

## Report on the Summer School on Risk Management and Risk Sharing.

The Summer School lasted five weeks, from June 7, 2010 to July 9.

During the first four weeks, Professor Bouchard (Universite Paris-Dauphine) taught a graduate course on Portfolio Management under Risk Constraints, and Professor Ekeland (UBC) taught a course on Asymmetry of Information and Risk Sharing in Finance. Each course was taught four times a week (one 1:30 lecture on M Tu Th F mornings), and had two tutorials a week (M Tu Th F) afternoon. Two Wednesdays were devoted to presentations by lecturers and students.

During the last week, Charles-Albert Lehalle, from Chevreux (the brokers of Credit Agricole), Jerome Lebuchoux, from Reech Alternative Investment Management, and Mathieu Rosenbaum, from Ecole Polytechnique, gave an Industrial Course on High-Frequency Trading. There were eight lectures, on M Tu W Th mornings, a tutorial on Wednesday afternoon, and on Friday there was an Industrial Day, with a series of lectures by finance companies in Vancouver.

The topics covered were at the cutting edge of research and of industrial practice. The ongoing financial crisis has moved the focus of financial mathematics away from arbitrage theory and towards the various aspects of risk. This in turn has raised a host of new research problems. The course of professor Bouchard was dedicated to portfolio management under risk constraints, which translates mathematically into stochastic control problems with stochastic targets, which in turn translate into a new class of HJB equations. The course of professor Ekeland focussed on the role of information in price formation, notably in the presence of adverse selection or moral hazard, and showed how these obstacles can be circumvented by new mathematical techniques, pertaining to optimal transportation theory or Malliavin calculus.

The Industrial Course by Lehalle and Rosenbaum was quite unique. It described the way new financial markets have sprung up during the last three years (dark pools) and how trading strategies have adapted to take advantage of the new opportunities. Most of these strategies are proprietary, so there is very little published, but Lehalle and Rosenbaum were able to give an overview of this new field, which is not covered in textbooks or in the academic literature, but which now represents 70% of all trading (and growing) in the US.

In conclusion, the Summer School was on the frontline of theoretical research and of financial practice. New mathematical techniques were described, and new trading were explained. Nowhere in the world did anything remotely similar happen.