Introduction

CptS 223 – Advanced Data Structures

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Advanced Data Structures

“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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- 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: \( \frac{\log_2 N}{2} \)
Analysis

- Does it matter?
  - N vs. (log₂ N)
Analysis

- 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

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

- 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

- **Course website**
  
  www.eecs.wsu.edu/~holder/courses/CptS223.html

- **Email list**
  
  Homework 0: Send me your name and email address

  To: holder@wsu.edu
  Subject: Student in 223
  
  Name: ...
  Email: ...