二分查找 Binary Search

主讲: 令狐冲

扫描二维码关注微信/微博
获取最新面试题及权威解答

微信: ninechapter
微博: http://www.weibo.com/ninechapter
官网: www.jiuzhang.com

Outline

Binary Search Template

When & How?

Binary Search in Rotated Sorted Array

Binary Search

Given an sorted integer array - nums, and an integer - target.

Find the **any/first/last** position of target in nums

Return **-1** if target doesn't exist.

What's the difference?

http://www.lintcode.com/problem/classical-binary-search/

http://www.lintcode.com/problem/first-position-of-target/

http://www.lintcode.com/problem/last-position-of-target/

$$T(n) = T(n/2) + O(1) = O(\log n)$$

通过O(1)的时间，把规模为n的问题变为n/2

思考：通过O(n)的时间，把规模为n的问题变为n/2？

Recursion or While-loop?

Recursion ? reply `R`

While-loop ? reply `W`

Both OK ? reply `B`

二分法程序实现中的常见问题

- 又死循环了！ what are you 弄撒捏！
- 循环结束条件到底是哪个？
  - start <= end
  - start < end
  - start + 1 < end
- 指针变化到底是哪个？
  - start = mid
  - start = mid + 1
  - start = mid - 1

通用的二分法模板

九章算法

http://www.jiuzhang.com/solutions/binary-search/

四点要素:

1. start + 1 < end
2. start + (end - start) / 2
3. A[mid] ==, <, >
4. A[start] A[end] ? target

When & How

When?

- 你需要优化一个O(n)的暴力算法到更快的算法
- Sorted Array or Rotated Sorted Array

How?

- 找到满足某个条件的**第一个**或者是**最后一个**位置

独孤九剑 之 破剑式

比O(n)更优的时间复杂度

几乎只能是O(logn)的二分法

Sqrt(x)

http://www.lintcode.com/problem/sqrtx/

http://www.jiuzhang.com/solutions/sqrtx/

Last number that number^2 <= x

Follow Up

What if return a double, not integer?

Search a 2D Matrix

http://www.lintcode.com/problem/search-a-2d-matrix/

http://www.jiuzhang.com/solutions/search-a-2d-matrix/

Last row that matrix[row][0] <= target

Search Insert Position

http://www.lintcode.com/problem/search-insert-position/

http://www.jiuzhang.com/solutions/search-insert-position/

First position >= target

(***Last*** position < target) + 1

Related Questions

Count of Smaller Number:

- http://www.lintcode.com/problem/count-of-smaller-number/

Search for a Range / Number of Target

- http://www.lintcode.com/problem/search-for-a-range/

Search in a Big/Infinite Sorted Array

- http://www.lintcode.com/problem/search-in-a-big-sorted-array/

Take a break

First Bad Version

http://www.lintcode.com/problem/find-bad-version/

http://www.jiuzhang.com/solutions/find-bad-version/

First version that is bad version

Find Minimum in Rotated Sorted Array

http://www.lintcode.com/problem/find-minimum-in-rotated-sorted-array/

http://www.jiuzhang.com/solutions/find-minimum-in-rotated-sorted-array/

First position <= Last Number

(WRONG: First position <= or < First Number)

Find the first/last position

vs

Keep the part that must have target in it

Search in Rotated Sorted Array

http://www.lintcode.com/problem/search-in-rotated-sorted-array/

http://www.jiuzhang.com/solutions/search-in-rotated-sorted-array/

Find Peak Element

http://www.lintcode.com/problem/find-peak-element/

http://www.jiuzhang.com/solutions/find-peak-element/

Follow Up: Find Peak Element II (by 强化班)

Related Questions

Recover Rotated Sorted Array

- http://www.lintcode.com/problem/recover-rotated-sorted-array/
- http://www.jiuzhang.com/solutions/recover-rotated-sorted-array/

Rotate String

- http://www.lintcode.com/problem/rotate-string/
- http://www.jiuzhang.com/solutions/rotate-string/