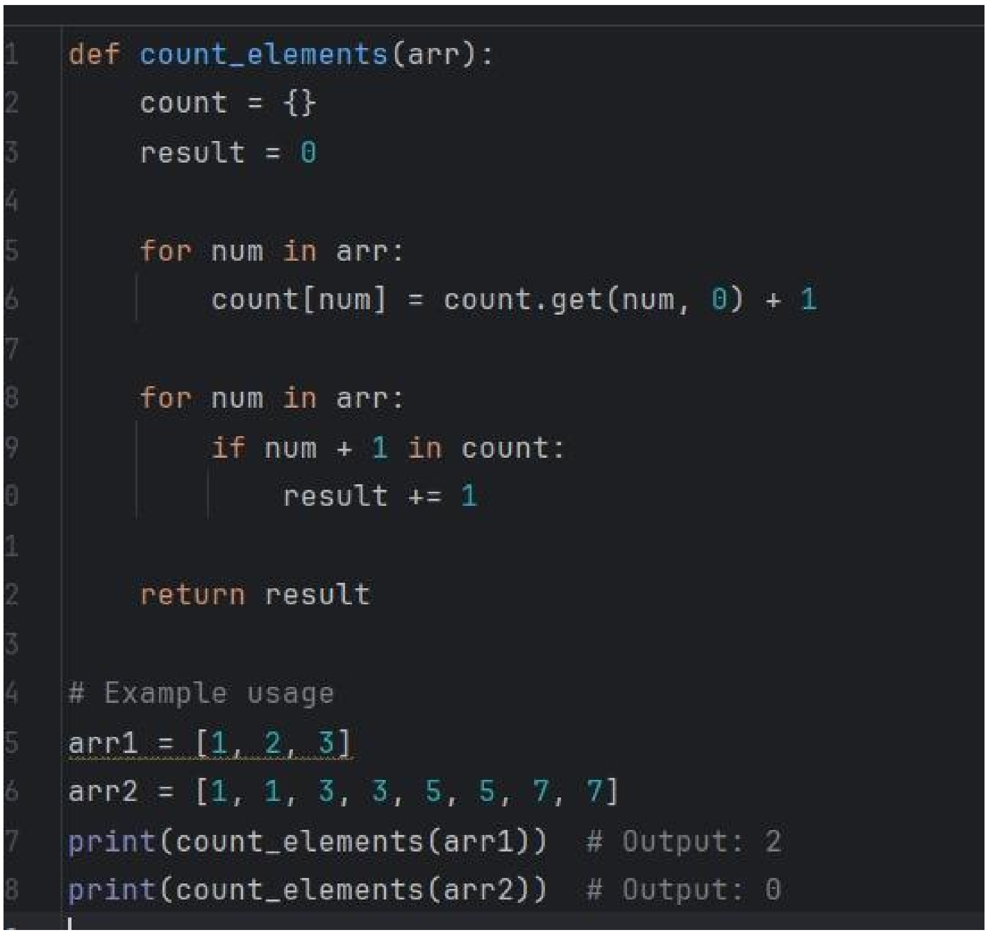
1. Counting Elements

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.
Example
Input: arr = [1,2,3]
Output: 2
Explanation: 1 and 2 are counted cause 2 and 3 are in arr.
Example 2:
Input: arr = [1,1,3,3,5,5,7,7]
Output: 0
Explanation: No numbers are counted, cause there is no 2, 4, 6, or 8 in arr.
Constraints:

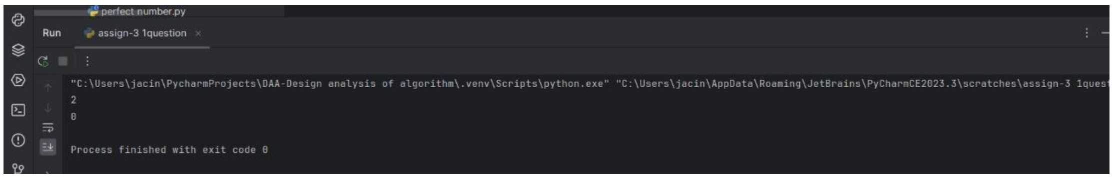
- 1 <= arr.length <= 1000
- 0 <= arr[i] <= 1000

CODING:



```python
def count_elements(arr):
    count = {}
    result = 0

    for num in arr:
        count[num] = count.get(num, 0) + 1

    for num in arr:
        if num + 1 in count:
            result += 1

    return result

# Example usage
arr1 = [1, 2, 3]
arr2 = [1, 1, 3, 3, 5, 5, 7, 7]
print(count_elements(arr1))  # Output: 2
print(count_elements(arr2))  # Output: 0
```

OUTPUT:



```
"C:\Users\jacin\PycharmProjects\DAA-Design analysis of algorithm\.venv\Scripts\python.exe" "C:\Users\jacin\AppData\Roaming\JetBrains\PyCharmCE2023.3\scratches\assign-3 1ques
2
0

Process finished with exit code 0
```

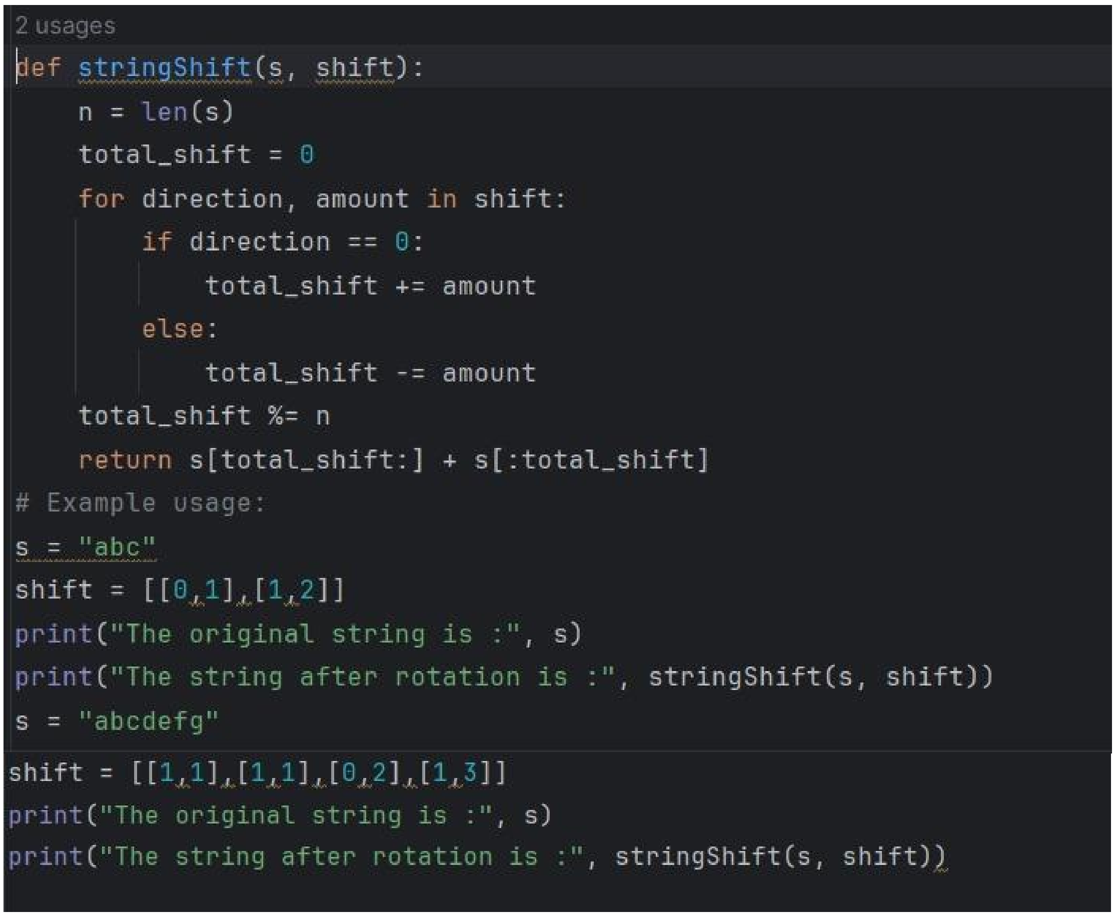
2. Perform String Shifts
You are given a string s containing lowercase English letters, and a matrix shift, where
shift[i] = [directioni, amounti]:

