SEARCHING ALGORITHMS

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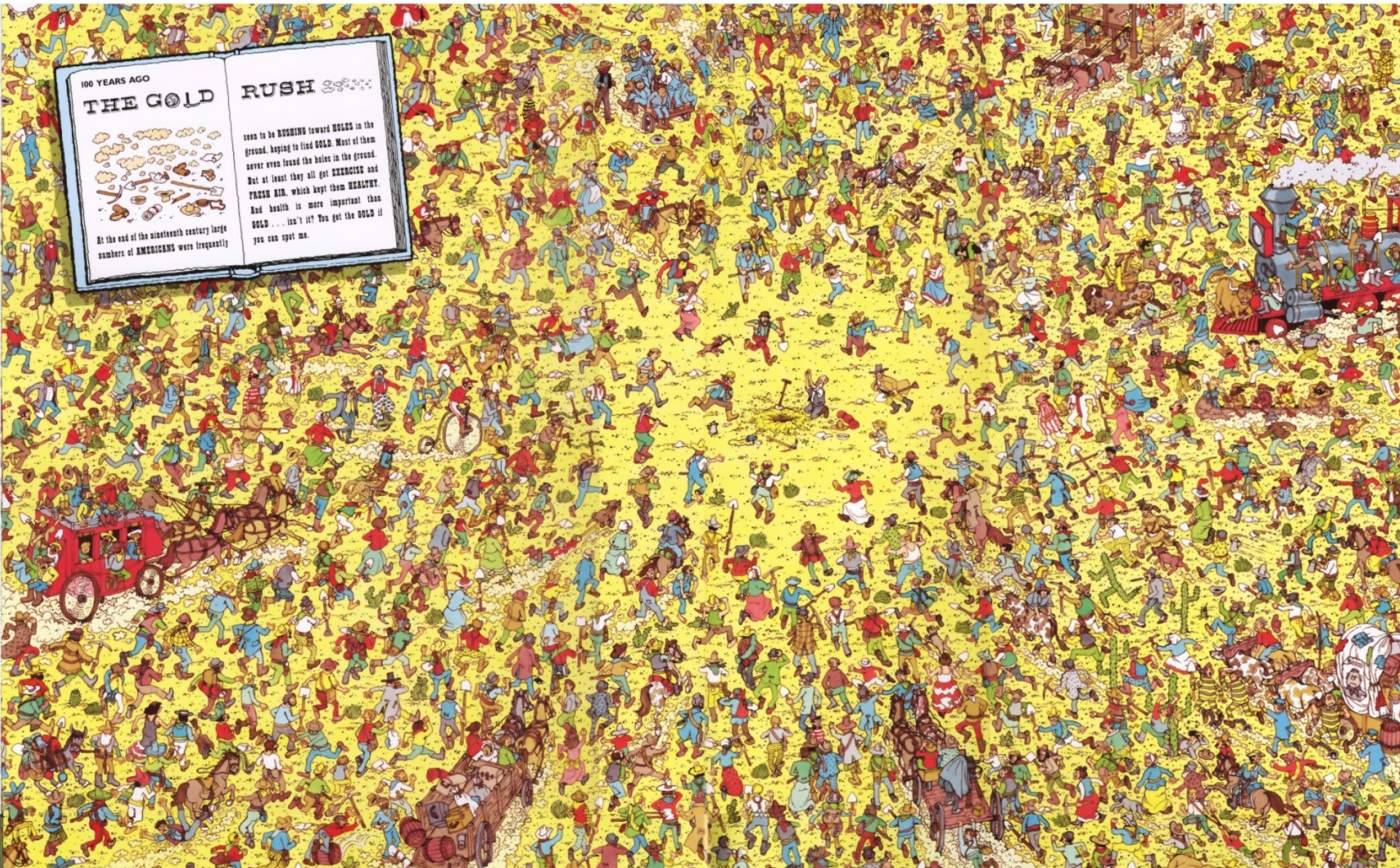
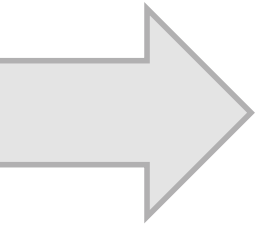
Where's Waldo?



