

(蒙地卡羅方法於金融工程之應用)

This course introduces Monte Carlo methods to solve for a large class of applications arising from financial engineering. Possible applications include subjects on risk management, option pricing, portfolio selection, systemic risk, rare event simulation, etc.

Basic methodologies and theories of Monte Carlo simulation and finance will be reviewed.

Accelerating techniques including parallel computing, variance reduction, and randomized Quasi Monte Carlo, etc. will be introduced. The course contents is as follows:



- (1) Review: Elementary Probability Theory. Simulation of Stochastic Processes. Ito's Calculus
- (2) Basic Monte Carlo Method, GPU computing
- (3) Historical Simulation and Risk Management - VaR/ CVaR
- (4) Black-Scholes-Merton Theory of Derivatives Pricing and Hedging.
- (5) European option Pricing. Exotic Option pricing.
- (6) American Options Pricing: Least Squares and Dual Methods
- (7) Randomized Quasi-Monte Carlo
- (8) Variance Reduction: Control Variate
- (9) Application: Calibration to Implied Volatility Surfaces.
- (10) Variance Reduction: Importance Sampling.
- (11) Rare Event Simulation. Large Deviation Theory.

- (12) Application: Default Probability Estimation of Large Portfolios. Portfolio Selection. Measuring Systemic Risk.
- (13) Greeks Computation
- (14) Some Generalizations

Grading: Assignments 40%, Course Project 30%, Exams(midterm and final) 30%.

Class Hours: first class meet at T 2-4 (will change to F 678)

Classroom Location: 台積館 204

Course Schedule: [see course website](#)

[http://mx.nthu.edu.tw/~chhan/MCFE\\_12.html](http://mx.nthu.edu.tw/~chhan/MCFE_12.html)

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Textbooks:

1. 韓傳祥, “金融隨機計算,” 新陸書局, 2012.
2. lecture notes and research papers will be provided.

References:

1. P. Glasserman, Monte Carlo Methods for Financial Engineering, Springer-Verlag, New York, 2003.
2. P. Jackel, “Monte Carlo Methods in Finance,” John Wiley & Sons Ltd. 2002. C. Lemieux, Monte Carlo and Quasi-Monte Carlo Sampling. Springer, 2009.

3. H. T. Huynh, V. S. Lai, and I. Soumare, Stochastic Simulation and Applications in Finance with Matlab Programs. Wiley, 2008.
4. J. A. Bucklew, Introduction to Rare Event Simulation. Springer, 2004.