LAB-5

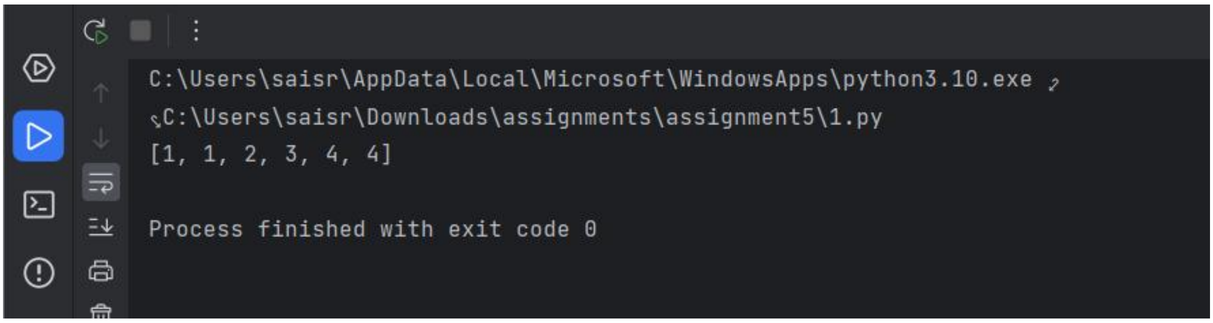
1.Merge Two Sorted Lists

You are given the heads of two sorted linked lists list1 and list2.Merge the two lists in a one sorted list. The list should be made by splicing together the nodes of the first two lists. Return *the head of the merged linked list.*

Coding:

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


class LinkedList:
    def __init__(self):
        self.head = None

    def insert(self, data):
        new_node = Node(data)
        if not self.head:
            self.head = new_node
        else:
            current = self.head
            while current.next:
                current = current.next
            current.next = new_node
            return self.head

    def s(self):
        data = []
        current = self.head
        while current:
            data.append(current.data)
            current = current.next
        r = sorted(data)
        return r


l = LinkedList()
#l1
l.insert(1)
l.insert(2)
l.insert(4)
#l2
l.insert(1)
l.insert(3)
l.insert(4)

print(l.s())
```

Output:



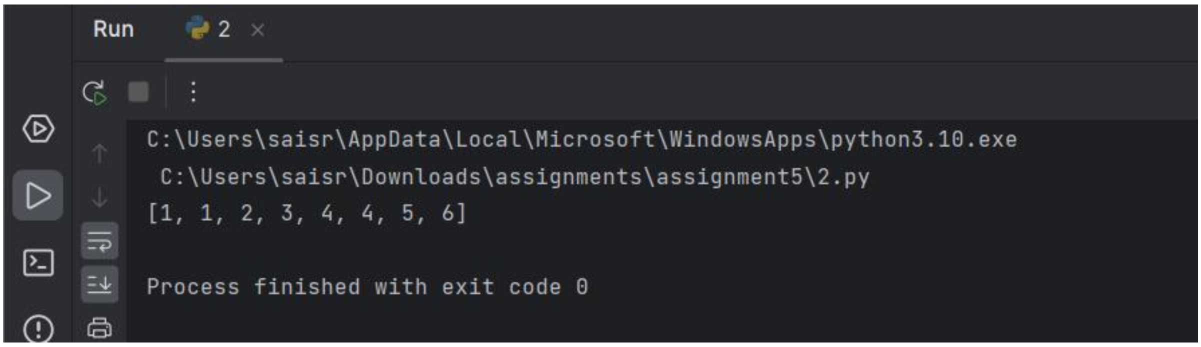
```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe 
C:\Users\saisr\Downloads\assignments\assignment5\1.py
[1, 1, 2, 3, 4, 4]

Process finished with exit code 0
```

1. Merge k Sorted Lists
You are given an array of k linked-lists lists, each linked-list is sorted in ascending order. ***Merge all the linked-lists into one sorted linked-list and return it.***

Coding:

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

class Linked_list:
    def __init__(self):
        self.head = None

    def insert(self,data):
        new_node = Node(data)
        if not self.head:
            self.head = new_node
        else:
            current = self.head
            while current.next:
                current = current.next
            current.next = new_node
        return self.head

    def s(self):
        data = []
        current = self.head
        while current:
            data.extend(current.data)
            current = current.next
        r = sorted(data)
        return r


ar = [[1,4,5],[1,3,4],[2,6]]
l = Linked_list()
for i in range(len(ar)):
    l.insert(ar[i])

print(l.s())
```

Output:

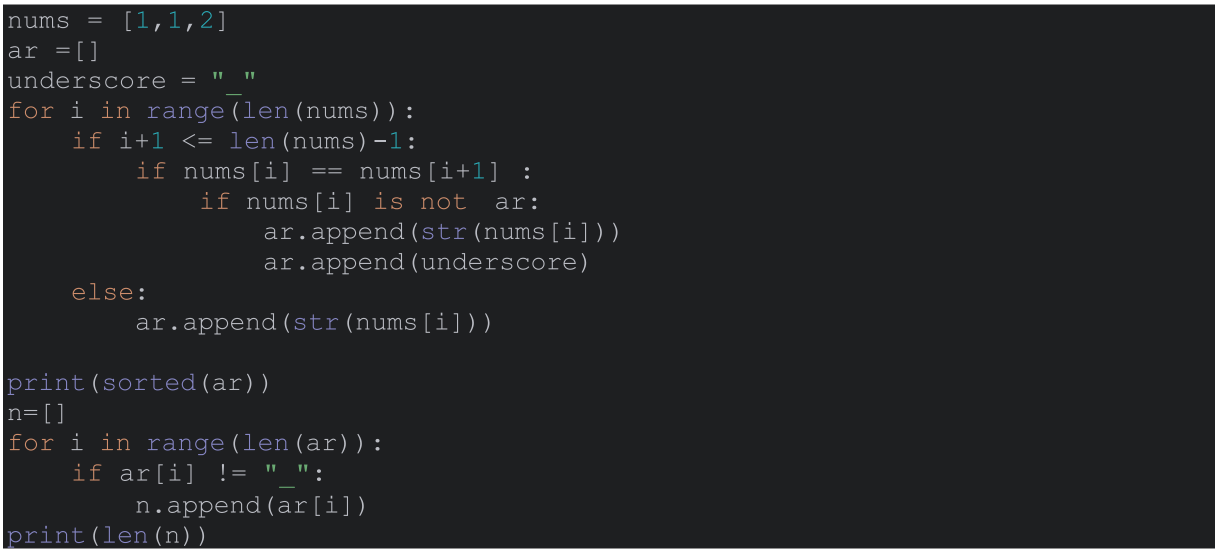


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\2.py
[1, 1, 2, 3, 4, 4, 5, 6]

