

Assignment 3:

1) Perform String Shifts You are given a string *s* containing lowercase English letters, and a matrix *shift*, where *shift*[*i*] = [*direction*_{*i*}, *amount*_{*i*}]:

- *direction*_{*i*} can be 0 (for left shift) or 1 (for right shift).
- *amount*_{*i*} is the amount by which string *s* is to be shifted.
- A left shift by 1 means remove the first character of *s* and append it to the end.
- Similarly, a right shift by 1 means remove the last character of *s* and add it to the beginning.

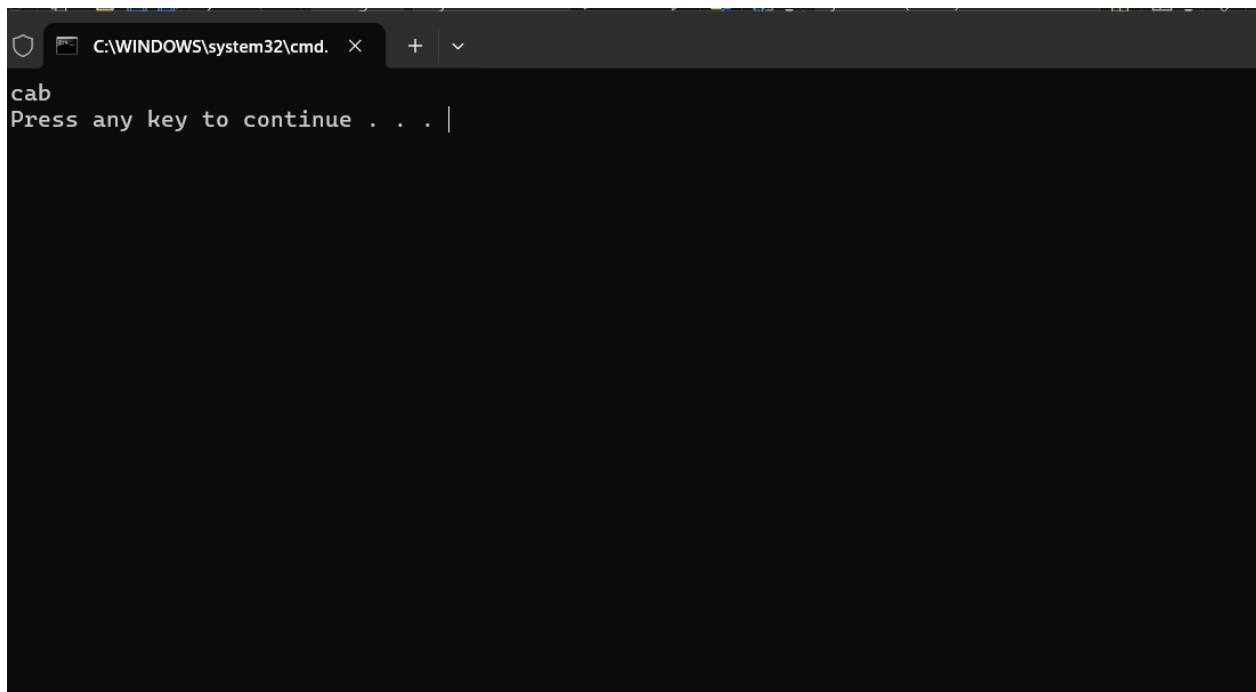
Return the final string after all operations. Example 1: Input: *s* = "abc", *shift* = [[0,1],[1,2]]
Output: "cab" Explanation: [0,1] means shift to left by 1. "abc" -> "bca" [1,2] means shift to right by 2. "bca" -> "cab"

CODE:

```
def string_shift(s, shift):
    total_shift = 0
    for direction, amount in shift:
        if direction == 0:
            total_shift -= amount
        else:
            total_shift += amount
    total_shift %= len(s)
    return s[-total_shift:] + s[:-total_shift]

s = "abcdefg"
shift = [[1,1],[1,1],[0,2],[1,3]]
result = string_shift(s, shift)
print(result)
```

OUTPUT:

A screenshot of a Windows command prompt window. The title bar shows the path 'C:\WINDOWS\system32\cmd.' and standard window controls. The command prompt displays the output 'cab' on the first line and 'Press any key to continue . . . |' on the second line, with a vertical cursor at the end of the second line.

