Coding challenges

Mohamed Boucetta

Exercise 0.1 *A peak of an array is an item array[i] such that array[i] $\geq$ array[i-1] and array[i] $\geq$ array[i+1]. Note that the first item array[0] is a peak if array[0] $\geq$ array[1] and the last item array[end] is a peak of array if array[end] $\geq$ array[end-1]. For instance,* $L = [2, 1, 4, 3, 7, 9, 10]$ *contains three peaks 2, 4, 10.*

Build a function which takes an array of integers and returns a peak. Note that an array contains always a peak and can have many peaks.

Solution : There is a brute-force solution which consists in scanning the array and comparing each item array[i] to array[i-1] and array[i+1]. This solution has a linear time complexity $O(N)$ and $O(1)$ space complexity. (N is the number of the items in the array).

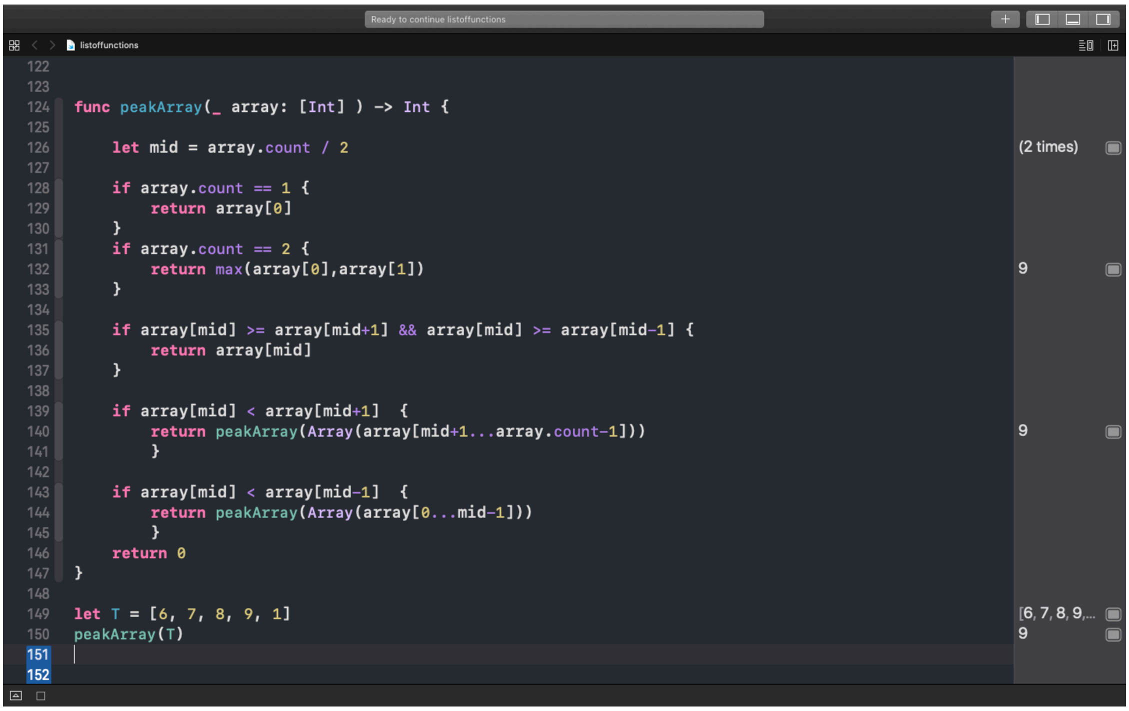
There is another solution which has time complexity $O(\ln N)$ and $O(1)$ space complexity. The idea is to choose the item array[N/2]. Then :

1. If array[N/2] $\geq$ array[N/2-1] and array[N/2] $\geq$ array[N/2+1] then array[N/2] is a peak,

2. If array[N/2] $<$ array[N/2-1] then you are certain that there is a peak in [array[0],..., array[N/2-1]] and you apply your function to this array,

3. If array[N/2] $<$ array[N/2+1] then you are certain that there is a peak in [array[N/2+1],..., array[end]] and you apply your function to this array,

It is a recursive algorithm and the base cases are when $N = 1$ the function returns the unique item in the array and when $N = 2$ the function returns the maximum of the array.



```swift
func peakArray(_ array: [Int] ) -> Int {

    let mid = array.count / 2

    if array.count == 1 {
        return array[0]
    }
    if array.count == 2 {
        return max(array[0],array[1])
    }

    if array[mid] >= array[mid+1] && array[mid] >= array[mid-1] {
        return array[mid]
    }

    if array[mid] < array[mid+1]  {
        return peakArray(Array(array[mid+1...array.count-1]))
        }

    if array[mid] < array[mid-1]  {
        return peakArray(Array(array[0...mid-1]))
        }
    return 0
}

let T = [6, 7, 8, 9, 1]
peakArray(T)
```