General instructions: After completing the given code templates, follow the steps described in `Instructions.pdf` to see the input and the expected output for each test case.

1   Find the Peak Element

Given a 0-indexed array A of size N, find the peak element in it and return its index. The peak element is defined as the element at index i such that:

$$A[k] \leq A[i] \geq A[j] \quad \text{where } 0 \leq k \leq i \leq j < N$$

Note: There is one and only one peak in the array. Where would the peak lie if the complete array is sorted in ascending or descending order?

TEST CASE 1
Input Array: $[1, 4, 5, 2]$
Output: 2
Explanation: 5 is the peak element since $5 > 4$ and $5 < 2$.

TEST CASE 2
Input Array: $[10, 9, 5, 3]$
Output: 0
Explanation: 10 is the peak element since $10 > 9$.

TEST CASE 3
Input Array: $[2, 4, 6, 7]$
Output: 3
Explanation: 7 is the peak element since $7 > 6$.

Expected Time Complexity: $O(\log(N))$, where N is the size of the input array. Solutions using $O(N)$ time complexity will not be accepted.

2   Maximum Profit from Stocks

The problem is to find the **maximum profit** that can be obtained by buying the stock on day i and selling it on day j, where $j > i$. Let $P[0..n]$ be the input array that contains the price of the stock from day 0 to day n. You need to find the maximum value of $P[j] - P[i]$, where $j > i$. Devise a **Divide-And-Conquer** algorithm to solve the maximum profit problem.

Note: You can only buy and sell the stock only **once**. Additionally, buying at the lowest price is not always the correct answer!

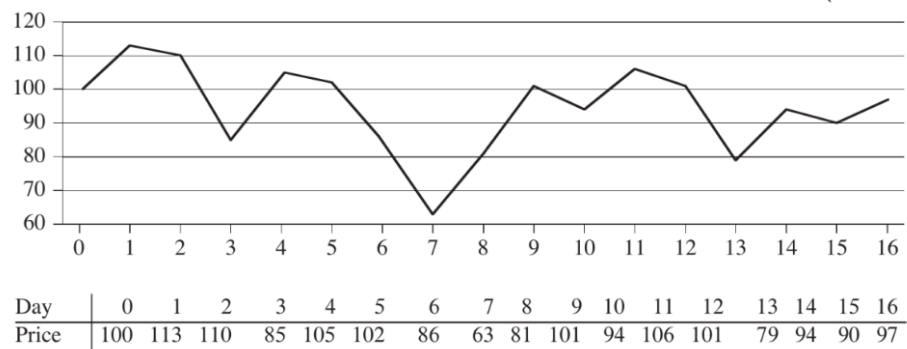| Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Price	100	113	110	85	105	102	86	63	81	101	94	106	101	79	94	90	97

Figure 1: The figure above shows the stock price of a company on different days. In this example, profit will be maximized when the stock is bought on day 7 and sold on day 11.

TEST CASE 1
Input Array: Given in Figure 1
Output: 43
Explanation: Buying on day 7 and selling on day 11.

TEST CASE 2
Input Array: $[70, 25, 50, 35, 60, 10, 30]$
Output: 35
Explanation: Buying on day 1 and selling on day 4.

TEST CASE 3
Input Array: $[7, 1, 5, 3, 6, 4]$
Output: 5
Explanation: Buying on day 1 and selling on day 4.

TEST CASE 4
Input Array: $[10, 5]$
Output: 0
Explanation: No profit can be made. This is a bad stock!

TEST CASE 5
Input Array: $[7]$
Output: 0
Explanation: There is only one day to buy and no day to sell, so no profit.

Input Format:
The first line contains N - the no. of elements in the array.
The next line contains N space-separated integers, denoting the prices of the stock on i^{th} day. $(1 \leq i \leq n)$

Output Format:
A single integer denoting the maximum profit possible.

Expected Time Complexity: $O(N \log(N))$, where N is the size of the input array.

Hint: Use a Divide-And-Conquer approach.