- directioni can be 0 (for left shift) or 1 (for right shift).
- amounti 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"
Example 2:
Input: s = "abcdefg", shift = [[1,1],[1,1],[0,2],[1,3]]
Output: "efgabcd"
Explanation:
[1,1] means shift to right by 1. "abcdefg" -> "gabcdef"
[1,1] means shift to right by 1. "gabcdef" -> "fgabcde"
[0,2] means shift to left by 2. "fgabcde" -> "abcdefg"
[1,3] means shift to right by 3. "abcdefg" -> "efgabcd"
Constraints:

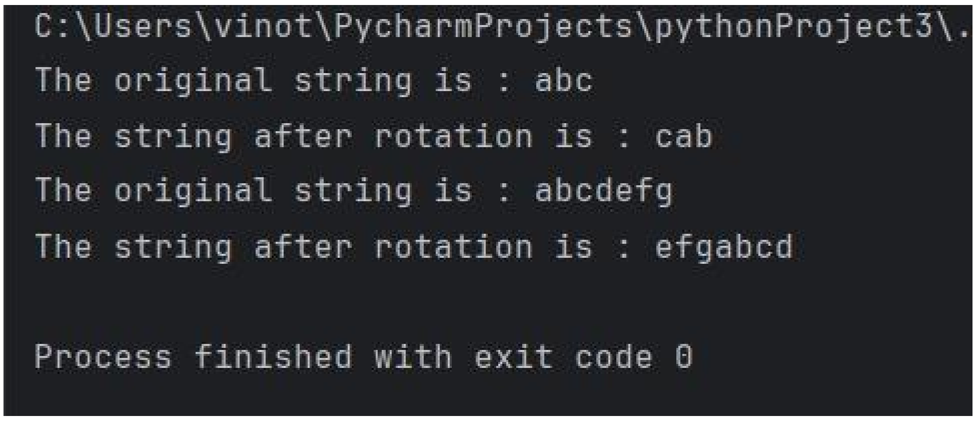
- 1 <= s.length <= 100
- s only contains lower case English letters.
- 1 <= shift.length <= 100

CODING:



```python
2 usages
def stringShift(s, shift):
    n = len(s)
    total_shift = 0
    for direction, amount in shift:
        if direction == 0:
            total_shift += amount
        else:
            total_shift -= amount
    total_shift %= n
    return s[total_shift:] + s[:total_shift]
# Example usage:
s = "abc"
shift = [[0,1],[1,2]]
print("The original string is :", s)
print("The string after rotation is :", stringShift(s, shift))
s = "abcdefg"
shift = [[1,1],[1,1],[0,2],[1,3]]
print("The original string is :", s)
print("The string after rotation is :", stringShift(s, shift))
```

OUTPUT:



```
C:\Users\vinot\PycharmProjects\pythonProject3\.
The original string is : abc
The string after rotation is : cab
The original string is : abcdefg
The string after rotation is : efgabcd

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.
You can't access the Binary Matrix directly. You may only access the matrix using a

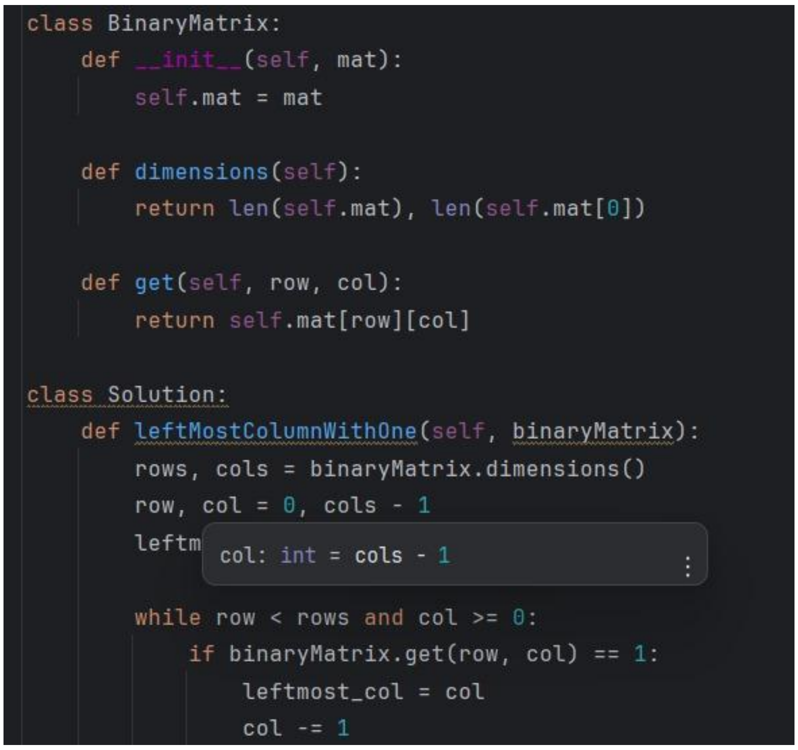
BinaryMatrix interface:

- 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.

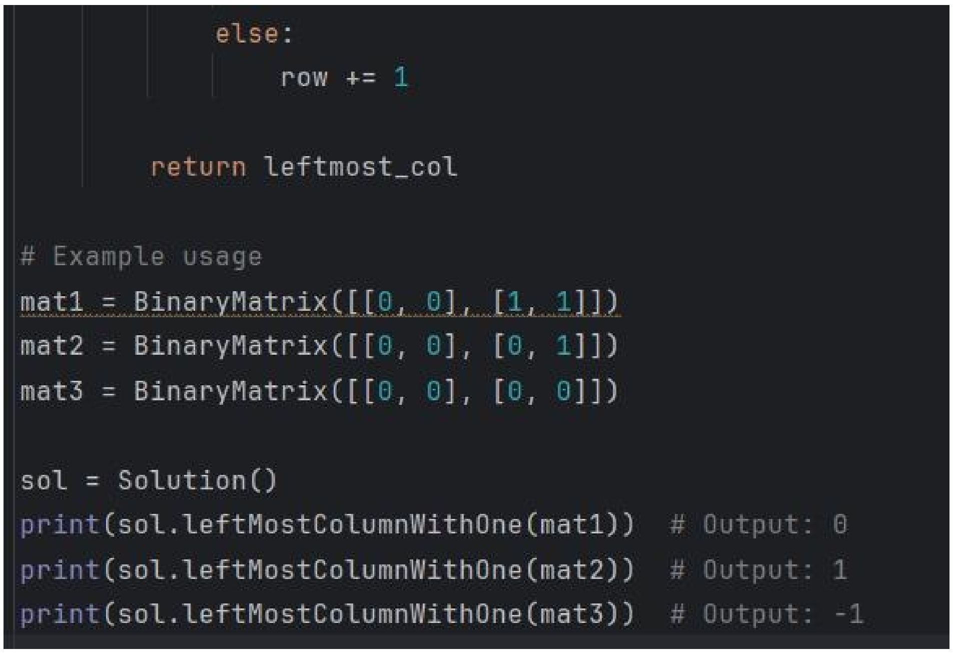
Submissions making more than 1000 calls to BinaryMatrix.get will be judged *Wrong Answer*. Also, any solutions that attempt to circumvent the judge will result in disqualification.
For custom testing purposes, the input will be the entire binary matrix mat. You will not
have access to the binary matrix directly.
Example 1:
Input: mat = [[0,0],[1,1]]
Output: 0
Example 2:
Input: mat = [[0,0],[0,1]]
Output: 1
Example 3:
Input: mat = [[0,0],[0,0]]
Output: -1
Constraints:● rows == mat.length

- cols == mat[i].length
- 1 <= rows, cols <= 100
- mat[i][j] is either 0 or 1.
- mat[i] is sorted in non-decreasing order.

CODING:

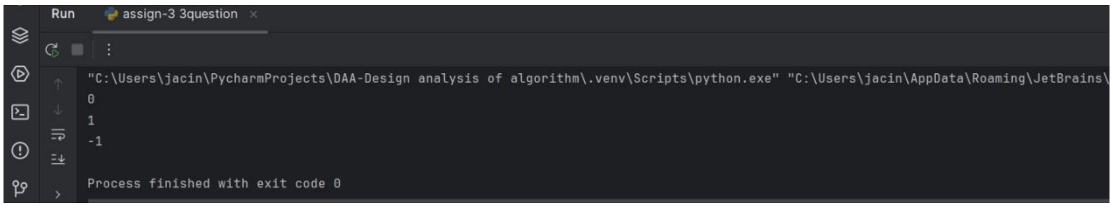


