UNC CHARLOTTE

College of Liberal Arts
Mathematics & Statistics Department

MATH 4226 Mathematics of Financial Markets

Faculty: Dr. Adriana Ocejo
e-*mail:* amonge2@uncc.edu

Lectures: TR 1:00 – 2:15 pm
Virtual Office hours: W 10-11 am & TR 5-6 pm

Course materials:

The course is based on the following study manual:

ACTEX Study Manual for SOA Exam IFM- Investments and Financial Markets
Fall 2020 Edition, Johnny Li.

You may buy the manual in the College eBookstore, where you can find a 20% college bookstore discount of 145-day student access license.

In this course, we aim to cover the quantitative part of the IFM Exam syllabus.

Learning objectives:

We will use basic probability and interest rate theory to understand, price and manage derivatives portfolios in an insurance context. The learning objectives are the following:

1. Understand how derivatives contracts (forward, futures, call and put options, and combinations) work in financial markets.
2. Understand how derivatives contracts can be used in conjunction with the underlying asset in a risk management context.
3. Understand how binomial trees can be used to approximate the prices of both European and American call and put options on various underlying assets.
4. Understand how the Black-Scholes formula can be used to form the prices of European call and put options on various underlying assets.
5. Understand the importance of Option Greeks and risk management techniques in forming hedged asset portfolios.

Module I. Introductory derivatives: Forwards, Futures, and Options.

Lesson 1. Stock as an underlying asset.

Lesson 2. Forward and prepaid Forward.

Lesson 3. Options and related strategies.

Lesson 4. Other underlying assets and applications.

Module II. Risk-neutral valuation in discrete-time.

Lesson 1. Introduction to binomial trees.

Lesson 2. Multiperiod binomial trees.

Lesson 3. Options on other assets.

Module III. Risk-neutral valuation in continuous-time.

Lesson 1. The Black-Scholes model.

Lesson 2. The Black-Scholes formula.

Lesson 3. Greek letters and elasticity.

Lesson 4. Risk management techniques.

Module IV. Further topics on option pricing.

Lesson 1. Exotic options I: Asian, Chooser, Barrier, Rebate, Lookback, Compound.

Lesson 2. Exotic options II: Exchange, Forward start, Gap.

Lesson 3. General properties of options: comparing options.

Lesson 4. Real options.

Calculator use:

This course heavily relies on the use of a calculator. I recommend you to use one of the following SOA approved calculators of Texas Instruments: BA-35, BA II Plus, BA II Plus Professional, TI-30Xa, TI-30X II (IIS solar or IIB battery), TI-30XS MultiView (or XB battery).

I will use the TI-30XS MultiView for class demonstrations.

To find normal probability values and percentiles, we will use the online calculator

https://calculator.coachingactuaries.com/

Lectures:

This is an **online synchronous class**. We will meet online via Zoom during the class time.

Participants will be initially muted to avoid unnecessary noise but can unmute themselves, for instance to ask questions. You can send a message visible to all participants or the instructor only, but no private messages to another participant. Lectures will be recorded and become accessible in Canvas.

While I understand there may be interruptions, I expect you to be present during the lecture (as in a regular classroom) and suggest that your meeting environment be as distraction free as possible. Please be mindful that at any time during the lecture I will launch a quick poll both to record attendance and to assess basic understanding of the material.

Virtual office hours:

Office hours are Wednesdays 10-11 am, Tuesdays 5-6 pm, and Thursdays 5-6 pm in my Zoom Virtual Room.

If you plan to attend office hours to discuss an exercise, please email me a picture of your work and briefly explain the issue to discuss before the meeting, whenever possible. This will help to make the most of our time.

When you join in, you will automatically see the message "Please wait, the meeting host will let you in soon". This is to prevent students from interrupting other student's tutoring. I may ask students their consent to let another student come into the virtual office at the same time, otherwise I will admit you into the virtual office as soon as possible.

Grading:

The scale is 0-100 and the final grade is distributed as usual:
89.5-100 (A), 79.5-89.4 (B), 69.5-79.4 (C), 59.5-69.4 (D), 0-59 (F).

- Homework (30%)
- Quizzes (10%)
- Two midterm exams (30%, that is 15% each)
- Final exam (30%)

Homework:

Regular homework will be assigned after each lecture using Academic GOAL. This Fall 2020, students will have free access! Information about how to register can be found in Canvas. The problems involve mostly <u>quantitative</u> skills and you will need a calculator.

The due date of every assignment is the Tuesday of the following week on which it was assigned, at midnight. *For example, homework assigned on 09/15 and 09/17 will be due on Tuesday 09/22 at 11:59 pm.*

In every homework set, you have the option to exit and return to it until the due date. To receive your grade, you must hit "Grade" and then "Submit for Grading". Answers and solutions will be released for review right after the due date.

Quizzes:

Quizzes will be weekly on Thursday and based on the homework. *For example, on Thursday 09/24 there will be a quiz based on homework assigned on 09/15 and 09/17.*

Each quiz will be during class time using Zoom Polls and of multiple-choice. You will have 5-10 minutes (depending on complexity) to submit your answer. If your result is incorrect, you will be notified by email after the lecture and encouraged to submit a make-up quiz by the end of the day, this time showing all your work. Make-up quizzes have 80% value.

Testing:

Midterm 1 on 10/08 and Midterm 2 on 11/12. There are no make-up midterms.

<u>Midterms</u> will be "live" during class time in Canvas using Respondus LockDown Browser and Webcam. Midterms link will be provided in advance of the test, with instructions.

Please have pencil/pen, calculator, and enough paper handy, as **you must show your work and submit it**. After the Midterm time is over, **you will have 10 minutes to upload your (hand-written) work to Canvas**. Please use an app, such as the free Adobe Scan app, to take pictures of ALL your work and save it as a SINGLE PDF file to be uploaded in Canvas. We will do a mock test to practice all of this.

Watch this brief video to get a basic understanding of LockDown Browser and the webcam feature.

https://www.respondus.com/products/lockdown-browser/student-movie.shtml

The <u>Final Exam</u> will be proctored. Specifics will be discussed closer the time when information becomes available.

Copyright. My lectures and course materials, including presentations, tests, exams, handouts, and similar materials, are protected by copyright and will be shared only within our Canvas course. I am the exclusive owner of copyright in those materials I create. I encourage you to take notes and make copies of course materials for your own educational use. However, you may not, nor may you knowingly allow others to reproduce or distribute lecture notes and course materials publicly without my express written consent. Students who publicly distribute or display or help others publicly distribute or display copies or modified copies of an instructor's course materials may be in violation of University Policy 406, The Code of Student Responsibility.

Disability Services. Students in this course seeking accommodations to disabilities must first consult with the Office of Disability Services and follow the instructions of that office for obtaining accommodations.

IT considerations. Given that this is an online class, the university requires that you have a laptop and suggests certain hardware specs. Check the details [here](). Note that *Chromebooks, iPads, tablets, and mobile devices do not meet this requirement.*

Syllabus Revision. The standards and requirements set forth in this syllabus may be modified at any time by the course instructor. Notice of such changes will be by Canvas announcement or email notice.

-Mathematics is the music of reason