**课程大纲**

**随机分析与应用**

课程编号：02806120　　　　　　　　　　授课对象：学术研究生

学　　分：2　　　　　　　　　　　　　　任课教师：李辰旭

课程类型：选修　　　　　　　　　　　　　开课学期：2015 年春

先修课程：

任课教师简历（500 字左右）：

李辰旭博士，北京大学光华管理学院讲师，2010 年获美国哥伦比亚大学博士学位。主要从事金融计量和金融工程等专题研究。多项研究成果已成功发表在 Annals of Statistics， Mathematics of Operations Research，Mathematical Finance 等重要学术期刊。作为研究的实践，参与金融机构的衍生品定价与量化交易模型的开发和改进。在北京大学光华管理学院他讲授金融中的量化方法，随机分析与应用，管理学中的统计方法，商务统计分析， 数据分析与统计决策等所涉课程。2004 年毕业于中国科大，获应用数学学士学位。他兴趣广泛，对文化艺术特别是钢琴演奏及钢琴艺术鉴赏和研究拥有诚挚的热爱。

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辅导、答疑时间：

待定

一、项目培养目标

1　**Learning Goal 1** Graduates will be thoroughly familiar with the specialized knowledge and theories required for the completion of academic research.

　　1.1　Objective 1 Graduates will have a deep understanding of basic knowledge and theories in their specialized area.

　　1.2　Objective 2 Graduates will be familiar with the latest academic findings in their specialized area and will be knowledgeable about related areas.

　　1.3　Objective 3 Graduates will be familiar with research methodologies in their specialized area, and will be able to apply them effectively.

2　**Learning Goal 2** Graduates will be creative scholars, who are able to write and publish high-quality graduation dissertation and research papers.

　　2.1　Objective 1 Graduates will write and publish high-quality graduation dissertation and research papers

　　2.2　Objective 2 Graduates will be critical thinkers and innovative problems solvers.

3 **Learning Goal 3** Graduates will have a broad vision of globalization and will be able to communicate and cooperate with international scholars

    3.1    Objective 1 Graduates will have excellent oral and written communication skills

    3.2    Objective 2 Graduates will be able to conduct efficient academic communication in at least one foreign language

4 **Learning Goal 4** Graduates will be aware of academic ethics and will have a sense of social responsibility.

    4.1    Objective 1 Graduates will have a sense of social responsibility.

    4.2    Objective 2 Graduates will be aware of potential ethical issues in their academic career.

    4.3    Objective 3 Graduates will demonstrate concern for social issues.

## 二、课程概述

A career in quantitative analysis and trading at financial institutions or academic research concentrating on dynamic and empirical asset pricing is sure to involve decision making based on stochastic models. This course focuses on a quick tutorial on stochastic analysis and then discuss their applications in various fields, especially finance and economic.

## 三、课程目标

For students who plan to pursue their career in academia, this course will provide solid fundamental tools for studying derivatives pricing, portfolio planning, the two major topics in financial economics. For students who plan to develop practical quantitative skills in financial industry, this course will serve as an indispensable preparation for both buy-side and sell-side quantitative positions, for example, quant modelers, developers, strategists, and technical traders.

## 四、内容提要及学时分配

Tentative topics on stochastic analysis may include, but not limited to, conditional expectations, stochastic processes, martingales, Markov processes, random walk, Brownian motion, Poisson process, stochastic integrations, stochastic calculus, the It\^{o} formulas, some fundamental theorems in stochastic analysis, for example, time-change, martingale representation, Girsanov change-of-measure, stochastic differential equations, interpretation of solutions to partial differential equations via the Feynman-Kac theorem, etc.

Based on these mathematical tools, we will further discuss their implementation via Monte Carlo simulation. Detailed topics may include, but not limited to, random number generation, exact simulation of important distributions and sample paths of stochastic models, variance reduction techniques, discretization methods for simulating solutions to stochastic differential equations. We will discuss the implementation of related algorithms in various softwares, for example, C/C++, Matlab, and Excel.

With the proliferation of fast and inexpensive information technology, it is important to be able to connect data and models intelligently. We will discuss econometric and statistical inference of continuous-time models based on discretely monitored data. For example, via maximum-likelihood estimation methods, we will provide a convenient tool for academic and

industrial empirical studies based on real market trading data.

For applications, we will target derivatives pricing and portfolio planning of a wide variety of asset classes, such as equity, equity index, fixed-income, credit, commodity, and foreign-exchange. If time allowed, we will discuss the development of the Chinese derivatives market, for example, modeling issues of option pricing on stocks index futures.

期末考试时间：

五、教学方式

六、教学过程中 IT 工具等技术手段的应用

七、教材

Course notes and slides

八、参考书目

References

[1] Campbell, J. Y., Lo, A. W. and Mackinlay, A. C. (1997). The Econometrics of Financial Markets. Princeton University Press.

[2] Duffie, D. (2001). Dynamic Asset Pricing Theory. 3rd ed. Princeton University Press.

[3] Glasserman, P. (2004). Monte Carlo methods in Financial Engineering, vol. 53 of Applications of Mathematics (New York). Springer-Verlag, New York. Stochastic Modelling and Applied Probability.

[4] Karatzas, I. and Shreve, S. E. (1991). Brownian Motion and Stochastic Calculus, vol. 113 of Graduate Texts in Mathematics. 2nd ed. Springer-Verlag, New York.

[5] Shreve, S. E. (2004). Stochastic Calculus for Finance. II. Springer Finance, Springer-Verlag, New York.

[6] Singleton, K. J. (2006). Empirical Dynamic Asset Pricing: Model Specification and Econometric Assessment. Princeton University Press.

九、教学辅助材料，如 CD、录影等

十、课程学习要求及课堂纪律规范

十一、 学生成绩评定办法（需详细说明评估学生学习效果的方法）

We will have a take-home and open-book final exam, which contains ten or more questions directly related to our discussions. This exam will be distributed almost right after the beginning of the class so that you can manage your time to complete it before the due date. So, the final grade will be based on this problem set.