```
class BinaryMatrix:
    def __init__(self, mat):
        self.mat = mat

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

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

class Solution:
    def leftMostColumnWithOne(self, binaryMatrix):
        rows, cols = binaryMatrix.dimensions()
        row, col = 0, cols - 1
        leftm  col: int = cols - 1

        while row < rows and col >= 0:
            if binaryMatrix.get(row, col) == 1:
                leftmost_col = col
                col -= 1
```



```python
                else:
                    row += 1

            return leftmost_col

# Example usage
mat1 = BinaryMatrix([[0, 0], [1, 1]])
mat2 = BinaryMatrix([[0, 0], [0, 1]])
mat3 = BinaryMatrix([[0, 0], [0, 0]])

sol = Solution()
print(sol.leftMostColumnWithOne(mat1))  # Output: 0
print(sol.leftMostColumnWithOne(mat2))  # Output: 1
print(sol.leftMostColumnWithOne(mat3))  # Output: -1
```

OUTPUT:



```
"C:\Users\jacin\PycharmProjects\DAA-Design analysis of algorithm\.venv\Scripts\python.exe" "C:\Users\jacin\AppData\Roaming\JetBrains\
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:

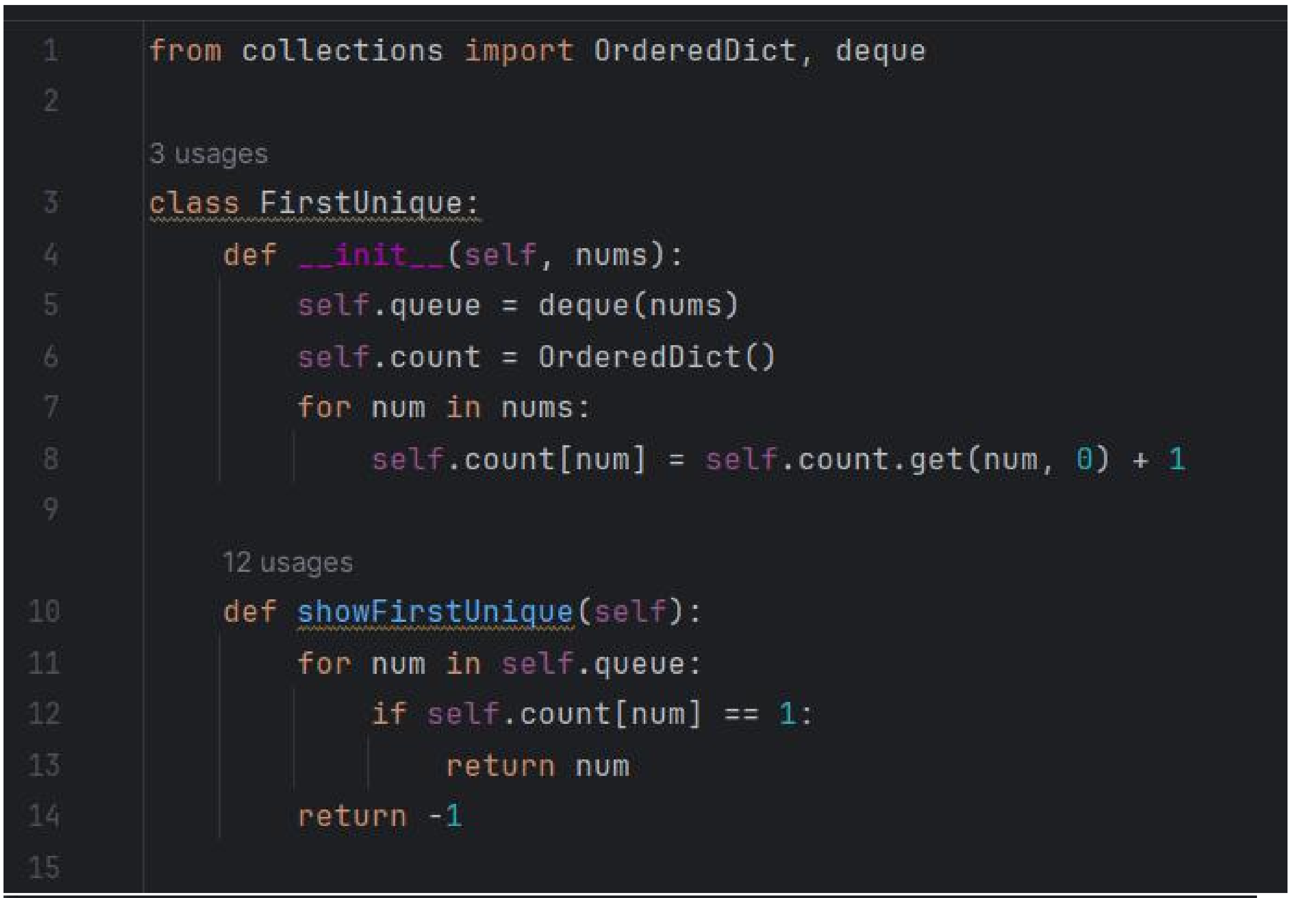
- FirstUnique(int[] nums) Initializes the object with the numbers in the queue.
- int showFirstUnique() returns the value of the first unique integer of the queue, and returns -1 if there is no such integer.
- void add(int value) insert value to the queue.

Example 1:
Input:
["FirstUnique","showFirstUnique","add","showFirstUnique","add","showFirstUnique","a
dd","showFirstUnique"]
[[[2,3,5]],[],[5],[],[2],[],[3],[]]
Output:
[null,2,null,2,null,3,null,-1]
Explanation:
FirstUnique firstUnique = new FirstUnique([2,3,5]);
firstUnique.showFirstUnique(); // return 2
firstUnique.add(5); // the queue is now [2,3,5,5]
firstUnique.showFirstUnique(); // return 2
firstUnique.add(2); // the queue is now [2,3,5,5,2]

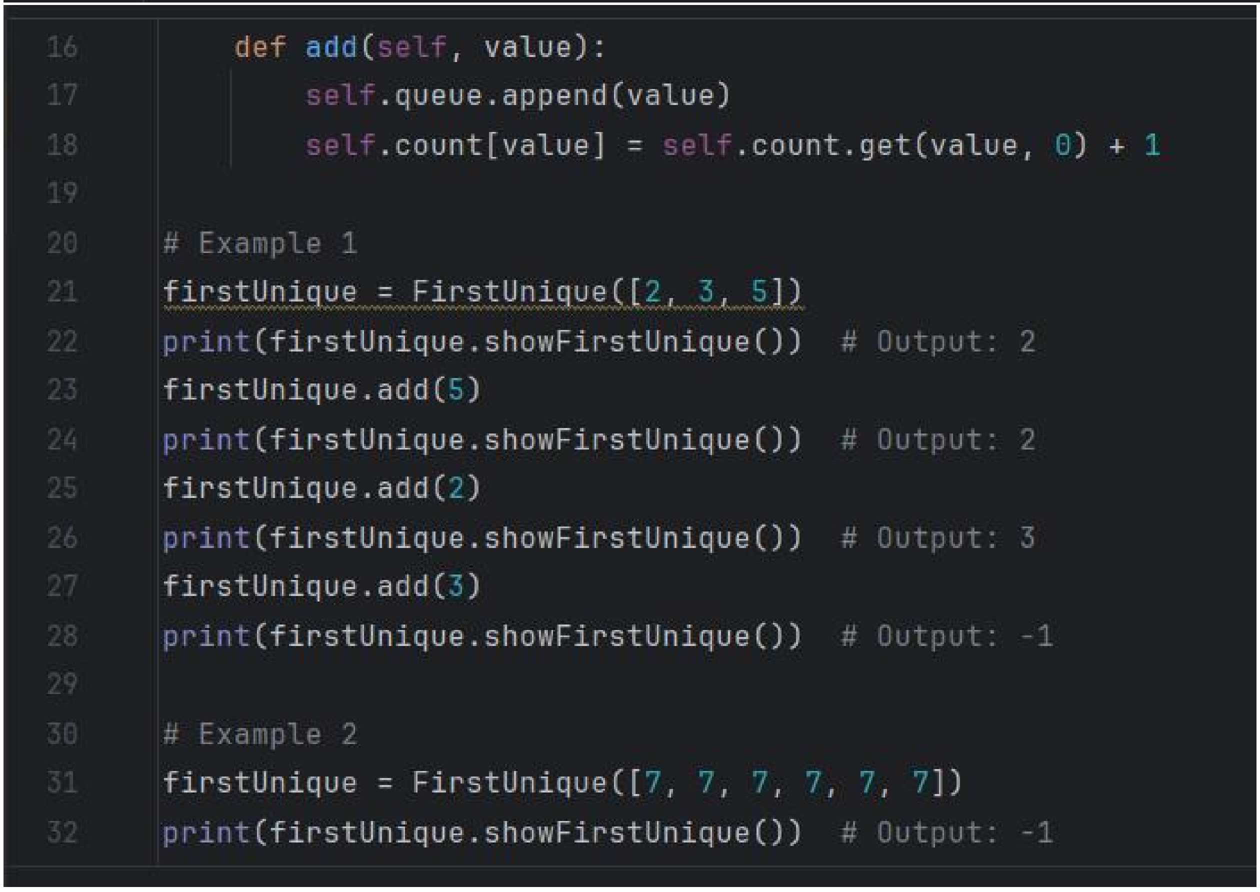
firstUnique.showFirstUnique(); // return 3
firstUnique.add(3); // the queue is now [2,3,5,5,2,3]
firstUnique.showFirstUnique(); // return -1
Example 2:
Input:
["FirstUnique","showFirstUnique","add","add","add","add","add","showFirstUnique"]
[[[7,7,7,7,7,7]],[],[7],[3],[3],[7],[17],[]]
Output:
[null,-1,null,null,null,null,null,17]
Explanation:
FirstUnique firstUnique = new FirstUnique([7,7,7,7,7,7]);
firstUnique.showFirstUnique(); // return -1
firstUnique.add(7); // the queue is now [7,7,7,7,7,7,7]
firstUnique.add(3); // the queue is now [7,7,7,7,7,7,7,3]
firstUnique.add(3); // the queue is now [7,7,7,7,7,7,7,3,3]
firstUnique.add(7); // the queue is now [7,7,7,7,7,7,7,3,3,7]
firstUnique.add(17); // the queue is now [7,7,7,7,7,7,7,3,3,7,17]
firstUnique.showFirstUnique(); // return 17
Example 3:Input:
["FirstUnique","showFirstUnique","add","showFirstUnique"]
[[[809]],[],[809],[]]
Output:
[null,809,null,-1]
Explanation:
FirstUnique firstUnique = new FirstUnique([809]);
firstUnique.showFirstUnique(); // return 809
firstUnique.add(809); // the queue is now [809,809]
firstUnique.showFirstUnique(); // return -1
Constraints:

