



# Introduction

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CptS 223 – Advanced Data Structures

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# Advanced Data Structures

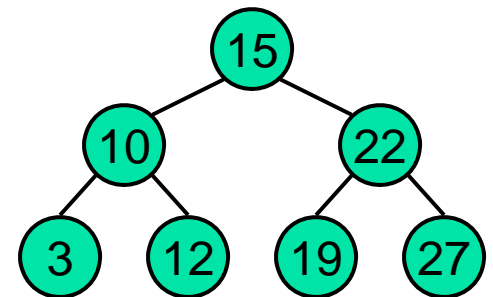
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- “Why not just use a big array?”
- Example problem
  - Search for a number  $k$  in a set of  $N$  numbers
- Solution
  - Store numbers in an array of size  $N$
  - Iterate through array until find  $k$
  - Number of checks
    - Best case: 1 ( $k=15$ )
    - Worst case:  $N$  ( $k=27$ )
    - Average case:  $N/2$

15	10	22	3	12	19	27
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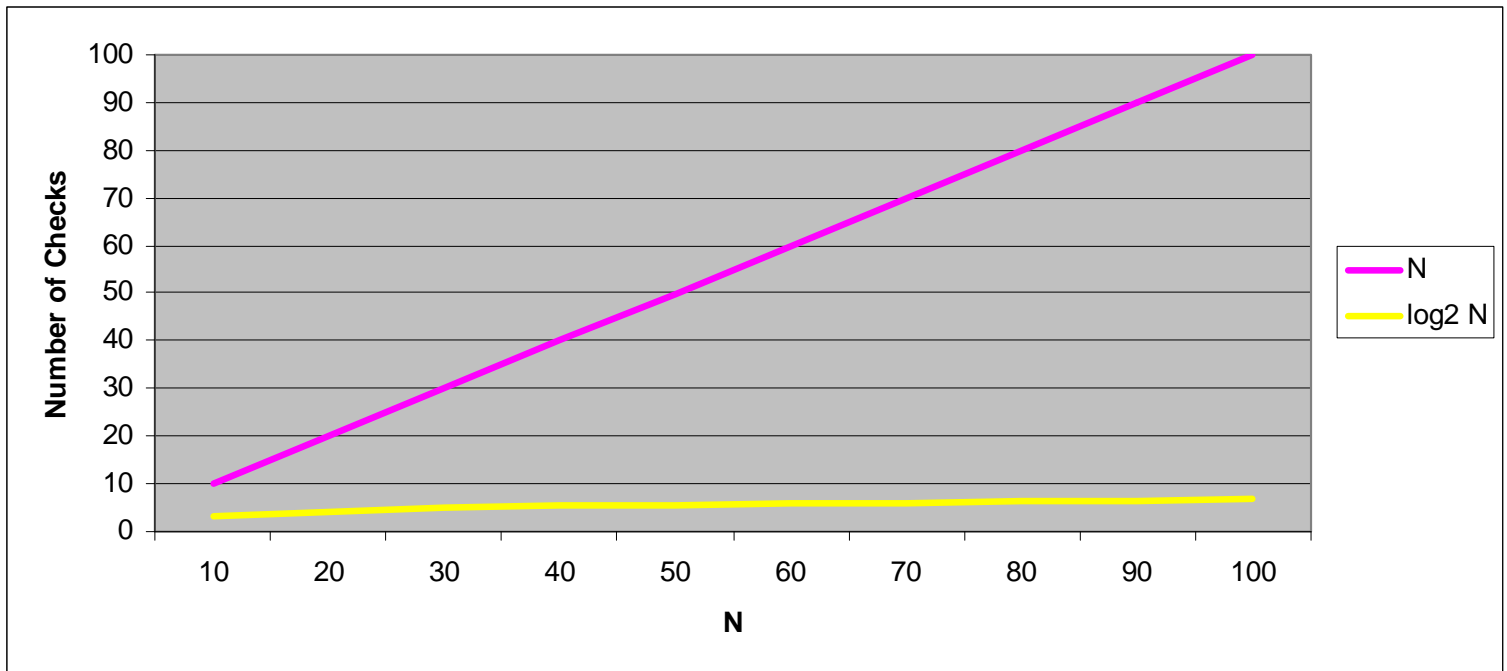
# Advanced Data Structures

- Solution #2
  - Store numbers in a binary search tree
  - Search tree until find k
  - Number of checks
    - Best case: 1 ( $k=15$ )
    - Worst case:  $\log_2 N$  ( $k=27$ )
    - Average case:  $(\log_2 N) / 2$



# Analysis

- Does it matter?
  - $N$  vs.  $(\log_2 N)$





# Analysis

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- Does it matter?
- Assume
  - $N = 1,000,000,000$ 
    - 1 billion (Walmart transactions in 100 days)
    - 1 Ghz processor =  $10^9$  cycles per second
- Solution #1 (10 cycles per check)
  - Worst case: 1 billion checks = 10 seconds
- Solution #2 (100 cycles per check)
  - Worst case: 30 checks = 0.000003 seconds



# Advanced Data Structures

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- Moral
  - Appropriate data structures ease design and improve performance
- Challenge
  - Design appropriate data structure and associated algorithms for a problem
  - Analyze to show improved performance



# Course Overview

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- Advanced data structures
  - Trees, hash tables, heaps, disjoint sets, graphs
- Algorithm development and analysis
  - Insert, delete, search, sort
- Applications
- Object-oriented implementation in C++



# Course Details

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- Course website

[www.eecs.wsu.edu/~holder/courses/CptS223.html](http://www.eecs.wsu.edu/~holder/courses/CptS223.html)

- Email list

- Homework 0: Send me your name and email address

To: [holder@wsu.edu](mailto:holder@wsu.edu)

Subject: Student in 223

Name: ...

Email: ...