**Assignment Questions 11**

**Question 1**

Given a non-negative integer x, return *the square root of* x *rounded down to the nearest integer*. The returned integer should be **non-negative** as well.

You **must not use** any built-in exponent function or operator.

* For example, do not use pow(x, 0.5) in c++ or x \*\* 0.5 in python.

**Example 1:**

Input: x = 4

Output: 2

Explanation: The square root of 4 is 2, so we return 2.

**Example 2:**

Input: x = 8

Output: 2

Explanation: The square root of 8 is 2.82842..., and since we round it down to the nearest integer, 2 is returned.

class Solution:

    def mySqrt(self, x: int) -> int:

        left, right = 1, x

        while left <=right:

            mid = (left + right)//2

            if mid\*mid == x:

                return mid

            elif mid\*mid < x:

                left = mid +1

            else:

                right = mid-1

        return right

**Question 2**

A peak element is an element that is strictly greater than its neighbors.

Given a **0-indexed** integer array nums, find a peak element, and return its index. If the array contains multiple peaks, return the index to **any of the peaks**.

You may imagine that nums[-1] = nums[n] = -∞. In other words, an element is always considered to be strictly greater than a neighbor that is outside the array.

You must write an algorithm that runs in O(log n) time.

**Example 1:**

Input: nums = [1,2,3,1]

Output: 2

Explanation: 3 is a peak element and your function should return the index number 2.

**Example 2:**

Input: nums = [1,2,1,3,5,6,4]

Output: 5

Explanation: Your function can return either index number 1 where the peak element is 2, or index number 5 where the peak element is 6.

Approach :

Since we know that adjacent numbers can not be equal to each other therefore we will compare with right and left side values of the mid and if the nums[mid]< nums[mid+1] we will search in the right side portion, therefore, left = mid+1 and vice versa.

class Solution:

    def findPeakElement(self, nums: List[int]) -> int:

        left, right = 0, len(nums)-1

        while left<=right:

            mid = (left + right)//2

            if (mid>0) and nums[mid]<nums[mid-1]:

                right = mid-1

            elif mid< len(nums)-1 and nums[mid] < nums[mid+1]:

                left = mid+1

            else:

                return mid

**Question 3**

Given an array nums containing n distinct numbers in the range [0, n], return *the only number in the range that is missing from the array.*

**Example 1:**

Input: nums = [3,0,1]

Output: 2

Explanation: n = 3 since there are 3 numbers, so all numbers are in the range [0,3]. 2 is the missing number in the range since it does not appear in nums.

**Example 2:**

Input: nums = [0,1]

Output: 2

Explanation: n = 2 since there are 2 numbers, so all numbers are in the range [0,2]. 2 is the missing number in the range since it does not appear in nums.

**Example 3:**

Input: nums = [9,6,4,2,3,5,7,0,1]

Output: 8

Explanation: n = 9 since there are 9 numbers, so all numbers are in the range [0,9]. 8 is the missing number in the range since it does not appear in nums.

class Solution:

    def missingNumber(self, nums: List[int]) -> int:

        return sum(range(0,len(nums)+1))-sum(nums)

        # we can even do this with the help of binary num i.e XOR operator; We will take the list of nums and take the XOR with nums array, SO all the same value nums will get canceled and we will be left with only one element that is the missing element.

**Question 4**

Given an array of integers nums containing n + 1 integers where each integer is in the range [1, n] inclusive.

There is only **one repeated number** in nums, return *this repeated number*.

You must solve the problem **without** modifying the array nums and uses only constant extra space.

**Example 1:**

Input: nums = [1,3,4,2,2]

Output: 2

**Example 2:**

Input: nums = [3,1,3,4,2]

Output: 3

Solution:

class Solution:

    def findDuplicate(self, nums: List[int]) -> int:

        # linked list cycle problem ; floyd's detection algorithm

        slow, fast = 0,0

        while True:

            slow = nums[slow]

            fast = nums[nums[fast]]

            if slow == fast:

                break

        slow2 = 0

        while True:

            slow = nums[slow]

            slow2 = nums[slow2]

            if slow == slow2:

                return slow

**Question 5**

Given two integer arrays nums1 and nums2, return *an array of their intersection*. Each element in the result must be **unique** and you may return the result in **any order**.