- 1 <= nums.length <= 10^5
- 1 <= nums[i] <= 10^8
- 1 <= value <= 10^8
- At most 50000 calls will be made to showFirstUnique and add.

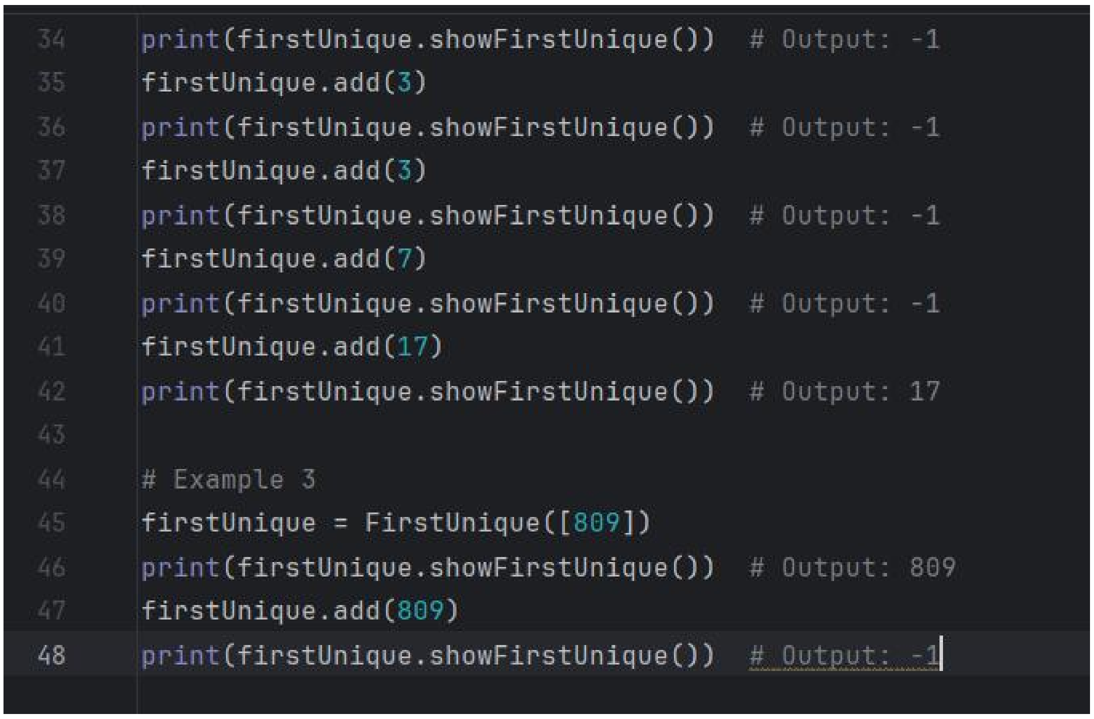
CODING:



```python
from collections import OrderedDict, deque

3 usages
class FirstUnique:
    def __init__(self, nums):
        self.queue = deque(nums)
        self.count = OrderedDict()
        for num in nums:
            self.count[num] = self.count.get(num, 0) + 1

    12 usages
    def showFirstUnique(self):
        for num in self.queue:
            if self.count[num] == 1:
                return num
        return -1

```

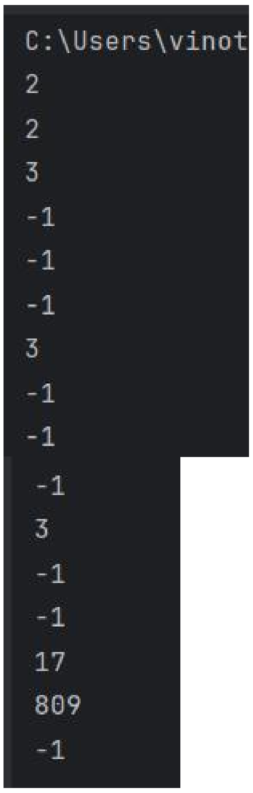


```python
    def add(self, value):
        self.queue.append(value)
        self.count[value] = self.count.get(value, 0) + 1

# Example 1
firstUnique = FirstUnique([2, 3, 5])
print(firstUnique.showFirstUnique())  # Output: 2
firstUnique.add(5)
print(firstUnique.showFirstUnique())  # Output: 2
firstUnique.add(2)
print(firstUnique.showFirstUnique())  # Output: 3
firstUnique.add(3)
print(firstUnique.showFirstUnique())  # Output: -1

# Example 2
firstUnique = FirstUnique([7, 7, 7, 7, 7, 7])
print(firstUnique.showFirstUnique())  # Output: -1
```



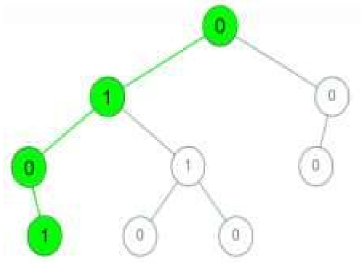
```
print(firstUnique.showFirstUnique())  # Output: -1
firstUnique.add(3)
print(firstUnique.showFirstUnique())  # Output: -1
firstUnique.add(3)
print(firstUnique.showFirstUnique())  # Output: -1
firstUnique.add(7)
print(firstUnique.showFirstUnique())  # Output: -1
firstUnique.add(17)
print(firstUnique.showFirstUnique())  # Output: 17

# Example 3
firstUnique = FirstUnique([809])
print(firstUnique.showFirstUnique())  # Output: 809
firstUnique.add(809)
print(firstUnique.showFirstUnique())  # Output: -1
```

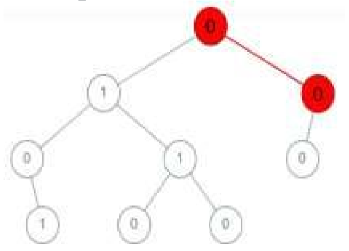
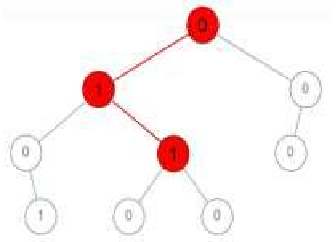
OUTPUT:



```
C:\Users\vinot
2
2
3
-1
-1
-1
3
-1
-1
-1
3
-1
-1
17
809
-1
```

