

CSC 2200

Computer Science II

Daniel Grosu

Department of Computer Science

Wayne State University

dgrosu@wayne.edu

<http://dgrosu.eng.wayne.edu/>

Goals

- Teach commonly used **data structures** and algorithms.
- Teach good **algorithm analysis** skills.
- Teach good **programming** skills.

=> **Develop efficient programs**

What's the Class About?

Selection problem:

Determine the k -th largest number from a set of N numbers.

Solution 1:

- Read the N numbers into an array.
- Sort the array in decreasing order.
- Return the element in position k .

Example:

$N = 5$ and $k = 3$

Read: 1 6 2 9 7

Sort: 9 7 6 2 1

Return: 6

What's the Class About?

Solution 2:

- Read the first k numbers into an array.
- Sort the array in decreasing order.
- Read each remaining element one by one.
- *If* (new element $<$ the k -th element)
 then ignore it.
 else place it in the correct location in the array
 and eliminate one element from the array.
- Return the element in the k -th position.

Example:

$N = 5$ and $k = 3$

1 6 2 9 7

Read: 1 6 2

Sort: 6 2 1

Read 9: $9 > 1 \rightarrow$ 9 6 2

Read 7: $7 > 2 \rightarrow$ 9 7 6

Return: 6

What's the Class About?

- Questions:
 - Which algorithm is better?
 - Is the algorithm good enough?
- Example:
 - $N = 30$ million numbers
 - $K = 15,000,000$
 - Execution time for both algorithms: several hours!
- Need to find a better algorithm!
- Known efficient algorithm: 1 second

What's the Class About?

- **Important:** Writing a working program is not good enough!
- **Learn:**
 - How to estimate the running time of an algorithm for large inputs?
 - How to compare the running time of two programs without coding them?
 - How to find sections of the code that need to be optimized?

Topics

- Math review. Recursion
- C++ Review
- Algorithm Analysis
- Lists, Stacks and Queues
- Trees (Binary, BST, AVL, Splay, B)
- Hashing
- Priority Queues
- Sorting
- Disjoint Sets
- Graphs
- Algorithm Design Techniques

Prerequisites

Prereqs:

- CSC 1500 - Fundamental Structures in Computer Science
- CSC 2110 - Computer Science I
- MAT 2010 – Calculus I
- BE 1200 – Basic Engineering I: Design in Engineering

What you should already know?

- Programming in C++ equivalent to that learned in CSC2110:
 - pointers and their use,
 - C strings and C++ string classes,
 - simple recursion,
 - classes including static data members
 - overloading, templates, inheritance, polymorphism, and exceptions.
- Proof techniques.
- Familiarity with the university compilers and debuggers on Windows platforms.

Textbook and Lab

- Textbook:

- Weiss, Mark Allen. [Data Structures and Algorithm Analysis in C++](#) (4th edition), Pearson. ©2014.
ISBN 978-0-13-284737-7
- Source code in text:
http://users.cis.fiu.edu/~weiss/dsaa_c++4/code/
- Author's Website:
<http://http://users.cis.fiu.edu/~weiss/>
- Errata:
http://http://users.cis.fiu.edu/~weiss/dsaa_c++4/errata.html

- Lab book:

- S. Brandle et al. [C++ Data Structures: A Laboratory Course, Third Edition](#), Jones and Bartlett Publishers, © 2008. ISBN: 978-0-7637-5564-5.
- Student Materials:
<http://www.jbpub.com/catalog/9780763755645>

Grading

- Midterm Exam (Monday March 2, 2022): 20%
- Final Exam (Wednesday April 27, 2022): 30%
- Homework Assignments (min. 8): 10%
- Quizzes (min. 4): 15%
- Lab: 25%

Graduate Teaching Assistants (GTAs)

Lecture:

Fatima Raadia (gh5670@wayne.edu)

Lab:

Xianting Shao (hj2468@wayne.edu)

Jahn timer Nannuri (hj1453@wayne.edu)