Process finished with exit code 0
```

2. Remove Duplicates from Sorted Array

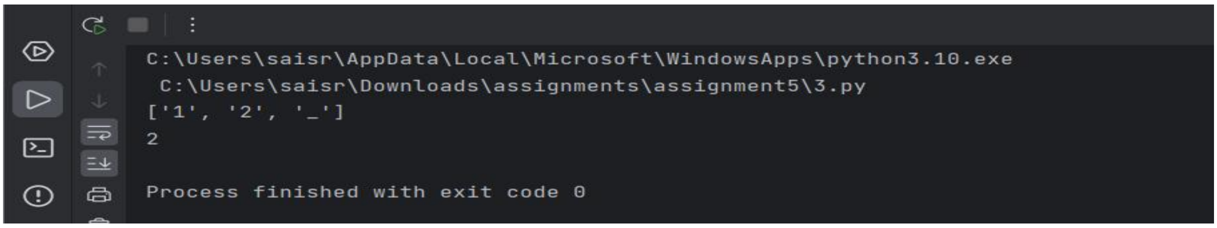
Given an integer array nums sorted in non-decreasing order, remove the duplicates inplace such that each unique element appears only once. The relative order of the elements should be kept the same. Since it is impossible to change the length of the array in some languages, you must instead have the result be placed in the first part of the array nums. More formally, if there are k elements after removing the duplicates, then the first k elements of nums should hold the final result. It does not matter what you leave beyond the first k elements. Return k *after placing the final result in the first* k *slots of* nums.

Coding:



```
nums = [1,1,2]
ar =[]
underscore = "_"
for i in range(len(nums)):
    if i+1 <= len(nums)-1:
        if nums[i] == nums[i+1] :
            if nums[i] is not  ar:
                ar.append(str(nums[i]))
                ar.append(underscore)
    else:
        ar.append(str(nums[i]))

print(sorted(ar))
n=[]
for i in range(len(ar)):
    if ar[i] != "_":
        n.append(ar[i])
print(len(n))
```

Output:

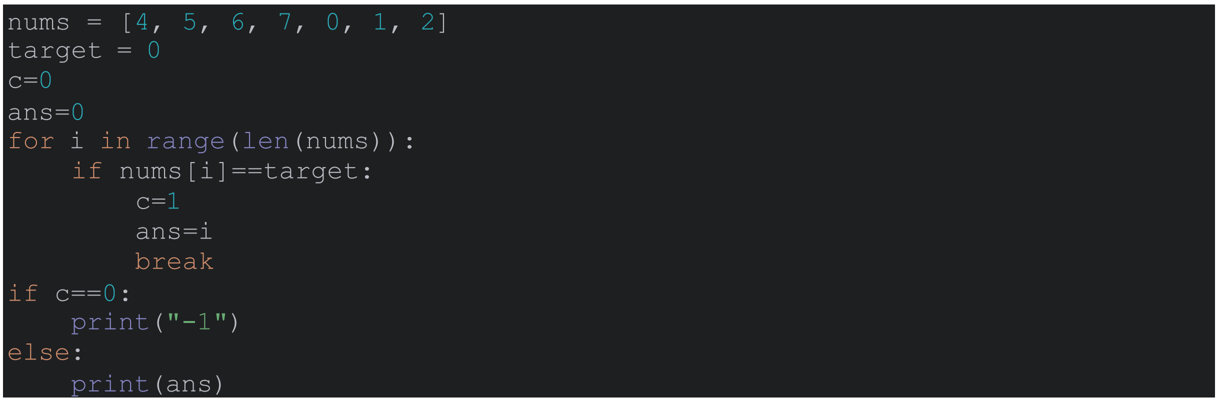


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\3.py
['1', '2', '_']
2

Process finished with exit code 0
```

3. Search in Rotated Sorted Array

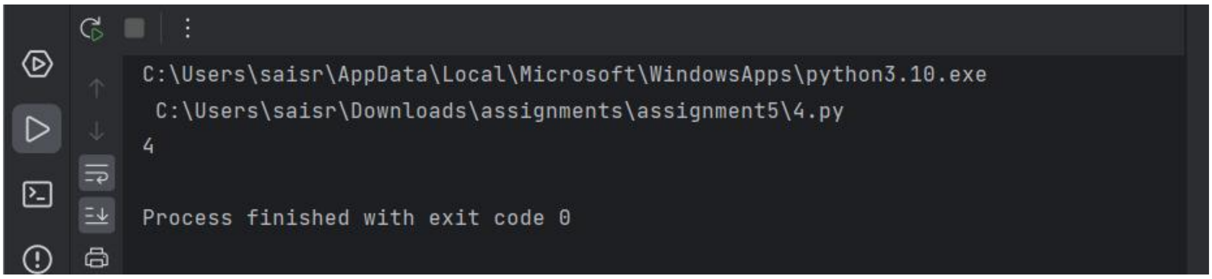
There is an integer array nums sorted in ascending order (with distinct values). Prior to being passed to your function, nums is possibly rotated at an unknown pivot index k (1 <= k < nums.length) such that the resulting array is [nums[k], nums[k+1], ..., nums[n-1], nums[0], nums[1], ..., nums[k-1]] (0-indexed). For example, [0,1,2,4,5,6,7] might be rotated at pivot index 3 and become [4,5,6,7,0,1,2].

Coding:



```
nums = [4, 5, 6, 7, 0, 1, 2]
target = 0
c=0
ans=0
for i in range(len(nums)):
    if nums[i]==target:
        c=1
        ans=i
        break
if c==0:
    print("-1")
else:
    print(ans)
```

Output:

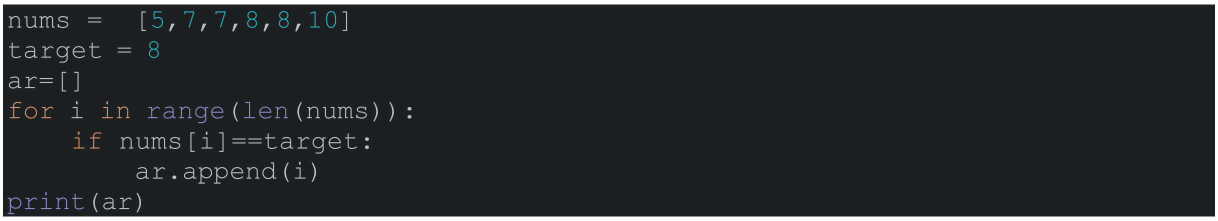


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\4.py
4

Process finished with exit code 0
```

4. Find First and Last Position of Element in Sorted Array

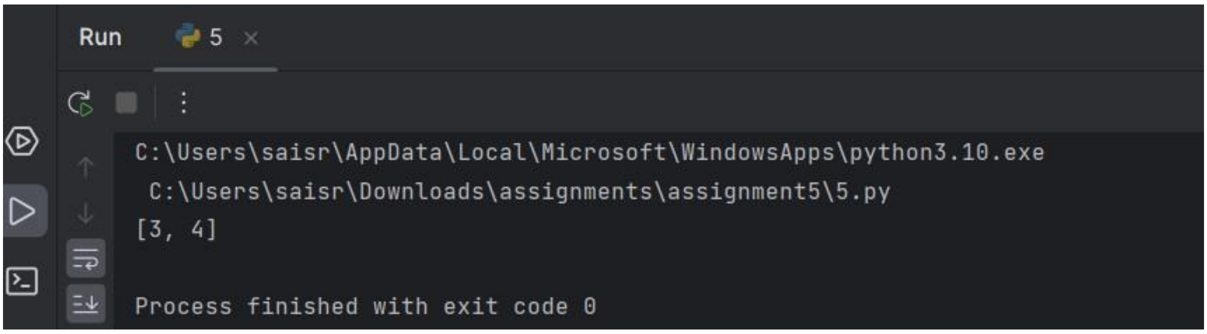
Given an array of integers nums sorted in non-decreasing order, find the starting and ending position of a given target value.If target is not found in the array, return [-1, -1].

Coding:



```
nums =  [5,7,7,8,8,10]
target = 8
ar=[]
for i in range(len(nums)):
    if nums[i]==target:
        ar.append(i)
print(ar)
```

Output:

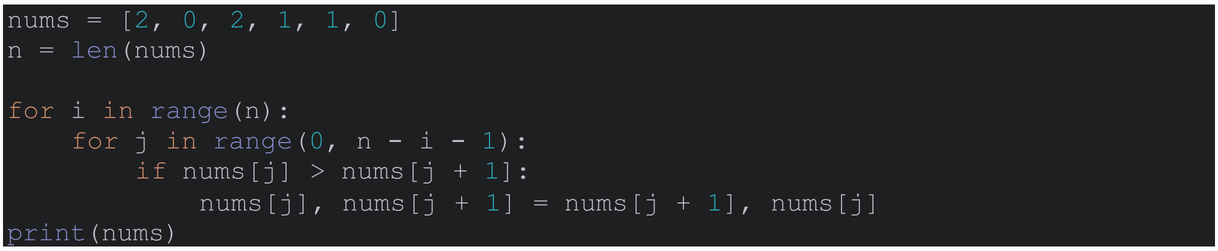


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\5.py
[3, 4]

Process finished with exit code 0
```

5. Sort Colors

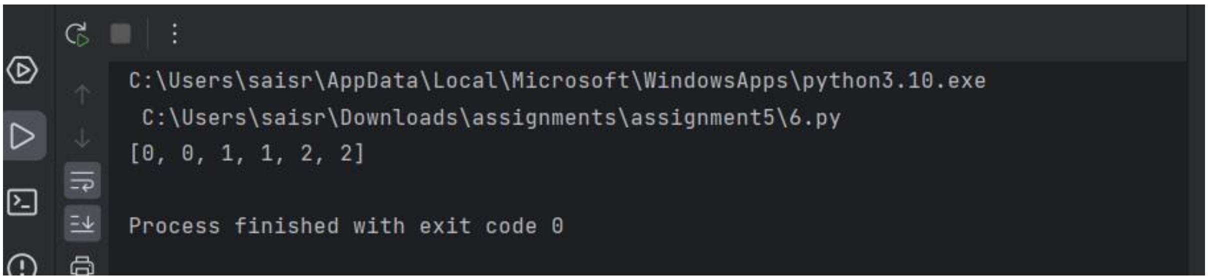
Given an array nums with n objects colored red, white, or blue, sort them in-place so that objects of the same color are adjacent, with the colors in the order red, white, and blue.We will use the integers 0, 1, and 2 to represent the color red, white, and blue, respectively. You must solve this problem without using the library's sort function.

Coding:



```
nums = [2, 0, 2, 1, 1, 0]
n = len(nums)

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

Output:



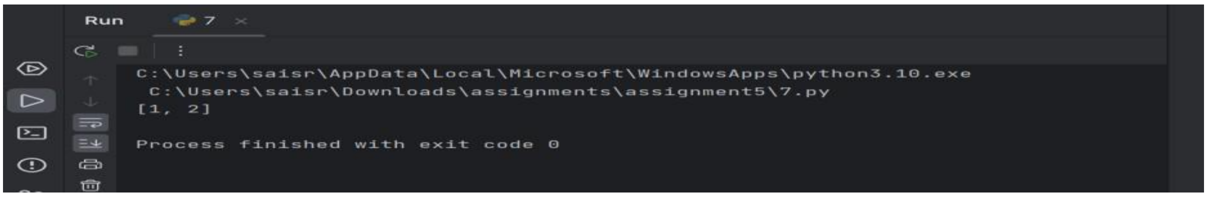
```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\6.py
[0, 0, 1, 1, 2, 2]

Process finished with exit code 0
```

6. Remove Duplicates from Sorted List
Given the head of a sorted linked list, *delete all duplicates such that each element appears only once*. Return *the linked list sorted as well*.

Coding:

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


class Linked_list:
    def __init__(self):
        self.head = None

    def insert(self, data):
        new_node = Node(data)
        if not self.head:
            self.head = new_node
        else:
            current = self.head
            while current.next:
                current = current.next
            current.next = new_node
        return self.head

    def dup(self):
        data = []
        current = self.head
        while current:
            data.append(current.data)
            current = current.next

        i = 0
        while i < len(data) - 1:
            if data[i] == data[i + 1]:
                data.pop(i)
            else:
                i += 1
        return data


ar = [1, 1, 2]
l = Linked_list()
for i in range(len(ar)):
    l.insert(ar[i])
print(l.dup())
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\7.py
[1, 2]

Process finished with exit code 0
```

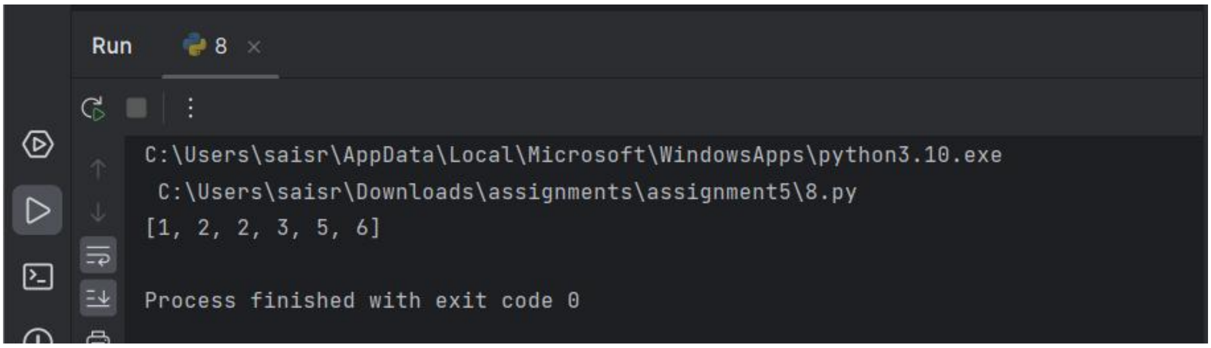
7. Merge Sorted Array

You are given two integer arrays nums1 and nums2, sorted in non-decreasing order, and two integers m and n, representing the number of elements in nums1 and nums2 respectively.