**Example 1:**

Input: nums1 = [1,2,2,1], nums2 = [2,2]

Output: [2]

**Example 2:**

Input: nums1 = [4,9,5], nums2 = [9,4,9,8,4]

Output: [9,4]

Explanation: [4,9] is also accepted.

class Solution:

    def intersection(self, nums1: List[int], nums2: List[int]) -> List[int]:

        m ={}

        if len(nums1)<len(nums2):

            nums1, nums2 = nums2, nums1

        for i in nums1:

            if i not in m:

                m[i] = 1

            else:

                m[i] +=1

        result = []

        for i in nums2:

            if i in m and m[i]:

                m[i] -=1

                if i not in result:

                    result.append(i)

        return result

**Question 6**

Suppose an array of length n sorted in ascending order is **rotated** between 1 and n times. For example, the array nums = [0,1,2,4,5,6,7] might become:

* [4,5,6,7,0,1,2] if it was rotated 4 times.
* [0,1,2,4,5,6,7] if it was rotated 7 times.

Notice that **rotating** an array [a[0], a[1], a[2], ..., a[n-1]] 1 time results in the array [a[n-1], a[0], a[1], a[2], ..., a[n-2]].

Given the sorted rotated array nums of **unique** elements, return *the minimum element of this array*.

You must write an algorithm that runs in O(log n) time.

**Example 1:**

Input: nums = [3,4,5,1,2]

Output: 1

Explanation: The original array was [1,2,3,4,5] rotated 3 times.

**Example 2:**

Input: nums = [4,5,6,7,0,1,2]

Output: 0

Explanation: The original array was [0,1,2,4,5,6,7] and it was rotated 4 times.

**Example 3:**

Input: nums = [11,13,15,17]

Output: 11

Explanation: The original array was [11,13,15,17] and it was rotated 4 times.

class Solution:

    def findMin(self, nums: List[int]) -> int:

        res = nums[0]

        left = 0

        right = len(nums)-1

        while left<= right:

            if nums[left]<nums[right]:

                res = min(res, nums[left]) #when it is sorted array

            mid = (left+right) // 2        #when not sorted array

            res = min(res, nums[mid])

            if nums[mid] >= nums[left]:

                left = mid+1

            else:

                right = mid-1

        return res

**Question 7**

Given an array of integers nums sorted in non-decreasing order, find the starting and ending position of a given target value.

If target is not found in the array, return [-1, -1].

You must write an algorithm with O(log n) runtime complexity.

**Example 1:**

Input: nums = [5,7,7,8,8,10], target = 8

Output: [3,4]

**Example 2:**

Input: nums = [5,7,7,8,8,10], target = 6

Output: [-1,-1]

**Example 3:**

Input: nums = [], target = 0

Output: [-1,-1]

CODE:

class Solution:

    def searchRange(self, nums: List[int], target: int) -> List[int]:

left = 0

        right = len(nums)-1

        while left<=right:

            mid = (left + right)//2

            if nums[mid] == target:

                if mid > 0 and nums[mid] == nums[mid-1]:

                    return [mid-1, mid]

                elif nums[mid] == nums[mid+1]:

                    return [right-mid, mid]

                return [mid, len(mid)-1]

            elif nums[mid]< target:

                left = mid+1

            elif nums[mid]>target:

                right = mid-1

            else:

                return [-1,-1]

        return [-1,-1]

THE ABOVE CODE IS PASSING ONLY 6 TEST CASES

**Question 8**

Given two integer arrays nums1 and nums2, return *an array of their intersection*. Each element in the result must appear as many times as it shows in both arrays and you may return the result in **any order**.

**Example 1:**

Input: nums1 = [1,2,2,1], nums2 = [2,2]

Output: [2,2]

class Solution:

    def intersection(self, nums1: List[int], nums2: List[int]) -> List[int]:

        m ={}

        if len(nums1)<len(nums2):

            nums1, nums2 = nums2, nums1

        for i in nums1:

            if i not in m:

                m[i] = 1

            else:

                m[i] +=1

        result = []

        for i in nums2:

            if i in m and m[i]:

                m[i] -=1

                if i not in result:

                    result.append(i)

        return result