LAB PROGRAMS-4

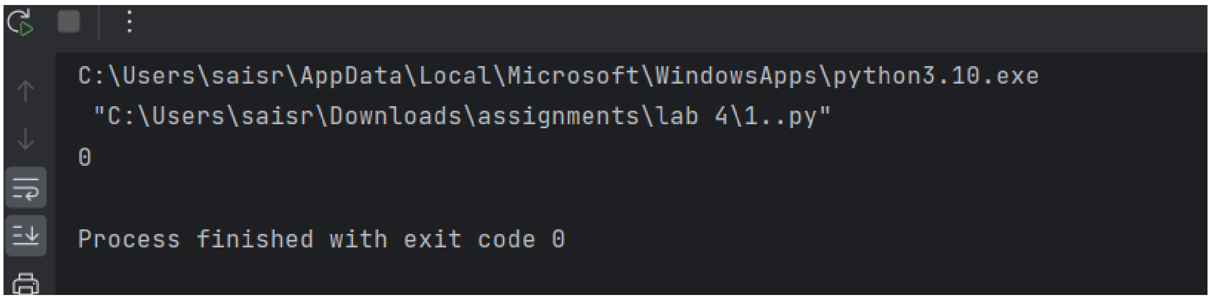
1.Counting Elements

Given an integer array arr, count how many elements x there are, such that x + 1 is also in arr. If there are duplicates in arr, count them separately.

Coding:

```python
ar =[1,1,3,3,5,5,7,7]
c=0
for i in range(len(ar)-1):
    if ar[i]+ ar[i+1] in ar:
        c+=2
print(c)
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\1..py"
0

Process finished with exit code 0
```

2. Perform String Shifts

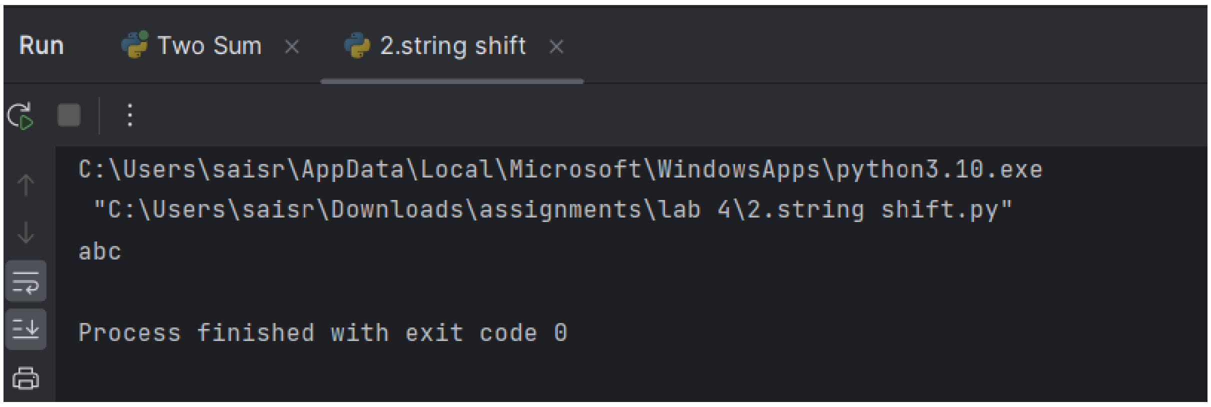
You are given a string s containing lowercase English letters, and a matrix shift, where shift[i] = [directioni, amounti]

Coding:

```python
s = "abc"
shift = [[0, 1], [1, 2]]

def left(a, s):
    return s[a:] + s[:a]

def right(a, s):
    return s[-a:] + s[:-a]

while shift:
    for i in range(len(shift)):
        if shift[i][0] == 0:
            a = shift[i][1]
            s = left(a, s)
        else:
            b = shift[i][1]
            s = right(b, s)
    shift.pop(0)
```

```python
print(s)
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\2.string shift.py"
abc

Process finished with exit code 0
```