Coding:

```
def merge(nums1, m, nums2, n):
    p1, p2, p = m - 1, n - 1, m + n - 1
    while p2 >= 0:
        if p1 >= 0 and nums1[p1] > nums2[p2]:
            nums1[p] = nums1[p1]
            p1 -= 1
        else:
            nums1[p] = nums2[p2]
            p2 -= 1
        p -= 1

    return nums1


nums1 = [1, 2, 3, 0, 0, 0]
m = 3
nums2 = [2, 5, 6]
n = 3

result = merge(nums1, m, nums2, n)
print(result)
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\8.py
[1, 2, 2, 3, 5, 6]

Process finished with exit code 0
```

8. Convert Sorted Array to Binary Search Tree

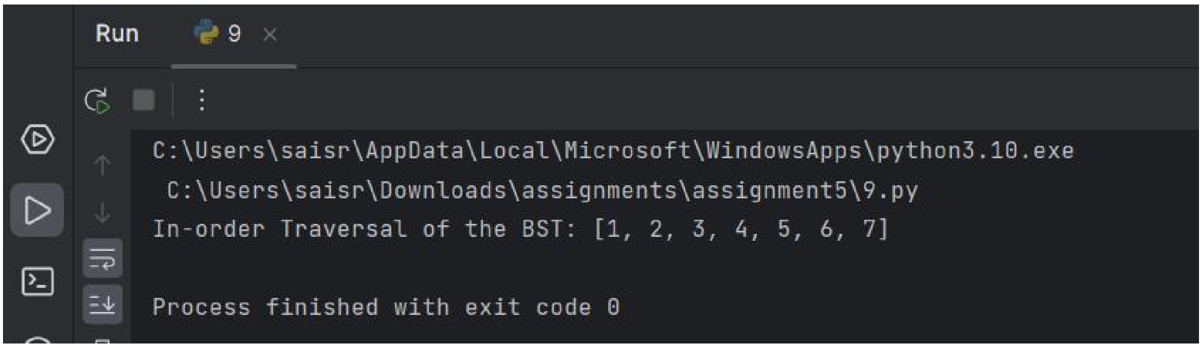
Given an integer array nums where the elements are sorted in ascending order, convert *it to a height-balanced binary search tree.*

Coding:

```
class Node:
    def __init__(self, key):
        self.key = key
        self.left = None
        self.right = None
```

```python
def sorte(nums):
    if not nums:
        return None

    mid = len(nums) // 2
    root = Node(nums[mid])
    root.left = sorte(nums[:mid])
    root.right = sorte(nums[mid + 1:])
    return root

def in_order(root):
    elements = []
    _in_order(root, elements)
    return elements

def _in_order(root, elements):
    if root:
        _in_order(root.left, elements)
        elements.append(root.key)
        _in_order(root.right, elements)

nums = [1, 2, 3, 4, 5, 6, 7]
bst_root = sorte(nums)
print("In-order Traversal of the BST:", in_order(bst_root))
```

Output:



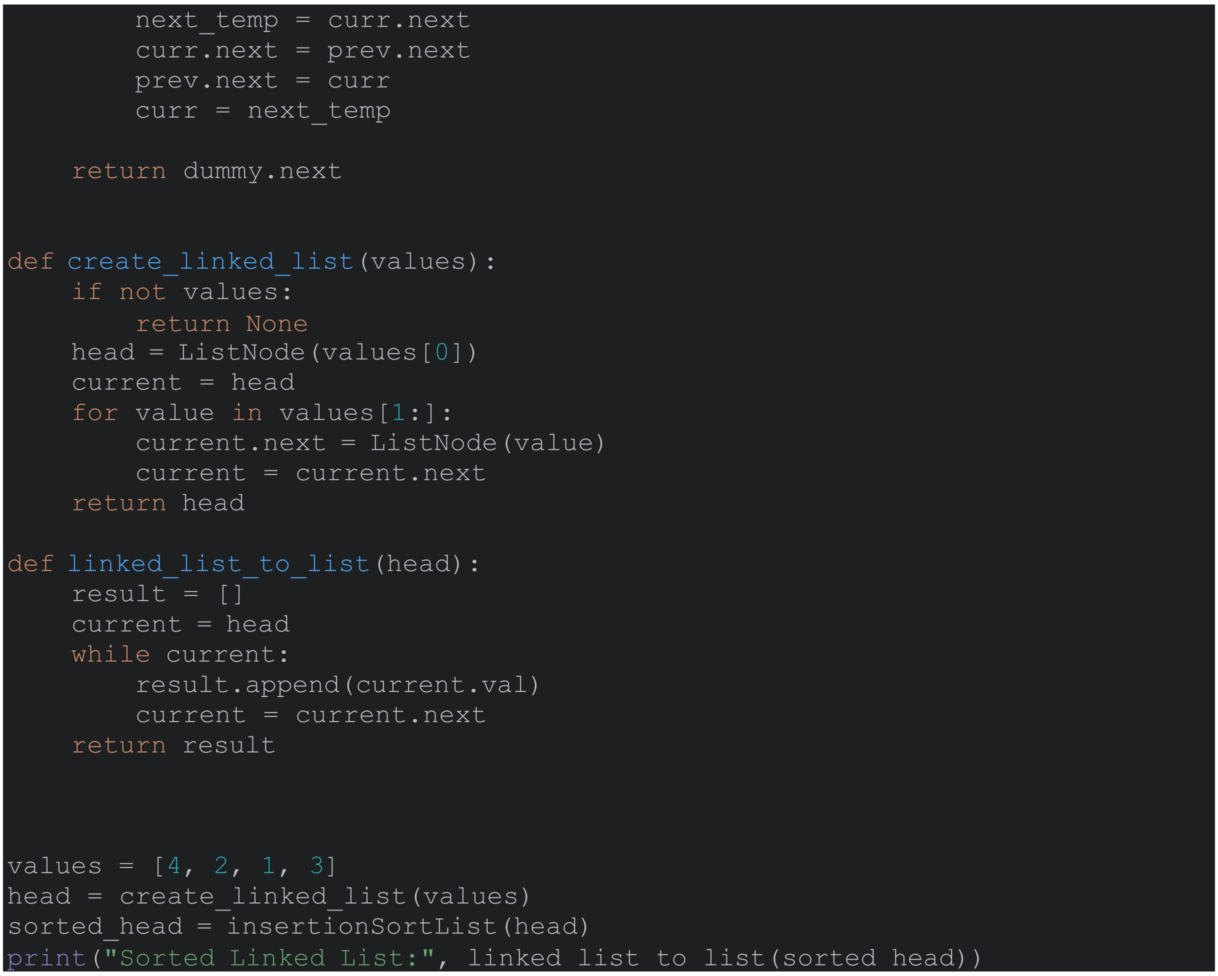
```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\9.py
In-order Traversal of the BST: [1, 2, 3, 4, 5, 6, 7]

Process finished with exit code 0
```

9. Insertion Sort List

Given the head of a singly linked list, sort the list using insertion sort, and return *the sorted list's head.*

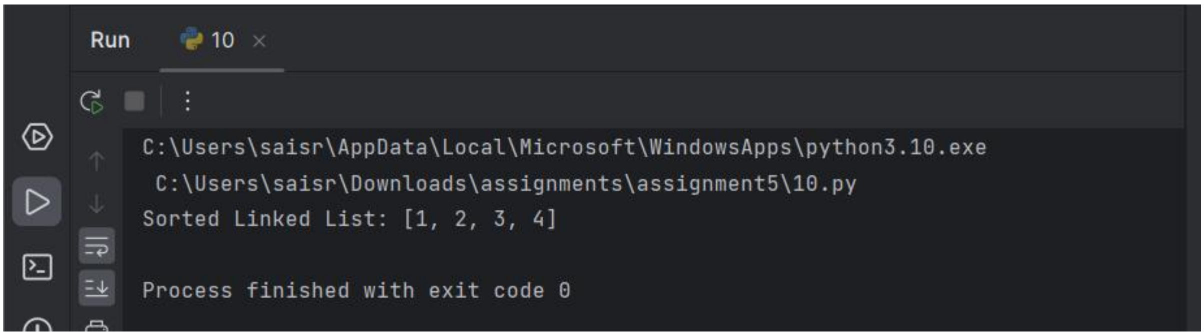
Coding:

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


def insertionSortList(head):
    dummy = ListNode(0)
    curr = head
    while curr:
        prev = dummy
        while prev.next and prev.next.val < curr.val:
            prev = prev.next
```



```
        next_temp = curr.next
        curr.next = prev.next
        prev.next = curr
        curr = next_temp

    return dummy.next


def create_linked_list(values):
    if not values:
        return None
    head = ListNode(values[0])
    current = head
    for value in values[1:]:
        current.next = ListNode(value)
        current = current.next
    return head

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



values = [4, 2, 1, 3]
head = create_linked_list(values)
sorted_head = insertionSortList(head)
print("Sorted Linked List:", linked_list_to_list(sorted_head))
```

Output:

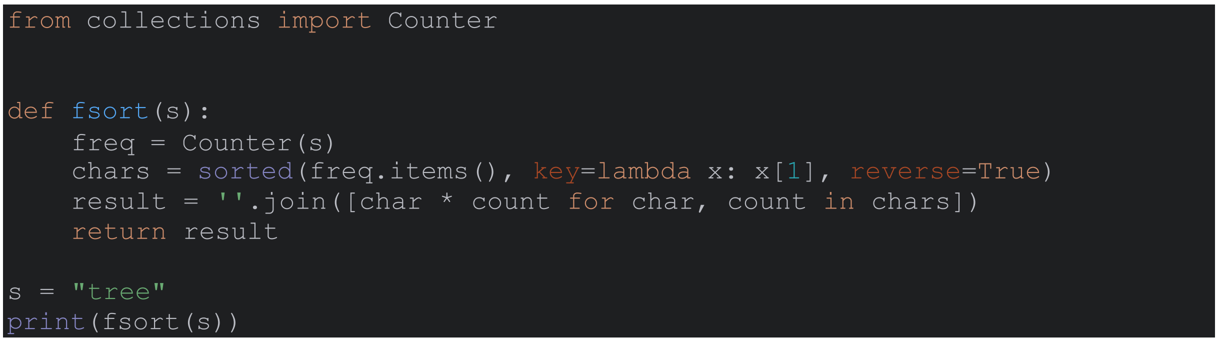


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\10.py
Sorted Linked List: [1, 2, 3, 4]

Process finished with exit code 0
```

10. **Sort Characters By Frequency**

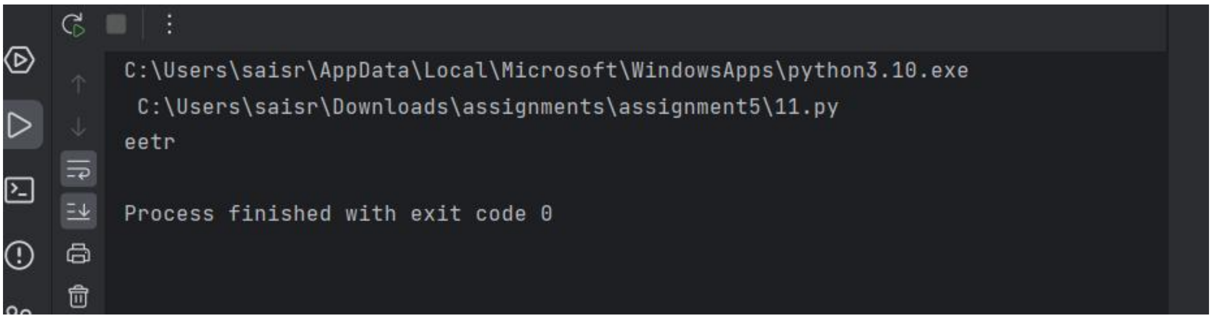
Given a string s, sort it in decreasing order based on the frequency of the characters. The frequency of a character is the number of times it appears in the string. Return *the sorted string*. If there are multiple answers, return *any of them*.

Coding:



```
from collections import Counter


def fsort(s):
    freq = Counter(s)
    chars = sorted(freq.items(), key=lambda x: x[1], reverse=True)
    result = ''.join([char * count for char, count in chars])
    return result

s = "tree"
print(fsort(s))
```

Output:

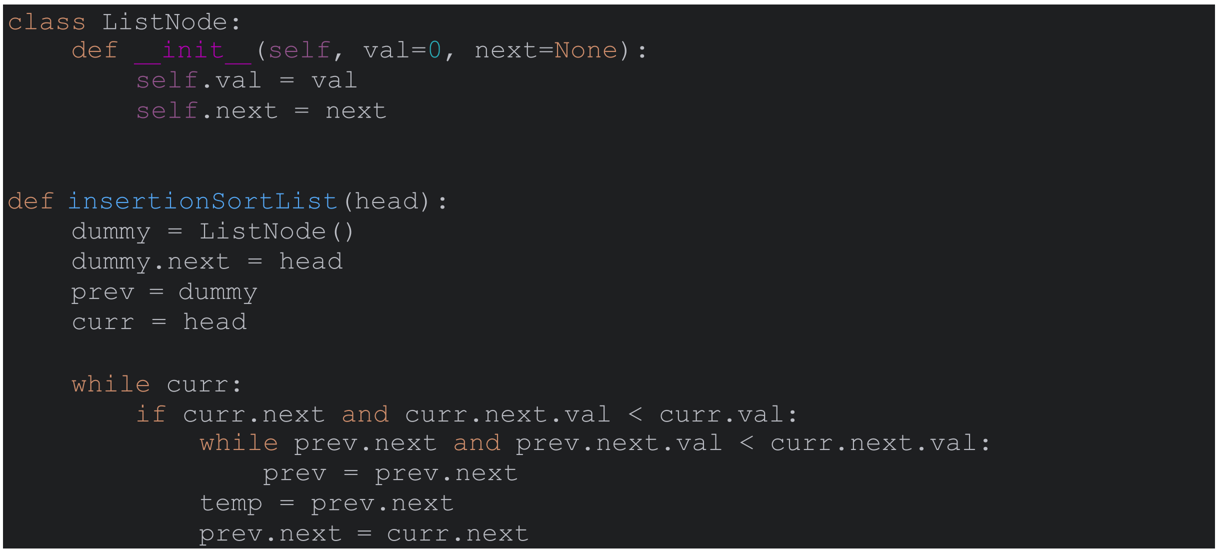


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\11.py
eetr

Process finished with exit code 0
```

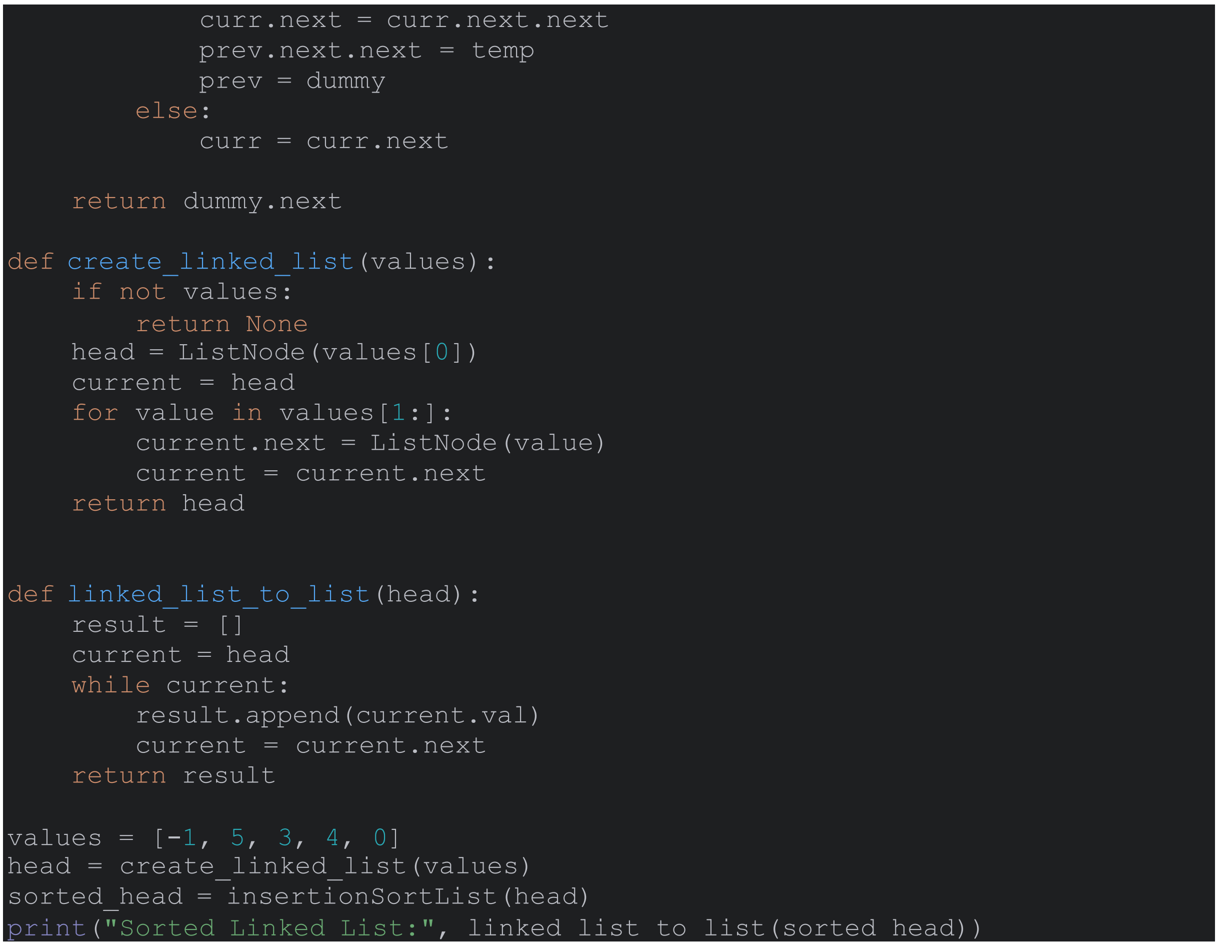
11. **Example 1:**

Input: head = [4,2,1,3] Output: [1,2,3,4]

Coding:

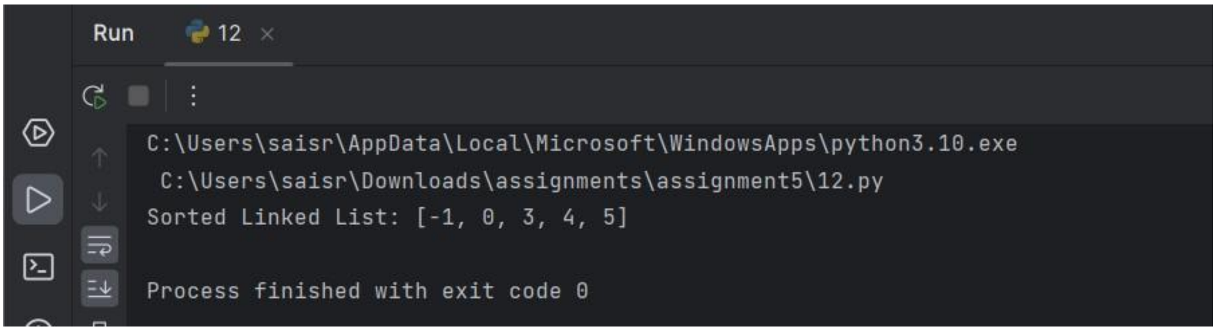


```
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next


def insertionSortList(head):
    dummy = ListNode()
    dummy.next = head
    prev = dummy
    curr = head

    while curr:
        if curr.next and curr.next.val < curr.val:
            while prev.next and prev.next.val < curr.next.val:
                prev = prev.next
            temp = prev.next
            prev.next = curr.next
```



```python
            curr.next = curr.next.next
            prev.next.next = temp
            prev = dummy
        else:
            curr = curr.next

    return dummy.next

def create_linked_list(values):
    if not values:
        return None
    head = ListNode(values[0])
    current = head
    for value in values[1:]:
        current.next = ListNode(value)
        current = current.next
    return head


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

values = [-1, 5, 3, 4, 0]
head = create_linked_list(values)
sorted_head = insertionSortList(head)
print("Sorted Linked List:", linked_list_to_list(sorted_head))
```

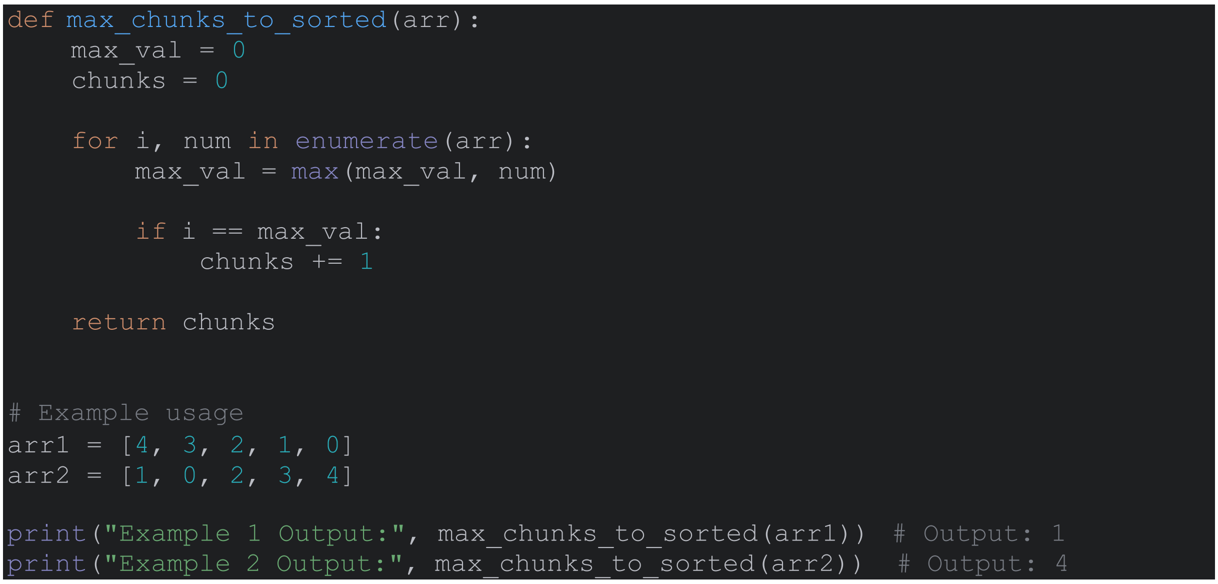
Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\12.py
Sorted Linked List: [-1, 0, 3, 4, 5]

Process finished with exit code 0
```