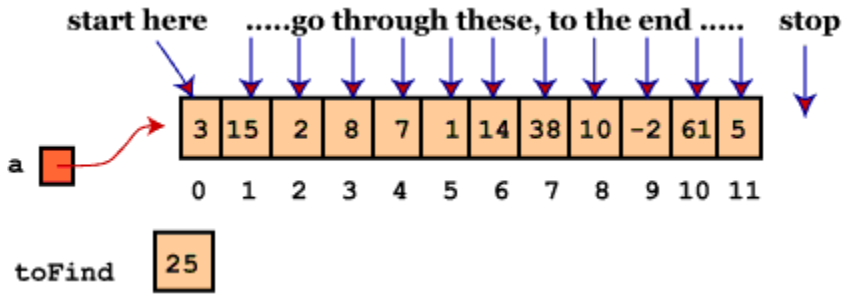
What would you do without this!?



Google Search I'm Feeling Lucky

Examples of Searches

- Linear Search
  - Best Case – O(1)
  - Worst Case – O(n)
  - Average – O(n)



Linear Search Logic

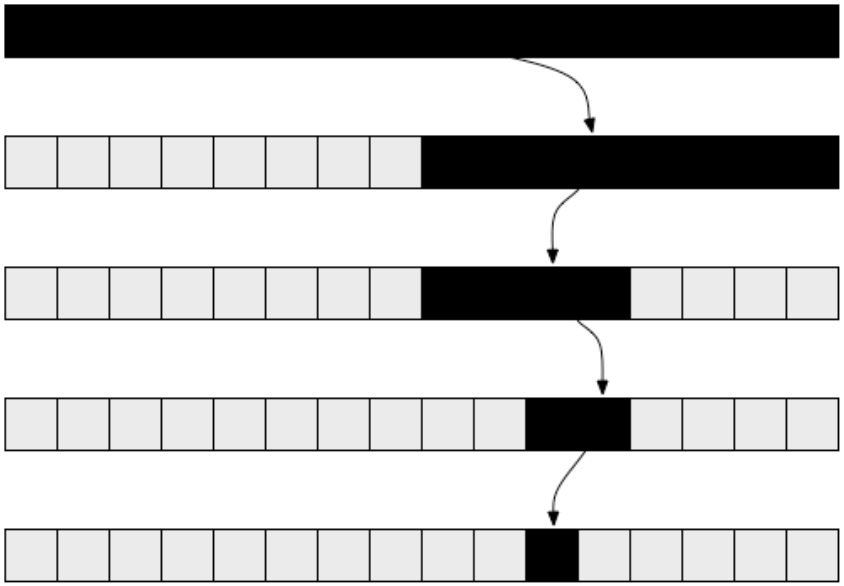
- Check the first index of the list to see if it is the value that we are looking for.
- If this is so, then return the index of the list where the element resides.
- Otherwise, move to the next index and continue checking from there to the end of the list.
- If you have traversed the entire list without finding the element, then return a value that designates that the element is not present in the list (usually an index of -1).

Linear Search Trade-offs

- For a slower average runtime, you gain the ability to search through unsorted lists.
- Simple programming logic – easy for beginning programmers.

Examples of Searches

- Binary Search
  - Best Case – O(1)
  - Worst Case – O(log(n))
  - Average – O(log(n))



