ASSIGMNENT -6

ARRAYS

QUESTION 1

A permutation perm of n + 1 integers of all the integers in the range [0, n] can be represented as a string s of length n where:

- s[i] == 'I' if perm[i] < perm[i + 1], and
- s[i] == 'D' if perm[i] > perm[i + 1].

Given a string s, reconstruct the permutation perm and return it. If there are multiple valid permutations perm, return **any of them**.

Example 1:

Input: s = "IDID"

Output:

[0,4,1,3,2]

SOLUTION:

TC: O(n), SC: O(1)

CODE:

```
class Solution:
    def diStringMatch(self, s: str) -> List[int]:
        i, n = 0, len(s)
        ans = []
        for c in s:
            if c == 'I':
                ans.append(i)
                i+=1
            else:
                ans.append(n)
                n-=1
        ans.append(i)
        return ans
```

QUESTION 2

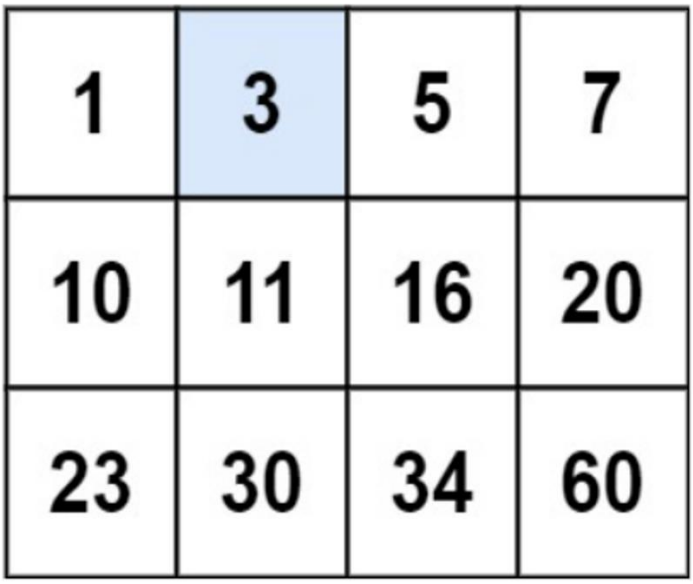
You are given an m x n integer matrix matrix with the following two properties:

- Each row is sorted in non-decreasing order.
- The first integer of each row is greater than the last integer of the previous row.

Given an integer target, return true *if* target *is in* matrix *or* false *otherwise*.

You must write a solution in O(log(m * n)) time complexity.

Example 1:



Input: matrix = [[1,3,5,7],[10,11,16,20],[23,30,34,60]], target = 3

Output: true

SOLUTION:

TC: O(logn), SC: O(1)

CODE:

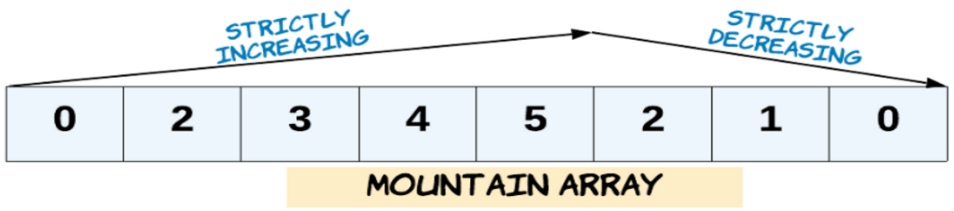
```
class Solution:
    def searchMatrix(self, matrix: List[List[int]], target: int) -> bool:
        row,col=len(matrix),len(matrix[0])
        left,right=0,row*col-1
        while left<=right:
            mid=(left+right)//2
            num=matrix[mid//col][mid%col]
            if num==target:
                return True
            if num>target:
                right=mid-1
            else:
                left=mid+1
        return False
```

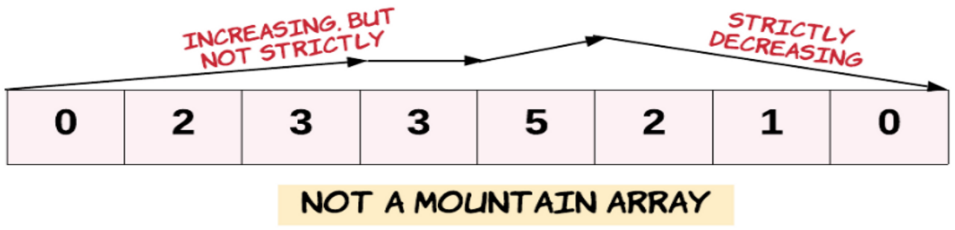
QUESTION 3

Given an array of integers arr, return *true if and only if it is a valid mountain array*.

