ACTL40008
Advanced Financial Mathematics II

SUBJECT GUIDE

Second Semester 2013

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Department of Economics
Faculty of Business and Economics
Subject Outline

This subject follows Advanced Financial Mathematics I and presents more advanced topics in financial mathematics. No-arbitrage derivative pricing will be reviewed in the martingale setting and then applied to the pricing of specific derivatives. The computational aspects will be important. Mathematica, a very powerful tool for numerical computation and symbolic mathematics, will be used for computations. Mathematica has many derivative prices pre-programmed, plus a myriad of special functions, graphical tools, symbolic mathematics, and the list goes on, more than enough to explore any topic in financial mathematics (and any area of applied mathematics). We will also do some simple programming of our own, coding known option pricing formulas. Simulation will be used on a few occasions.

The topics covered this semester are:


4. Alternative models for asset prices in derivative pricing. The justification for these models is the smile effect, or the fact that the implied volatilities found from observed option prices do not always agree with the Black-Scholes formula. This involves some classical mean reverting processes. Reference: lecture notes.

To learn the basics of Mathematica we will use excerpts from the book by William Shaw, *Modelling Financial Derivatives with MATHEMATICA*. Mathematica will be used in parts 3-4-5 (above) to compute derivative prices using simulation and Fourier transform inversion. To make this possible you will start to learn Mathematica from the second week, at the same time as covering the material in parts 1-2.

**Exercises**

Exercises have more than one function, they check that we understand the material, introduce topics that are easier or else will be used in subsequent lectures, and also (to some degree) serve as practice for the exam. Not all exercises are of same type as exam questions, and learning the exercises and their solutions by heart is not the best way to study for the exam. The exam will be made of questions that are of similar difficulty to the exercises but are not very long to solve. Understanding is the most important point as far as the exam is concerned. Topics that are not exam material will be specifically identified. Exercises will be given every week; solutions will be put up on the LMS the following week. Exercises do not necessarily follow the lectures exactly. For instance, some exercises are useful preparation for topics to
come later. At the end of semester, you will be able to see that absolutely all the exercises were about the topics covered.

Software

Mathematica will be required to do many of the exercises, so you will need to have access to Mathematica. The best thing for you is to purchase a temporary personal license, that you can install on your own computer. The pricing of Mathematica for students is very reasonable, a six-month student license is sold for US $45, less than the price of most textbooks (while those in the business world pay $2500 for a standard Mathematica license). The software can be downloaded from Wolfram’s website; this is very quick, though they ask for proof that you are a student. (The Australian company Hearne Software sells Mathematica, but they only show a price for a perpetual student license, worth AU $170.) For a preview of what Mathematica can do, go to http://www.wolfram.com/mathematica/. Mathematica may help you in other subjects as well (including Honours essays or projects). N.B. Version 8 or 9 of Mathematica is needed, previous versions do not have the same preprogrammed instructions for option pricing.

Assessment

The subject will be assessed by a 50-minute mid-semester test (worth 20%) and a two-hour end of semester examination (worth 80%). The date of the mid-semester test will be given at beginning of semester and put up on the LMS.

Note that, for the test and exam, only one non-programmable calculator will be allowed; dictionaries and other personal materials will not be allowed.

Practical Information

This subject has three lecture hours per week. There are no tutorials, but many exercises will be solved in class. All of the material will be available from the ACTL40008 page in the Learning Management System (LMS), at http://www.lms.unimelb.edu.au/

Contact Details

Room 325, tel. 8344 5324, email: dufresne@unimelb.edu.au

The weekly office hour for students enrolled in this subject will be announced in class and put up on the LMS.

Recording of lectures

Permission will not be granted to record lectures.