2) 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. You can't access the Binary Matrix directly. You may only access the matrix using a `BinaryMatrix` interface: • `BinaryMatrix.get(row, col)` returns the element of the matrix at index (row, col) (0-indexed). • `BinaryMatrix.dimensions()` returns the dimensions of the matrix as a list of 2 elements [rows, cols], which means the matrix is rows x cols. Submissions making more than 1000 calls to `BinaryMatrix.get` will be judged Wrong Answer. Also, any solutions that attempt to circumvent the judge will result in disqualification. For custom testing purposes, the input will be the entire binary matrix `mat`. You will not have access to the binary matrix directly.

CODE:

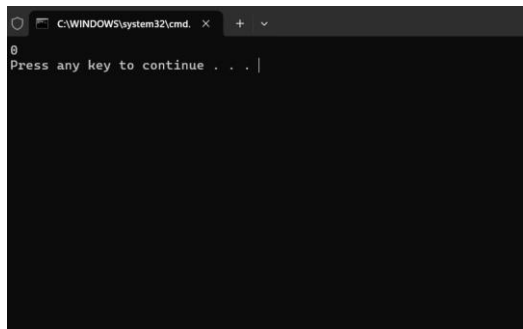
```
class BinaryMatrix:
    def __init__(self, matrix):
        self.matrix = matrix
    def get(self, row: int, col: int) -> int:
        return self.matrix[row][col]
    def dimensions(self) -> list:
        return [len(self.matrix), len(self.matrix[0])]
def leftMostColumnWithOne(binaryMatrix: "BinaryMatrix") -> int:
    rows, cols = binaryMatrix.dimensions()
    current_row = 0
    current_col = cols - 1
    leftmost_col = -1

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

    return leftmost_col

mat = [[0, 0], [1, 1]]
binaryMatrix = BinaryMatrix(mat)
result = leftMostColumnWithOne(binaryMatrix)
print(result)
```

OUTPUT:



- 3) 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.

CODE:

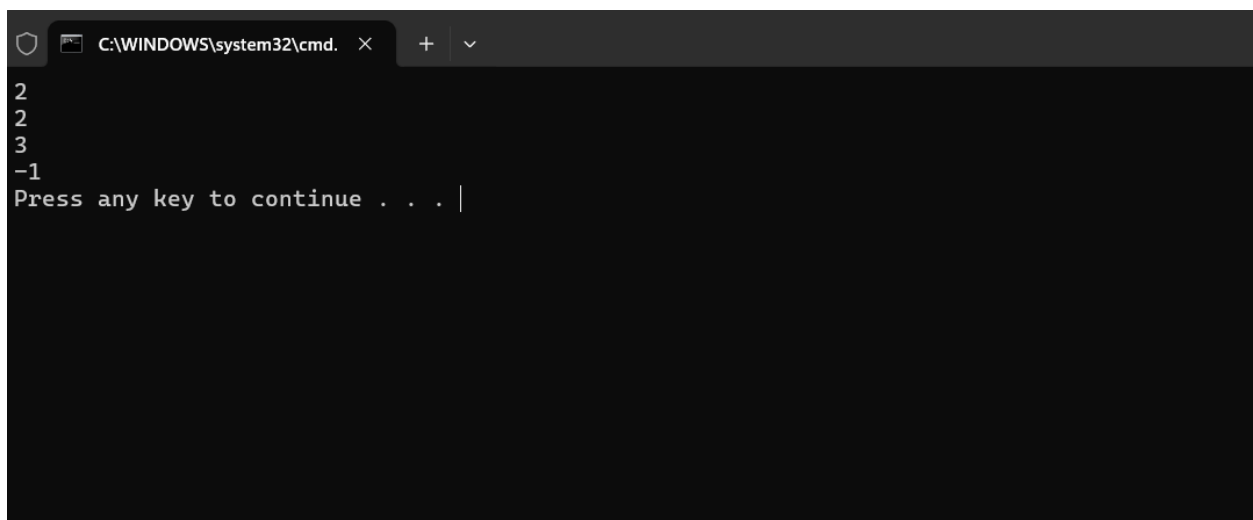
```
from collections import OrderedDict, deque

class FirstUnique:
    def __init__(self, nums):
        self.queue = deque()
        self.counts = {}
        for num in nums:
            self.add(num)

    def showFirstUnique(self) -> int:
        while self.queue and self.counts[self.queue[0]] > 1:
            self.queue.popleft()
        return self.queue[0] if self.queue else -1

    def add(self, value: int) -> None:
        self.counts[value] = self.counts.get(value, 0) + 1
        if self.counts[value] == 1:
            self.queue.append(value)
```

```
firstUnique = FirstUnique([2, 3, 5])
print(firstUnique.showFirstUnique())
firstUnique.add(5)
print(firstUnique.showFirstUnique())
firstUnique.add(2)
print(firstUnique.showFirstUnique())
firstUnique.add(3)
print(firstUnique.showFirstUnique())
OUTPUT:
```

