ORIE 5600 Financial Engineering with Stochastic Calculus I
Fall 2013, 4 credits

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Lectures: Tue and Thu 8:40 - 9:55am in PHL 203
TA:
Andrey Krishenik (recitation): Email: ak757@cornell.edu
Rinald Murataj (grading): Email: rinaldmurataj@gmail.com

Recitations will start on Wed, 4th Sep.

Office hours:
Andreea Minca (Instructor): Monday 10 a.m. - 12 p.m in RHD 222. Email: acm299@cornell.edu
Andrey Krishenik / Rinald Murataj: Tuesday 3-4 p.m. RHD 431.

Final exam: Mon, Dec 16, 2013 02:00 PM - 04:30 PM
Prelim exam: 11/5/2013 UPSB17: Upson Hall B17

Website: The course website is available through http://blackboard.cornell.edu/. Please register with the site and check it regularly.

Contents: This is the first part of a two semester course providing an introduction to continuous-time models of financial engineering and the mathematical tools behind them. The first semester (Financial Engineering with Stochastic Calculus I) develops a practical knowledge of stochastic calculus, culminating in the analysis and first applications of the Black-Scholes model. Building on these foundations, the second semester (Financial Engineering with Stochastic Calculus II) develops more advances models, and presents further applications such as pricing of exotic options and analysis of fixed income markets. Topics of Financial Engineering with Stochastic Calculus I include
I: Introduction: financial engineering, binomial model

II: Background in probability: information and $\sigma$-algebras, independence, general conditional expectations, martingales, fundamental theorem of asset pricing

III: Brownian motion (BM): scaled random walks, definition of BM, distribution of BM, filtration for BM, martingale property of BM, quadratic variation

IV: Stochastic calculus: stochastic integral, Itô processes, Itô-Doeblin formula, Black-Scholes-Merton equation, multivariable stochastic calculus

V: Risk-neutral pricing: Girsanov’s theorem, risk-neutral measure, martingale representation, fundamental theorems of asset pricing, dividend paying assets.

VI: Miscellaneous topics (if time permits)

Prerequisites: A good knowledge of elementary probability theory is required (ORIE 3500 or equivalent). This includes random variables, probability distributions, density functions, expectation and variance, and multidimensional random variables.

Literature: The course is based on chapters 1 to 5 of the textbook


Further reading


Assignments: Assignment sheets will be posted on the course homepage at http://www.blackboard.cornell.edu/. The homework sets will be posted on Mondays every two weeks and due the next Thursday, before the class begins. Written homeworks should be left in the drop box of the course. One or two homeworks will have computational assignments, you can choose any programming environment. The working code, commented, will be sent by email to Rinald.

Questions: are best responded to during office hours (as opposed to email). Clarifying questions regarding the material are particularly welcome during lectures.

Late homework policy: No late homework is accepted, with the exception of medical reasons (with documentation). In the latter case, please contact the TA to find a solution.
**Grading:** The final grade will be based on homework assignments (40%), a mid-term exam (25%) and a final exam (35%).

There will be five homework sets and the lowest grade will be dropped, provided all homeworks are conscientiously attempted and the student has made a contribution in collecting and making the best effort to proposing solutions to quantitative interview questions. The contribution must be typed (preferably in Latex). For the quantitative interview questions you may work in groups of two.

The deadline for submitting the contribution (by Email to Rinald) is 1st Dec 2013. Your contribution will be made available by the end of the semester to the other students. *If there is a dispute about grading (a homework set or an exam), you may turn in the work with a written request for a regrade within a week of the work being returned. All of the work, and not just the disputed question, will be regraded.*

**Attendance:** at both the lectures and one of the recitations is expected but not required. You are responsible for being aware of the announcements and content of lectures and recitations.

**Exams:** You may bring the textbook, your classroom notes and your homework. You may not bring a computer, but may bring a calculator that does not have any communication capability.

**Make-up Exam:** Students requiring a make-up final exam must speak to the instructor by 9/6/2013. If you miss an exam for medical reasons (with documentation), you are allowed to take a make-up exam.

**Academic Conduct:** Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any homework should be the student’s own work, unless otherwise specified. In particular:

- You may not discuss with other students other than the level of a corridor discussion. No notes should be taken away from such discussions.
- You may not work through solutions with others and cannot share computer files.
- You may not discuss the homework with past students who have significant knowledge of the details of the problem set.
- You are not allowed to derive advantage in any way from the existence of solutions prepared in prior years, whether they are instructor-supplied or a student’s own work.

If you violate this policy then you risk failing the course. If you have any questions about this policy, please do not hesitate to contact me.