

STOCHASTIC CALCULUS AND MATHEMATICAL FINANCE (II)

MA530b (Spring 2016)

Professor Jin Ma

Office: KAP 250

Office hours: WF 11:00-12:30pm, or by appointment

Phone: 740-3771

email: jinma@usc.edu

Course Description

This course is a continuation of MA530a (Stochastic Calculus and Mathematical Finance, I) offered in the Fall semester. We will further develop the mathematical tools necessary for studying advanced problems in finance and optimization problems. These include a deeper understanding of martingale theory, such as martingale representation theorem, and Girsanov theorem, etc., and their applications in the risk neutral valuations. We will continue studying arbitrage pricing theory, focusing more on the incomplete markets, and exotic options. The aspects of stochastic portfolio optimization and the stochastic control theory, the term structure of interest rates, and some related issues involving partial differential equations will be explored at an appropriate level.

Textbook:

Arbitrage Theory in Continuous Time (2nd Edition), by Tomas Bjork, Oxford University Press, 2004.

Suggested Reading:

The Mathematics of Financial Derivatives. A student introduction, by P. Wilmott, S. Howison, J. Dewynne, Cambridge U. Press, 1995.

Introduction to Stochastic Calculus Applied to Finance, by D. Lamberton and B. Lapeyre, Chapman Hall/CRC Press, 1996.

Forward-backward Stochastic Differential Equations and Their Applications, by Jin Ma and Jiongmin Yong, Lecture Notes in Mathematics **1702**, Springer, 1999.

Subjects to be presented:

- Review; Completeness of Black-Scholes Models;
Further study of Stochastic Analysis and Martingale Theory (including
Martingale Representation Theorem and Girsanov Transformations) (Chap. 11, 2 weeks)
- Martingale Approach of Arbitrage Pricing (Chap. 12-14, 2 weeks)
- Pricing in incomplete markets (Chap. 15, 2 weeks)
- Exotic and path-dependent options (Chap. 18, 2 weeks)
- Portfolio Optimization and Stochastic Control (Chap. 19, 3 weeks)
- Term Structure of Interest Rates (Chap. 20-24, 4 weeks)

Grading Policy

- Homeworks 20%
- Midterms 40%
- Final (take home) Exam 40%

Classroom Policy

The assessment of a student's performance for the course will be based on the total score of all the graded assignments, which include homework, quizzes, exams, and projects, if any. During the semester no letter grades (such as "A", "B", ...) will be given for any of the tests/projects. However, a "progress report" of the whole class will be handed out periodically, usually after a midterm exam or class project, so that each student can find his/her ranking in the class. The final letter grade will depend largely on the ranking in a natural way.

While it is acceptable to work in groups for homework and/or projects, each student must turn in an individual assignment. Plagiarism (copying other people's work) will not be tolerated.

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.-5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.