A screenshot of a Windows command prompt window. The title bar shows the path 'C:\WINDOWS\system32\cmd.' and standard window controls. The command prompt displays the output of the code: the first two 'print' statements output '2', the third outputs '3', and the fourth outputs '-1'. Below the output, it says 'Press any key to continue . . . |' with a cursor.

4) 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 forms 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. Example 1: Input: root = [0,1,0,0,1,0,null,null,1,0,0], arr = [0,1,0,1] Output: true Explanation: The path 0 -> 1 -> 0 -> 1 is a valid sequence (green color in the figure). Other valid sequences are: 0 -> 1 -> 1 -> 0 0 -> 0 -> 0

CODE:

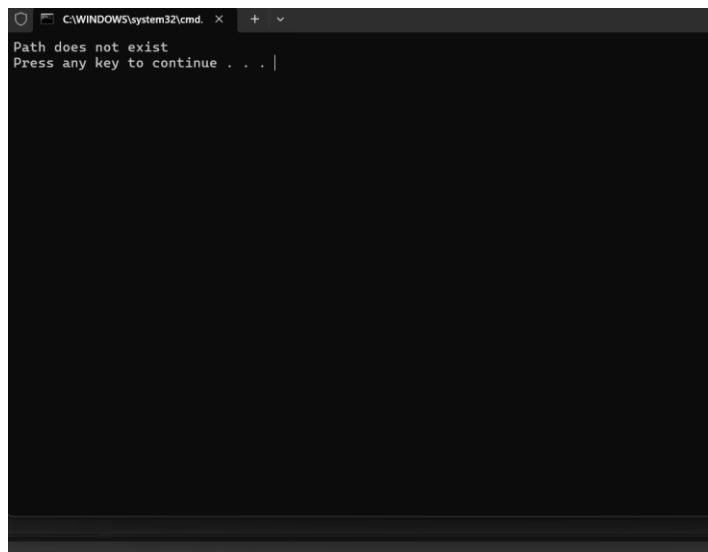
```
class Node:
    def __init__(self, val):
        self.val = val
        self.left = None
        self.right = None

def exist_path(root):
    if root is None:
        return False
    if root.left is None and root.right is None:
        return root.val
    return False

root = Node(5)
root.left = Node(2)
root.right = Node(7)
root.left.left = Node(1)
root.left.right = Node(4)
root.right.left = Node(6)
root.right.right = Node(8)

if exist_path(root):
    print("flath exists")
else:
    print("flath does not exist")
```

