

Week 7 LIVE 

Array Problems And Doubts Session

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Sort Colors

Given an array `nums` with n objects colored red, white, or blue, sort them in-place so that objects of the same color are adjacent, with the colors in the order red, white, and blue.

We will use the integers 0, 1, and 2 to represent the color red, white, and blue, respectively.

Input: `nums = [2,0,2,1,1,0]`
 Output: `[0,0,1,1,2,2]`

Handwritten annotations above the input array:

 0 0 1 1 2 2

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 zero = 2

 one = 2

 two = 2

$O(n^2) \longrightarrow O(n \log n) \longrightarrow O(n)$

Sort Colors

$a = [0, 0, 0, 1, 1, 1, 1, 2, 2]$

Diagram showing pointers l , h , and m pointing to elements in the array a :

- l points to the first 1 (index 3).
- h points to the last 1 (index 6).
- m points to the first 2 (index 7).

zeros
 $\leftarrow l$

twos
 $h \rightarrow$

$a[m] == 2 \rightarrow$

$a[m] = a[h]$
 $a[h] = 2; h--;$

$a[m] == 0 \rightarrow$

$a[m] = a[l]$
 $a[l] = 0$

$l++; m++;$

$a[m] == 1 \rightarrow$

$m++;$

Sort Colors

$a = [0, 0, 0, 0, 1, 1, 1, 2, 2, 2]$

Diagram illustrating the initial array a and pointers l , h , and m :

- l points to the first element (0).
- h points to the first element (0).
- m points to the first element (0).

zeros
 $\leftarrow l$

twos
 $h \rightarrow$

$a[m] == 2 \rightarrow$

$a[m] = a[h]$
 $a[h] = 2; h--;$

$a[m] == 0 \rightarrow$

$a[m] = a[l]$
 $a[l] = 0$

$l++; m++;$

$a[m] == 1 \rightarrow$

$m++;$

Max Chunks To Make Sorted - I

You are given an integer array A of length n that represents a permutation of the integers in the range $[0, n - 1]$.

We split A into some number of Partitions, and individually sort each chunk. After joining them, the result should equal the sorted array.

Return the largest number of chunks we can make to sort the array.

Input:

$[0, 1, 2, 4, 3]$ \rightarrow $[0 \ 1 \ 2 \ 3 \ 4]$

Output:

4

Max Chunks To Make Sorted - I

$$a = [(0), (1), (2), (4, 3)] \rightarrow 4$$

0 1 2 3 4

$n = 7$

$$a = [(2, 0, 1), (5, 3, 4), (6)] \rightarrow 3$$

0 1 2 3 4 5 6

$$a = [(3, 4, 5, 2, 0, 1), (6)] \rightarrow 2$$

0 1 2 3 4 5 6

Max Chunks To Make Sorted - I

$$a[] = \{ \overset{0}{2}, \overset{1}{0}, \overset{2}{1}, \overset{3}{5}, \overset{4}{3}, \overset{5}{4}, \overset{6}{6} \}$$

max = 6
 chunk = 3

$$a[] = \{ \overset{0}{4}, \overset{1}{2}, \overset{2}{0}, \overset{3}{1}, \overset{4}{3}, \overset{5}{6}, \overset{6}{7}, \overset{7}{5} \}$$

max = 7
 chunk = 2

```

static int maxChunk1(int a[]) {
    if(a.length == 0) return 0;
    int chunks = 0;
    int maxSoFar = a[0];

    for(int i = 0; i < a.length; i++) {
        maxSoFar = Math.max(maxSoFar, a[i]);
        if(i == maxSoFar) {
            chunks++;
        }
    }
    return chunks;
}
  
```


Max Chunks To Make Sorted - II

You are given an integer array `arr`.

We split `arr` into some number of chunks (i.e., partitions), and individually sort each chunk. After concatenating them, the result should equal the sorted array.

Return the largest number of chunks we can make to sort the array.

Input:

`arr = [8, 2, 5, 2]`

Output:

1

Max Chunks To Make Sorted - II

$a[] = \{ (6, 3, 5) \mid (8, 7) \mid (12, 11, 9) \}$

$\xrightarrow{\quad}$
 $\underset{6}{6} \mid \underset{7}{7}$
 $\underset{8}{8} \mid \underset{9}{9}$

$(3, 6) \rightarrow (7, 8) \rightarrow (9, 12)$

$a[] = \{ 0, 1, 2, 3, 4 \}$

$a[] = \{ [1, 0], [3, 2], [4] \}$

Max Chunks To Make Sorted - II

$a[] = \{ [3, 1] | [4] [6, 5] [8, 7] \}$ $O(N)$
 $max\ left[] = \{ 3, 3, 4, 6, 6, 8, 8 \}$
 $min\ right[] = \{ 1, 1, 4, 5, 5, 7, 7 \}$

$a[] = \{ [2, 1] | [2] | [4, 3, 3] \} \rightarrow 3$
 $left = \{ 2, 2, 2, 4, 4, 4 \}$
 $right = \{ 1, 1, 2, 3, 3, 3 \}$

