Syllabus
Introduction to C++ Programming and Numerical Analysis
Spring 2016

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overview: This course offers an introduction to C++ programming and numerical analysis to incoming MFE students. Students do not need to have a background in programming to succeed in the course, but must be prepared to spend extensive time outside of the classroom to do assignments and exercises. The format of the course is a combination of lectures and exercises. There are also six mandatory assignments (see below).

There are twelve lectures. The initial seven cover general programming in C++ and an introduction to numerical analysis. The last five lectures provide an introduction to object oriented programming (OOP), available external libraries, and also discuss several finance applications, including binomial option pricing. The course material consists of comprehensive lecture notes, which will be available for download. Additional text books are suggested below for the interested reader. Prata and Horton provide introductions to C++ programming, whereas Stroustrup is more advanced (a “bible” for advanced students). For numerical analysis, Atkinson and Han’s book provides a sufficient introduction, whereas Stoer and Bulirsch is more advanced. Throughout the course, references to material where students can self-study concepts that we do not have time to cover in class will be given.
suggested texts:  
C++:  
• The C++ programming language, by Bjarne Stroustrup, Addison-Wesley, 2000. 

Numerical analysis:  

also required:  
A laptop with Visual C++ 2015 (for Windows) installed. Bring the laptop to class. Detailed instructions for installing Visual C++ Community Edition, compiling programs and running programs are given in the first assignment. Alternatively, the Eclipse C++ compiler may be used.

We recommend that you use Visual C++. The lectures will be based on this platform, so students with little or no programming experience may therefore find it easier to use this platform. GSI support will mainly be given for Visual C++, although we offer limited support for Eclipse. You are, however, allowed to use other C++ compilers if you wish. If you use a Macintosh computer, you are strongly encouraged to use Visual C++ within a Windows emulator. Installing the necessary developer tools on a Mac to run a C++ compiler natively is not an easy task and we will not be able to help you with the installation.

homepage:  
We will be using bCourses and Study.Net 

assignments:  
There are six mandatory assignments. It is extremely important that students complete these, since the only way to learn to learn programming is through extensive hands-on practice. Assignment 1 is due at the beginning of the first lecture. Most students should be able to complete this assignment on their own. For students who run into trouble, the GSI will be on duty the week before the course begins, and there will be a lab-session scheduled on the weekend before the course starts. Assignments 4-6 are extensive, and students should plan accordingly.

Assignments should be submitted electronically, and in time, via bCourses. Detailed instructions for what is to be submitted, when, and how, are provided on the first page of each assignment. Should you choose (against our recommendation) to use another compiler than the Visual C++ or Eclipse compiler, you should contact the GSI to get instructions about what needs to be submitted.

Students are allowed to consult all the material provided in the course (lecture notes, course books, programs, etc.), as well as the Internet, but are not allowed to use any material that – even remotely – resembles a “solution” to the assignment. If there is any doubt, please contact the instructor. Also, students are allowed, and encouraged, to discuss the material and assignments, e.g., in the bCourses forum and chat room. However, assignments should be solved individually, and the provision of actual code, detailed descriptions of algorithms, etc., to another student is strictly prohibited.

The material (assignments, slides, source code, solutions, and all other material) in the course is proprietary. Posting of material on the web is strictly prohibited and will lead to legal action.

We have a strict policy on submission deadlines. Assignments received up to 24 hours late will get a point deduction of 50% of the points. Assignments received more than 24 hours late get a 100% point deduction.

grades:  
Students who complete the assignments satisfactorily and on time will receive a certificate that they have passed the course. All other students will not receive such a certificate. There is thus no “fail grade” in the course. Students who decide to “audit” the course therefore do not need to take any formal action, but are encouraged to send an e-mail to inform the professor about their decision.

exam:  
There is no exam.
gsi sessions: We will conduct the GSI sessions online (except for the first session), using Adobe Connect. You will receive instructions for how to log on before the first online session.
lecture plan: For simplicity, topics and readings are presented as full lectures. Some topics may run over to the next lecture. Consequently, we may fall behind the listed schedule a bit at some points and then catch up soon thereafter.

Sat, January 16 Lab: Opportunity for students to get hands-on help with Assignment 1. GSI Session 1

Sat, January 23 Due: Assignment 1

DAY I

topic: Introduction to computers, programming, C++ and algorithms.
Basic I/O, variables, simple arithmetics, conditional statements.
Lecture 1 2 hours

topic: Loops and functions.
Scope, break, continue.
Call by value/call by reference.
Lecture 2 2 hours

Sat, January 30

DAY II

topic: Introduction to numerical analysis, call back functions, root finding.
Lecture 3 2 hours

topic: simple bond valuation, arrays
Lecture 4 2 hours

Jan 29 & 31 Online Lab: Opportunity for students to get hands-on help with assignments. GSI Session 2

Sat, February 6 Due: Assignment 2

DAY III

topic: Strings and pointers, static versus dynamic memory allocation
function approximation, introduction to classes
and advanced data structures, attributes
Lecture 5 2 hours

Methods and attributes, public, private and protected,
constructors, destructors, this pointer,
file structures, operator overloading.
Lecture 6 2 hours

February 5 & 7 Online Lab: Opportunity for students to get hands-on help with assignments. GSI Session 3

Sat, February 13

DAY IV

topic: File I/O. Exercises on classes and data structures.
fstream, read, write, close, good
Friends
Introduction to OOP
Lecture 7 2 hours

Object oriented programming (OOP):
Taxonomies, inheritance, protected.
Polymorphism, static/dynamic binding, virtual methods.
Lecture 8 2 hours

February 12 & 14 Online Lab: Opportunity for students to get hands-on help with assignments. GSI Session 4

Tue, February 16 Due: Assignment 3

Syllabus for MFE C++ Programming – Spring 2016
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 19 &amp; 21</td>
<td>Online Lab: Opportunity for students to get hands-on help with assignments.</td>
<td></td>
<td>GSI Session 5</td>
</tr>
</tbody>
</table>
| Sat, February 27 | Due: **Assignment 4**  
**DAY V**  
**topic:** OOP: Modularity and reusability.  
Templates, C++ libraries |                                                                         | Lecture 9 2 hours |
| Sat, March 5 | **DAY VI**  
**topic:** Numerical analysis 2, numerical solution of PDEs,  
limit order markets - Introduction to Assignment 5 |                                                                         | Lecture 10 2 hours |
| Mar 4 & March 6 | Online Lab: Opportunity for students to get hands-on help with assignments. |                                                                         | GSI Session 6 |
| Tue, March 8 | Due: **Assignment 5**  
**Mar 11 & 13**  
Online Lab: Opportunity for students to get hands-on help with assignments. |                                                                         | GSI Session 7 |
| Tue, March 15 | Due: **Assignment 6**  
**Mar 11 & 13**  
Online Lab: Opportunity for students to get hands-on help with assignments. |                                                                         |             |