OUTPUT:

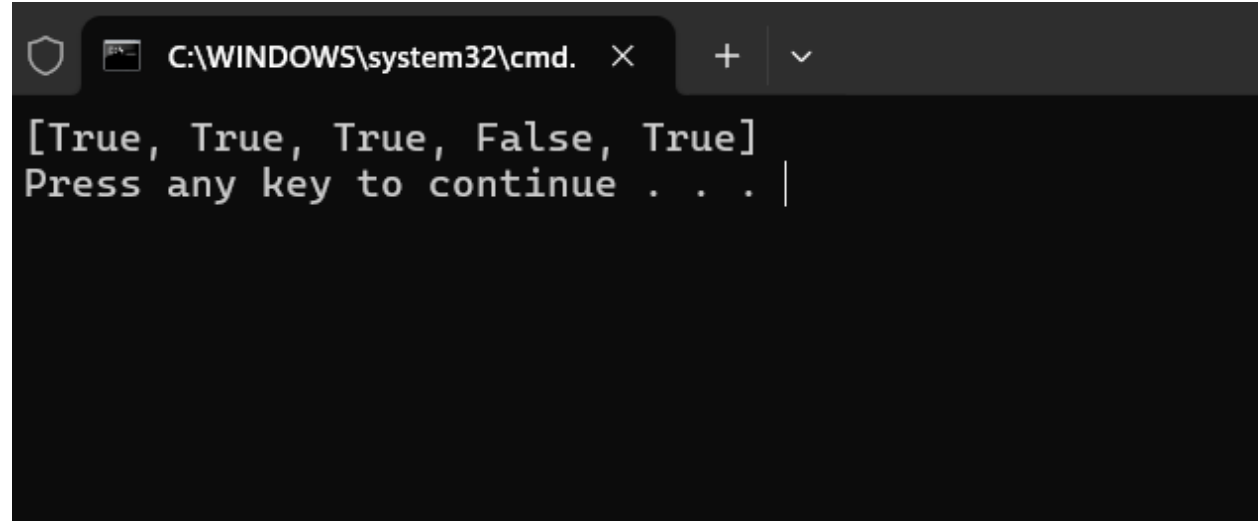


5) Kids With the Greatest Number of Candies There are n kids with candies. You are given an integer array candies, where each candies[i] represents the number of candies the ith kid has, and an integer extraCandies, denoting the number of extra candies that you have. Return a boolean array result of 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.

CODE:

```
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  
output = kidsWithCandies(candies, extraCandies)  
print(output)  
OUTPUT:
```



The screenshot shows a Windows Command Prompt window with the title bar "C:\WINDOWS\system32\cmd.". The window has a dark background and displays the output of the Python code: "[True, True, True, False, True]" followed by the prompt "Press any key to continue . . . |".

6)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 ($0 \leq x \leq 9$). • Pick another digit y ($0 \leq y \leq 9$). 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.