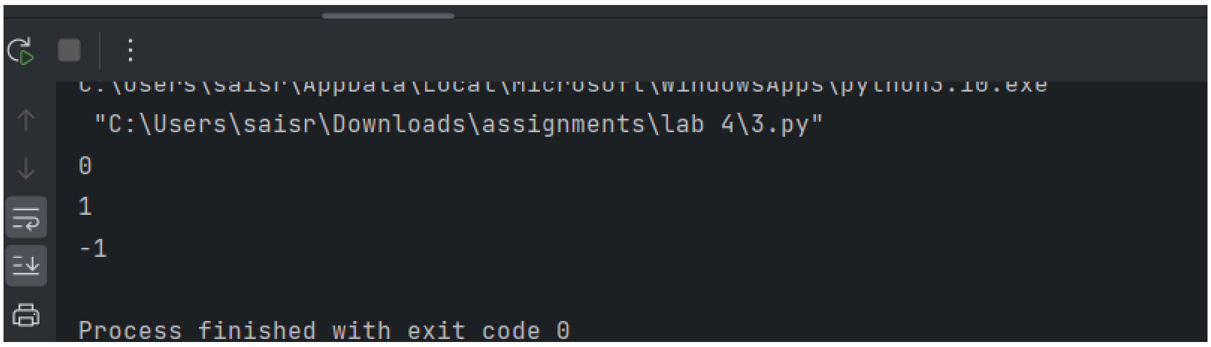
3. Leftmost Column with at Least a One
A row-sorted binary matrix means that all elements are 0 or 1 and each row of the matrix is sorted in non-decreasing order.Given a row-sorted binary matrix binaryMatrix, return the index (0-indexed) of the leftmost column with a 1 in it. If such an index does not exist, return -1.

Coding:

```python
class BinaryMatrix:
    def __init__(self, mat):
        self.mat = mat

    def get(self, row: int, col: int) -> int:
        return self.mat[row][col]

    def dimensions(self) -> list:
        return [len(self.mat), len(self.mat[0])]


def leftMostColumnWithOne(binaryMatrix):
    rows, cols = binaryMatrix.dimensions()
    current_row = 0
    current_col = cols - 1
    leftmost_col_with_one = -1


    while current_row < rows and current_col >= 0:
        if binaryMatrix.get(current_row, current_col) == 1:
            leftmost_col_with_one = current_col
            current_col -= 1
        else:
            current_row += 1

    return leftmost_col_with_one
```

```
mat1 = [[0, 0], [1, 1]]
binaryMatrix1 = BinaryMatrix(mat1)
print(leftMostColumnWithOne(binaryMatrix1))

mat2 = [[0, 0], [0, 1]]
binaryMatrix2 = BinaryMatrix(mat2)
print(leftMostColumnWithOne(binaryMatrix2))


mat3 = [[0, 0], [0, 0]]
binaryMatrix3 = BinaryMatrix(mat3)
print(leftMostColumnWithOne(binaryMatrix3))
```

Output:



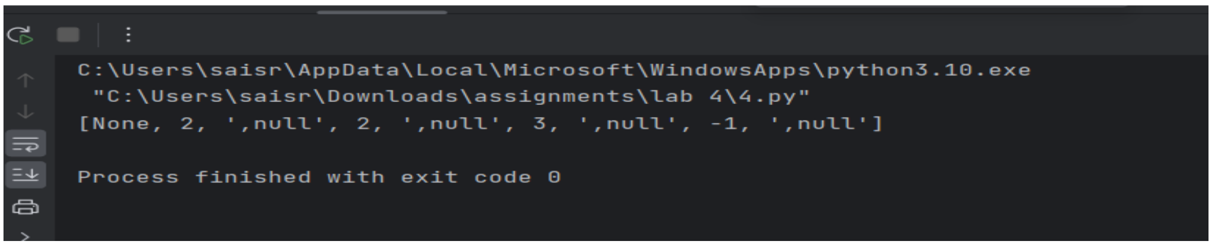
```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\3.py"
0
1
-1

Process finished with exit code 0
```

4. First Unique Number
You have a queue of integers, you need to retrieve the first unique integer in the queue.
Implement the FirstUnique class:
- FirstUnique(int[] nums) Initializes the object with the numbers in the queue.
- int showFirstUnique() returns the value of the first unique integer of the queue, and returns -1 if there is no such integer.
- void add(int value) insert value to the queue.

