Instructor: Dr. Hwan C. Lin

Office: 217B Friday Building

Office Hours: Tu, Wed, 3:00 – 4:30 pm

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My Website: http://belkcollege.uncc.edu/hwlin/

UNCC Moodle: http://moodle.uncc.edu/


Course Description: Numerical Methods for Financial Derivatives. This course is to introduce students to numerical and computational techniques for solving both European- and American-style financial derivatives. The approach will be the finite difference methods and the basic theoretical concepts will be introduced. Final projects will involve implementing the techniques on computers. Some spectral and Monte Carlo methods may be discussed.

C/C++ Programming: The course requires students to program numerical methods in C or C++ for homework assignments. Students are assumed to have computer programming experience with C/C++ or any other programming languages. Students who had never programmed in C/C++ are urged to start immediately to learn it by themselves. The course is entirely concentrated in the study of numerical methods or algorithms. Some C/C++ sample programs will be used in class or posted in the moodle website.

It is highly that students use the open-source C/C++ compiler from GCC:

http://gcc.gnu.org/install/binaries.html

It is also recommended that students download Eigen in your computer. Eigen is a C++ template library for linear algebra: matrices, vectors, numerical solvers, and related algorithms:

Useful resources: [http://www.cplusplus.com/](http://www.cplusplus.com/)

References:

The following books, though not required, are good references:

- **Computational Methods in Finance** by Ali Hirsa (2013)
- **Options, Futures, and Other Derivatives** by Hull (2005)
- **Introduction to C++ and Numerical Methods** by Ortega & Grimshaw (1998)
- **Precise Numerical Methods Using C++** by Alberth (1998)
- **An Introduction to Numerical Methods in C++** by Flowers (2000)
- **Numerical Methods in Finance with C++** by Capinski & Zastawniak (2012)
- **C++ Design and Derivatives Pricing** by Joshi (2nd, 2008)

Attendance: Students are expected to attend every class on time and not to leave early. No points are added for attendance nor subtracted for absences. But please notice that in general there is an unambiguous positive relationship between class attendance and class performance (grades). If you miss classes, you will easily get lost in class and will tend to a lower semester grade in the end.

All cell phones and pagers must either be turned off before class begins or placed in silent mode.

While important announcements will be posted in the University’s [Moodle](http://moodle2.uncc.edu) website, you may still miss some class announcements in your class absence. It is your responsibility to ask other students, rather than the instructor, for the class announcement you missed.

Grading Policy:

1. The course grade is based on homework assignments, two exams, and one project.

2. Each of the two exams counts for 100 points and the project counts for 100 points.

3. The homework assignments count for 100 points in total. Each homework will require you to write C/C++ programs to do computation. You must turn in your completed homework in the classroom as soon as the class begins on the due date. You will earn zero point from any overdue homework.

4. Homework assignments are to be posted online in the University’s [Moodle](http://moodle2.uncc.edu) website. You shall notice that while group discussions are welcome, your
completed homework shall not simply be a duplicate of any other student’s work or some sources elsewhere. Should such things be found, both your homework and the original author’s will lose 50%

6. The maximum points you can earn from the course are $400 = 100 \text{ (Homework)} + 100 \text{ (Exam 1)} + 100 \text{ (Exam 2)} + 100 \text{ (Project)}$ Your average percentage score will determine your course grade.

7. Course Grade: A = 90\% or above, B = 80\% - 89\%, C = 70\% - 79\%, U = 70\% below

8. No make-up exam shall be given, unless you can provide justifiable reasons. To justify a make-up exam, you will be asked to provide official documents. Yet, the decision is subject to the instructor’s approval. You will earn zero point from any exam you miss.

**Important Dates:**

- First Day of Classes – Tuesday, January 14, 2014
- Last Day of Classes – Wednesday, April 29
- Exam #1 – Tuesday, February 25
- Exam #2 – Tuesday, April 29
- Project due – May 6, 8:00 - 11:59 pm

**Lecture Outline (subject to changes)**

- Fourier Transform and Black-Scholes Equation
- Fourier Transform, Characteristic Function, and Derivative Pricing
- Topic 5: Computing Option Prices with Fast Fourier Transform (FFT)

  - Topic 1 -- Introduction
  - Topic 2 -- The Black-Scholes Equation
  - Topic 3 -- Fourier Transform and Black-Scholes Equation
  - Topic 4 -- Fourier Transform, Characteristic Function, and Derivative Pricing
  - Topic 5 -- Computing Option Prices with Fast Fourier Transform (FFT)
  - Topic 6 -- Binomial Trees
  - Topic 7 -- Trinomial Trees and a First Look at FDM
  - Topic 8 -- The Matrix Structure of Finite Difference Methods
  - Topic 9 -- Accuracy, Consistency, Convergence, and Stability
  - Topic 10 -- Direct Solvers for Linear Systems of Equations
  - Topic 11 -- Iterative Methods for Linear Systems of Equations
  - Topic 12 -- Boundary Conditions and Free Boundary Problems
  - Topic 13 -- Computation of American Options
  - Topic 14 -- Exotic Options and Other Issues

**Academic Integrity:**

Students have the responsibility to know and observe the requirements of The UNC Charlotte Code of Student Academic Integrity (Catalog, page 275). This code forbids cheating, fabrication or falsification of information, multiple submissions of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty. Any special requirements or permission regarding academic integrity in this course will be stated by the instructor and are binding on the students. Academic evaluations in this course include a judgment that the student’s work is free from academic dishonesty of any type; and
grades in this course therefore should be and will be adversely affected by academic dishonesty. Students who violate the code can be expelled from UNC Charlotte. The normal penalty for a first offense is zero credit on the work involving dishonesty and further substantial reduction of the course grade. In almost all cases, the course grade is reduced to F. Copies of the code can be obtained from the Dean of Students Office. Standards of academic integrity will be enforced in this course. Students are expected to report cases of academic dishonesty to the course instructor.

Statement on Diversity: The Belk College of Business strives to create an inclusive academic climate in which the dignity of all individuals is respected and maintained. Therefore, we celebrate diversity that includes, but is not limited to ability/disability, age, culture, ethnicity, gender, language, race, religion, sexual orientation, and socio-economic status.