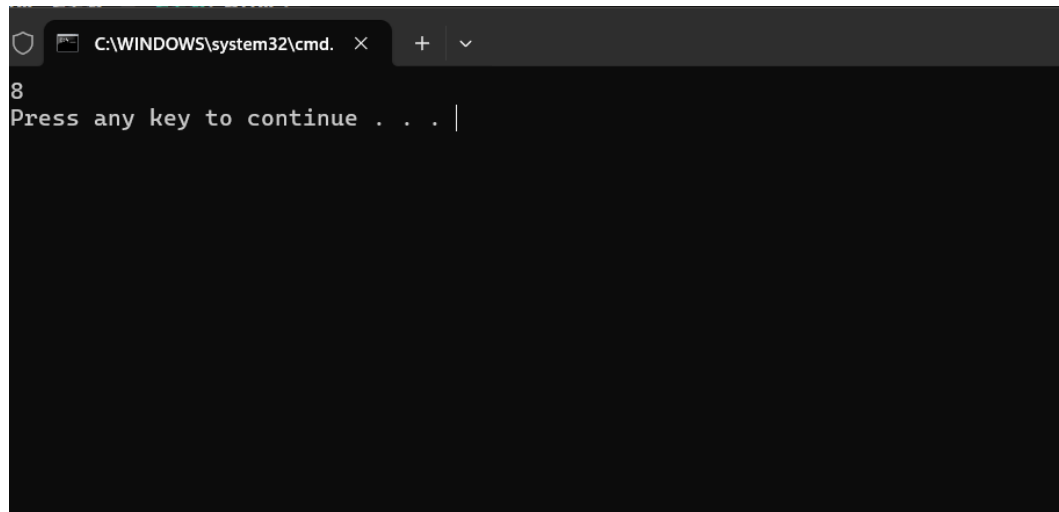
CODE:

```
def maxDiff(num: int) -> int:
    num_str = str(num)
    max_diff = 0

    for i, digit in enumerate(num_str):
        if digit != '9':
            new_num_str = num_str.replace(digit, '9')
            max_diff = max(max_diff, int(new_num_str) - num)
            break
    if num_str[0] != '1':
        new_num_str = num_str.replace(num_str[0], '1')
        max_diff = max(max_diff, num - int(new_num_str))

    return max_diff
print(maxDiff(9))
```

OUTPUT:

A screenshot of a Windows Command Prompt window. The title bar shows the path 'C:\WINDOWS\system32\cmd.' and standard window controls. The command prompt displays the number '8' on the first line, followed by the prompt 'Press any key to continue . . . |' on the second line. The rest of the window is dark and empty.

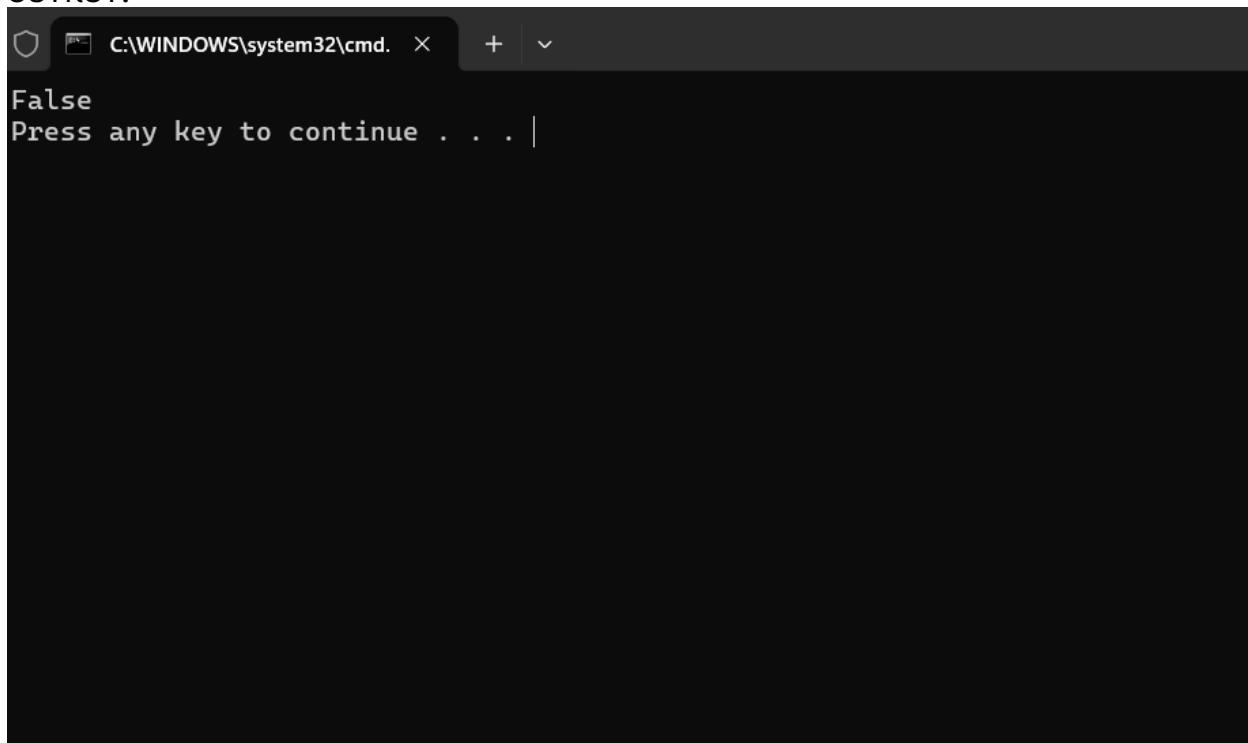
7) Check If a String Can Break Another String Given two strings: s1 and s2 with the same size, check if some permutation of string s1 can break some permutation of string s2 or vice-versa. In other words s2 can break s1 or vice-versa. A string x can break string y (both of size n) if $x[i] \geq y[i]$ (in alphabetical order) for all i between 0 and n-1. Example 1: Input: s1 = "abc", s2 = "xya" Output: true Explanation: "ayx" is a permutation of s2="xya" which can break to string "abc" which is a permutation of s1="abc".

