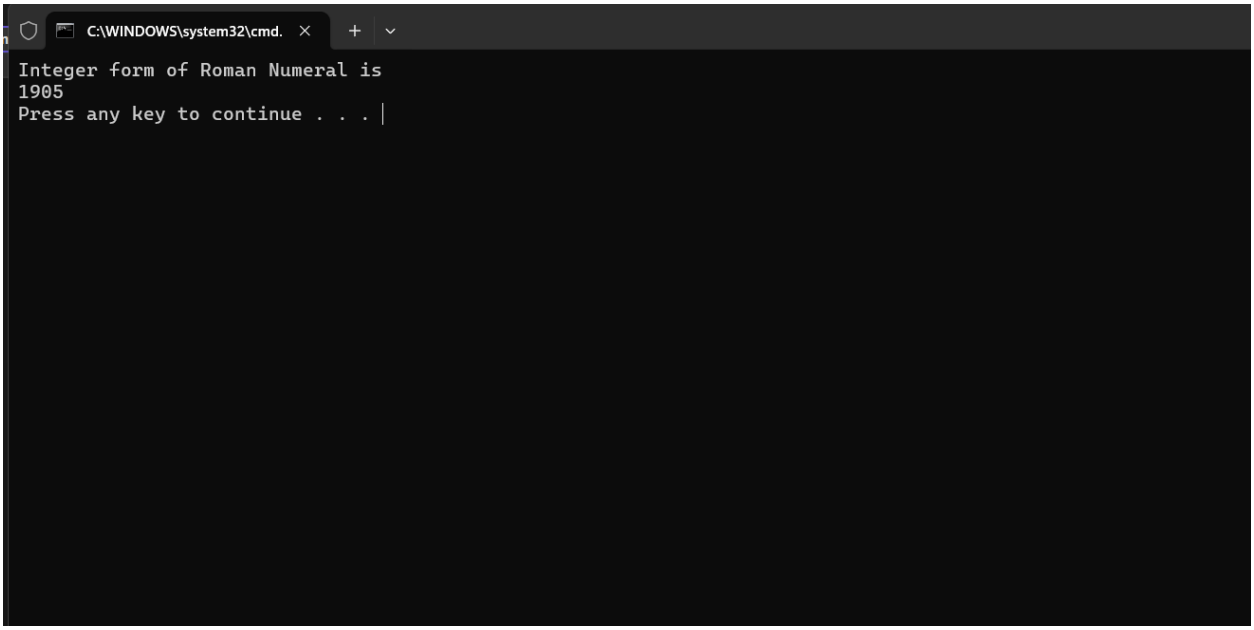
12) 12. Roman numerals are represented by seven different symbols: I, V, X, L, C, D and M. Symbol Value I 1 V 5 X 10 L 50 C 100 D 500 M 1000 For example, 2 is written as II in Roman numeral, just two one's added together. 12 is written as XII, which is simply X + II. The number 27 is written as XXVII, 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.

CODE:

```
def value(r):
    if (r == 'I'):
        return 1
    if (r == 'V'):
        return 5
    if (r == 'X'):
        return 10
    if (r == 'L'):
        return 50
    if (r == 'C'):
        return 100
    if (r == 'D'):
        return 500
    if (r == 'M'):
        return 1000
    return -1
def romanToDecimal(str):
    res = 0
    i = 0
    while (i < len(str)):
        s1 = value(str[i])
        if (i + 1 < len(str)):
            s2 = value(str[i + 1])
        if (s1 >= s2):
            res = res + s1
            i = i + 1
        else:
            res = res + s2 - s1
            i = i + 2
    else:
        res = res + s1
        i = i + 1
        return res
print("Integer form of Roman Numeral is"),
print(romanToDecimal("MCMIV"))
```

OUTPUT:

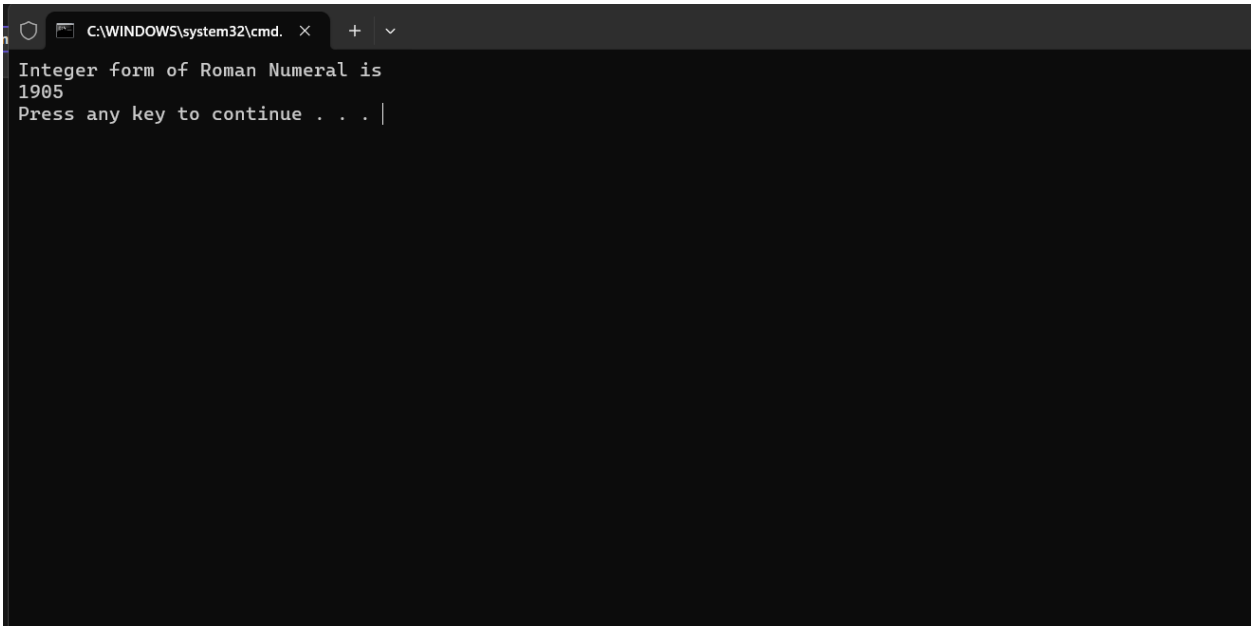


13) 13. Roman to Integer Roman numerals are represented by seven different symbols: I, V, X, L, C, D and M. Symbol Value I 1 V 5 X 10 L 50 C 100 D 500 M 1000 For example, 2 is written as II in Roman numeral, just two ones added together. 12 is written as XII, which is simply X + II. The number 27 is 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.

CODE:

```
roman = {'I':1,'V':5,'X':10,'L':50,'C':100,'D':500,'M':1000}

class Solution:
    def romanToInt(self, S: str) -> int:
        summ = 0
        prev_num = 0

        for i in range(len(S)-1, -1, -1):
            num = roman[S[i]]

            if num < prev_num:
                summ -= num
            else:
                summ += num

            prev_num = num

        return summ
```

OUTPUT:

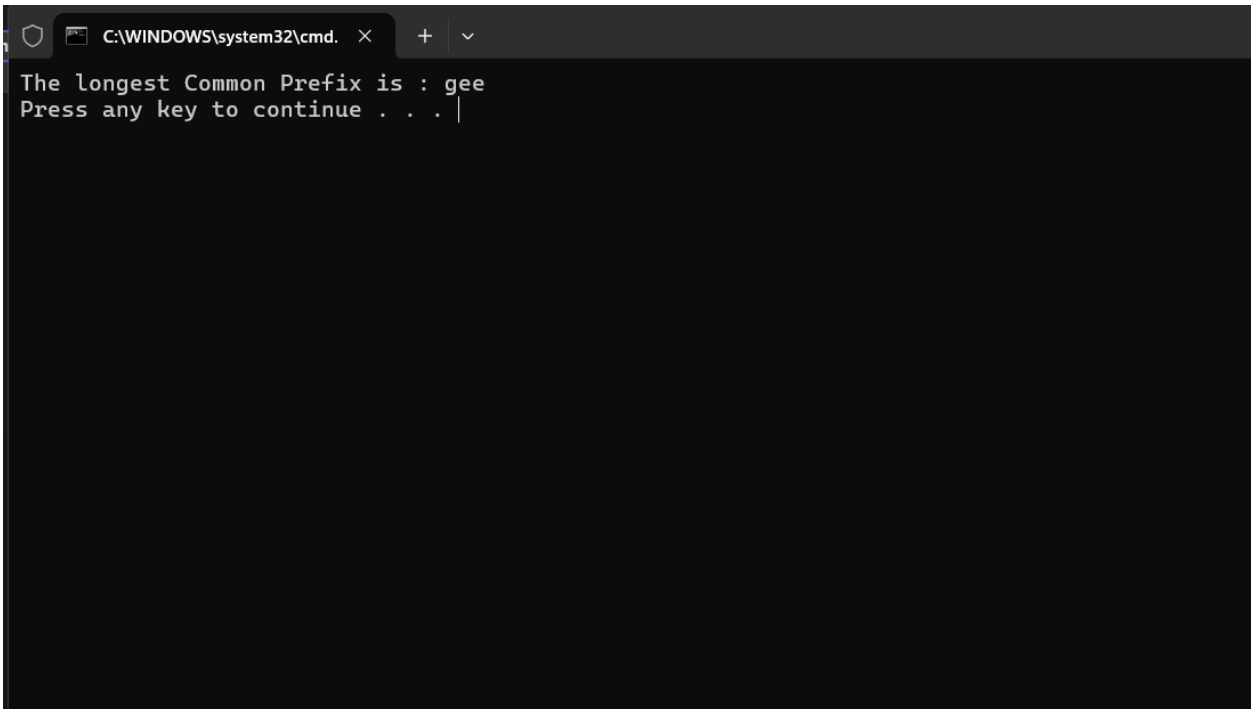


14) Longest Common Prefix Write a function to find the longest common prefix string amongst an array of strings. If there is no common prefix, return an empty string ""

CODE:

```
def longestCommonPrefix( a):
    size = len(a)
    if (size == 0):
        return ""
    if (size == 1):
        return a[0]
    a.sort()
    end = min(len(a[0]), len(a[size - 1]))
    i = 0
    while (i < end and a[0][i] == a[size - 1][i]):
        i += 1
        pre = a[0][0: i]
    return pre
if __name__ == "__main__":
    input = ["geeksforgeeks", "geeks",
"geek", "geezer"]
    print("The longest Common Prefix is :" ,
longestCommonPrefix(input))
```

OUTPUT:



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.

CODE:

```
def findTriplets(nums, n, Sum):
    i = 0
    j = 0
    k = 0
    triplet = []
    uniqTriplets = set()

    nums.sort()

    for i in range(n - 2):
        j = i + 1
        k = n - 1

        while j < k:
            if nums[i] + nums[j] + nums[k] == Sum:
                temp = str(nums[i]) + ":" + str(nums[j]) + ":" + str(nums[k])
                if temp not in uniqTriplets:
                    uniqTriplets.add(temp)
                    triplet.append([nums[i], nums[j], nums[k]])

                j += 1
                k -= 1
            elif nums[i] + nums[j] + nums[k] > Sum:
```

```
                k -= 1
            else:
                j += 1

    if not triplet:
        return 0

    for t in triplet:
        print(t, end=", ")

    return 1
nums = [12, 3, 6, 1, 6, 9]
n = len(nums)
Sum = 24

if not findTriplets(nums, n, Sum):
    print("No triplets can be formed.")
```

OUTPUT:

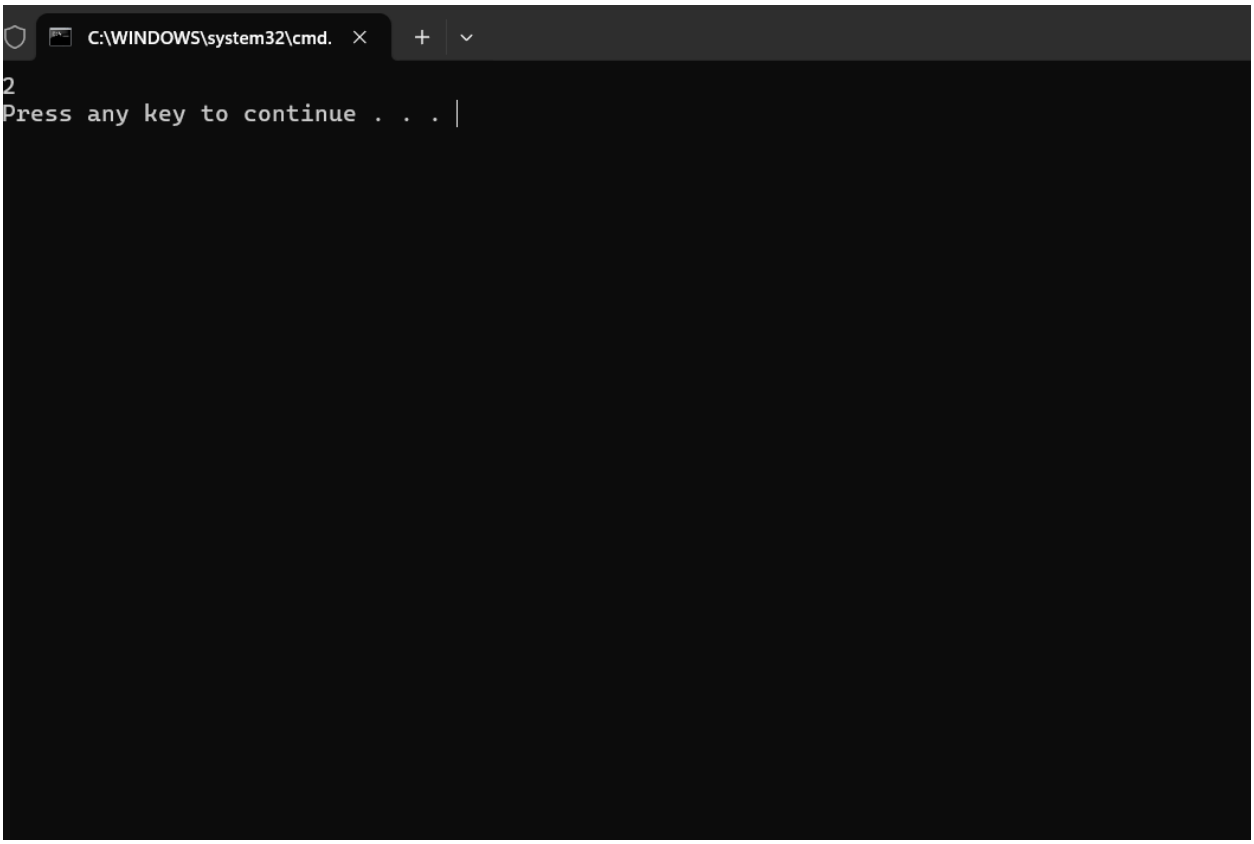
16) 3Sum Closest Given an integer array nums of length n and an integer target, find three integers in nums such that the sum is closest to target. Return the sum of the three integers. You may assume that each input would have exactly one solution.

CODE:

```
import sys

def solution(arr, x):
    closestSum = sys.maxsize
    for i in range(len(arr)):
        for j in range(i + 1, len(arr)):
            for k in range(j + 1, len(arr)):
                current_sum = arr[i] + arr[j] + arr[k]
                if abs(x - current_sum) < abs(x - closestSum):
                    closestSum = current_sum
```

```
    return closestSum

if __name__ == "__main__":
    arr = [-1, 2, 1, -4]
    x = 1
    print(solution(arr, x))
```

OUTPUT:



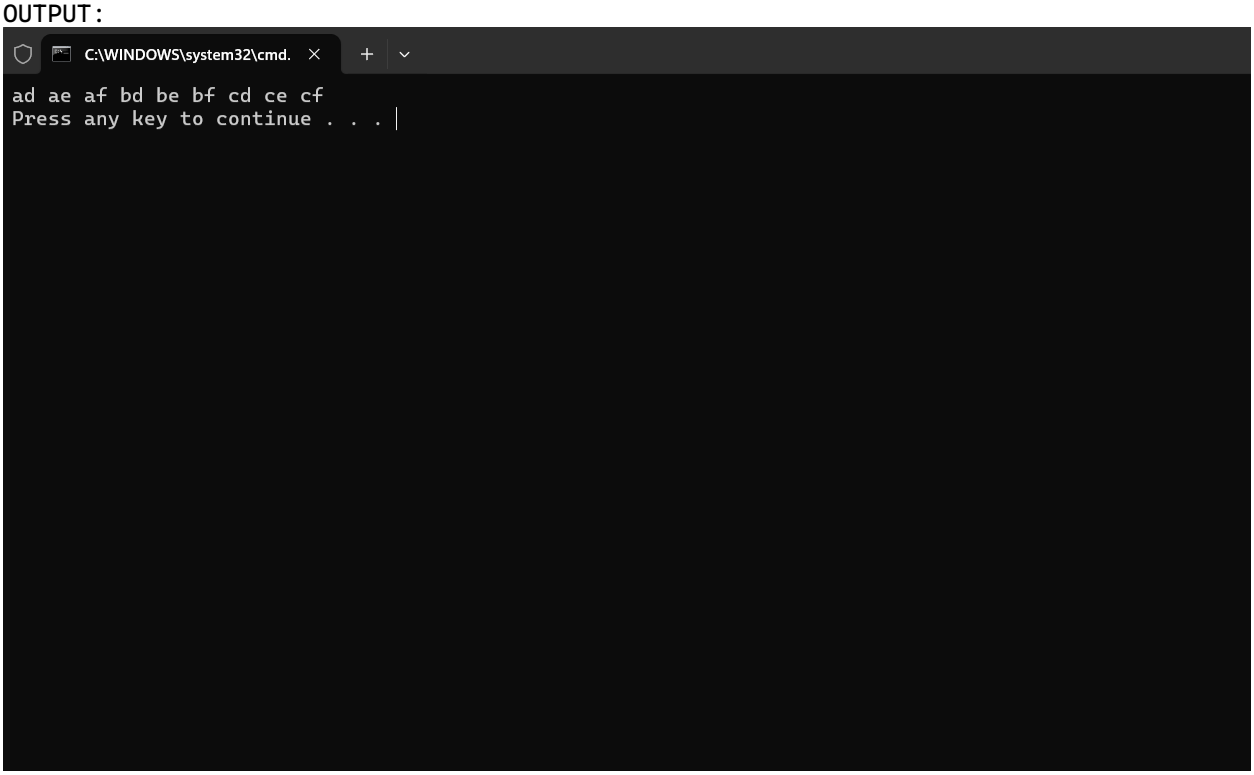
17) Letter Combinations of a Phone Number Given a string containing digits from 2-9 inclusive, return all possible letter combinations that the number could represent. Return the answer in any order. A mapping of digits to letters (just like on the telephone buttons) is given below. Note that 1 does not map to any letters.

CODE:

```
from collections import deque

def letterCombinationsUtil(number, n, table):
    result = []
    q = deque()
    q.append("")

    while q:
        s = q.popleft()

        if len(s) == n:
```

```
            result.append(s)
        else:
            for letter in table[int(number[len(s)])]:
                q.append(s + letter)

    return result

def letterCombinations(number, n):
    table = ["0", "1", "abc", "def", "ghi", "jkl", "mno", "pqrs", "tuv", "wxyz"]
    result = letterCombinationsUtil(number, n, table)

    output = ""
    for word in result:
        output += word + " "

    print(output)

number = ['2', '3']
n = len(number)

letterCombinations(number, n)
```

OUTPUT:

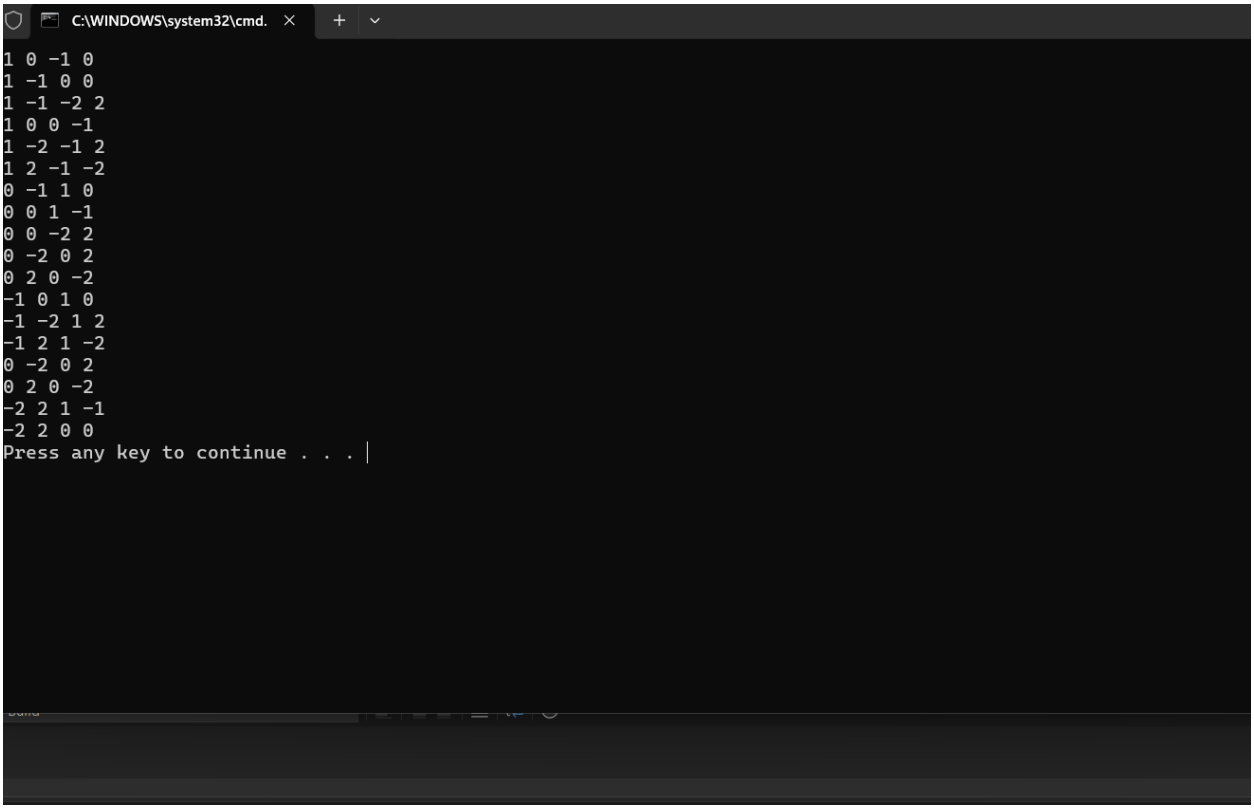


18) 4Sum Given an array nums of n integers, return an array of all the unique quadruplets [nums[a], nums[b], nums[c], nums[d]] such that: ● 0 <= a, b, c, d < n ● a, b, c, and d are distinct. ● nums[a] + nums[b] + nums[c] + nums[d] == target

CODE:

```
class Pair:
    def __init__(self, x, y):
```

```
        self.index1 = x
        self.index2 = y

def GetQuadruplets(nums, target):
    map = {}
    ans = set()
    for i in range(len(nums) - 1):
        for j in range(i + 1, len(nums)):
            sum = nums[i] + nums[j]
            if sum not in map:
                map[sum] = [Pair(i, j)]
            else:
                map[sum].append(Pair(i, j))
    for i in range(len(nums) - 1):
        for j in range(i + 1, len(nums)):
            lookUp = target - (nums[i] + nums[j])
            if lookUp in map:
                temp = map[lookUp]
                for pair in temp:
                    if pair.index1 != i and pair.index1 != j and pair.index2 != i
and pair.index2 != j:
                        print(nums[i], nums[j], nums[pair.index1],
nums[pair.index2])

arr = [1, 0, -1, 0, -2, 2]
K = 0
GetQuadruplets(arr, K)
OUTPUT:
```

