Day – 3 : Arrays- III

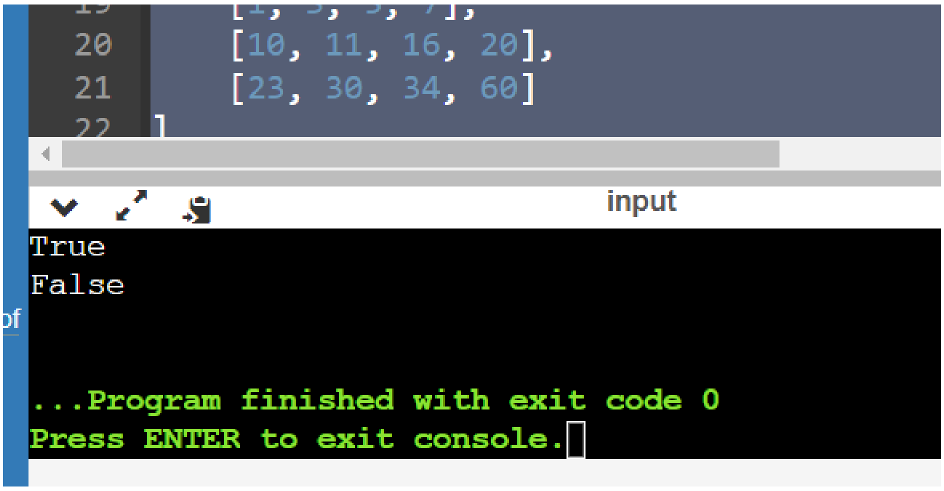
Problem 1: Given an m*n 2D matrix and an integer, write a program to find if the given integer exists in the matrix.

```
def search_matrix(matrix, target):
    if not matrix or not matrix[0]:
        return False
    rows = len(matrix)
    cols = len(matrix[0])
    row = 0
    col = cols - 1

    while row < rows and col >= 0:
        if matrix[row][col] == target:
            return True
        elif matrix[row][col] > target:
            col -= 1
        else:
            row += 1

    return False
matrix1 = [
    [1, 3, 5, 7],
    [10, 11, 16, 20],
    [23, 30, 34, 60]
]
target1 = 3
print(search_matrix(matrix1, target1))

matrix2 = [
    [1, 3, 5, 7],
    [10, 11, 16, 20],
   [23, 30, 34, 60]
]
target2 = 13
print(search_matrix(matrix2,target2))
```



```
    [1, 3, 5, 7],
    [10, 11, 16, 20],
    [23, 30, 34, 60]
]
```

```
True
False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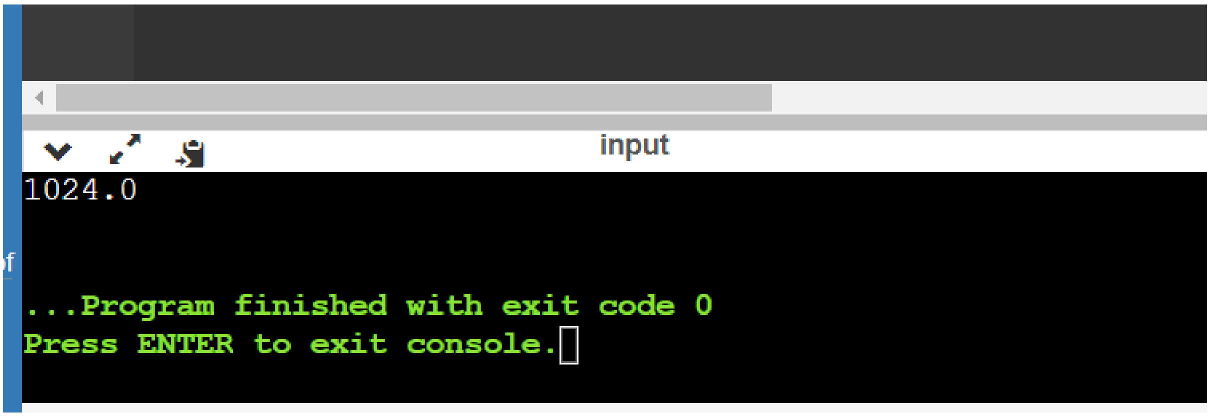
Press ENTER to exit console.
```

Problem -2: Given a double x and integer n, calculate x raised to power n. Basically Implement pow(x, n).

```
def pow(x, n):
   if n == 0:
      return 1.0
   elif n < 0:
      x = 1 / x
      n = -n

   result = 1.0
   while n > 0:
      if n % 2 == 1:
         result *= x
      x *= x
      n //= 2
```

```
    return result
x = 2.00000
n = 10
print(pow(x, n))
```



```
1024.0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```

Problem 3: Given an array of **N integers**, write a program to return an element that occurs more than **N/2** times in the given array. You may consider that such an element always exists in the array.

```
def majority_element(nums):
    candidate = None
    count = 0
    for num in nums:
        if count == 0:
            candidate = num
            count = 1
        elif num == candidate:
            count += 1
        else:
            count -= 1



    count = 0
    for num in nums:
        if num == candidate:
            count += 1



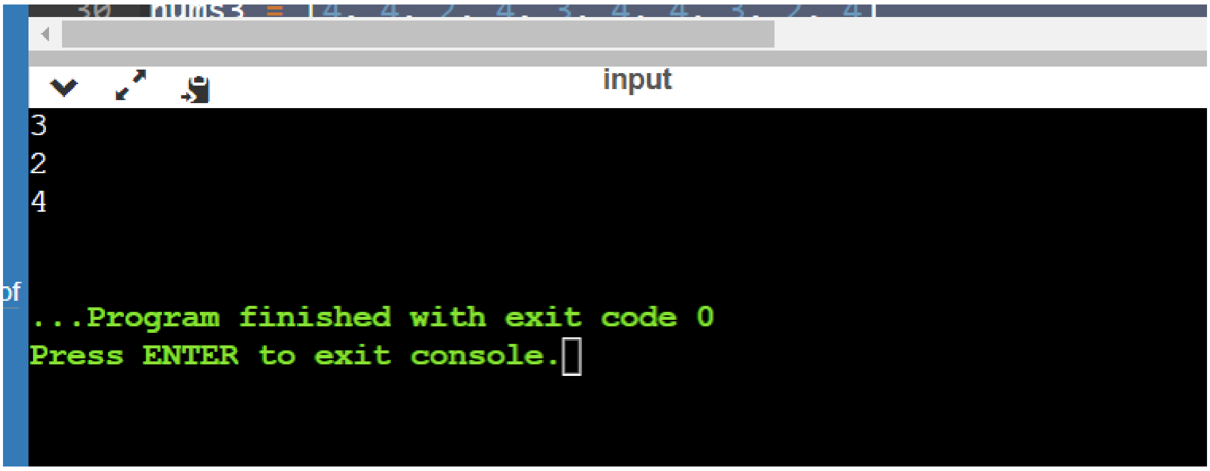
    if count > len(nums) // 2:
        return candidate



nums1 = [3, 2, 3]
print(majority_element(nums1))

nums2 = [2, 2, 1, 1, 1, 2, 2]
print(majority_element(nums2))

nums3 = [4, 4, 2, 4, 3, 4, 4, 3, 2, 4]
print(majority_element(nums3))
```



```
3
2
4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```

Problem 4: Given an array of N integers. Find the elements that appear more than **N/3** times in the array. If no such element exists, return an empty vector.

```
def majority_element(nums):
```

```
candidate1, candidate2 = None, None
count1, count2 = 0, 0


for num in nums:
    if candidate1 == num:
        count1 += 1
    elif candidate2 == num:
        count2 += 1
    elif count1 == 0:
        candidate1, count1 = num, 1
    elif count2 == 0:
        candidate2, count2 = num, 1
    else:
        count1 -= 1
        count2 -= 1


count1, count2 = 0, 0
for num in nums:
    if num == candidate1:
        count1 += 1
    elif num == candidate2:
        count2 += 1
    n = len(nums)

    result = []

    if count1 > n // 3:

        result.append(candidate1)

    if count2 > n // 3:

        result.append(candidate2)


    return result



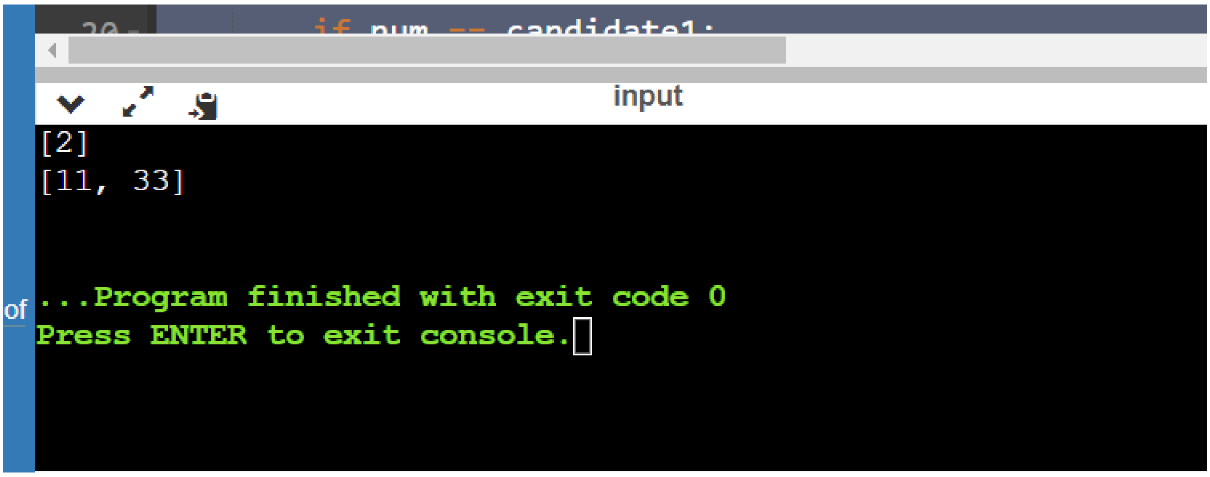

nums1 = [1, 2, 2, 3, 2]

print(majority_element(nums1))



nums2 = [11, 33, 33, 11, 33, 11]

print(majority_element(nums2))
```



```
        if num == candidate1:
```

```
[2]
[11, 33]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```

Problem 5: Given a matrix **m X n**, count paths from left-top to the right bottom of a matrix with the constraints that from each cell you can either only move to the rightward direction or the downward direction.

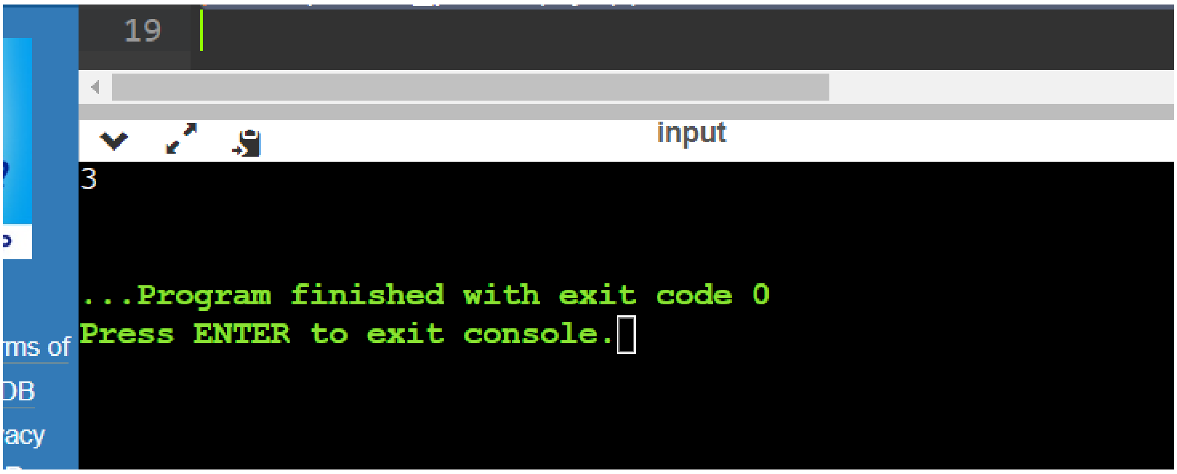
```
def count_paths(m, n):
    dp = [[0] * n for _ in range(m)]
    dp[0][0] = 1

    for j in range(1, n):
        dp[0][j] = 1

    for i in range(1, m):
        dp[i][0] = 1

    for i in range(1, m):
        for j in range(1, n):
            dp[i][j] = dp[i-1][j] + dp[i][j-1]

    return dp[m-1][n-1]
m = 2
n= 3
print(count_paths(m,n))
```



```
3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Problem 6: Given an array of numbers, you need to return the count of reverse pairs. **Reverse Pairs** are those pairs where i<j and arr[i]>2*arr[j].

What is an inversion of an array? Definition: for all i & j < size of array, if i < j then you have to find pair (A[i],A[j]) such that A[j] < A[i].

```
def mergeSortAndCount(arr, start, end):
  if start == end:
    return 0

  mid = (start + end) // 2
  countLeft = mergeSortAndCount(arr, start, mid)
  countRight = mergeSortAndCount(arr, mid + 1, end)

  countPairs = 0
  i = start
  j = mid + 1

  while i <= mid and j <= end:
    if arr[i] > 2 * arr[j]:
      countPairs += (mid - i + 1)
      j += 1
    else:
      i += 1

  merged = []
  i = start
  j = mid + 1

  while i <= mid and j <= end:
    if arr[i] <= arr[j]:
            merged.append(arr[i])
            i += 1
        else:
            merged.append(arr[j])
            j += 1

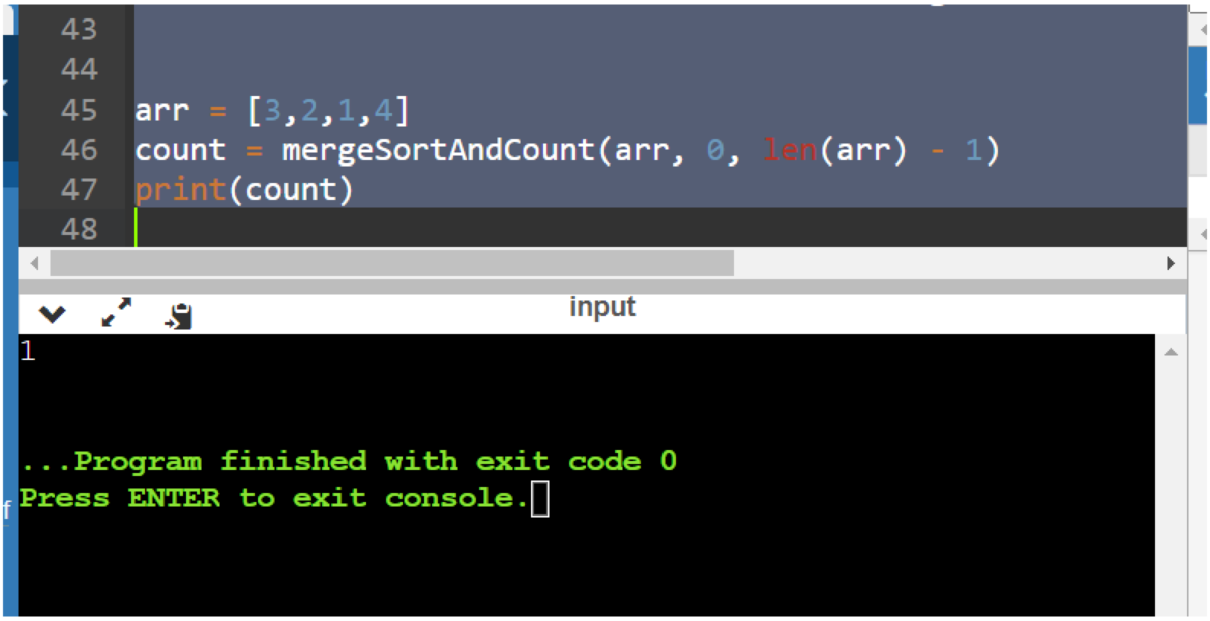
    while i <= mid:
        merged.append(arr[i])
        i += 1

    while j <= end:
        merged.append(arr[j])
        j += 1

    arr[start:end + 1] = merged

    return countPairs + countLeft + countRight


arr = [3,2,1,4]
count = mergeSortAndCount(arr, 0, len(arr) - 1)
print(count)
```



```
arr = [3,2,1,4]
count = mergeSortAndCount(arr, 0, len(arr) - 1)
print(count)
```

```
1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```