CODE:

```
def checkIfCanBreak(s1, s2):
    s1_sorted = sorted(s1)
    s2_sorted = sorted(s2)

    if all(s1_char >= s2_char for s1_char, s2_char in zip(s1_sorted, s2_sorted)) or
    all(s2_char >= s1_char for s1_char, s2_char in zip(s1_sorted, s2_sorted)):
        return True
    else:
        return False
```

```
s1 = "abe"
s2 = "acd"
print(checkIfCanBreak(s1, s2))
OUTPUT:
```

A screenshot of a Windows command prompt window. The title bar shows the path 'C:\WINDOWS\system32\cmd.' with a close button, a plus sign, and a dropdown arrow. The window content shows the output 'False' on the first line and 'Press any key to continue . . . |' on the second line, with a vertical cursor at the end of the second line.

8)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 $10^9 + 7$. Example 1: Input: hats = [[3,4],[4,5],[5]] Output: 1

Explanation: There is only one way to choose hats given the conditions. First person choose hat 3,

Second person choose hat 4 and last one hat 5. Example 2: Input: hats = [[3,5,1],[3,5]] Output: 4

Explanation: There are 4 ways to choose hats: (3,5), (5,3), (1,3) and (1,5)

CODE:

```
def countWaysToWearHats(hats):
    MOD = 10**9 + 7
    n = len(hats)
    dp = [0] * (1 << n)
    dp[0] = 1

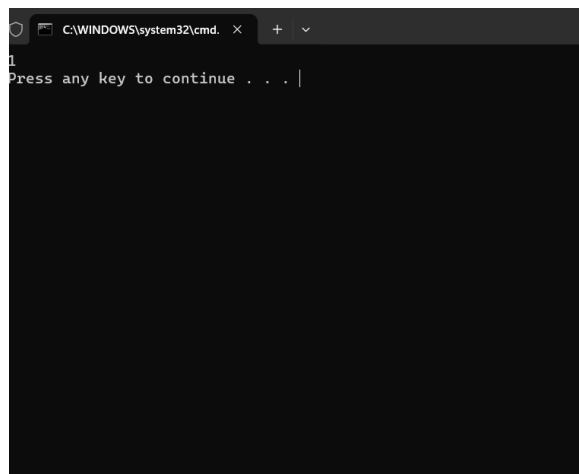
    hat_to_people = [[] for _ in range(41)]
    for i in range(n):
        for hat in hats[i]:
            hat_to_people[hat].append(i)

    for hat in range(1, 41):
        for state in range((1 << n) - 1, -1, -1):
            for person in hat_to_people[hat]:
                if state & (1 << person):
                    continue
                dp[state | (1 << person)] += dp[state]
                dp[state | (1 << person)] %= MOD

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

hats1 = [[3, 4], [4, 5], [5]]
print(countWaysToWearHats(hats1))
```

OUTPUT:



9)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 will be exactly one destination city. Example 1: Input: paths = [["London","New York"],["New York","Lima"],["Lima","Sao Paulo"]] Output: "Sao Paulo" Explanation: Starting at "London" city you will reach "Sao Paulo" city which is the destination city. Your trip consist of: "London" -> "New York" -> "Lima" -> "Sao Paulo".

