

## Mathematical Finance/Data Science

### Overview:

The aim of this course is to build the foundations for a non-computer engineer to secure jobs in finance industry. The targeted jobs are quantitative finance and data science. The focus of the course would be on software and analytical skills. Many senior professionals who are currently working in financial industry will be invited as guest lecturers. We have already invited a handful of professionals from Scotiabank, RBC, Canada Pension Plan, Ontario Teachers' Pension Plan, IBM and NEXX consulting, we will invite more senior professionals. Different course subjects will be taught by these individuals. However, basic analytical and programming skills will be taught by NuPhysics' members. At the end of the training, a professional recruiting company, Lussier Search, that is specialized in finance industry will help students to secure internships and jobs. Few of our invited lectures along with Lussier Search will train students with interview skills. We are currently working on securing internships for all students in a financial organization.

### Course context:

Data analysts need to use strong methods to extract quantitative information from large quantities of data. Especially in financial market, there is a strong interest in measuring investment risk using market and economic data. Fundamental of Statistics, Time Series with applications in finance, Model calibration, Data analysis and statistics with applications in financial market, Numerical solutions to ODEs and Machine learning are some typically sought in many finance jobs.

More importantly, most engineers lack software skills. In this course, we put a great emphasis on teaching common software tools that are used in finance industry. Object oriented programming in C++, Linux, Python, R, VBA in excel and parallel program are the main tools that we will cover in the course. Also, specific tools for data science such as Hadoop ecosystem, Hive, Spark or Sqoop will be introduced.

In this course after covering basic statistics, probability, matrix calculation and regression analysis, we aim to discuss more advanced topics including multivariate distribution, VaR, expected shortfall, cointegration and financial risk factor modeling. R will be heavily used in this course to analyze financial data and estimate statistical models. Please see the tentative syllabus in the next page for more information.

The course will be around 120 hours in total that will be taught in 2 month. Students are expected to spend significant amount of time assignments and few large projects that mimics actual project in the finance industry.

## Tentative Syllabus

	Training	Schedule	Hours
<b>Analytical Skills</b>	Fundamental of Statistics, Time Series with applications in finance, Model calibration, Data analysis and statistics with applications in financial market, Numerical solutions to ODEs, (R programming to be self-trained)	Mondays, Wednesdays, Fridays, 2 hours/day	24 hours
	Introduction to Machine learning and available libraries	End of the training on Weekdays	8 Hours
<b>Software Skills</b>	Object oriented programming and UNIX: C++ coding in Linux environment	Mondays, Wednesdays, Fridays, 2 hours/day	30 hours
	Basics of Parallel programming	End of C++ training on Weekdays	2 Hours
	Python	Mondays, Wednesdays, Fridays, 2 hours/day	14 hours
	Advanced Excel training using VBA	End of the training on Weekdays	6 hours
	SQL	End of the training on Weekdays	6 hours
<b>Special Topics</b>	Pricing library, Risk Management, Basel Model, Stress Testing	Weekends	10 hours
	Introduction on big data tools: Hadoop ecosystem, Hive, Spark, Sqoop and NoSql databases, transactional data, clickstream data	Weekends	10 hours
	Interview Skills	Weekends	8 hours
	Networking with professionals	Weekends	N/A