Binary Search Logic

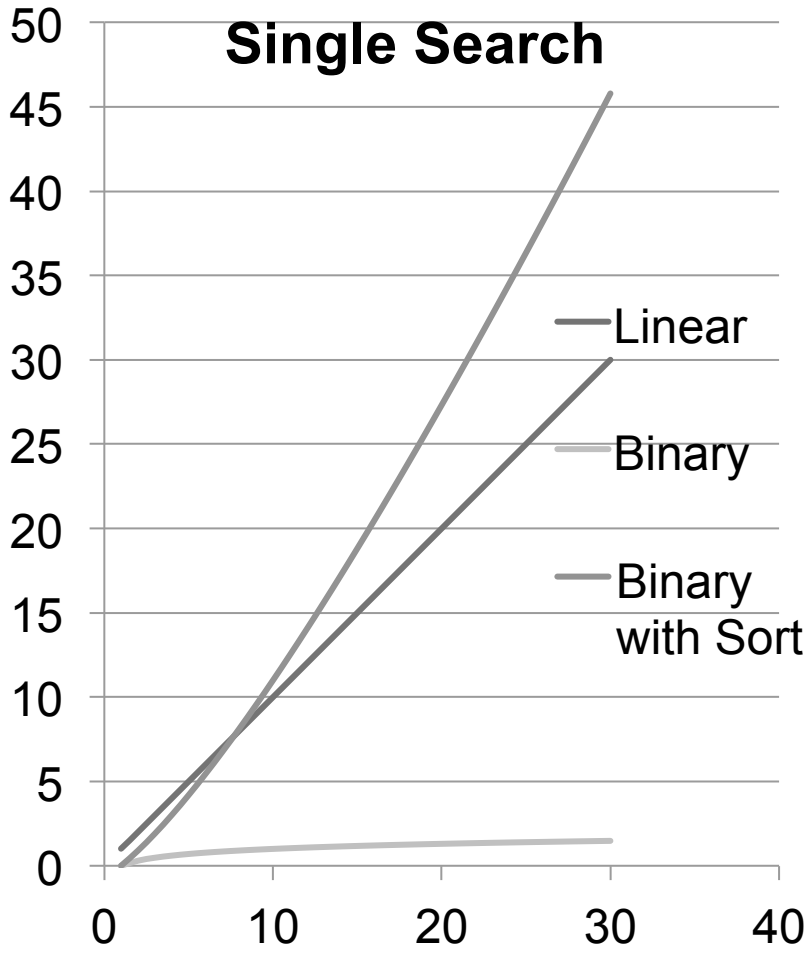
- Compare the element of the middle index of the list.
- If this element is what we are looking for, then return its index in the list. If this element compares less than what we are searching for, then divide the lower half of the remaining list in half and search the middle value of this half. If this element compares more than what we are searching for, then divide the upper half of the remaining list in half and search the middle value of this half.
- Recursively continue this until you have either found what you are searching for or have found that it isn't present in the list.

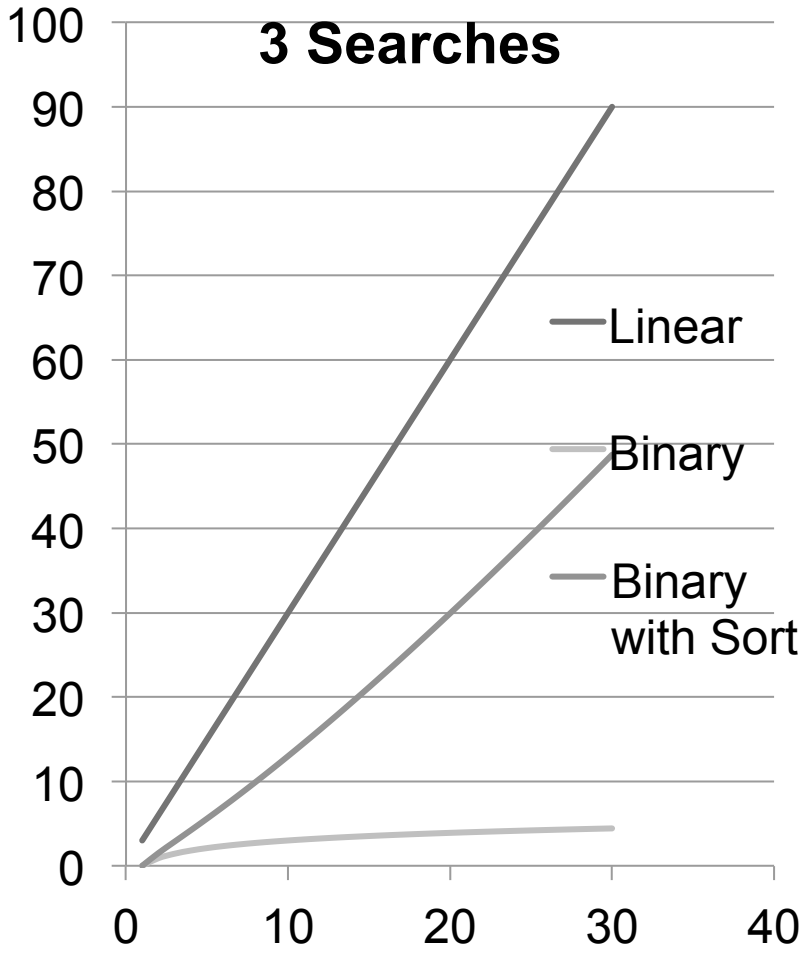
Binary Search Trade-offs

- Searching for elements in a list using a binary search has a much shorter average runtime compared to that of a linear search.

- The list that you are searching through must be sorted for the binary search to work.

Comparison


Single Search
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
Linear
Binary
Binary with Sort


3 Searches
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
Linear
Binary
Binary with Sort