Unit 1: Problem Solving

Part 6: Binary Search

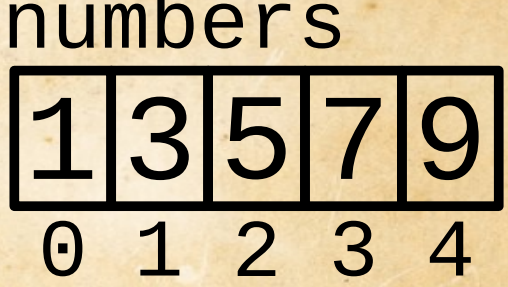
Topic 3: Sorting and Searching Algorithms

Lecture Contents

- Review Linear Search
- Binary Search
- Reading:
  - "*Searching Algorithms: Binary Search*" (top of page 20 until end of page 22), including *Efficiency of Searching Algorithms*

Linear Search

- Not very efficient
- Frequently used because it’s very simple
- Start at the beginning and go through each element step by step



Binary Search

- Consider… how do you find a specific page in a book?
  - Linear search?
    - Start at page 1 and keep flipping through the pages?

Binary Search

- Consider… how do you find a specific page in a book?
  - Linear search?
    - Start at page 1 and keep flipping through the pages?
  - Divide and conquer!
    - Open the book somewhere in the middle.
    - Is it the right page?
    - Do we need to search before or after this page?
    - (repeat until found)

Binary Search

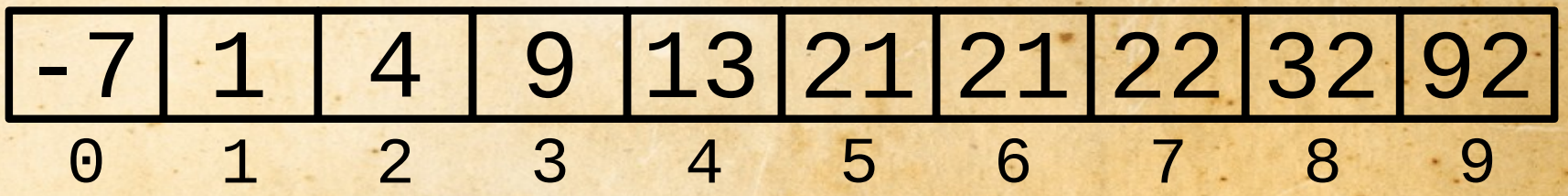
- Things to consider about ***binary search***
  - Requires the data to be sorted
    - It takes much longer to sort the data than it does to do a linear search

Binary Search

- Things to consider about ***binary search***
  - Requires the data to be sorted
    - It takes much longer to sort the data than it does to do a linear search
  - The benefits are only significant when the data set is large
    - While the code for ***binary search*** is slightly more complicated than for ***linear search***.

Binary Search

- We can estimate time by counting the number of comparisons...
  - How long does it take to find an element using ***linear search***,
    - worst case?
    - on average?
  - How long does it take to find an element using ***binary search***, worst case?



Binary Search

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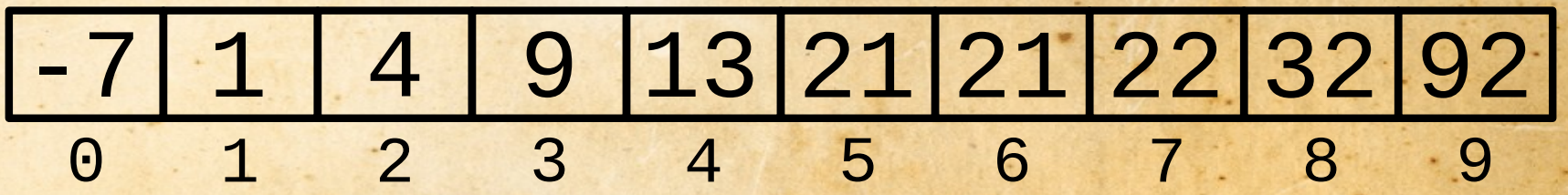
  - How long does it take to find an element using ***linear search***,
    - worst case? **10 comparisons → for *n* elements, *n* comparisons**
    - on average? **For *n* elements, (*n*/2) comparisons**
  - How long does it take to find an element using ***binary search***, worst case?



Binary Search

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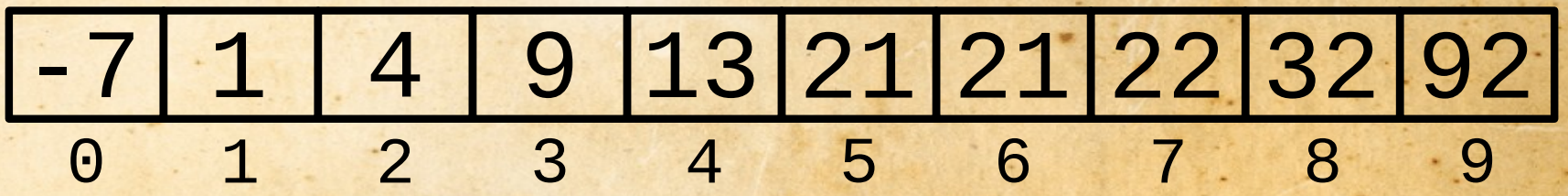
  - How long does it take to find an element using ***binary search***, worst case?
    - **$\log_2(n)$**



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