

Automation and Algorithms for Advanced Financial Modelling, Valuation, Risk and Data Analysis

Module D of the CinFM

Course Description

This 3-day course covers areas of financial modelling and data analysis where automation or algorithms are required.

The main aims of the course are: First, to provide an understanding of the many areas where automation is useful, as well as a strong capability to automate tasks as appropriate in participants' own applications. Second, to provide a foundation knowledge of a wide range of concepts or application in advanced finance and data analysis.

The course starts with an introduction to VBA macros, and their uses and benefits in terms of enhancing Excel modelling and overcoming limitation of the pure Excel tabular environment. We apply these to topics in general financial modelling and data analysis, conducting hands-on exercises in advanced sensitivity analysis, dealing with circularities, automation of general tasks in data manipulation, and the creation of user-defined functions for advanced statistical applications.

We then introduce a range of specific advanced topics, including risk assessment using Monte Carlo simulation, the valuation of derivative and options, an introduction to credit risk modelling, as well as some core concepts in machine learning. In each case, we explain the main concepts and conduct hands-on exercises to reinforce these whilst solidifying participants' skills in algorithm conception, development and implementation.

On a stand-alone basis, this course serves to create a widely applicable set of capabilities in the use of automation using the Excel/VBA platform in financial modelling and data analysis, as well as some insight into the more general uses of automation that would often in practice be implemented in non-Excel platforms.

From the perspective of the CinFM, this course module serves to consolidate the skills learned in the other modules and round out the overall capability and knowledge of someone who holds the Advanced Certification in Financial Modelling and Data Analysis.



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Topics Covered

- VBA macros · Benefits, uses · Key steps
- Sensitivity and scenario analysis · GoalSeek · Circular references · Optimisation · Solver
- Data cleaning and manipulation · Automating filters and extraction · Automating Data Refresh · Worksheet consolidation · Worksheet events and changes
- User-defined functions · Advanced statistics · Bespoke statistical calculations
- Risk assessment and management · Probability distributions · Random sampling · Inverse functions · Random walks and Brownian motion · Monte Carlo simulation · Cost budgeting · Time schedule risk · Correlation · Results analysis and control
- Introduction to quantitative finance · Risk-neutral valuation · Binomial trees · Options valuation · Black-Scholes' formulae
- Introduction to credit modelling · Vasicek and Merton formula · Default probabilities · Transition matrices · Portfolio losses · Capital requirements
- Model calibration using optimisation · Multiple regression
- Introduction to machine learning · Conditional probability · Bayesian analysis · Real options · Value of information · Entropy · Cluster analysis · Optimal decision trees and information sequencing · Reinforcement learning

Learning Objectives

- Learn to identify situations where automation is necessary or highly beneficial
- Develop practical skills to create and use macros and user-defined functions
- Enhance capabilities by build macros that deal with the most common situations encountered in financial modelling and data analysis
- Learn about core concepts in risk assessment and the benefits in quantifying risk for decision purposes
- Learn key aspects of Monte Carlo simulation, probability distributions and random sampling
- Gain hands-on experience using simulation in a variety of business and financial contexts
- Gain an understanding of risk-neutral valuation and its applicability
- Learn the core concepts in credit risk
- Conduct hands-on exercises using advanced Excel, VBA macros and user-defined functions for various applications in finance, derivatives and credit
- Reinforce knowledge of advanced statistics
- Learn key concepts in machine learning
- Conduct hands-on exercises using macros to implement some selected core concepts in machine learning
- Develop a solid capability to apply automation across a range of applications in modelling and data analysis