



East China Normal University
GEC International Summer School

COMP 313 Effective Programming in C, C++

Term: October 7th to November 10th, 2024

Class Hours: Monday to Friday, 9:00 AM – 11:00 AM (in person, 2,750 minutes in total)

Class Location: Physics Building 210

Lab Hours: Friday, 2:00 PM – 4:00 PM

Lab Location: Physics Building 601

Instructor: Bai Jiangang

Home institution: Peking University

Office Hours: TBD

Email: jgbai2235@gmail.com

Course Description

This course is a fast-paced introduction to the C and C++ programming languages, with an emphasis on good programming practices and how to be an effective programmer in these languages. Topics include object-oriented programming, memory management, advantages of C and C++, optimization, and others. Students are given weekly coding assignments and a final project to hone their skills. Recommended for programmers with some background and experience in other languages. An introduction to the languages of C and C++, and topics you need to know in order to be an effective programmer. These include the syntax, compilers, debugging, working on C/C++ projects, object-oriented programming in C++, the power of generic programming, writing a compiled library, memory management, modern best practices, and other powerful tools available (such as threading / parallelism, new features of C++11, and optimization techniques).

Prerequisite: None



Course Objectives

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

- Write C/C++ code using pointers to create and manipulate complex data structures;
- Debug significant C/C++ programs using GDB and Valgrind;
- Read and write basic Makefiles;
- Explain the process of making a system call;
- Describe fundamental differences between C and C++;
- Write programs that interact with files, directories, and the network using the POSIX library;
- Write multi-threaded C programs using pthreads;

Required Text

1. *C++ Primer (5th Edition)*, by Lippman, Lajoie & Moo.

ISBN: 0-321-71411-3

2. *Effective C++: 55 Specific Ways to Improve Your Programs and Designs (3rd Edition)*, by Scott Meyers.

ISBN 0321334879.

Course Hours

The course has 25 class sessions in total. Each class session is 110 minutes in length, for a total of 2750 minutes of in-class time. The course meets from Monday to Friday. ECNU awards 3 credits for this course. Different universities may count course credits differently. Consult officials at your own home institution.

Attendance

Summer school is very intense and to be successful, students need to attend every class. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. ECNU policy requires a medical certificate to be excused. Any absence may impact on the student's grade. Moreover, ECNU policy is that a student who has more than 3 absences will fail the course. Arriving late or leaving



early will count as a partial absence.

Grading Policy

ECNU awards grades of A, A-, B+, B, B-, C+, C, D, and F. Most colleges and universities do not award transfer credit for grades of D or F.

In this course, grading will be based on the following:

Assignment*3	10%*3=30%
Participation	10%
Midterm Exam	25%
Final Exam	35%

General Expectations

Students are expected to:

- Attend all classes and be responsible for all material covered in class and otherwise assigned. Any unexcused absence may impact a student's grade.
- Arrive to class on-time: Late arrivals are disruptive to your fellow students and to the conduct of the class.
- Complete the day's required reading and assignments before class.
- Review the previous day's notes before class; make notes about questions you have about the previous class or the day's reading.
- Refrain from texting, phoning or engaging in computer activities unrelated to class during class (不要用手机). It is highly disrespectful to the professor and to the class.
- Participate in class discussions and complete required written work on time.

Course Schedule

The planned schedule sketched out below may be modified to suit the interests or abilities of the enrolled students or to take advantage of special opportunities or events that may arise during the term.



Week 1

- *Day 1*
 - o *Introduction: C, C++ and Unix*
- *Day 2: C Programming*
 - o *Pointers, structs, casts*
 - o *Arrays and strings*
 - o *2-D arrays with and without pointers*
- *Day 3: C Programming*
 - o *Dynamic storage allocation (malloc/free)*
 - o *C preprocessor, multifile programs*
 - o *Core C libraries (I/O, strings, etc.)*
- *Day 4: Essential Tools for C/C++*
 - o *Compilers, debuggers, make*
 - o *Advanced tools (memory leak detection, performance profiling, code coverage)*
 - o *Version control, code reviews, unit testing*
- *Day 5: Memory Management and System Interface*
 - o *Idioms for manual memory management; avoiding dangling pointers and memory leaks*
 - o *Memory management implementation*
 - o *Assignment 1 due*

Week 2

- *Day 1: Memory Management and System Interface*
 - o *Linking and libraries: how a program is assembled*
 - o *Relation between libraries and underlying OS services*
- *Day 2: C++ Programming*
 - o *Basic C++: "a better C", C with classes*



- *Class definitions, constructors, copy constructors, destructors, const, other details*
- *Day 3: C++ Programming*
 - *Dynamic memory allocation (new/delete), classes with dynamic data*
 - *Classes and inheritance in C++; overloading, overriding*
- *Day 4: C++ Programming*
 - *C++ templates and STL*
 - *Smart pointers*
- *Day 5*
 - *Tutorial/ Discussion*
 - *Assignment 2 due*

Week 3

- *Day 1: Networking*
 - *TCP/IP overview*
 - *Basics of client-side and server-side programming*
- *Day 2: Concurrency in C/C++*
 - *General Concurrent programming beyond 351*
 - *Asynchronous I/O, networking, and user interfaces*
 - *Brief reintroduction to threads*
- *Day 3: Concurrency in C/C++*
 - *Security Issues in C/C++*
- *Day 4*
 - *Midterm Review Session*
- *Day 5*
 - *Midterm*

Week 4

- *Day 1: Arrays*



- *Arrays declaration*
- *Single dimensional arrays*
- *Day 2: Arrays*
 - *Multidimensional arrays*
 - *Character arrays*
 - *Arrays and Functions*
- *Day 3: Pointers*
 - *Declaration of a Pointer*
 - *Initializing Pointers*
 - *Pointer Arithmetic*
- *Day 4: Pointers*
 - *Pointers and Arrays*
 - *Arrays of pointers*
 - *Pointers and strings*
- *Day 5*
 - *Tutorial/Discussion*
 - *Assignment 3 due*

Week 5

- *Day 1: Preprocessor Directives and I/O*
 - *C++ Stream*
 - *Preprocessor Directives*
- *Day 2: Preprocessor Directives and I/O*
 - *Unformatted I/O Functions*
- *Day 3: Unix Command Line*
 - *Basic Unix Command*
- *Day 4*
 - *Final Exam Review Session*
 - *Tutorial/Discussion*



- *Day 5*
 - o *Final Exam*

Academic Honesty

Students are expected to maintain high standards of academic honesty. Specifically, unless otherwise directed by the professor, students may not consult other students, books, notes, electronic devices or any other source, on examinations. Failure to abide by this may result in a zero on the examination, or even failure in the course.