UNIVERSITY OF CALIFORNIA, LOS ANGELES

ANDERSON SCHOOL OF MANAGEMENT

MGMTMFE 405-2
Computational Methods in Finance

Quarter: WINTER 2019

Time: Lectures: Thursdays, 4:10-7:00PM in **D307**

Exceptions:

January 24 class –>	moved to:	**January 18**, 4:10 - 7 PM in Royce 190
March 7 class –>	moved to:	**March 1**, 4:10 - 7 PM in Royce 190
March 14 class –>	moved to:	**March 8**, 4:10 - 7 PM in Royce 190

Instructor: Dr. Levon Gukasian

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Office Hours: 12–1PM on Thursdays

TA: Geoffery Zheng, E-mail: geoffery.zheng.1@anderson.ucla.edu
TA's office hours: Mondays, 4-5:30PM, in TBD.

Course Objectives:

This course introduces some of the major numerical methods needed for quantitative work in finance, focusing on derivatives pricing and fixed income applications. Topics will include the binomial method for European, American and various Exotic options pricing, treatment of discrete dividends, American bond option valuations, numerical methods for stochastic differential equations, random number generators, Monte-Carlo methods for European and Least-Square Monte-Carlo methods for American options pricing. Variance reduction techniques will be covered. We will also cover the Low-Discrepancy Sequences and implement the Quasi Monte Carlo method. The numerical methods of the partial differential equations and finite difference methods that appear in financial engineering will be covered. The course is heavily lab oriented.

Prerequisites:

Knowledge of a programming language (C/C++, Matlab, R, Java, etc.)

Required Preparation and Materials:

Required:

Paul Glasserman, "Monte Carlo Methods in Financial Engineering", Springer-Verlag, 2005.

Optional:

Yuh-Dauh Lyuu, "Financial Engineering and Computation: Principles, Mathematics, and Algorithms", Cambridge University Press, 2001.

Software:

You must be familiar with a programming language, such as C/C++, Matlab, R, Java, etc. No particular one is required, but I strongly recommend using C++ for implementing class projects.

Administration:

Lectures relate to reading material in the text, but also include some examples and additional material introduced in class. While I will not take attendance, you are expected to attend all classes, and are responsible for any material covered in classes you miss. I may post some lecture notes and assignments on the web - on the course's site. All students are required to obtain access to this site, and to check it regularly for notes and bulletins. I may distribute some class resources only electronically.
You will submit your project codes via emails by their due day/time. The due day/times are at 12PM on Thursdays when the projects are due.

Your codes should be emailed to the following address: **MGMTMFE405.2@gmail.com**. The email-subject should reflect your name and project number as follows:

Last name_First name_Project number. For example: **Wang_George_Project3.**

Grading:

Grading will be based on weekly Computational Projects (9 of them) and the Final Exam.

All projects combined are worth 60% of your overall score, and the Final Exam is worth 40% of your overall score. The **Final Exam** will be held **11:30AM-2:30PM on MARCH 21, 2019.** The Final Exam is comprehensive and it will be based on the material covered during the course. More details about the final exam will be discussed in class.

The weekly Computational Projects will not be of equal weights. You will submit your project codes via emails by their due day/time. The due day/times will be at 12PM on Thursdays of the weeks when the projects are due. You may be asked to demonstrate (to the course instructor or the TA(s)) how your codes work under different parameter settings, explain the outcomes, and answer related-questions.

There will be no late or make-up projects. Your projects' grades will be based on your implementation and the demonstration of the projects, the accuracy and quality of your codes, and your answers to questions. All projects are individual.

Every project that you submit should have a title, description of inputs and outputs, and codes should have detailed descriptions and explanation of major steps.

No parts of projects' codes can be shared with other students; nor can the codes be taken from outside sources. **Various methods will be employed to compare the submitted codes and to detect any uses of online source codes for class projects.**

Those project submissions that are written in C/C++ will earn 10% extra credit, up to the max possible score for the project.

The project grades will be based on the following grading schedule:

Projects 1- 3: 50 points each

Projects 4 -9: 75 points each

Your course grade will be based only on your performance on all projects and the final exam.

There will not be any provision for extra credit.

Tentative schedule of classes and homework assignments

Session	Topic(s)	Assigned Project	Assignment Due dates
1	Random Number Generation, Discrete and Continuous Random Variable Simulation	1	Thursday of the following week
2	Monte Carlo Simulation, Option pricing – the first steps Variance Reduction techniques.	2	Thursday of the following week
3	Simulation of Stochastic Processes, discretization schemes (Euler, Milstein, etc.), Pricing Securities by Simulation – the first steps. Low-Discrepancy sequences, Applications.	3	Thursday of the following week
4	Binomial, Trinomial methods of pricing European and American options. Estimation of Greeks.	4	Thursday of the following week
5	Pricing American Options by Simulation, Least Square Monte Carlo (LSMC) method.	5	Thursday of the following week
6	Exotic option valuation: Asian options, Barrier options, Variance/Volatility Swap Valuation. Consumer Loan Default modeling and pricing	6	Thursday of the following week
7	Numerical Partial Differential Equations-Methods, finite difference schemes – Implicit, Explicit, Crank-Nicolson Methods.	7	Thursday of the following week
8	Interest rate models – Single or Multiple Factors (Vasicek, CIR, Longstaff-Schwartz, G2++, Hull-White), Pricing Options on Discount Bonds, Pricing Options on Coupon-Paying Bonds.	8	Thursday of the following week
9	Simulation methods of Valuation and Hedging of Mortgage-Backed Securities. Prepayment Models, Option-Adjusted Spread-Duration and Convexity. (*may take two lectures)*	9	Thursday of the following week
10	Valuation and Hedging of MBS. IOs and POs. Prepayment and Default Models, MBS Embedded Options.		