Department of Mathematics & Statistics
Concordia University

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MACF 402 (MAST 729A)
Mathematical & Computational Finance II
Fall 2015

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Instructor: Dr. C. Hyndman, Office: LB 921-15 (SGW), Phone: (514) 848-2424, Ext. 5219
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Office Hours: To be announced.

Class Schedule: Tuesdays and Thursdays, 16:15-17:30.

Text: *Quantitative Finance: An Object Oriented Approach in C++* by Erik Schlögl, Chapman & Hall CRC Financial Mathematics Series, 2014.

Outline: This course focuses on computational aspects, implementation, continuous-time models, and advanced topics in Mathematical and Computational Finance. We shall attempt to cover the following topics:

- Calibration of Binomial models and implementation of the pricing algorithms.
- Computer simulation: pseudo-random numbers, simulating asset paths, statistical tests, time-scale invariance;
- Brownian motion and stochastic calculus: elements of continuous time finance, the Black-Scholes model, short-rate models, and bond prices
- Finite-difference techniques: heat equation, discretization, stability and convergence, Crank-Nicolson;
- Monte-Carlo methods: Monte-Carlo for Option Valuation, Monte-Carlo for Greeks, variance reduction techniques; antithetic variates in option valuation, control variates in option valuation, Longstaff-Schwartz method for American option valuation;
- Volatility: implied volatility, historical volatility, Monte-Carlo estimates, maximum likelihood, stochastic volatility;
- Hedging: discrete hedging, continuous hedging, delta at expiry, Monte-Carlo methods;
- Exotic derivatives: barrier options, lookback options, Bermudan options, Asian options;
- Risk management: loss probabilities and value at risk, credit risk
- Other topics (time permitting)

Course Evaluation: Weighted average of Assignments (20%), Midterm Examination (35%), and the Final Examination (45%). Some assignment problems will require programming algorithms. MACF program students are strongly encouraged to use *C++* or *Java* for these problems; these languages are industry standards for Quantitative Finance.