Modelling, Simulation, Optimisation and Machine Learning

Using Microsoft Excel®

Focus on: The Manager ☑ The Specialist ☑ Spotlight Programme ☐ Hands-on Skills ☑

Course Overview

The analysis of numerical information provides everyday insight into matters like risk assessment, corporate finance, production engineering and product quality control. However, the advent of the Internet-of-Things, the consequential growth in Big Data, and the ever-increasing organisational needs to model and predict, mean that many of the analytical opportunities and needs of a modern, high performing company cannot be met using conventional analytical methods alone. More and more companies are wrestling with complex modelling and simulation problems, addressing matters like trying to optimise production systems, to maximise performance efficiency, to minimise operating costs, to mitigate risk, to detect fraud and to predict future behaviour and outcomes.

This course is 100% computer-based and uses Problem-Based Learning to demonstrate how a wide range of highly realistic modelling, simulation, optimisation and prediction problems can be both analysed and solved using Microsoft Excel®. Most people use only a fraction of the true capabilities of Microsoft Excel®; it is a hugely powerful piece of software and this course explores many of its more advanced features and capabilities.

The methods covered include Bayesian models, Newtonian and Artificial Intelligence (AI)-based methods like Genetic Optimisation, Monte Carlo simulations, Markov Models, advanced Scenario and What If analysis, Time Series models, Non-linear Regression, Linear Programming, Multivariate Correlation and the principles of Machine Learning.

Throughout the course delegates are presented with a series of real problems drawn from the widest possible range of applications – they range from healthcare to supply chain logistics, from chemistry to engineering, and from production optimisation to financial risk minimisation. Each problem presents and exemplifies the need for a different modelling, simulation or optimisation approach.

Course Objectives		This Course is Ideal For:	
1	To teach delegates how to solve a wide range of business problems which require modelling, simulation and predictive analytical approaches	✓	Anyone working in a role which requires that they analyse data and make informed decisions from this
2	To show delegates how to implement a wide range of the more common modelling, simulation and predictive analytical methods using Microsoft Excel®	✓	Anyone wishing to improve their analytical skills by mastering the more advanced and extremely powerful features of Microsoft Excel®

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3	To provide delegates with both a conceptual understanding and practical experience of a range of the more common modelling, simulation, optimisation and predictive analytical techniques	✓	Anyone seeking hands-on practical experience of creating a model of a system, using the model to simulate system behaviour, optimising system performance and utilising machine learning to predict future system behaviour.
4	To provide a clear understanding of why the best companies in the world see modelling, simulation, optimisation and predictive analytics as essential to delivering the right quality products and optimised services at the lowest possible costs		

Course Content

Day	Theme	Coverage
1	System Modelling and an Introduction to Simulation	• Introduction to the modelling of systems – *Problem Based Learning activity on an amortising car loan* • Understanding deterministic systems and how to extract models from them – *Problem Based Learning activity on break even analysis for a new business venture* • An introduction to conventional optimisation methods – *Problem Based Learning activity on refinery production optimisation*
2	System Simulation and an Introduction to Optimisation	• Regression analysis as a predictor of future behaviour - *Problem Based Learning activity on the remaining useful lifetime estimation of a radio transmitter* • An introduction to machine learning – *Problem Based Learning activity on estimating the number of Western visitors coming to a city next year* • How to use machine learning to make future predictions – *Problem Based Learning activity on optimising the loading of LNG onto ships in a Gas-to-Liquids plant*
3	More Advanced Optimisation, the Visualisation of Functions and using AI-based Optimisation Methods	• Higher-order functions and multi-variate optimisation problems – *Problem Based Learning activity on the optimisation and visualisation of yield from a batch chemical reactor* • Artificial Intelligence-based Optimisation using Genetic Algorithms – *Problem Based Learning activity on the optimisation of a robot's trajectory (an example application of the classic Travelling Salesperson Problem)*

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4	A Deep Dive into Optimisation Methods and an Introduction to Multi-Objective Optimisations	• The details of Linear, Non-Linear and Genetic Optimisers – *Problem Based Learning activity on the optimisation of increasingly complex mathematical models* • Multi-objective optimisations – *Problem Based Learning activity on a complex supply chain model and optimisation*
5	Modelling of Problems Governed by Binary Logic Decisions, and How to Create and Combine Probability-based Models	• Binary logic-controlled problems (Knapsack Problems) – *Problem Based Learning activity on the minimisation of risk from contractual penalties in a fuel supply company* • An introduction to Monte Carlo Analysis and Markov Chains – *Problem Based Learning activity on the medical staffing and patient experience of a mobile healthcare surgery*

Course Assessment	Certification
Participants will be assessed on: Participation in sessions Completion of exercises & case studies Performance in assessments	Upon successful completion of the course, participants will receive a **Certificate of Successful Completion**, along with a **Transcript of Marks** showing the performance by grade in each element of assessment and overall.

Course Instructor

This speaker for this course is a world-famous professor at a leading UK University, and one of the top 10 world-ranked researchers in the field of signal processing and data analytics.
He has over 35 years of experience in the field of modelling and simulation, and he has made over 1000 peer reviewed publications in this subject area.

