

UNIVERSITE PARIS-DAUPHINE. MASTER 104

Course Syllabus: "Computational Finance with MATLAB "

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Course Overview:

The students will learn important principles of implementation of financial models and master algorithms of evaluation of different types of derivative securities: European, American, standard, barrier and path dependent options on stocks. This course gives a comprehensive introduction to Monte Carlo and finite difference methods for pricing financial derivatives. At the end of the course, the student should have a thorough understanding of the theory behind Monte Carlo methods, be able to implement them for a range of applications, and have an appreciation of some of the current research areas.

Class 1 and 2:

Introduction to MATLAB. Tutorial with numerical optimization of Rosenbrock's function. Markowitz portfolio optimization.

Class 3:

Binomial options pricing model. European, American, Butterfly and Barrier Knock - Out options. Simulation of a Binomial tree and assets trajectories.

Class 4:

Black and Scholes Model. Monte-Carlo method for option valuation. European option. Correlated Brownian motions. Basket et Exchange options.

Class 5:

Black and Scholes Model. Strongly Path-dependent options. Asian option. Lookback and Choosers. Stochastic volatility models. Euler-Maruyama approximation of SDEs. Option and asset pricing in the Heston model.

Class 6:

Merton Model. Simulation of assets trajectories with jumps. Option pricing in the Merton model.

Class 7:

Finite difference methods for Black -Scholes PDE equation.

Control of Knowledge: Defense of a Project:

Reading List:

- 1) S E Shreve, Stochastic Calculus for Finance II: Continuous-Time Models, Springer 2004.
- 2) P Glasserman, Monte Carlo Methods in Financial Engineering, Springer-Verlag, 2004.
- 3) P Wilmott, S D Howison and J Dewynne, Mathematics of Financial Derivatives, CUP, 1995.