Number Range (medium)

We'll cover the following

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Problem Statement

Given an array of numbers sorted in ascending order, find the range of a given number 'key'. The range of the 'key' will be the first and last position of the 'key' in the array.

Write a function to return the range of the 'key'. If the 'key' is not present return [-1, -1].

Example 1:

```
Input: [4, 6, 6, 6, 9], key = 6
Output: [1, 3]
```

Example 2:

```
Input: [1, 3, 8, 10, 15], key = 10
Output: [3, 3]
```

Example 3:

```
Input: [1, 3, 8, 10, 15], key = 12
Output: [-1, -1]
```

Try it yourself

Try solving this question here:

```
👙 Java
             Python3
                            Js JS
                                          ⊘ C++
 1 def find_range(arr, key):
       result = \begin{bmatrix} -1, -1 \end{bmatrix}
 3
       # TODO: Write your code here
 4
       return result
 5
 6 def main():
       print(find range([4, 6, 6, 6, 9], 6))
```

Solution

The problem follows the **Binary Search** pattern. Since Binary Search helps us find a number in a sorted array efficiently, we can use a modified version of the Binary Search to find the first and the last position of a number.

We can use a similar approach as discussed in Order-agnostic Binary Search (https://www.educative.io/collection/page/5668639101419520/5671464854355968/630411019209 9328/). We will try to search for the 'key' in the given array; if the 'key' is found (i.e. key == arr[middle) we have two options:

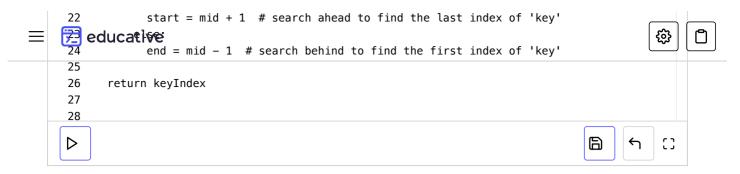
- 1. When trying to find the first position of the 'key', we can update end = middle 1 to see if the key is present before middle.
- 2. When trying to find the last position of the 'key', we can update start = middle + 1 to see if the key is present after middle.

In both cases, we will keep track of the last position where we found the 'key'. These positions will be the required range.

Code

Here is what our algorithm will look like:

```
Python3
                         G C++
                                     Js JS
👙 Java
 1 def find_range(arr, key):
      result = [-1, -1]
 3
      result[0] = binary_search(arr, key, False)
      if result [0] != -1: # no need to search, if 'key' is not present in the input array
 4
 5
        result[1] = binary_search(arr, key, True)
      return result
 6
 7
 8
 9 # modified Binary Search
10 def binary_search(arr, key, findMaxIndex):
      keyIndex = -1
11
12
      start, end = 0, len(arr) - 1
13
      while start <= end:</pre>
14
        mid = start + (end - start) // 2
15
        if key < arr[mid]:</pre>
          end = mid - 1
16
17
        elif key > arr[mid]:
18
          start = mid + 1
19
        else: # key == arr[mid]
20
         keyIndex = mid
21
         if findMaxIndex:
```



Time complexity

Since, we are reducing the search range by half at every step, this means that the time complexity of our algorithm will be O(logN) where 'N' is the total elements in the given array.

Space complexity

The algorithm runs in constant space O(1).