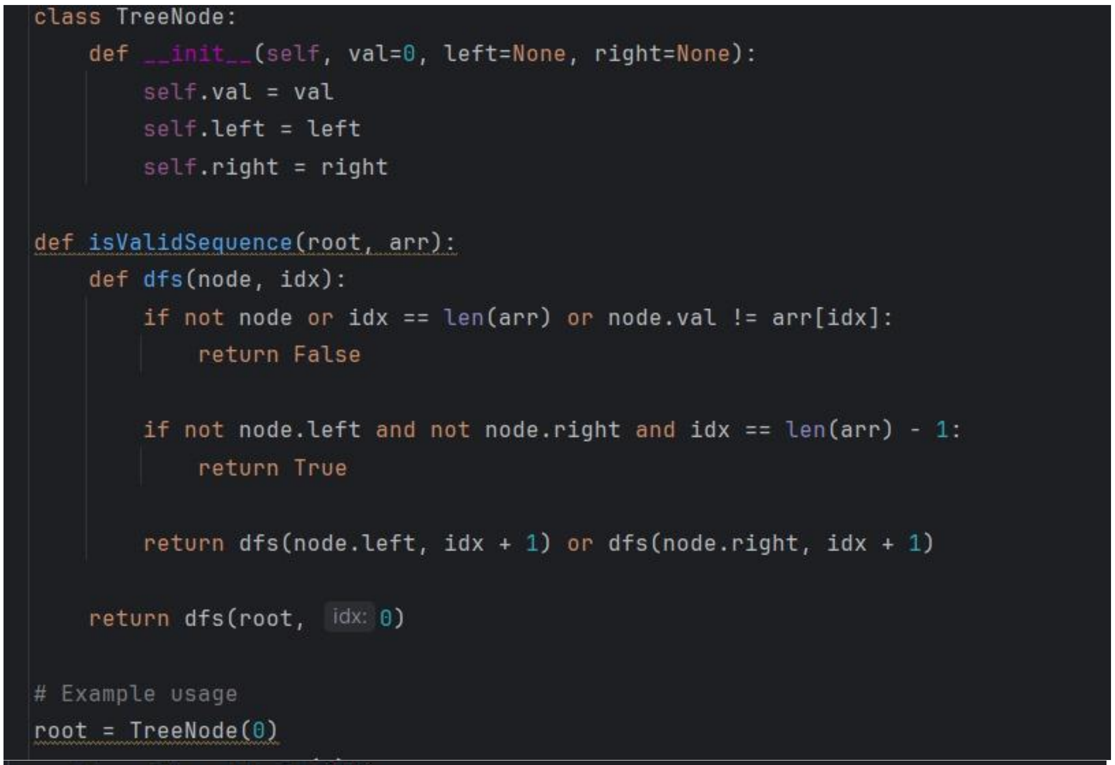
5. Check If a String Is a Valid Sequence from Root to Leaves Path in a Binary Tree Given a binary tree where each path going from the root to any leaf form a valid
sequence, check if a given string is a valid sequence in such binary tree.
We get the given string from the concatenation of an array of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

binary tree.
Example 1:


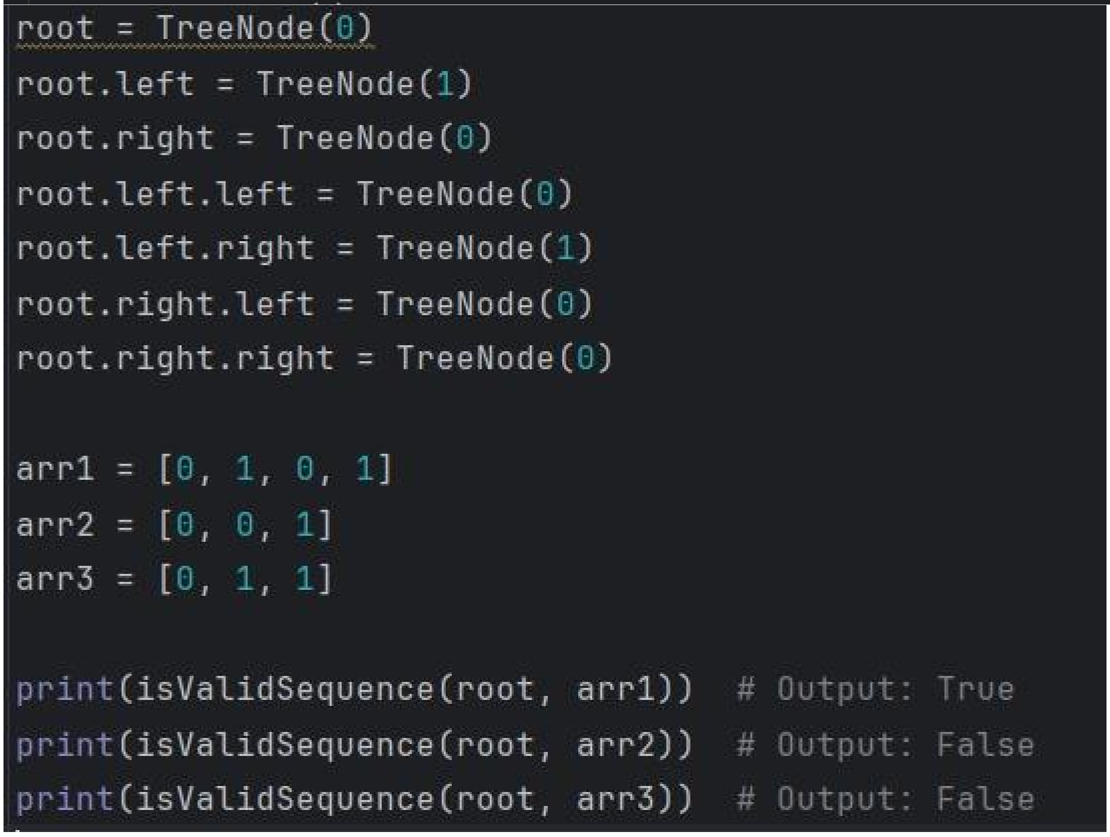
Input: root = [0,1,0,0,1,0,null,null,1,0,0], arr = [0,1,0,1]
Output: true
Explanation:
The path 0 -> 1 -> 0 -> 1 is a valid sequence (green color in the figure).
Other valid sequences are:
0 -> 1 -> 1 -> 0
0 -> 0 -> 0
Example 2:

Input: root = [0,1,0,0,1,0,null,null,1,0,0], arr = [0,0,1]
Output: false
Explanation: The path 0 -> 0 -> 1 does not exist, therefore it is not even a sequence.
Example 3:

Input: root = [0,1,0,0,1,0,null,null,1,0,0], arr = [0,1,1]
Output: false
Explanation: The path 0 -> 1 -> 1 is a sequence, but it is not a valid sequence.
Constraints:

- 1 <= arr.length <= 5000
- 0 <= arr[i] <= 9
- Each node's value is between [0 - 9]

CODING:

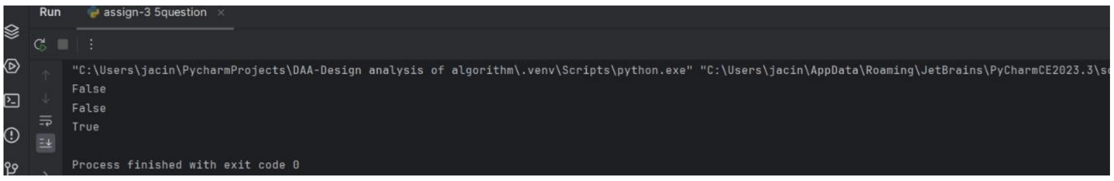


```python
class TreeNode:
    def __init__(self, val=0, left=None, right=None):
        self.val = val
        self.left = left
        self.right = right

def isValidSequence(root, arr):
    def dfs(node, idx):
        if not node or idx == len(arr) or node.val != arr[idx]:
            return False

        if not node.left and not node.right and idx == len(arr) - 1:
            return True

        return dfs(node.left, idx + 1) or dfs(node.right, idx + 1)

    return dfs(root,  idx: 0)

# Example usage
root = TreeNode(0)
```



```python
root = TreeNode(0)
root.left = TreeNode(1)
root.right = TreeNode(0)
root.left.left = TreeNode(0)
root.left.right = TreeNode(1)
root.right.left = TreeNode(0)
root.right.right = TreeNode(0)

arr1 = [0, 1, 0, 1]
arr2 = [0, 0, 1]
arr3 = [0, 1, 1]

print(isValidSequence(root, arr1))  # Output: True
print(isValidSequence(root, arr2))  # Output: False
print(isValidSequence(root, arr3))  # Output: False
```

