Congratulations on joining the MSc in Mathematics and Finance at Imperial College London this October. We look forward to welcoming you here and, in the meantime, would like to give you some information about the programme itself and how you can prepare yourself for the course. General information to help you navigate around the College during your first few weeks is available at www.imperial.ac.uk/students/new-students/. The academic content of the MSc in Mathematics and Finance is both highly theoretical and practical, combining technical modules in mathematics (stochastic processes, numerical analysis, statistical methods) as well as more finance-oriented topics (option pricing, algorithmic trading, risk management, interest rate modelling, machine learning). Most of the modules will have some coding component, and a strong knowledge of programming is necessary in order to be awarded the degree. In order to help you prepare as optimally as possible, we recommend the following reading list before the beginning of the programme:

**Computing**

Coding is an essential part of the daily task of a quantitative analyst, and C/C++ have historically been the main languages used in the financial industry. We will teach you both C and C++, but it is highly recommended that you already have some notions beforehand. A good reference to start is

B. Stroustrup (designer of C++), *Programming: Principles and Practice Using C++.*

Aside from C/C++, Python has become one of the most widely used languages in the financial industry. It is an open source, interpreted, high-level, multipurpose and cross-platform programming language. It also allows easy manipulation of data (even with direct imports from Yahoo Finance or Google), which is becoming more and more essential in the Big Data context nowadays. Several modules in the MSc programme use Python, and we strongly recommend you to have a first look at it. Full details about the language itself as well as its installation are available at www.python.org. A good finance-oriented reference is


Finally, on the statistical side, the reference language is R (see The Comprehensive R Archive Network for full details). It is a free programming language implementing a wide variety of statistical tools, including time-series analysis and statistical tests, and has an extensive list of add-on packages for specialised techniques, such as big-data analysis and survival analysis. A good reference to understand its use in finance is the following:

R. Carmona, *Statistical Analysis of Financial Data in R.*

There are of course many other useful programming languages and computing environment (C#, Java, MATLAB, S+), but a large part of the financial industry (banks, hedge funds, regulators,...) seem to now shift towards a combination of C++ for its speed and Python for its ease of use and compatibility, and R for its statistical capabilities.
Mathematics

The Imperial College MSc in Mathematical Finance is both highly theoretical and very practical. The theoretical aspects rely on a strong background in Mathematics, with a particular focus on analysis and, ideally some probability. The main reference for the Analysis background are the following two books:


Rudin’s book should have been covered in your undergraduate courses. Folland’s monograph goes deeper in analysis, covering functional analysis and some elements of measure theory. For background on Probability and Statistics, you should look at


Partial differential equations are fundamental in mathematical finance, and we highly recommend the following book for a review on the topic:


We highly recommend you to familiarise yourself (or refresh your memories) on these topics. Grimmet and Stirzaker’s book contains both standard probability theory (random variables, generating functions, convergence), as well as some essential results—which will be covered in the MSc—on stochastic processes. Some familiarity with standard probability theory concept would definitely be an advantage.

Finance

This is an MSc in Mathematical Finance and, even though the underlying tools of quantitative analysis in banks and hedge funds are highly mathematical, one should not lose track of the surrounding context and objectives. Standard (non-mathematical) book about options derivatives are


If you wish to learn about the history and the making of quantitative finance, we recommend the following novels, which should be read with some pinch of critical mind, as they present the author’s view on the financial industry:

- S. Patterson:*The Quants, the maths geniuses who brought down Wall Street* (Princeton University Press, 2014): history of the largest quantitative hedge funds from their creatins to the 2007-2008 crisis.

Internet also has a lot of information, and the following videos will get you familiar with quantitative finance:

- Quants - The Alchemists of Wall Street.
- Money & Speed: Inside the Black Box.
• An interview with Jim Simons.2
• An interview with Damiano Brigo3: discussion about the situation of quantitative finance today.
• A.E. Khandani, A.W. Lo: What happened to the Quants in August 2007?: detailed account and explanations of the huge losses suffered by many quantitative hedge funds.

The following websites should also be checked regularly:
• Bloomberg is a financial software company providing analytics, equity trading platform, data services, and news to financial companies.
• Financial Times is one of the main newspaper regarding business and economics.

Other activities during the year
Apart from lectures, courseworks and exams, your academic year in Imperial College will be filled with research seminars, weekly meetings with industry partners, as well as regular mini-lectures on specific topics by practitioners.

---
1Marco Avellaneda is a mathematician and a financial consultant.
2Jim Simons is a mathematician (Chern-Simons theory) and the founder of Renaissance, one of the largest hedge funds in the world.
3Damiano Brigo is the co-director of the MSc in Mathematics and Finance at Imperial College London