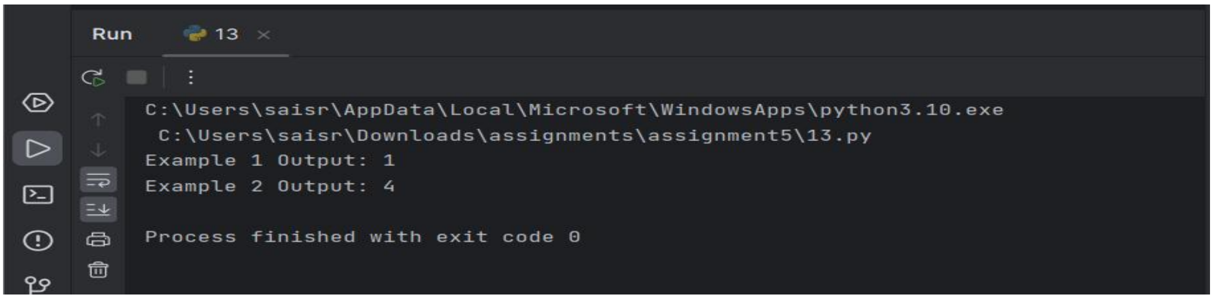
12. Max Chunks To Make Sorted
You are given an integer array arr of length n that represents a permutation of the integers in the range [0, n - 1].We split arr into some number of chunks (i.e., partitions), and individually sort each chunk. After concatenating them, the result should equal the sorted array. Return *the largest number of chunks we can make to sort the array*

Coding:



```python
def max_chunks_to_sorted(arr):
    max_val = 0
    chunks = 0

    for i, num in enumerate(arr):
        max_val = max(max_val, num)

        if i == max_val:
            chunks += 1

    return chunks


# Example usage
arr1 = [4, 3, 2, 1, 0]
arr2 = [1, 0, 2, 3, 4]

print("Example 1 Output:", max_chunks_to_sorted(arr1))  # Output: 1
print("Example 2 Output:", max_chunks_to_sorted(arr2))  # Output: 4
```

Output:

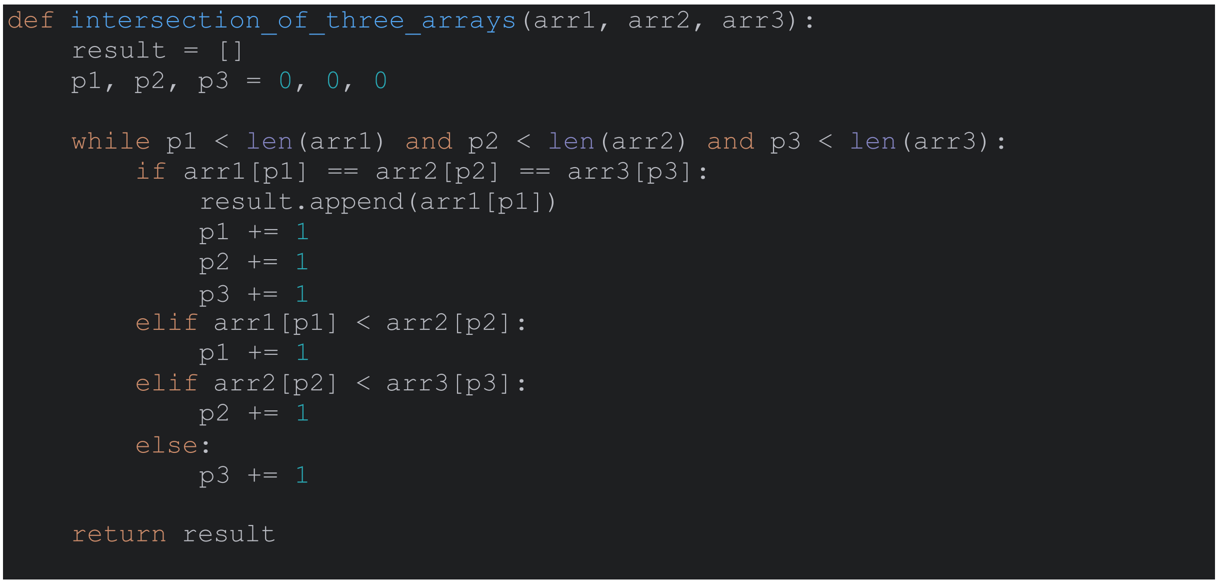


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\13.py
Example 1 Output: 1
Example 2 Output: 4

Process finished with exit code 0
```

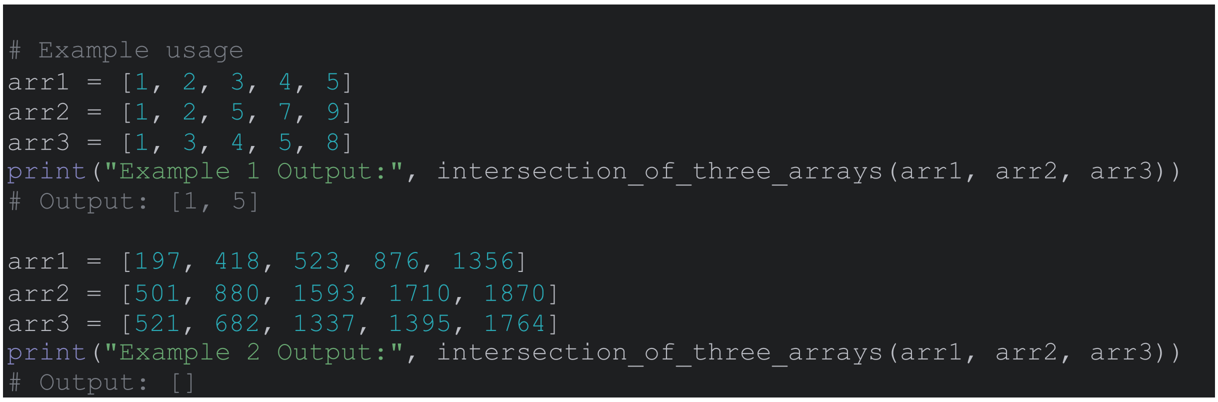
14 Intersection of Three Sorted Arrays

Given three integer arrays arr1, arr2 and arr3 sorted in strictly increasing order, return a sorted array of only the integers that appeared in all three arrays.

Coding:

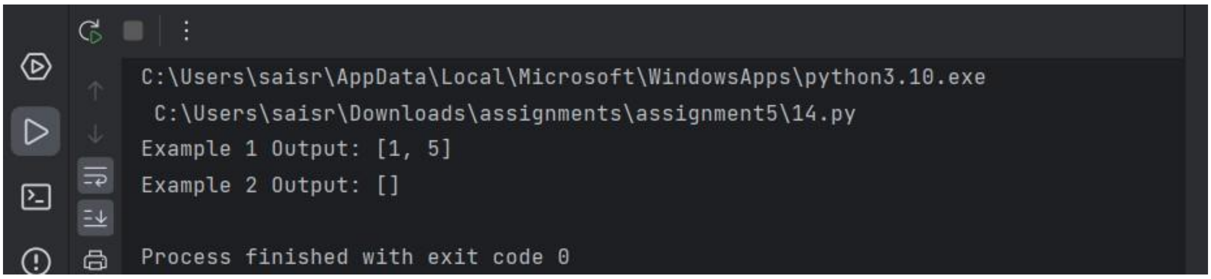