OUTPUT:

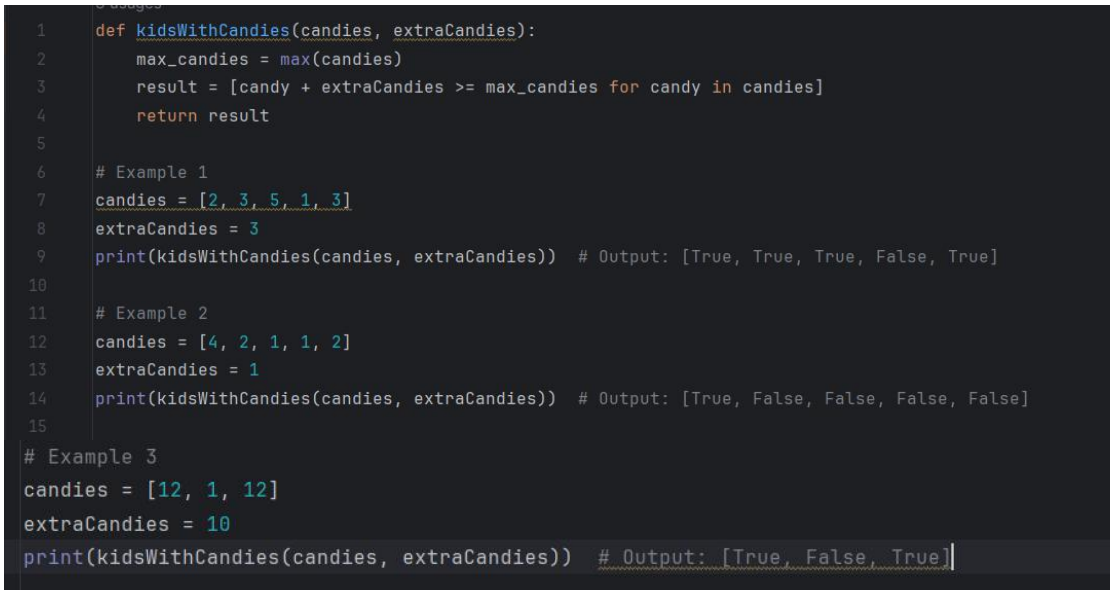


```
"C:\Users\jacin\PycharmProjects\DAA-Design analysis of algorithm\.venv\Scripts\python.exe" "C:\Users\jacin\AppData\Roaming\JetBrains\PyCharmCE2023.3\s
False
False
True

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.
Example 1:
Input: candies = [2,3,5,1,3], extraCandies = 3
Output: [true,true,true,false,true]
Explanation: If you give all extraCandies to:
- Kid 1, they will have 2 + 3 = 5 candies, which is the greatest among the kids.
- Kid 2, they will have 3 + 3 = 6 candies, which is the greatest among the kids.
- Kid 3, they will have 5 + 3 = 8 candies, which is the greatest among the kids.- Kid 4, they will have 1 + 3 = 4 candies, which is not the greatest among the kids.
- Kid 5, they will have 3 + 3 = 6 candies, which is the greatest among the kids.
Example 2:
Input: candies = [4,2,1,1,2], extraCandies = 1
Output: [true,false,false,false,false]
Explanation: There is only 1 extra candy.
Kid 1 will always have the greatest number of candies, even if a different kid is given the
extra candy.
Example 3:
Input: candies = [12,1,12], extraCandies = 10
Output: [true,false,true]
Constraints:

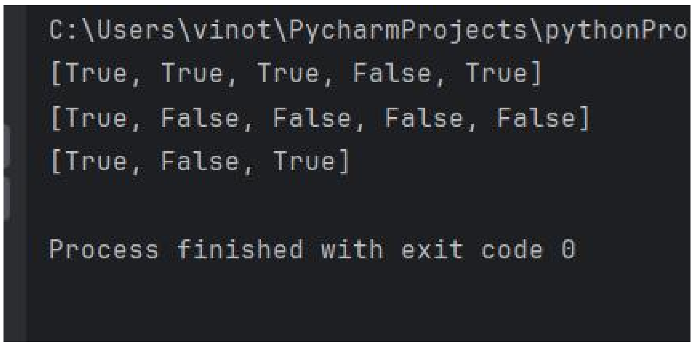
- n == candies.length
- 2 <= n <= 100
- 1 <= candies[i] <= 100
- 1 <= extraCandies <= 50

CODING:



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

# Example 1
candies = [2, 3, 5, 1, 3]
extraCandies = 3
print(kidsWithCandies(candies, extraCandies))  # Output: [True, True, True, False, True]

# Example 2
candies = [4, 2, 1, 1, 2]
extraCandies = 1
print(kidsWithCandies(candies, extraCandies))  # Output: [True, False, False, False, False]

# Example 3
candies = [12, 1, 12]
extraCandies = 10
print(kidsWithCandies(candies, extraCandies))  # Output: [True, False, True]
```

OUTPUT:



```
C:\Users\vinot\PycharmProjects\pythonPro
[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:

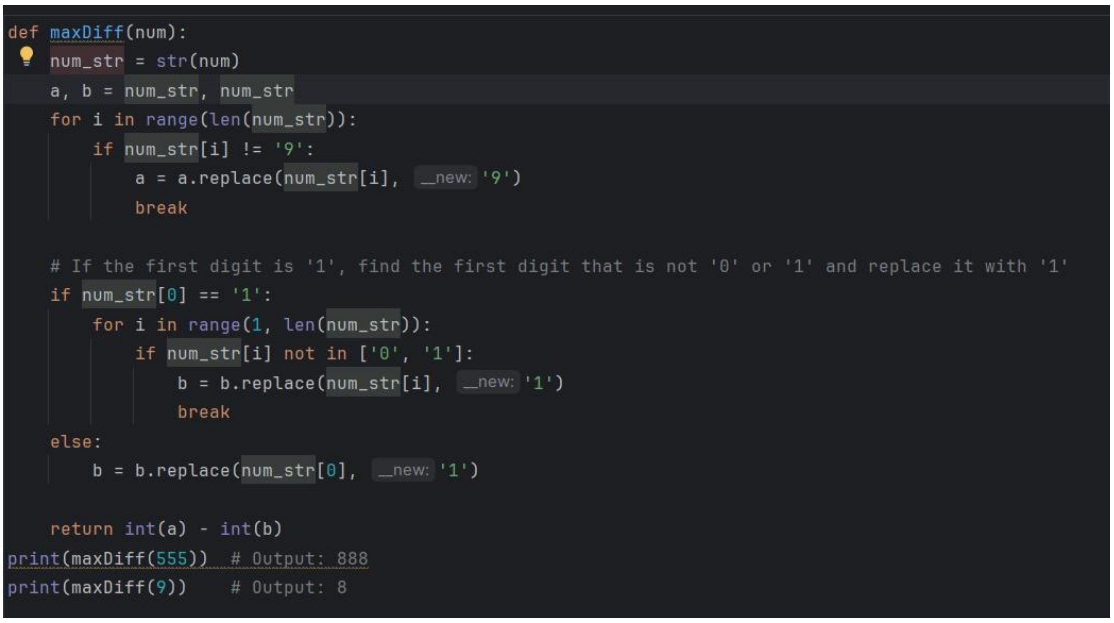
- Pick a digit x (0 <= x <= 9).
- Pick another digit y (0 <= y <= 9). The digit y can be equal to x.
- Replace all the occurrences of x in the decimal representation of num by y.
- The new integer cannot have any leading zeros, also the new integer cannot be 0.

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.
Example 1:
Input: num = 555
Output: 888
Explanation: The first time pick x = 5 and y = 9 and store the new integer in a.
The second time pick x = 5 and y = 1 and store the new integer in b.
We have now a = 999 and b = 111 and max difference = 888
Example 2:
Input: num = 9
Output: 8
Explanation: The first time pick x = 9 and y = 9 and store the new integer in a.

The second time pick x = 9 and y = 1 and store the new integer in b.
We have now a = 9 and b = 1 and max difference = 8Constraints:

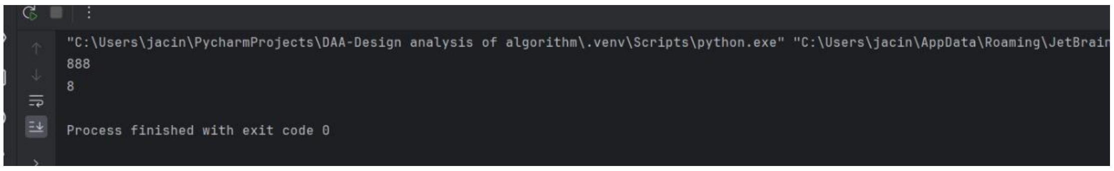
● 1 <= num <= 108

CODING:



```python
def maxDiff(num):
    num_str = str(num)
    a, b = num_str, num_str
    for i in range(len(num_str)):
        if num_str[i] != '9':
            a = a.replace(num_str[i],  __new: '9')
            break

    # If the first digit is '1', find the first digit that is not '0' or '1' and replace it with '1'
    if num_str[0] == '1':
        for i in range(1, len(num_str)):
            if num_str[i] not in ['0', '1']:
                b = b.replace(num_str[i],  __new: '1')
                break
    else:
        b = b.replace(num_str[0],  __new: '1')

    return int(a) - int(b)
print(maxDiff(555))  # Output: 888
print(maxDiff(9))    # Output: 8
```

OUTPUT:



```
"C:\Users\jacin\PycharmProjects\DAA-Design analysis of algorithm\.venv\Scripts\python.exe" "C:\Users\jacin\AppData\Roaming\JetBrai
888
8

Process finished with exit code 0
```

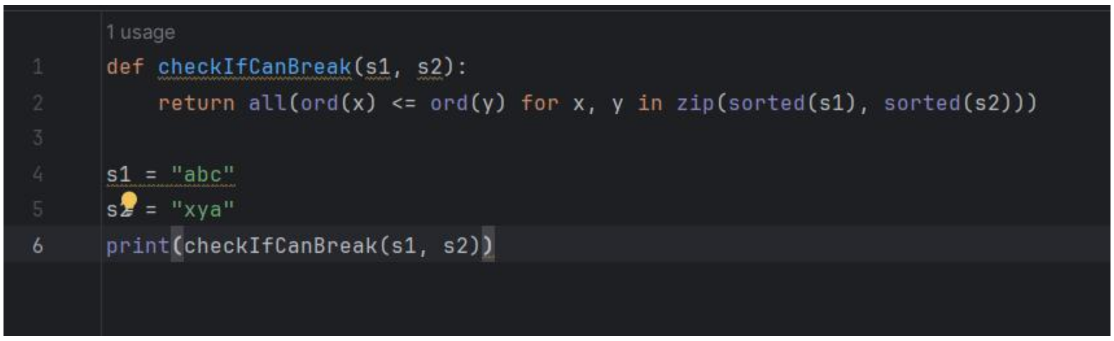
8. Check If a String Can Break Another String

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.
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".
Example 2:
Input: s1 = "abe", s2 = "acd"
Output: false
Explanation: All permutations for s1="abe" are: "abe", "aeb", "bae", "bea", "eab" and

"eba" and all permutation for s2="acd" are: "acd", "adc", "cad", "cda", "dac" and "dca".
However, there is not any permutation from s1 which can break some permutation from
s2 and vice-versa.
Example 3:
Input: s1 = "leetcodee", s2 = "interview"
Output: true
Constraints:

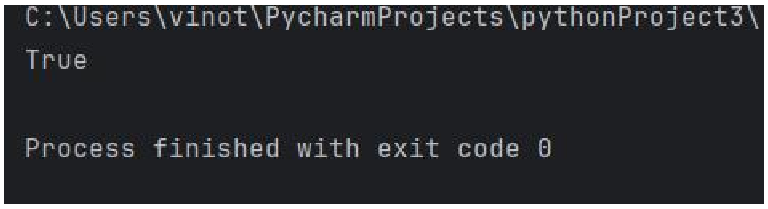
- s1.length == n
- s2.length == n
- 1 <= n <= 10^5
- All strings consist of lowercase English letters.

CODING:



```python
1 usage
def checkIfCanBreak(s1, s2):
    return all(ord(x) <= ord(y) for x, y in zip(sorted(s1), sorted(s2)))

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

OUTPUT:



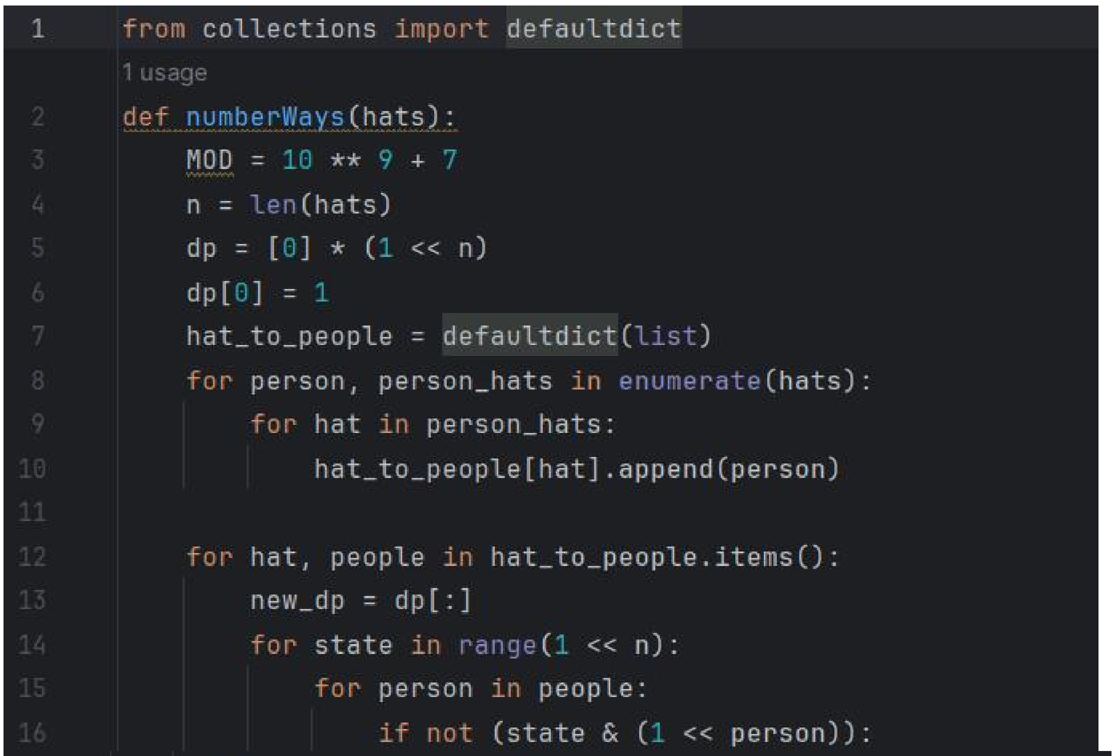
```
C:\Users\vinot\PycharmProjects\pythonProject3\
True

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.
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)

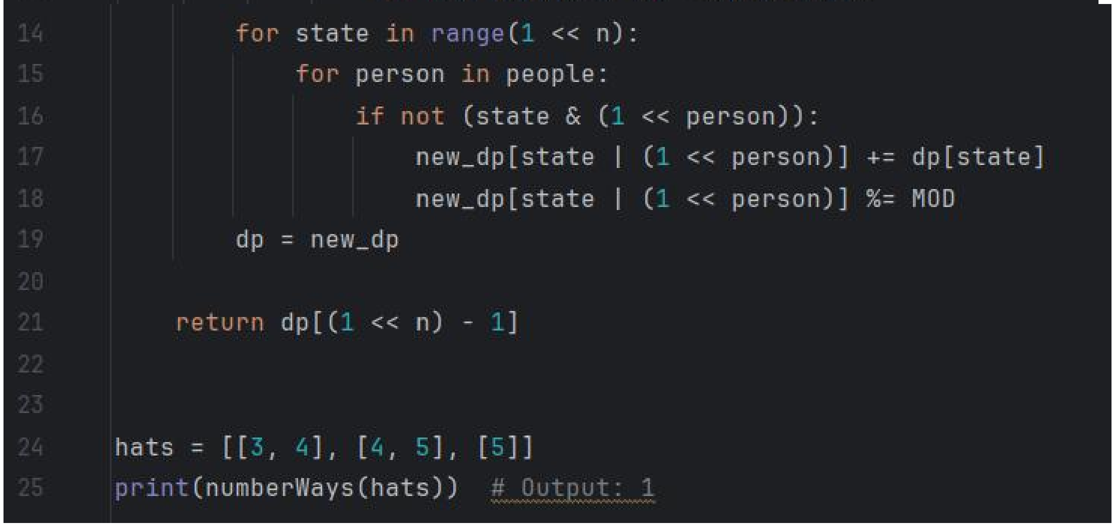
Example 3:
Input: hats = [[1,2,3,4],[1,2,3,4],[1,2,3,4],[1,2,3,4]]
Output: 24
Explanation: Each person can choose hats labeled from 1 to 4.
Number of Permutations of (1,2,3,4) = 24.
Constraints:

- n == hats.length
- 1 <= n <= 10
- 1 <= hats[i].length <= 40
- 1 <= hats[i][j] <= 40
- hats[i] contains a list of unique integers.

CODING:



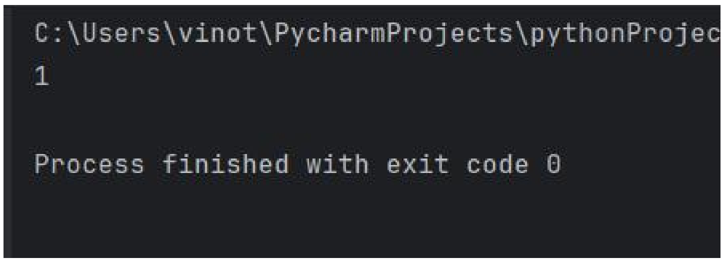
```python
from collections import defaultdict
1 usage
def numberWays(hats):
    MOD = 10 ** 9 + 7
    n = len(hats)
    dp = [0] * (1 << n)
    dp[0] = 1
    hat_to_people = defaultdict(list)
    for person, person_hats in enumerate(hats):
        for hat in person_hats:
            hat_to_people[hat].append(person)

