UCL SUMMER SCHOOL

QUANTITATIVE FINANCE: MATHS IN INVESTMENT BANKING

Key Information

Module code        ISSU0062
Taught during      Session Two: Monday 22 July - Friday 9 August 2019
Module workload    45 teaching hours plus approximately 100 study hours
Module leader      Dr Riaz Ahmad
Department         Department of Mathematics, Faculty of Mathematical and Physical Sciences
Credit            15 UCL credits, 7.5 ECTS, 4 US
Level              Level 2, second year undergraduate
Pre-requisites     Two years of undergraduate training in maths, physics, engineering or mathematical economics.
Assessment         In-class test (40%), Computational exercise (60%)

Module Overview
Quantitative Finance remains one of the fastest growing areas in modern finance. Alternative names are Financial Engineering, Mathematical Finance or Financial Mathematics. This is an application based course on the mathematical and computational aspects of derivative pricing. It lies at the heart of mathematics, computing, finance and economics. Both theory and numerical techniques will be presented, with computer simulations performed on MS Excel. If you are interested in technical finance and have wondered what Brownian Motion is, or how Monte Carlo methods are used to price options; then this module is precisely what you are looking for – covering Itô Calculus, Black-Scholes world and Monte Carlo simulations. This is not a theorem-proof based course, but all results will be derived.

Week One
● Maths refresher: differential equations and probability theory
● Introduction to the global financial markets and products that are traded in them – asset classes, futures/forwards and options. Fixed income world and bonds
● Modelling stock price returns – Excel based exercise

Week Two
● Binomial Model – no arbitrage and delta hedging; risk-neutrality and risk-neutral probabilities
● Applied Stochastic Calculus – Brownian motion (construction and properties), Itô’s lemma and applications. Models for stocks, interest rates, volatility.

Week Three
● Black-Scholes model – assumptions, equation and famous Nobel prize winning formula.
● Plain vanillas and simple exotics

Please note that this module description is indicative and may be subject to change.
Monte Carlo Method – connection between option prices and simulations.

Module Aims
Students will gain competence and confidence in understanding some of the essential mathematical and numerical techniques, and their practical use in investment banking to price options. These include the mathematical methods and computational finance schemes such as Monte Carlo. To provide international students the unique opportunity to study a very popular yet highly specialised branch of finance in an accessible way, which has a solid foundation in the department of mathematics at UCL. Completion of the module will generate further interest amongst students in the area of technical finance. More importantly students will appreciate that Quantitative Finance does not need to look like Rocket Science!

Teaching Methods
A combination of three methods. Traditional university style maths lecturing on large white boards. Students appreciate the detailed working and steps, as opposed to reading from slides. My lectures are interactive and students are asked questions throughout the sessions. For the finance and products part of the module, these will be slides from my place of full-time employment and based on the Chartered Financial Analyst (CFA) syllabus – this will be particularly attractive as the CFA is a global certification which most practitioners are expected to achieve. For the data analysis and simulations, we will be using computers so having access to a class with PCs will facilitate the teaching.

Learning Outcomes
Upon successful completion of this module, students will:

- Have gained an applied understanding of the global financial markets and some of the types of products that are traded in them
- Feel confident when conversing with those from established economics and finance backgrounds. In particular it will assist with preparation for finance based job interviews as well as graduate applications to business schools.
- Have received a hands on approach to analysing stock price data and inferring statistical properties using computational methods.
- Have formed an understanding of financial calculus and derivative pricing through lectures and problem sheets
- Appreciate the power of simulation methods using the Monte Carlo framework to price a variety of options contracts.

Assessment Methods
- In-class maths based test (40%)
- Computational exercise pricing derivatives in Excel (60%)

Module Leader
Dr Riaz Ahmad works at the Fitch Group and teaches Mathematical Finance; C++ and Python programming for financial engineering applications. He has been training in the financial markets for almost 15 years; in London, New York and the Far East. The range of audiences he has taught include front office professionals and new graduate hires at investment banks. Riaz has been teaching Mathematical and Computational Finance courses at UCL since 2005 to BSc and MSc students. At the MSc, MBA and executive education levels, Riaz has lectured in Mathematical Finance at Oxford University, Lahore University of Management Sciences and Institute of Business Administration (Karachi). He is also fluent in Urdu, Punjabi and Hindi.

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Key Texts

_CFA Level 1 Quants_ (slide pack), Fitch Learning