

## Syllabus for CS493 Advanced C++ Programming

**Instructor:** Dr. Randy L. Ribler

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**Class Web Page:** **Class Web Page:** [http://ribler\\_r.web.lynchburg.edu/cs493](http://ribler_r.web.lynchburg.edu/cs493)

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**Office Hours: MWThF:** 11:00-12:00, 2:00-6:00, or by appointment.

**Meeting Times:** Hobbs 116 TuTh (1:00-2:15pm)

### Texts:

*Effective C++*, Third Edition – 55 Specific Ways to Improve Your Programs and Designs, by Scott Meyers

*The C++ Standard Library: A Tutorial and Reference*, by Nicolai M. Josuttis

**Course Description:** This course will cover a number of advanced topics in C++, with emphasis on the standard template library, advanced language features, and effective object-oriented design.

### Course Purpose:

Computer science majors and minors may apply this course to satisfy 3 credits of their elective coursework (300-level or above).

**Course Requirements:** This course requires students to have an understanding of the C++ language commensurate with that of students who have successfully completed the CS141/CS142 sequence. It also requires an understanding of basic data structures commensurate with that of students who have successfully completed CS241.

### Principal Topics:

- Writing Better C++ Programs

- Smart Pointers and Reference Counting

- Optimization

  - Profiling

  - Costs associated with common C++ implementations

  - Loop unrolling

- Design Patterns

- Envelope/Letter Classes

- Exceptions

- Standard Template Library

  - Container Classes

  - Iterators

  - Algorithms

  - Container Adaptors

  - Function Objects

  - Binders, Negators, and Function Adaptors

- Generic Algorithms

Coding Conventions and Styles (Ellemtel)  
Defensive Programming  
Interfacing with other languages  
Threads and Thread Synchronization  
Memory Management  
Constructor, Destructors, and Assignment Operators  
Classes and Functions  
    Design and Declaration  
    Implementation  
Inheritance and Object-Oriented Design  
Multiple Inheritance  
C<sup>++</sup>/CLI (Microsoft Extensions)

### **Course Objectives:**

- 1.) Students will be able to apply generic algorithms to both Standard Template Library containers and to data structures utilizing primitive data types.
- 2.) Students will know when it is appropriate to use the const keyword.
- 3.) Student will understand when to pass parameters by value and when to pass parameters by reference.
- 4.) Students will know when the compiler will write missing member functions, and understand the circumstances in which this is detrimental.
- 5.) Students will be able to describe and implement the singleton, factory, and letter-envelope design patterns.
- 6.) Students will be able to profile their programs to identify which parts of the program are consuming the most resources.
- 7.) Students will understand the costs and advantages associated with using C<sup>++</sup> exceptions.
- 8.) Students will be able to transform a loop to an unrolled version that provides superior performance on large data sets.
- 9.) Students will be able to identify the appropriate container class (vector, list, deque, map, multimap, set, or multiset) given a general description of a data structure's application.
- 10.) Students will be able to utilize all the container classes in the Standard Template Library.
- 11.) Students will be able to utilize the coding standards described in the Ellemtel standard.
- 12.) Students will be able to describe the consequences of incorporating multiple inheritance into a design.

### **Grading:**

10-15 Take-home Quizzes, Programs, Writing Assignments (one dropped) (65%)  
Class participation (15%)  
Final Exam (20%)

## Reading Assignments in Effective C<sup>++</sup>

Week 1 (Aug 28)

Effective C<sup>++</sup>: Introduction & Items 1, 2, and 3

Week 2 (Sep 4)

Effective C<sup>++</sup>: Items 4-7

Week 3 (Sep 11)

Effective C<sup>++</sup>: Items 8-12

Week 4 (Sep 18)

Effective C<sup>++</sup>: Items 13-17

Week 5 (Sep 25)

Effective C<sup>++</sup>: Items 18-22

Week 6 (Oct 2)

Effective C<sup>++</sup>: Items 23-26

Week 7 (Oct 9)

Effective C<sup>++</sup>: Items 27-31

Week 8 (Oct 16)

Effective C<sup>++</sup>: Items 32-35

Week 9 (Oct 23)

Effective C<sup>++</sup>: Items 36-40

Week 10 (Oct 30)

Effective C<sup>++</sup>: Items 41-48

Week 11 (Nov 6)

More Effective C<sup>++</sup>: Items 49-52

Week 12 (Nov 13)

Thanksgiving Break

Week 13 (Nov 20)

Effective C<sup>++</sup>: Items 53-55