

Keywords

Linear search – Each item in the list is checked in order.
Binary search – An ordered list is divided in 2 with each comparison.

Algorithms

Linear and Binary Search

Questions



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COMMUNITY SCHOOL

Objectives

ADVANCED:
Explain how
linear and binary
searches find
data.

EXPERT:
State the
differences
between a linear
and binary
search.

- How do you search for an item that you have lost?
- How do you search for a book in a library?
- How does a search engine find specific websites?
- How would you tell a computer how to search for something?

Shuffle and deal 10 cards upside down on the desk in front of you.

Only 1 card can be turned over at a time.

Do you have a Jack?

Can you write an algorithm (series of steps) to search for the Jack?





Linear Search Algorithm

Objectives

ADVANCED:
Explain how
linear and binary
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data.

EXPERT:
State the
differences
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and binary
search.

The binary search only works if data is in order.

If it is not in order use a linear search.

- Check the first value
- IF it is the value you are looking for:
Celebrate and stop
- ELSE move to and check the next value
- REPEAT UNTIL you have checked all the elements and found/not found the value you are looking for.

Linear Search



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Value	1	2	3	4	5	6	7	8	9	10
Number	65	2	10	8	102	53	21	22	3	66

Search the list to see if 102 is in it.

Get the first value	1	2	3	4	5	6	7	8	9	10
Is it 102?	65	2	10	8	102	53	21	22	3	66

No, move to get the next value (the second)

Is it 102? No	1	2	3	4	5	6	7	8	9	10
	65	2	10	8	102	53	21	22	3	66



C O M P U T E R S C I E N C E

Linear Search



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Is it 102?

1	2	3	4	5	6	7	8	9	10
65	2	10	8	102	53	21	22	3	66

No, move to the next element (4th)

Is it 102?

1	2	3	4	5	6	7	8	9	10
65	2	10	8	102	53	21	22	3	66

No, move to the next element (5th)

Is it 102?

1	2	3	4	5	6	7	8	9	10
65	2	10	8	102	53	21	22	3	66

Yes – celebrate and finish.





Binary Search Algorithm

Objectives

ADVANCED:
Explain how
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EXPERT:
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and binary
search.

The list needs to be in order.

Take the middle value.

Compare to the value you are looking for.

- IF it is the value you are looking for.
Celebrate, and stop.
- ELSEIF it is larger than the one you are looking for.
Take the values to the left of the middle value.
- IF it is smaller than the one you are looking for.
Take the values to the right of the middle value.

Repeat with the new list.



Binary Search

Value	1	2	3	4	5	6	7	8	9	10
Number	2	6	9	12	16	18	20	23	45	99

Take the middle value (there are 10 values, so $10 / 2 = 5$), the 5th value

1	2	3	4	5	6	7	8	9	10
2	6	9	12	16	18	20	23	45	99

Is this equal to, greater than, or smaller than 9?

$16 > 9$ so make a new list with all the numbers to the left

1	2	3	4	5	6	7	8	9	10
2	6	9	12	16	18	20	23	45	99



Binary Search



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Search the new list for **9**

1	2	3	4
2	6	9	12

Take the middle value ($4/2=2$), the 2nd value

1	2	3	4
2	6	9	12

Is this equal to, greater than, or smaller than 9?

Smaller than, so take the numbers to the right

1	2	3	4
2	6	9	12



C O M P U T E R S C I E N C E

Binary Search

Search the new list for **9**

3	4
9	12

Take the middle value ($2/2=1$), the 1st value

3	4
9	12

Is this equal to, greater than, or smaller than **9**?

Equal to! Celebrate, and stop you've found it.



Differences



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What are the differences between the binary and linear searches?

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	Binary	Linear
Ordered Data?	The list needs to be in order	The list does not need to be in order
Length of Search?	The worst case scenario is you have to check half the values	The worst case scenario is you have to check all the values
Complexity of Algorithm?	The algorithm is longer and more complex to write	The algorithm is simpler to write