Coding:

```
from collections import deque

class Queue:
    def __init__(self, nums):
        self.queue = deque(nums)
        self.unique_elements = set(nums)

    def showUnique(self):
        if self.unique_elements:
            return self.queue[0]
        return -1

    def add(self, value):
        if value in self.unique_elements:
            self.unique_elements.remove(value)
        else:
            self.queue.append(value)
            self.unique_elements.add(value)

        while self.queue and self.queue[0] not in self.unique_elements:
            self.queue.popleft()


s = ["FirstUnique", "showFirstUnique", "add", "showFirstUnique", "add", "showFirstUnique", "add",
"showFirstUnique"]
ar = [[2, 3, 5], [], [5], [], [2], [], [3], []]

firstUnique = None
ans = []

for i, op in enumerate(s):
    if op == "FirstUnique":
        firstUnique = Queue(ar[i])
        ans.append(None)
    elif op == "showFirstUnique":
        ans.append(firstUnique.showUnique())
        ans.append(“,null”)
    elif op == "add":
        firstUnique.add(ar[i][0])

print(ans)
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\4.py"
[None, 2, ',null', 2, ',null', 3, ',null', -1, ',null']

Process finished with exit code 0
```

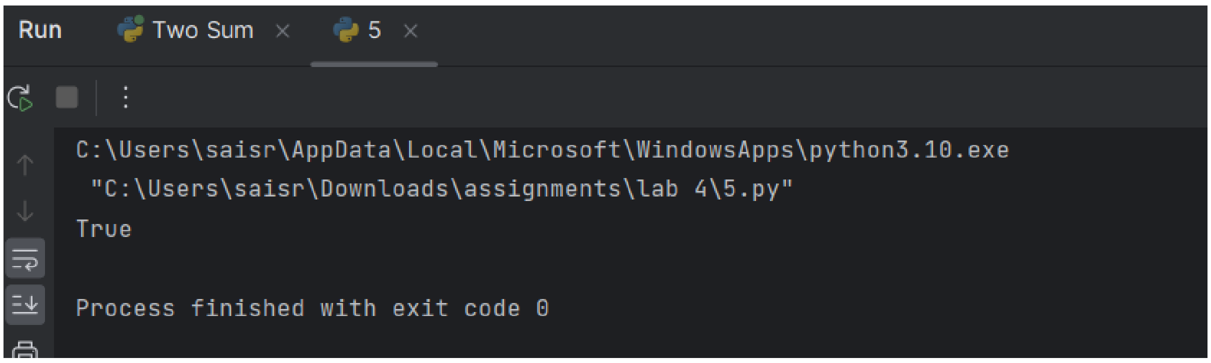
5. Check If a String Is a Valid Sequence from Root to Leaves Path in a Binary Tree
Given a binary tree where each path going from the root to any leaf form a valid sequence, check if a given string is a valid sequence in such binary tree.
We get the given string from the concatenation of an array of integers arr and the concatenation of all values of the nodes along a path results in a sequence in the given
binary tree.

Coding:

```
class TreeNode:
    def __init__(self, x):
```

```python
        self.val = x
        self.left = None
        self.right = None

def construct_tree(lst):
    if not lst:
        return None
    root = TreeNode(lst[0])
    queue = [root]
    i = 1
    while i < len(lst):
        node = queue.pop(0)
        if lst[i] is not None:
            node.left = TreeNode(lst[i])
            queue.append(node.left)
        i += 1
        if i < len(lst) and lst[i] is not None:
            node.right = TreeNode(lst[i])
            queue.append(node.right)
        i += 1
    return root

def isValidSequence(root, arr):
    if not root or not arr:
        return False
    if root.val != arr[0]:
        return False
    if len(arr) == 1:
        return not root.left and not root.right
    return isValidSequence(root.left, arr[1:]) or isValidSequence(root.right, arr[1:])


lst = [0,1,0,0,1,0,None,None,1,0,0]
arr = [0,1,0,1]
root = construct_tree(lst)
print(isValidSequence(root, arr))
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\5.py"
True

Process finished with exit code 0
```

