Math 573: Computational Methods of Financial Mathematics
Spring 2016   WPI

Instructor: Marcel Blais   **Course Assistant:**   TBA
Stratton Hall 104A
508-831-5677
myblais@wpi.edu

Class Info: Section 191: Thursday, 5:30pm – 8:20pm, Stratton Hall 308
myWpi will be used to manage many of the course details.

Text: *Monte Carlo Methods in Financial Engineering*, by Paul Glasserman,
ISBN 978-0-387-00451-8

Overview: Most realistic financial derivatives models are too complex to allow explicit analytic solutions. The computational techniques used to implement those models fall into two broad categories: finite difference methods for the solution of partial differential equations (PDEs) and Monte Carlo simulation. Accordingly, this course consists of two blocks covering the following topics.

Part I: Parabolic PDEs, Black-Scholes PDE for European and American options; explicit, implicit and Crank-Nicholson finite difference methods; far boundary conditions, convergence, stability, variance bias; early exercise and free boundary conditions.

Part II: Random number generation and testing; generation of sample paths of Brownian motion; evaluation of expected payoff by Monte Carlo simulation; variance reduction techniques—control variates, antithetic variates, importance sampling; efficient evaluation of sensitivity measures; methods suitable for multifactor and term-structure dependent models.

Grading: The final grades will be computed using:

HW / Projects	60%
Midterm Exam	20%
Final Exam	20%

Computing: Projects & assignments will require computing resources. MATLAB and Microsoft Excel will be used. A project will be assigned using an Interactive Brokers paper trading account.

Exams:

03/03/2016	Midterm Exam,	5:30pm
04/28/2016	Final Exam,	5:30pm

Make-up Exam Policy:

Make-up exams will only be allowed in the event of a documented emergency. You are responsible for avoiding conflicts with the exams. Do not plan to leave campus for the term before the final exam.

Homework: There will be regular homework assignments. In general you are allowed to work together on homework assignments, but your solutions must be written up independently.

Project: A substantial project will be assigned. Students are *required* to work in pairs for project work. Students taking this course as a master's capstone course will be assigned a more sophisticated project and will have to formally present the results.

Late HW: Late assignments without prior consent of the professor will not be accepted and will receive a grade of 0. Extensions will be granted only in the event of unforeseen emergencies or extenuating situations that you discuss with the professor in advance.

Capstone: This course can be used as a capstone course for the Financial Mathematics
Option   M.S. degree. Inform the instructor in the beginning of the course if you would like to take MA 573 as a capstone course. This requires instructor approval and depends on many factors. Extra work will be assigned for this option.

Additional Resources:

- *Pricing Financial Instruments: The Finite Difference Method*, by Domingo Tavella & Curt Randall, ISBN 0-471-19760-2

- *Stochastic Calculus for Finance I: Discrete-Time Models*, by Steven Shreve. On reserve at the library.

- *Stochastic Calculus for Finance II: Continuous-Time Models*, by Steven Shreve, ISBN 0-387-40101-6

- *Derivative Securities, Second Edition,* by Robert Jarrow & Stuart Turnbull.

- *The Mathematics of Financial Derivatives: A Student Introduction,* by Paul Wilmott, Sam Howison, & Jeff Dewynne.

- *Options, Futures, and Other Derivatives, 7thEdition*, by John C. Hull.

- MATLAB materials: http://www.cs.cornell.edu/courses/cs99/2003su/

Academic   WPI has an established academic honor code, described in *The WPI*
Honesty: *Student Judicial Policies and Procedures*. Each student is expected to familiarize him/herself with WPI's Academic Honesty policies, which can be found at http://www.wpi.edu/offices/policies/honesty.
All acts of fabrication, plagiarism, cheating, and facilitation will be prosecuted according to the university's policy. If you are ever unsure as to whether your intended actions are considered academically honest or not, please see Prof. Blais.

Disability   If you need course adaptations or accommodations because of a disability, or if
Services: you have medical information to share with me, please make an appointment as soon as possible. If you have not already done so, students with disabilities, who believe that they may need accommodations in this class, are encouraged to contact the Office of Disability Services (ODS), as soon as possible to ensure that such accommodations are implemented in a timely fashion. The DSO is located in 137 Daniels Hall, its phone number is (508) 831-4908, and its email is DisabilityServices@wpi.edu.

This syllabus is subject to change at the instructor's discretion