```python
def intersection_of_three_arrays(arr1, arr2, arr3):
    result = []
    p1, p2, p3 = 0, 0, 0

    while p1 < len(arr1) and p2 < len(arr2) and p3 < len(arr3):
        if arr1[p1] == arr2[p2] == arr3[p3]:
            result.append(arr1[p1])
            p1 += 1
            p2 += 1
            p3 += 1
        elif arr1[p1] < arr2[p2]:
            p1 += 1
        elif arr2[p2] < arr3[p3]:
            p2 += 1
        else:
            p3 += 1

    return result
```



```
# Example usage
arr1 = [1, 2, 3, 4, 5]
arr2 = [1, 2, 5, 7, 9]
arr3 = [1, 3, 4, 5, 8]
print("Example 1 Output:", intersection_of_three_arrays(arr1, arr2, arr3))
# Output: [1, 5]

arr1 = [197, 418, 523, 876, 1356]
arr2 = [501, 880, 1593, 1710, 1870]
arr3 = [521, 682, 1337, 1395, 1764]
print("Example 2 Output:", intersection_of_three_arrays(arr1, arr2, arr3))
# Output: []
```

Output:

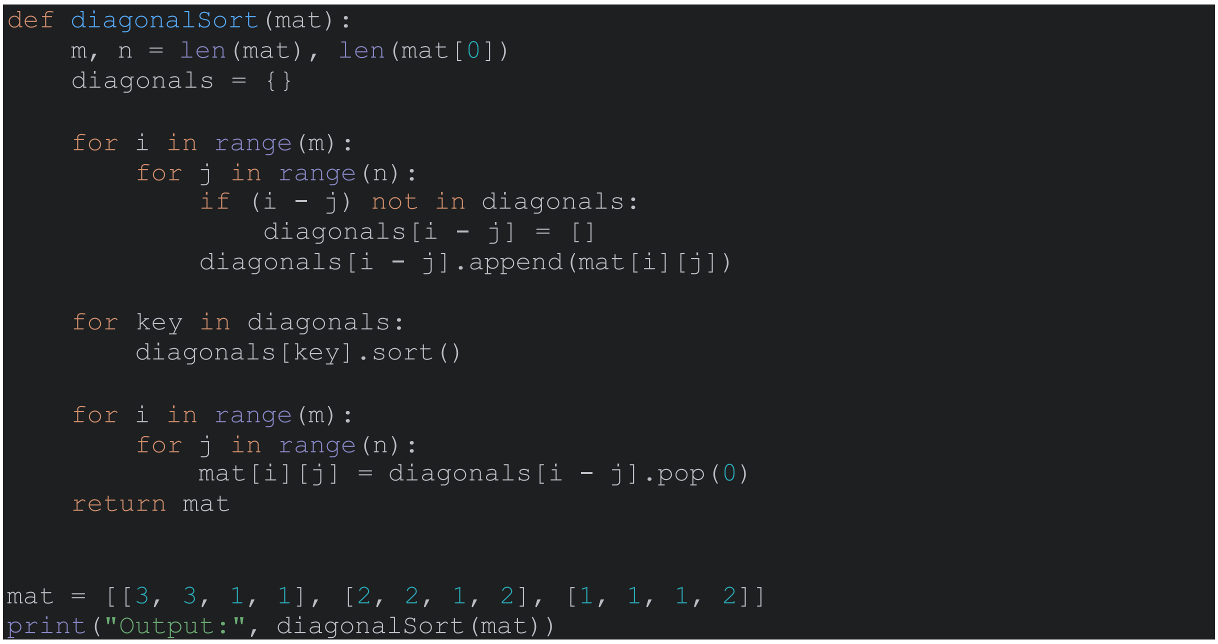


```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\14.py
Example 1 Output: [1, 5]
Example 2 Output: []

Process finished with exit code 0
```

15. Sort the Matrix Diagonally

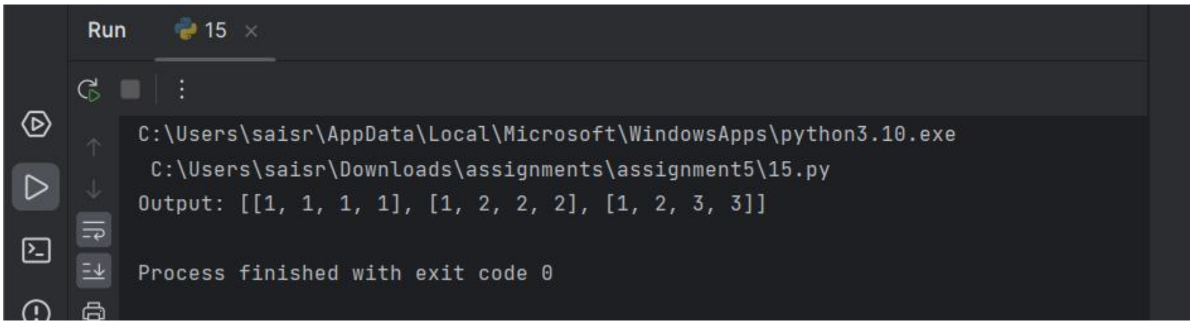
A matrix diagonal is a diagonal line of cells starting from some cell in either the topmost row or leftmost column and going in the bottom-right direction until reaching the matrix's end. For example, the matrix diagonal starting from mat[2][0], where mat is a 6 x 3 matrix, includes cells mat[2][0], mat[3][1], and mat[4][2].

Coding:



```
def diagonalSort(mat):
    m, n = len(mat), len(mat[0])
    diagonals = {}

    for i in range(m):
        for j in range(n):
            if (i - j) not in diagonals:
                diagonals[i - j] = []
            diagonals[i - j].append(mat[i][j])

    for key in diagonals:
        diagonals[key].sort()

    for i in range(m):
        for j in range(n):
            mat[i][j] = diagonals[i - j].pop(0)
    return mat


mat = [[3, 3, 1, 1], [2, 2, 1, 2], [1, 1, 1, 2]]
print("Output:", diagonalSort(mat))
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 C:\Users\saisr\Downloads\assignments\assignment5\15.py
Output: [[1, 1, 1, 1], [1, 2, 2, 2], [1, 2, 3, 3]]

Process finished with exit code 0
```