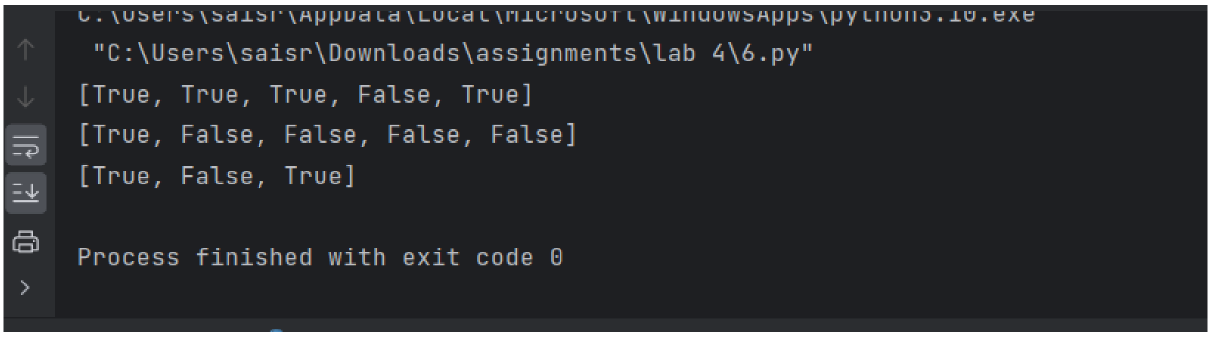
6. Kids With the Greatest Number of Candies

There are n kids with candies. You are given an integer array candies, where each candies[i] represents the number of candies the ith kid has, and an integer extraCandies, denoting the number of extra candies that you have.Return a boolean array result of length n, where result[i] is true if, after giving the ith kid all the extraCandies, they will have the greatest number of candies among all the kids, or false otherwise. Note that multiple kids can have the greatest number of candies.

Coding:

```
def kidsWithCandies(candies, extraCandies):
    max_candies = max(candies)
    result = [candy + extraCandies >= max_candies for candy in candies]
    return result

candies = [2,3,5,1,3]
extraCandies = 3
print(kidsWithCandies(candies, extraCandies))
candies = [4,2,1,1,2]
extraCandies = 1
print(kidsWithCandies(candies, extraCandies
candies = [12,1,12]
extraCandies = 10
print(kidsWithCandies(candies, extraCandies))
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\6.py"
[True, True, True, False, True]
[True, False, False, False, False]
[True, False, True]

Process finished with exit code 0
```

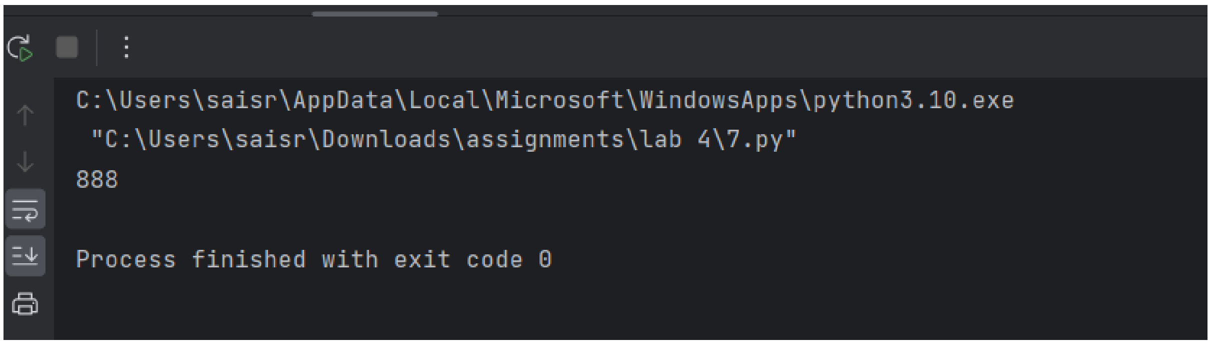
7. Max Difference You Can Get From Changing an Integer
You are given an integer num. You will apply the following steps exactly two times:
- Pick a digit x (0 <= x <= 9).
- Pick another digit y (0 <= y <= 9). The digit y can be equal to x.
- Replace all the occurrences of x in the decimal representation of num by y.
- The new integer cannot have any leading zeros, also the new integer cannot be 0.