    for hat, people in hat_to_people.items():
        new_dp = dp[:]
        for state in range(1 << n):
            for person in people:
                if not (state & (1 << person)):
```



```python
        for state in range(1 << n):
            for person in people:
                if not (state & (1 << person)):
```

```python
                    new_dp[state | (1 << person)] += dp[state]
                    new_dp[state | (1 << person)] %= MOD
        dp = new_dp

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


hats = [[3, 4], [4, 5], [5]]
print(numberWays(hats))  # Output: 1
```

OUTPUT:



```
C:\Users\vinot\PycharmProjects\pythonProjec
1

Process finished with exit code 0
```

10. Next Permutation
A permutation of an array of integers is an arrangement of its members into a sequence or
linear order.

- **For example, for arr = [1,2,3], the following are all the permutations of arr: [1,2,3],**
[1,3,2], [2, 1, 3], [2, 3, 1], [3,1,2], [3,2,1].

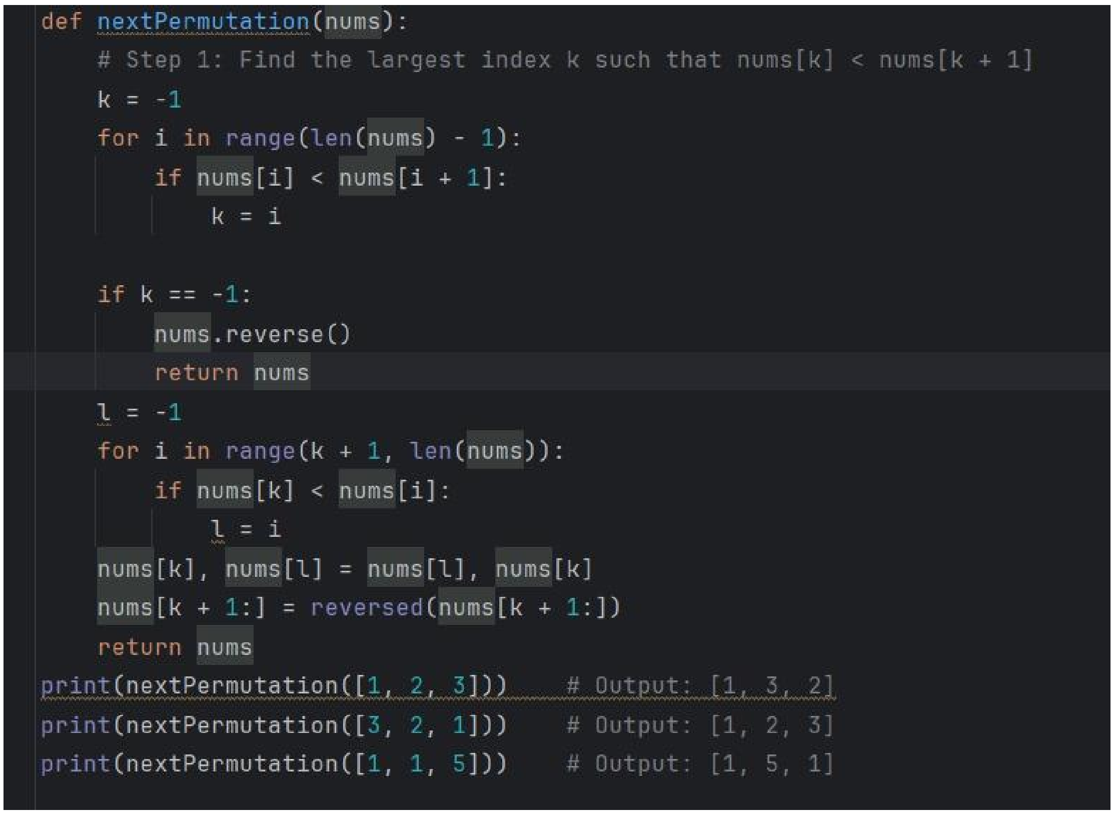
The next permutation of an array of integers is the next lexicographically greater permutation of its integer. More formally, if all the permutations of the array are sorted in
one container according to their lexicographical order, then the next permutation of that
array is the permutation that follows it in the sorted container. If such arrangement is not
possible, the array must be rearranged as the lowest possible order (i.e., sorted in ascending
order).

- **For example, the next permutation of arr = [1,2,3] is [1,3,2].**
- **Similarly, the next permutation of arr = [2,3,1] is [3,1,2].**
- **While the next permutation of arr = [3,2,1] is [1,2,3] because [3,2,1] does not have a**
lexicographical larger rearrangement.

Given an array of integers nums, *find the next permutation of* nums.
The replacement must be in place and use only constant extra memory.
Example 1:
Input: nums = [1,2,3]
Output: [1,3,2]
Example 2:
Input: nums = [3,2,1]
Output: [1,2,3]
Example 3:
Input: nums = [1,1,5]
Output: [1,5,1]
Constraints:

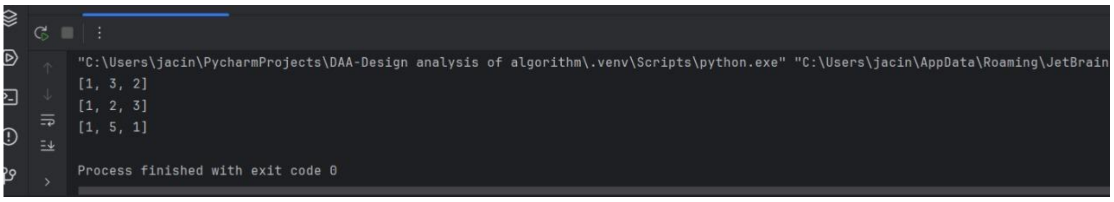
- **1 <= nums.length <= 100**
- **0 <= nums[i] <= 100**

CODING:



```python
def nextPermutation(nums):
    # Step 1: Find the largest index k such that nums[k] < nums[k + 1]
    k = -1
    for i in range(len(nums) - 1):
        if nums[i] < nums[i + 1]:
            k = i

    if k == -1:
        nums.reverse()
        return nums
    l = -1
    for i in range(k + 1, len(nums)):
        if nums[k] < nums[i]:
            l = i
    nums[k], nums[l] = nums[l], nums[k]
    nums[k + 1:] = reversed(nums[k + 1:])
    return nums
print(nextPermutation([1, 2, 3]))     # Output: [1, 3, 2]
print(nextPermutation([3, 2, 1]))     # Output: [1, 2, 3]
print(nextPermutation([1, 1, 5]))     # Output: [1, 5, 1]
```

OUTPUT:



```
"C:\Users\jacin\PycharmProjects\DAA-Design analysis of algorithm\.venv\Scripts\python.exe" "C:\Users\jacin\AppData\Roaming\JetBrain
[1, 3, 2]
[1, 2, 3]
[1, 5, 1]

Process finished with exit code 0
```