

MACF 402 (MAST 729H)
Mathematical & Computational Finance II
Winter 2015

- Instructor:** Dr. C. Hyndman, Office: LB 921.15(SGW), Phone: 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 Schögl, Chapman & Hall CRC Financial Mathematics Series, 2014.
- Outline:** This course is a continuation of MACF401 focusing on computational aspects, implementation, continuous-time models, and advanced topics:
- Calibration of Binomial models and implementation of the pricing algorithms from MACF 401.
 - 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
- 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.