Let a and b be the results of applying the operations to num the first and second times,
respectively.
Return the max difference between a and b.

Coding:

```python
def maximumGap(num: int) -> int:
    num_str = str(num)
    max_num = int(".join('9' if c != '0' else c for c in num_str))
    min_num = int(".join('1' if c == '9' else '0' if c == '0' else '1' for c in num_str))
    return max_num - min_num


num = 555
print(maximumGap(num))
```

Output:



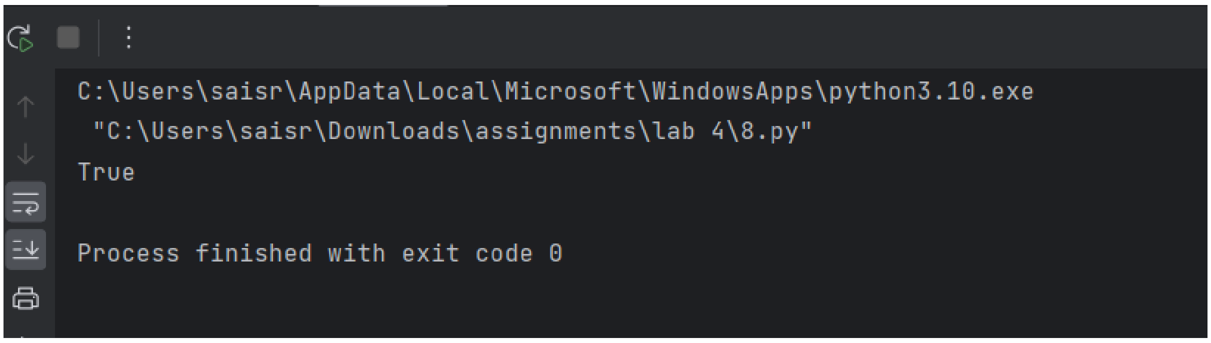
```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\7.py"
888

Process finished with exit code 0
```

8. Check If a String Can Break Another String
Given two strings: s1 and s2 with the same size, check if some permutation of string s1
can break some permutation of string s2 or vice-versa. In other words s2 can break s1 or vice-versa.A string x can break string y (both of size n) if x[i] >= y[i] (in alphabetical order) for all I between 0 and n-1.

Coding:

```python
def checkIfCanBreak(s1: str, s2: str) -> bool:
    s1_sorted = sorted(s1)
    s2_sorted = sorted(s2)

    return (all(x >= y for x, y in zip(s1_sorted, s2_sorted)) or
            all(x >= y for x, y in zip(s2_sorted, s1_sorted)))


s1 = "abc"
s2 = "xya"
print(checkIfCanBreak(s1, s2))
```

