MATH 6204 (8204) – 090
Numerical Methods for Financial Derivatives
Fall 2016
Tuesday, 6:30 - 9:15 pm
Friday Building #106

Instructor: Dr. Hwan C. Lin
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My Website: http://belkcollege.uncc.edu/hwlin/
UNCC Moodle: http://moodle.uncc.edu/

Lecture notes, homework assignments, projects, some class announcements, and other course-related materials will be posted in the Moodle website.


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.

Instructional Method
The course is offered with classroom lectures. Some numerical methods and their applications to options pricing will be discussed. Students are required to learn computer programming to implement numerical methods for computing values of financial derivatives. Computer lab #339 will be used for practicing computer programming.

Computer Programming Language
Students will need to know some programming languages. My suggestion is for you to learn the Python language. Python is an open-source general-purpose programming language. It has clear and simple syntax and is powerful for scientific computation. For the course, you are advised to download the following four core components:

Python (http://python.org/),
Numpy, Scipy (http://www.scipy.org/Download)
Matplotlib (http://matplotlib.sourceforge.net/).
Plus, do not forget to install Numba (http://numba.pydata.org/). Numba allows Python code to be just-in-time compiled. This gives you the power to speed up your applications with high-performance functions written directly in Python.

Installing the above Python components individually may be difficult to some students. Instead, you can download a comprehensive Python package including many more components from either of the following two Python distribution websites:

Continuum Analytics Anaconda: https://store.continuum.io/cshop/anaconda/
Enthought Canopy: https://store.enthought.com/

My personal preference is in favor of the Continuum Analytics Anaconda distribution. Please be advised that Python 2.7 is a preferred version, although Python 3 is also available. To learn Python programming, you can consult many online tutorials including the one from Python’s official website:

https://docs.python.org/2/tutorial/

Do a Google search, and you will easily find many other tutorials or some related information.

References:

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

- A Primer on Scientific Programming with Python by Hans Petter Langtangen (2014)
- Options, Futures, and Other Derivatives by Hull (2005)

Attendance: Students are expected to attend every class on time and not to leave early. No grade points are added for class attendance nor subtracted for class absence. But please notice that in general there is an unambiguous positive relationship between class attendance and student 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 website (http://moodle2.uncc.edu), 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 class participation, homework, and project. Class participation counts for 10%, homework 60%, and project 30%. There are no exams.
2) Course Grade: A = 90% or above, B = 80% - 89%, C = 70% - 79%, U = 70% below.
3) You must turn in your completed homework on line before the class begins on the due date. You will earn zero point from any overdue homework.
4) One project will be assigned for our course. The due date is Dec. 13 (see Important Dates below). If your project cannot meet the due date, then one day delay will make you lose 20% of your score, two days delay will make you lose 40%, and so on.
5) Both homework and project are to be assigned online in the University’s Moodle website (http://moodle.uncc.edu). You shall notice that while group discussions are welcome, your completed homework or project should represent your independent work and should not be a duplicate of any other student’s work. Should such things be found, both your homework (or project) score and the original author’s will lose 50%.

Important Dates:

First Day of Classes – Wednesday, August 23, 2016
Last Day of Classes – Wednesday, December 6, 2016
Project Due – December 13, 8:00 - 11:59 pm

Lecture Outline (subject to changes)

- Topic 1 -- Introduction to Python
- Topic 2 -- Introduction to Options (ch.1)
- Topic 3 -- The Black-Scholes Equation and Monte Carlo Simulation (ch.1 & 2)
- Topic 4 -- Algorithms for Simulating Sample Paths and Computing European Options (Ch. 3)
- Topic 5 -- Monte Carlo Simulation for American Options (ch. 3)
- Topic 6 -- Fourier Series and the Fourier Transform
- Topic 7 -- Characteristic Function, Fourier Transform and Derivative Pricing
- Topic 8 -- Fast Fourier Transform (FFT) using Python
- Topic 9 -- The Matrix Structure of Finite Difference Methods
- Topic 10 -- Accuracy, Consistency, Convergence, and Stability
- Topic 11 -- Direct Solvers for Linear Systems of Equations
- Topic 12 -- Iterative Methods for Linear Systems of Equations
- Topic 13 -- Boundary Conditions and the Free Boundary Problem of American Options
- Topic 14 -- Computation of American Options with Finite Difference Methods
- Topic 15 -- 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.