Recall that arr is a mountain array if and only if:

- arr.length >= 3
- There exists some i with 0 < i < arr.length - 1 such that:
  - arr[0] < arr[1] < ... < arr[i - 1] < arr[i]
  - arr[i] > arr[i + 1] > ... > arr[arr.length - 1] </aside>





Example 1:

Input: arr = [2,1]

Output:

false

SOLUTION:

TC: O(n), SC: O(1)

CODE:

```
class Solution:
  def validMountainArray(self, a: List[int]) -> bool:
    start, end, L = 0, -1, len(a)

    while start < L-1 and a[start] < a[start+1]:
      start += 1
    while end > -L and a[end] < a[end-1]:
      end -= 1

    return start == end + L and 0 < start and end < -1
```

QUESTION 4

Given a binary array nums, return *the maximum length of a contiguous subarray with an equal number of* 0 *and* 1.

Example 1:

Input: nums = [0,1]

Output: 2

Explanation:

[0, 1] is the longest contiguous subarray with an equal number of 0 and 1.

SOLUTION:

TC: O(n), SC: O(1)

CODE:

```
class Solution:
    def findMaxLength(self, nums: List[int]) -> int:
        m,c=0,0
        d={0:-1}
        for i in range(len(nums)):
            if nums[i]==0:
                c-=1
            else:
                c+=1
            if c in d:
                m=max(m,i-d[c])
            else:
                d[c]=i
        return m
```

QUESTION 5

The **product sum** of two equal-length arrays a and b is equal to the sum of a[i] * b[i] for all 0 <= i < a.length (**0-indexed**).

- For example, if a = [1,2,3,4] and b = [5,2,3,1], the **product sum** would be 1*5 + 2*2 + 3*3 + 4*1 = 22.

Given two arrays nums1 and nums2 of length n, return *the* ***minimum product sum*** *if you are allowed to* ***rearrange*** *the* ***order*** *of the elements in* nums1.

Example 1:

Input: nums1 = [5,3,4,2], nums2 = [4,2,2,5]

Output: 40

Explanation:

We can rearrange nums1 to become [3,5,4,2]. The product sum of [3,5,4,2] and [4,2,2,5] is *3*4 + *5*2 + 4*2 + *2*5 = 40.

SOLUTION:

TC: O(n), SC: O(1)

CODE:

```
class Solution:
    def minProductSum(self, nums1: List[int], nums2: List[int]) -> int:
        nums1.sort()
        nums2.sort()
        n, res = len(nums1), 0
        for i in range(n):
            res += nums1[i] * nums2[n - i - 1]
        return res
```

QUESTION 6

An integer array original is transformed into a **doubled** array changed by appending **twice the value** of every element in original, and then randomly **shuffling** the resulting array.

Given an array changed, return original *if* changed *is a* ***doubled*** *array. If* changed *is not a* ***doubled*** *array, return an empty array. The elements in* original *may be returned in* ***any*** *order.*

Example 1:

Input: changed = [1,3,4,2,6,8]

Output: [1,3,4]

Explanation: One possible original array could be [1,3,4]:

- Twice the value of 1 is 1 * 2 = 2.
- Twice the value of 3 is 3 * 2 = 6.
- Twice the value of 4 is 4 * 2 = 8.

Other original arrays could be [4,3,1] or [3,1,4].

