IB3K2-15 Financial Optimisation

24/25

Department
Warwick Business School
Level
Undergraduate Level 3
Module leader
Nalan Gulpinar
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

N/A.

Module web page

Module aims

The module aims to introduce modelling and solving approaches for mathematical programming problems arising in finance. The optimization methods such as linear, integer, dynamic, nonlinear and stochastic programming will be motivated through practical financial decision making problems. The main topics to be covered in Financial Optimisation include asset allocation, portfolio optimisation, risk management, asset/liability cash-flow matching, and option pricing and hedging. A modelling language AMPL using different commercial solvers for financial decision-making problems will be introduced.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Revision (linear algebra, calculus and optimisation).

- Introduction to AMPL: modelling and solving optimization problems.
- Linear programming: dedication and cash flow matching.
- Duality: applications to asset pricing, option pricing and arbitrage detection.
- Quadratic programming: mean-variance portfolio optimization.
- Nonlinear programming: parameter estimation in portfolio optimization, robust assset allocation.
- Modelling with discrete decisions: constructing an index fund.
- Dynamic optimization for fixed-income securities.
- Stochastic programming: asset and liability management, corporate debt management, robust asset allocation.
- Scenario optimization: mean-absolute deviation models, risk management (Conditional Value-at-Risk).

Learning outcomes

By the end of the module, students should be able to:

- Define concepts and optimisation methods commonly used in finance.
- Use a range of techniques to solve typical financial optimisation problems.
- Understand the particular challenges of modelling and solving financial optimisation problems.
- Identify appropriate methods for financial optimisation problems.
- Determine the strengths and weaknesses of different approaches.
- Analyse case studies and model the underlying problems properly.

Indicative reading list

- S. A. Zenios, Practical Financial Optimization: Decision Making for Financial Engineers, John Wiley & Sons, 2008.
- G. Cornuejols and R. Tutuncu, Optimization Methods in Finance, Cambridge University Press, 2007.
- W. T. Ziemba and R. G. Vickson, Stochastic Optimization Models in Finance, World Scientific, 2006.
- G. Cornuejols and R. Tutuncu, Optimization Methods in Finance, Cambridge University Press, 2007.
- F. Fabozzi, P. Kolm, D. Pachamanova, S. Focardi, Robust Portfolio Optimization and Management, John Wiley & Sons, 2007.
- D. G. Luenberger, Investment Science, 2nd Edition, Oxford University Press, 2013.

Subject specific skills

Use AMPL to model decision making problems in finance.
Apply bult-in/add-on solvers to solve optimisation problems.

Transferable skills

Distinguish between different modelling and solution approaches for finance problems.

Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (13%)
Tutorials	10 sessions of 1 hour (13%)
Online learning (independent)	10 sessions of 1 hour (13%)
Private study	48 hours (62%)
Total	78 hours

Private study description

Private Study.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D3

	Weighting	Study time
Quiz Work	10%	7 hours
Quiz work (scores from the nine/ten weekly quizzes would be added up and the percentage of the whole would be given as this score).		
Individual Assignment (15 CATS)	20%	14 hours
The written assessment is based on problem solving. The number of questions will vary from 2 to 4 related to subjects to be covered in the module. Depending on the complexity of real cases and their application areas, each question may have several parts. Accordingly the page limit will vary from 5 to 8 pages. A supplementary document can be used for presenting data, intermediate calculations and/or computer codes if necessary.		
Online Examination	70%	51 hours
Exam		

	Weighting	Study time
~Platforms - AEP		

- Online examination: No Answerbook required

Feedback on assessment

Feedback via my.wbs.

Past exam papers for IB3K2

Availability

Pre-requisites

Students are required to have basic knowledge on modelling and solving linear (and/or integer) programming problems.

To take this module, you must have passed:

- Any of
  - IB104-12 Mathematical Programming I
  - IB207-12 Mathematical Programming II

Courses

This module is Optional for:

- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 4 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 5 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Unusual option for:

- UPHA-L1CA Undergraduate Economics, Psychology and Philosophy
  - Year 2 of L1CA Economics, Psychology and Philosophy
  - Year 3 of L1CA Economics, Psychology and Philosophy
- UPHA-V7ML Undergraduate Philosophy, Politics and Economics
  - Year 3 of V7ML Philosophy, Politics and Economics (Tripartite)
  - Year 3 of V7ML Philosophy, Politics and Economics (Tripartite)
  - Year 3 of V7ML Philosophy, Politics and Economics (Tripartite)

This module is Option list A for:

- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
  - Year 3 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
  - Year 3 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
  - Year 4 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
  - Year 3 of Y602 Mathematics,Operational Research,Stats,Economics
  - Year 3 of Y602 Mathematics,Operational Research,Stats,Economics

This module is Option list B for:

- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
  - Year 3 of GG14 Mathematics and Statistics
  - Year 3 of GG14 Mathematics and Statistics
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)

This module is Option list C for:

- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
  - Year 4 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
- Year 5 of USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated

This module is Option list D for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
  - Year 3 of G30G Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream) Int
  - Year 4 of G30G Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream) Int
- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)

This module is Option list G for:

- UPHA-V7ML Undergraduate Philosophy, Politics and Economics
  - Year 2 of V7ML Philosophy, Politics and Economics (Tripartite)
  - Year 2 of V7ML Philosophy, Politics and Economics (Tripartite)

- Year 2 of V7ML Philosophy, Politics and Economics (Tripartite)