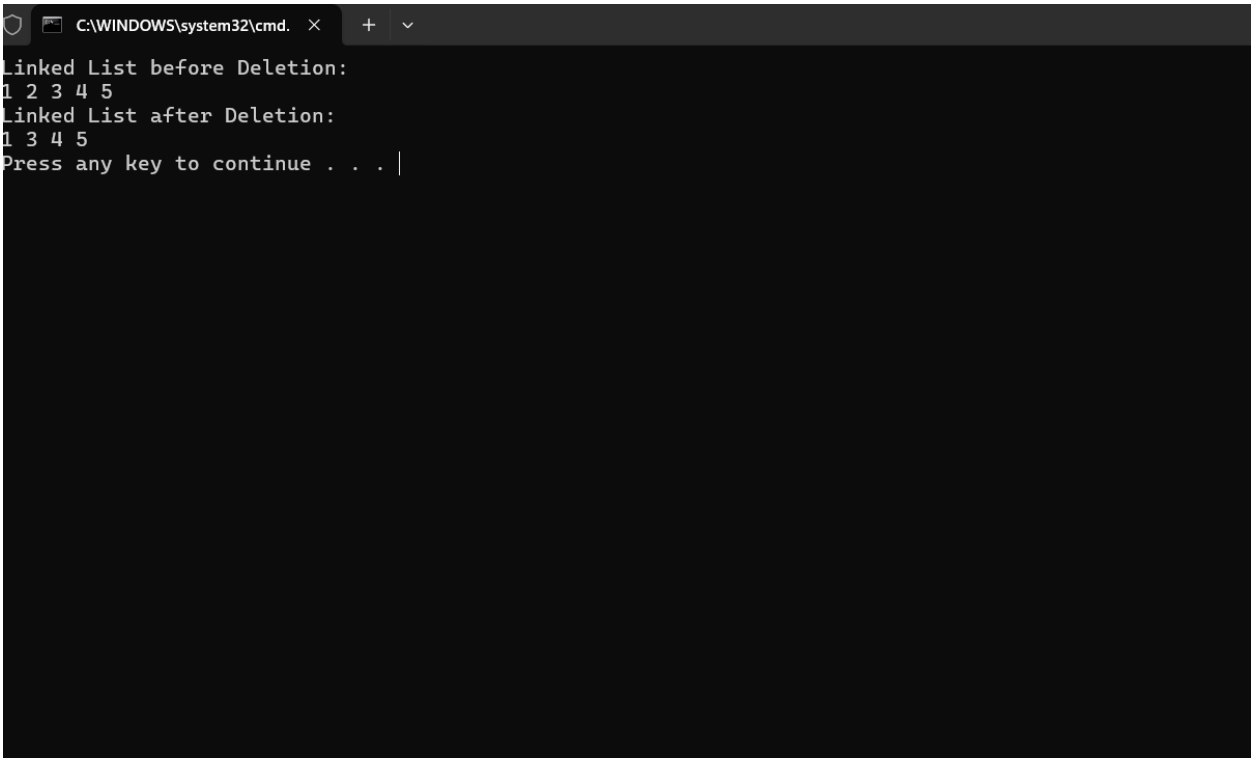


19) . Remove Nth Node From End of List Given the head of a linked list, remove the nth node from the end of the list and return its head.

CODE:

```
class Node:
    def __init__(self, value):
        self.data = value
        self.next = None

def length(head):
    temp = head
    count = 0
    while temp is not None:
        count += 1
        temp = temp.next
    return count

def printList(head):
    ptr = head
    while ptr is not None:
        print(ptr.data, end=" ")
        ptr = ptr.next
    print()

def deleteNthNodeFromEnd(head, n):
    Length = length(head)
    nodeFromBeginning = Length - n + 1
    prev = None
    temp = head

    if nodeFromBeginning == 1:
        head = head.next
        return head

    for i in range(1, nodeFromBeginning):
        prev = temp
        temp = temp.next

    prev.next = temp.next
    return head

if __name__ == '__main__':
    head = Node(1)
    head.next = Node(2)
    head.next.next = Node(3)
    head.next.next.next = Node(4)
    head.next.next.next.next = Node(5)

    print("Linked List before Deletion:")
    printList(head)

    head = deleteNthNodeFromEnd(head, 4)

    print("Linked List after Deletion:")
    printList(head)
```

OUTPUT:



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.

OUTPUT:

```
def areBracketsBalanced(expr):
    stack = []
    opening_brackets = ["(", "{", "["]
    closing_brackets = [")", "}", "]"]


    for char in expr:
        if char in opening_brackets:

            stack.append(char)
        elif char in closing_brackets:

            if not stack:
                return False
            current_char = stack.pop()
            if opening_brackets.index(current_char) != closing_brackets.index(char):
                return False


    if stack:
        return False
    return True

if __name__ == "__main__":
    expr = "{()}[]"

    if areBracketsBalanced(expr):
```

```
        print("Balanced")
    else:
        print("Not Balanced")
```

OUTPUT: