

Data Structures

Searching Technique – Binary Search



CODE
FOR THINGS

Introduction

Introduction

- It is fast and Efficient Searching Technique
- List should be in a sorted order
- It can be implemented using
 - Iterative
 - Recursive

Data Structure – Binary Search

Concept

arr[SIZE]

SIZE = 10



Data Structure – Binary Search

Concept

arr[SIZE]

key = 12

SIZE = 10

2	3	6	8	10	12	14	16	34	88
arr[0]	arr[1]	arr[2]	arr[3]	arr[4]	arr[5]	arr[6]	arr[7]	arr[8]	arr[9]
↑									↑
low									high



Data Structure – Binary Search

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↑									↑
low									high

low

high

mid = (low+high)/2



Data Structure – Binary Search

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arr[7]

arr[8]

arr[9]

low

high

low

high

mid = (low+high)/2

0

9

mid = (0+9)/2 = 4



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$\text{mid} = (\text{low} + \text{high}) / 2$

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↑				↑					↑
low				mid					high

low	high	$\text{mid} = (\text{low} + \text{high}) / 2$
0	9	$\text{mid} = (0 + 9) / 2 = 4$
5	9	



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				↑	↑		↑		↑
				mid	low		mid		high

low	high	$\text{mid} = (\text{low} + \text{high}) / 2$
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low

↑
mid

↑
high

low

high

$\text{mid} = (\text{low} + \text{high}) / 2$

0

9

$\text{mid} = (0 + 9) / 2 = 4$

5

9

$\text{mid} = (5 + 9) / 2 = 7$

5

6



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↑
low

↑
high

↑
mid

↑
high

low

high

mid = (low+high)/2

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mid = (0+9)/2 = 4

5

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mid = (5+9)/2 = 7

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mid	low	high	mid
	0	9	$\text{mid} = (\text{low} + \text{high}) / 2$
	5	9	$\text{mid} = (0 + 9) / 2 = 4$
	5	6	$\text{mid} = (5 + 9) / 2 = 7$
			$\text{mid} = (5 + 6) / 2 = 5$

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↑ ↑ ↑
mid low high

	low	high	mid = (low+high)/2
	0	9	mid = (0+9)/2 = 4
	5	9	mid = (5+9)/2 = 7
	5	6	mid = (5+6)/2 = 5

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↑ ↑ ↑
mid low high

mid = 5

	low	high	mid = (low+high)/2
	0	9	mid = (0+9)/2 = 4
	5	9	mid = (5+9)/2 = 7
	5	6	mid = (5+6)/2 = 5

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low			high	mid					high

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0	9	mid = (0+9)/2 = 4
0	3	



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		↑	↑						
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	↑	↑	↑						
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		mid							

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	↑	↑							
	high	low							
		mid							

low	high	mid = (low+high)/2
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0	3	mid = (0+3)/2 = 1
2	3	mid = (2+3)/2 = 2
2	1	



Time Complexity

Linear Search

- Time Complexity = $O(n)$

Binary Search

List is sorted

- Time Complexity = $O(\log n)$

List is unsorted

- Time Complexity = $TC(\text{sort}) + O(\log n)$
= $O(n \log n) + O(\log n)$
= $O(n \log n)$

Algorithm - Binary Search Iterative