SOLUTION:

TC:O(n), SC:O(1)

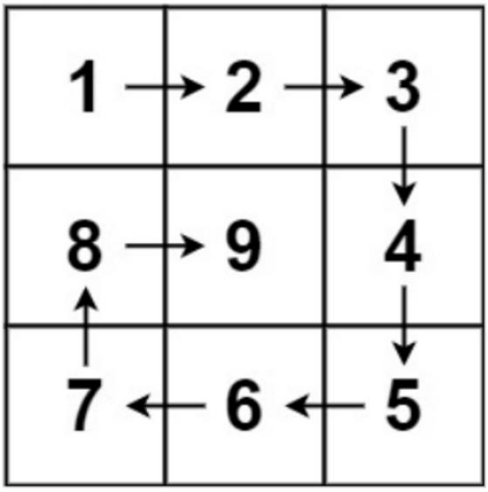
CODE:

```
class Solution:
    def findOriginalArray(self, changed: List[int]) -> List[int]:
        c = Counter(changed)

        zeros, m = divmod(c[0], 2)
        if m: return []
        ans = [0]*zeros

        for n in sorted(c.keys()):
            if c[n] > c[2*n]: return []
            c[2*n]-= c[n]
            ans.extend([n]*c[n])

        return ans
```

QUESTION 7

Given a positive integer n, generate an n x n matrix filled with elements from 1 to n2 in spiral order.

Example 1:



Input: n = 3

Output: [[1,2,3],[8,9,4],[7,6,5]]

SOLUTION:

TC: O(n), SC: O(1)

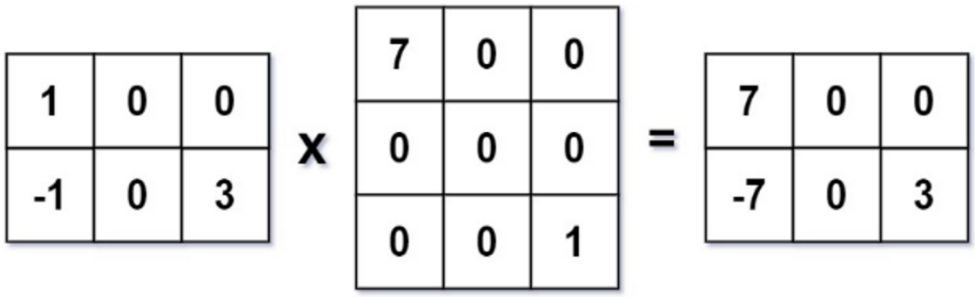
CODE:

```
class Solution:
    def generateMatrix(self, n: int) -> List[List[int]]:
        if not n:
            return []
        matrix = [[0 for _ in range(n)] for _ in range(n)]
        left, right, top, bottom, num = 0, n-1, 0, n-1, 1
        while left <= right and top <= bottom:
            for i in range(left, right+1):
                matrix[top][i] = num
                num += 1
            top += 1
            for i in range(top, bottom+1):
                matrix[i][right] = num
                num += 1
            right -= 1
            if top <= bottom:
                for i in range(right, left-1, -1):
                    matrix[bottom][i] = num
                    num += 1
                bottom -= 1
            if left <= right:
                for i in range(bottom, top-1, -1):
                    matrix[i][left] = num
                    num += 1
                left += 1
        return matrix
```

QUESTION 8

Given two sparse matrices mat1 of size m x k and mat2 of size k x n, return the result of mat1 x mat2. You may assume that multiplication is always possible.

Example 1:



Input: mat1 = [[1,0,0],[-1,0,3]], mat2 = [[7,0,0],[0,0,0],[0,0,1]]

Output: [[7,0,0],[-7,0,3]]

SOLUTION:

TC:O(m*n), SC:O(m+n)

CODE:

```
class Solution:
    def multiply(self, mat1: List[List[int]], mat2: List[List[int]]) ->
List[List[int]]:
        r1, c1, c2 = len(mat1), len(mat1[0]), len(mat2[0])
        res = [[0] * c2 for _ in range(r1)]
        mp = defaultdict(list)
        for i in range(r1):
            for j in range(c1):
                if mat1[i][j] != 0:
                    mp[i].append(j)
        for i in range(r1):
            for j in range(c2):
                for k in mp[i]:
                    res[i][j] += mat1[i][k] * mat2[k][j]
        return res
```