

1. Course number and name

CptS 223: Advanced Data Structures in C++

2. Credits and contact hours

3 credits, 3 lecture hours

3. Instructor's or course coordinator's name

Aaron Crandall

4. Textbook, title, author, and year

M. Weiss. 2014. *Data Structures and Algorithm Analysis in C++* (4th ed.). Addison-Wesley Longman, Inc. ISBN: 013284737X. (Required)

B. Stroustrup. 2013. *The C++ Programming Language* (4th ed). Addison-Wesley. ISBN 978-0321563842. (Optional)

5. Specific course information

a. *Catalog description:* Advanced data structures, object oriented programming concepts, concurrency, and program design principles taught in C/C++ programming language.

b. *Prerequisites or corequisites:* CptS 122, MATH 216 (concurrent enrollment okay).

6. Specific goals for the course

By the end of the course, students will be able to

- Analyze and compare a variety of data structures (1b, 2a, 2b)
- Design efficient algorithms (2g, 6a)
- Apply the knowledge gained in the class in order to solve real-world problems using different data structures and design techniques (1c, 1d, 2e)
- Implement software solutions in C++ in the Linux OS environment (6a, 7g)
- Use industry standard tools for software development including Git, Valgrind, and testing tools (1e, 6b, 6d)

7. Brief list of topics to be covered

- Software development in C++
- Introduction to the C++ Software Template Library (STL)
- Advanced data structures and algorithms:
 - Hashtables: Separate chaining, linear/quadratic probing
 - Tree: BST, AVL, Red-Black, B+
 - Heaps
 - Sorting: Bubblestort, Insertion sort, quicksort, Heapsort, Mergesort
 - Graphs: Dijkstra's algorithm, Topological sort
- Algorithm analysis with Big-O for both time and space complexity
- Empirically comparing algorithms for space and time in different applications
- Linux use, notably command line tools g++ and GNU Make
- Git version control to manage software projects

- Valgrind, and software testing tools