CODE:

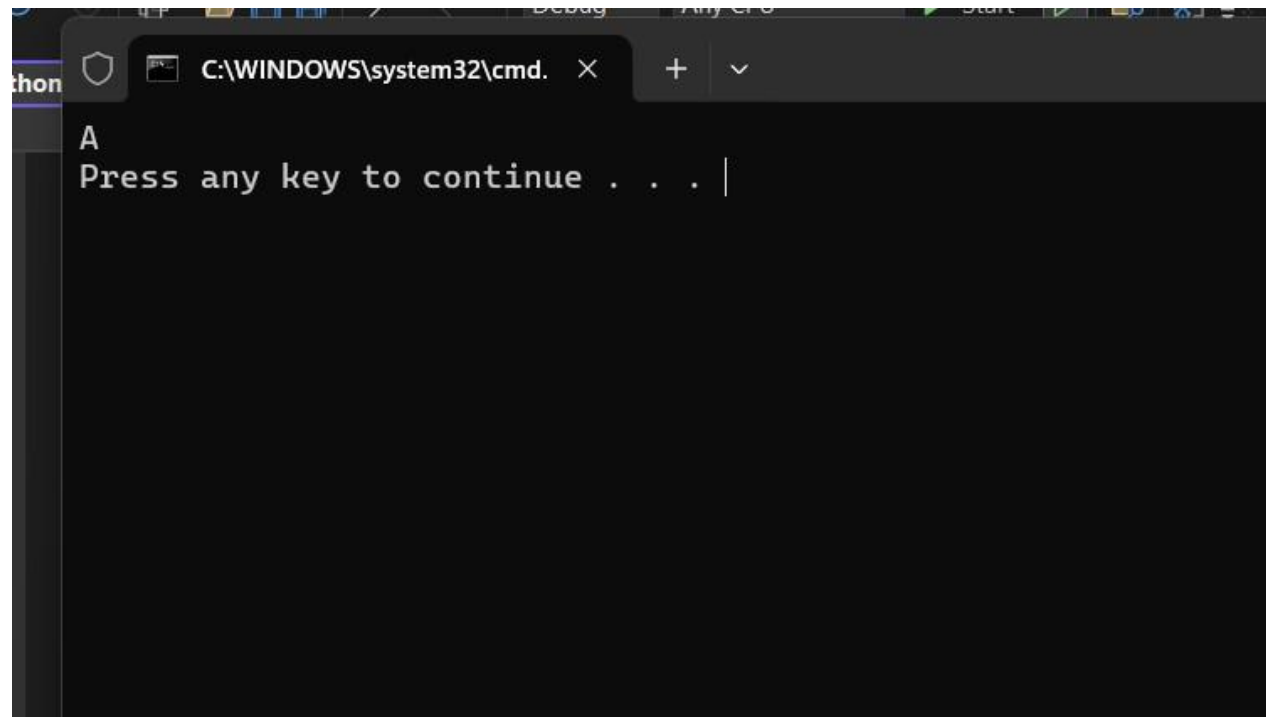
```
def destCity(paths):
    start_cities = set()
    dest_cities = set()

    for path in paths:
        start_cities.add(path[0])
        dest_cities.add(path[1])

    return (dest_cities - start_cities).pop()
```

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

OUTPU:

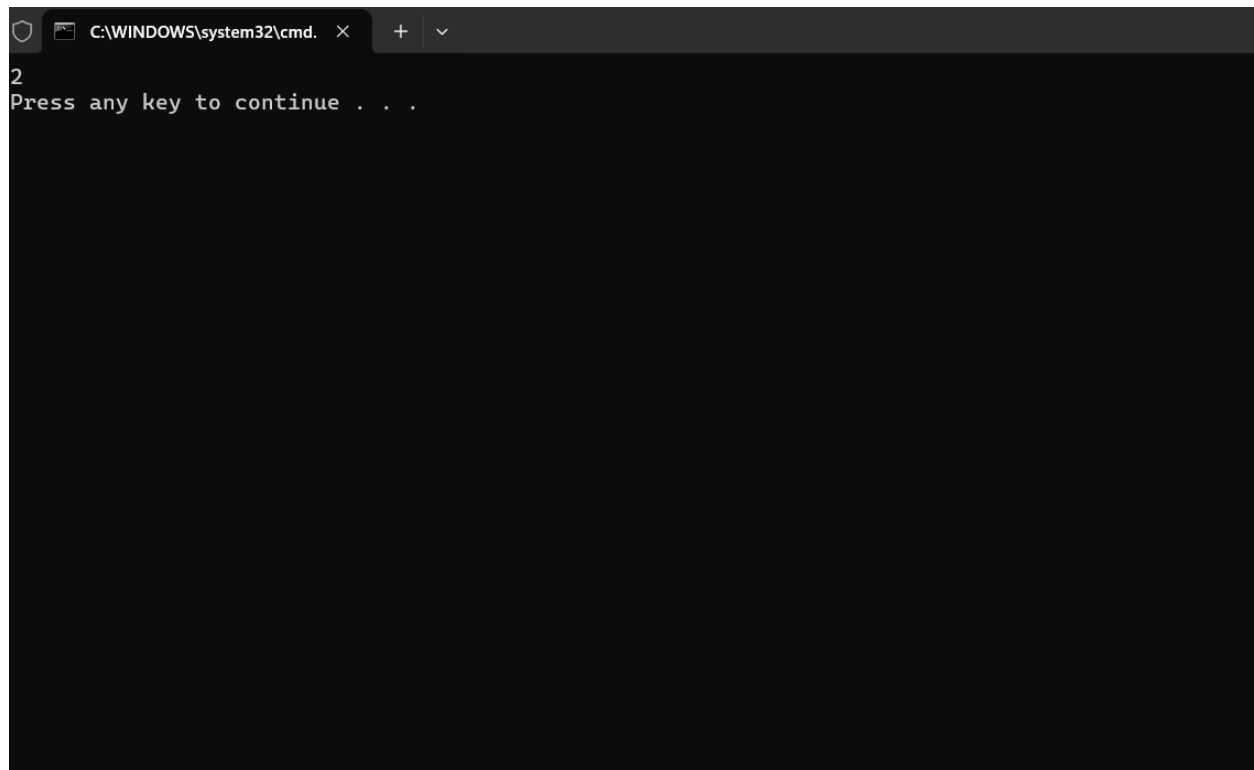


10)Counting Elements Given an integer array arr, count how many elements x there are, such that $x + 1$ is also in arr. If there are duplicates in arr, count them separately. Example Input: arr = [1,2,3] Output: 2
Explanation: 1 and 2 are counted cause 2 and 3 are in arr.

CODE:

```
def count_elements(arr):  
    count = 0  
    num_set = set(arr)  
  
    for x in arr:  
        if x + 1 in num_set:  
            count += 1  
  
    return count  
arr1 = [1, 2, 3]  
  
print(count_elements(arr1))
```

OUTPUT:

A screenshot of a Windows command prompt window. The title bar shows the path 'C:\WINDOWS\system32\cmd.' and standard window controls. The command prompt displays the output '2' on the first line and 'Press any key to continue . . .' on the second line, indicating the program has finished execution.