Module Leader

Dr H Jiang [1]

Lecturer

Dr H Jiang

Lab Leader

Dr H Jiang

Timing and Structure

Christmas vacation - dates below; Assessment: Coursework 100% ind project combining spreadsheet modelling, written analysis and a management-style report - details TBA. You may conduct some Excel modelling with fellow students. Michaelmas/Lent Term break.

Prerequisites

All participants are expected to be familiar with probability and statistics at the level of a final year high school or introductory undergraduate course. See the prerequisites document on the course website for details. Participants are also expected to be familiar with basic Excel spreadsheet modelling (see e.g. http://best-excel-tutorial.com/54-basics for a tutorial). The basic Excel functions and tasks that you must know how to use competently are: MAX, AVERAGE, COUNT, IF, SUMPRODUCT; mathematical formulas based on relative and absolute references; creating simple tables; plotting pie, bar, column and line charts.

Aims

The aims of the course are to:

- See below.

Objectives

As specific objectives, by the end of the course students should be able to:

- See below.

Content

- Module Time: 3 full days (9.00am – 5.00pm) on 3rd, 5th, and 7th December 2018.
- Reserve 3rd – 10th December 2018 for TPE25 only.
- Reserve 8th and 10th December 2018 for conducting part I of the course assessment.
- Reserve a compulsory Q&A session for the course assessment at 9am-11am on 10th December 2018.
- It is useful for you to have a Window-based laptop for Excel modelling. If you do not have a laptop, be prepared to stay in Cambridge for a few more days after 10th December 2018 so that you can conduct
Excel modelling in the CJBS Computer Lab.
- The level of mathematical theory may be below the expectation of some CUED students.

This module introduces students to two essential and complementary ways of dealing with future uncertainties. On one hand, we have diversification, the notion that you should "not put all your eggs in one basket", is both intuitive and ubiquitous in modern management. This exemplifies passive risk management. On the other, we have the real options paradigm. This emphasises that future value depends both on unfolding uncertainties, which you cannot control, and the flexibility of your future responses. By investing in research and development projects, for example, companies buy the option to launch a product, which they may or may not exercise, depending on the level of success of the R and D effort and on market conditions at the time of launch. However, flexibility also costs money: R and D expenditure, for example in the biotech industry, can be huge. So how much flexibility shall we build into the system? This is the realm of project design for active risk management. System designers and project managers need tools that help them decide if added flexibility is worth the money. This course provides the students with a mindset and a suite of tools to tackle such problems.

The emphasis is on management and design of technological projects. Examples and case studies will illustrate how theory can be adapted to actual conditions.

Please note that the number of places available to Part IIB Engineers is limited. A ballot will be held if the module looks likely to be oversubscribed. The ballot will take place on the first day of lectures, after which the Teaching Office will be in touch with any unsuccessful applicants to ask them to select another module.

Day 1: Foundations

- Course aims and objectives
- Review of traditional project valuation
- System value is a shape, not a number
- Monte Carlo Simulation
- (Valuing flexibility)

Preparatory reading:

- If you have not seen Net Present Value (NPV) or Discounted Cash Flows before, read Brealey and Meyers, Ch. 2: ‘Present values’

Day 2: Portfolio Thinking

- Diversification
- Hedging
- Trading off risk against return

Preparatory reading:

- www.moneychimp.com/articles/risk/riskintro.htm [2], first five sections (short!) from ‘MPT Introduction’ to ‘Build a Portfolio’.
- Optionally, Brealey and Meyers, Ch. 9: ‘Risk’ [For 8th edition, use Ch. 8]

Day 3: Real Options Analysis

- Flexibility: Intuition behind real options
- Lattice valuations
Preparatory reading:

- Brealey and Meyers, Ch. 10: ‘Project Analysis’, Ch. 20: ‘Understanding Options’ [For the 9th edition, use Ch. 11, Ch. 21]
- de Neufville and Scholtes (2011), Ch. I: ‘High Level Overview’ (pp. 1-39)

Further notes

Required software

The basic modelling tool will be Microsoft Excel. Essential add-ins include Analysis ToolPak and Solver, both of which come with Excel but may require the Excel installation disks, and @Risk, which will be distributed to you.

Coursework

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<tr>
<th>Coursework</th>
<th>Format</th>
<th>Due date &amp; marks</th>
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<tbody>
<tr>
<td>100% individual project combining spreadsheet modelling, written analysis and a management-style report. The coursework consists of two parts: Task I (65%-70%) and Task II (30%-35%).</td>
<td>Individually Assessed Answer Sheet, Presentation Document and Excel Files anonymously marked</td>
<td>The coursework out during Michaelmas/Lent term break and will be submitted right before the beginning of the Lent term in January 2019. Marks will be available in three-four weeks after the submission date.</td>
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<td>Task I contains a number of subtasks, in which students are asked to conduct intensive Excel modelling, to answer questions, to provide analysis, and to give intuitive business interpretations.</td>
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<td>Task II is a short presentation and is assessed by a set of criteria: intuition (business implication), prioritising information (structure), clarity and use of visual aids such as charts and graphs, and language.</td>
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or


*N.B. For Brealey and Myers, any edition from 6th ed. onwards is fine.*

*Decision Making with Insight*. Belmont, CA: Brooks/Cole


**Examination Guidelines**

Please refer to [Form & conduct of the examinations](#) [6].

**UK-SPEC**

The [UK Standard for Professional Engineering Competence (UK-SPEC)](#) [7] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the *Accreditation of Higher Education Programmes* (AHEP) document [8] which sets out the standard for degree accreditation.

The [Output Standards Matrices](#) [9] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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