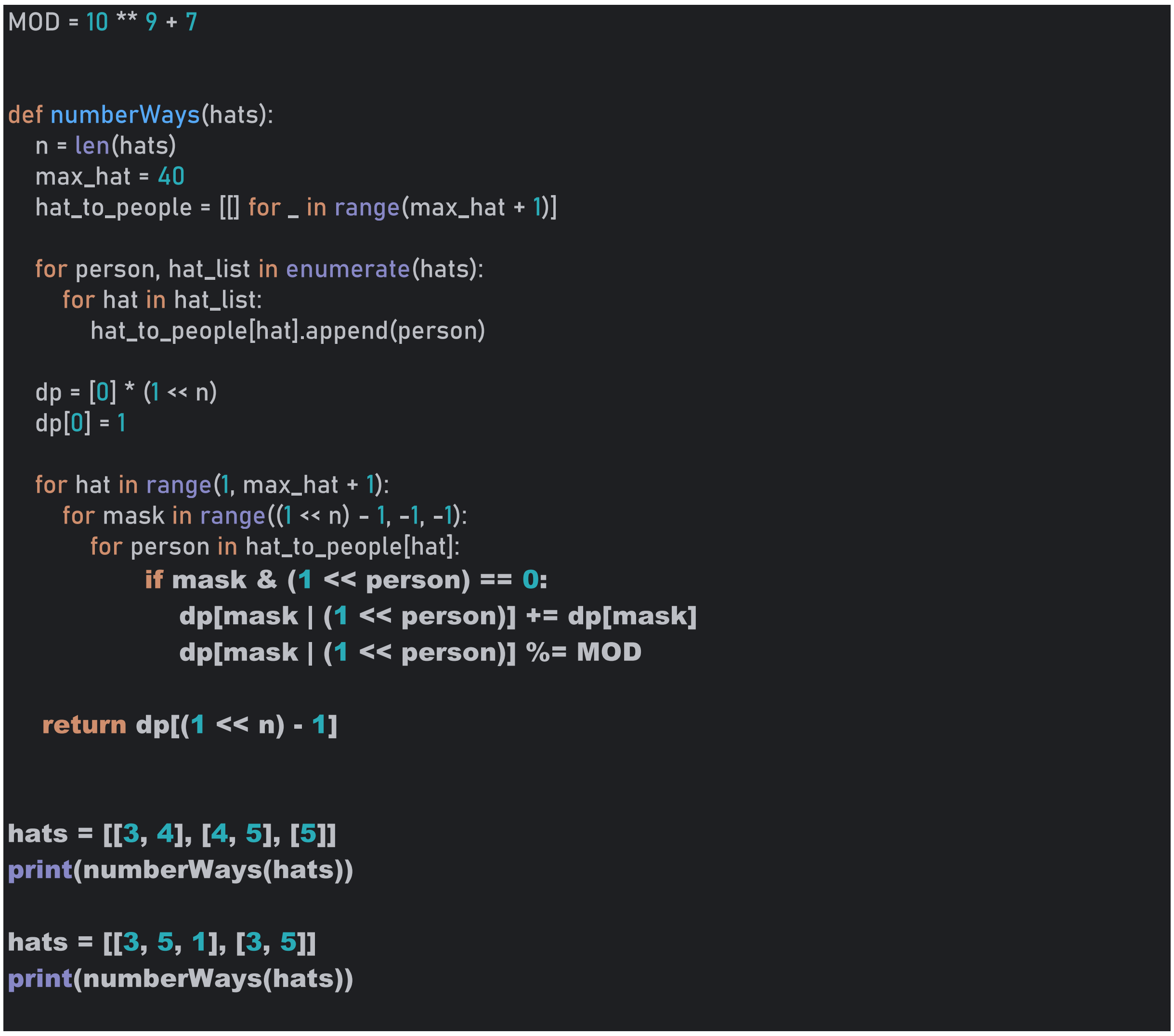
Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\8.py"
True

Process finished with exit code 0
```

9. Number of Ways to Wear Different Hats to Each Other
There are n people and 40 types of hats labeled from 1 to 40.Given a 2D integer array hats, where hats[i] is a list of all hats preferred by the ith person.Return the number of ways that the n people wear different hats to each other.Since the answer may be too large, return it modulo 109 + 7.

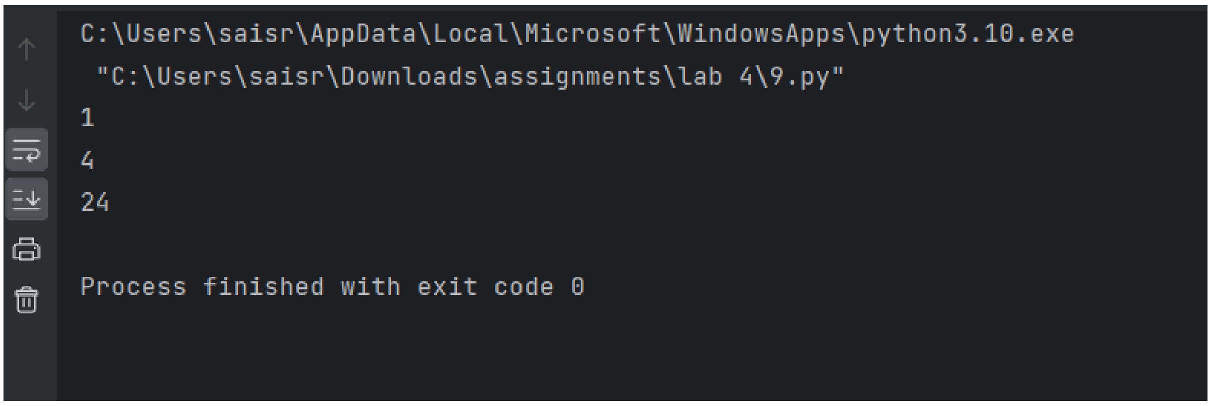
Coding:



```python
MOD = 10 ** 9 + 7


def numberWays(hats):
    n = len(hats)
    max_hat = 40
    hat_to_people = [[] for _ in range(max_hat + 1)]

    for person, hat_list in enumerate(hats):
        for hat in hat_list:
            hat_to_people[hat].append(person)

    dp = [0] * (1 << n)
    dp[0] = 1

    for hat in range(1, max_hat + 1):
        for mask in range((1 << n) - 1, -1, -1):
            for person in hat_to_people[hat]:
                if mask & (1 << person) == 0:
                    dp[mask | (1 << person)] += dp[mask]
                    dp[mask | (1 << person)] %= MOD

    return dp[(1 << n) - 1]


hats = [[3, 4], [4, 5], [5]]
print(numberWays(hats))

hats = [[3, 5, 1], [3, 5]]
print(numberWays(hats))
```

```python
hats = [[1, 2, 3, 4], [1, 2, 3, 4], [1, 2, 3, 4], [1, 2, 3, 4]]
print(numberWays(hats))
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\9.py"
1
4
24

Process finished with exit code 0
```

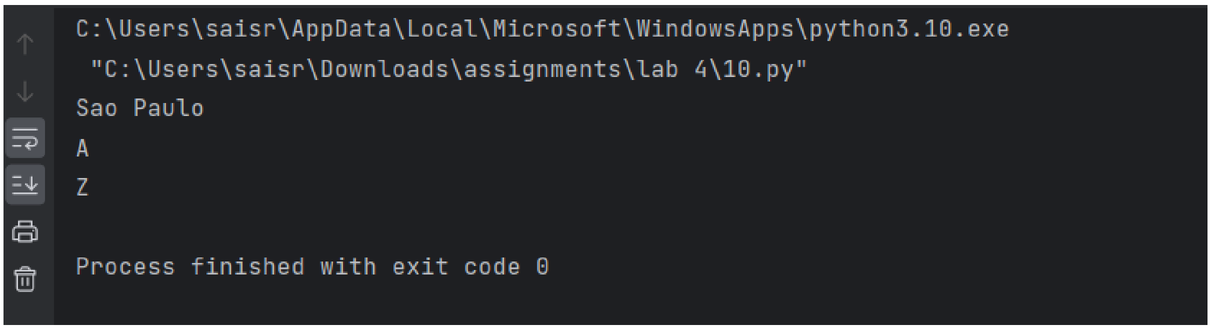
10. Destination City
You are given the array paths, where paths[i] = [cityAi, cityBi] means there exists a
Direct path going from cityAi to cityBi. Return the destination city, that is, the city
without any path outgoing to another city.It is guaranteed that the graph of paths forms a line without any loop, therefore, there willbe exactly one destination city.

Coding:

```python
def destCity(paths):
    outgoing = set()

    for path in paths:
        outgoing.add(path[0])

    for path in paths:
        if path[1] not in outgoing:
            return path[1]

paths = [["London", "New York"], ["New York", "Lima"], ["Lima", "Sao Paulo"]]
print(destCity(paths))
```

```python
paths = [["B", "C"], ["D", "B"], ["C", "A"]]
print(destCity(paths))

paths = [["A", "Z"]]
print(destCity(paths))
```

Output:



```
C:\Users\saisr\AppData\Local\Microsoft\WindowsApps\python3.10.exe
 "C:\Users\saisr\Downloads\assignments\lab 4\10.py"
Sao Paulo
A
Z

Process finished with exit code 0
```