ST234-10 Games and Decisions

26/27

Department
Statistics
Level
Undergraduate Level 2
Module leader
Samuel Touchard
Credit value
10
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module is available for students on a course where it is a listed option and as an Unusual Option for students who have the required background as covered in the pre-requisite modules.

Pre-requisites:
ST119 Probability 2 OR ST120 Introduction to Probability.

Module web page

Module aims

Throughout their history, game and decision theories have used ideas from mathematics and probability to help understand, explain, and direct human behaviour. Questions explored in the module include: What is probability? A set of axioms, a relative amount of outcomes, a belief? And how can this be elicited? What guides decision-making when outcomes are uncertain? What happens when information is only partial or ambiguous? What if there is more than one person, or how are decisions made in games?

Answers will be embedded into theories and illustrated with practical examples from a wide range of applications including engineering, economics, finance, business, sciences, psychology and medicine.

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.

This module introduces the use of decision theory for making rational decisions in the face of uncertainty

1. Introduction. Motivating examples. What is decision theory?
2. Normative decision theory: elicitation and calculation, actions and outcomes, games.
3. Review of Probability. Frequentist vs subjective.
4. Frequentist approach to assigning probabilities to real-world events as long-run frequencies.
5. Elicitation. Calibration and coherence.
6. Decisions. Decision spaces and decision rules.
7. Decision trees.
8. Preferences. Axioms of preference, utility functions, risk.
9. Normative game theory: Games, payoffs.
10. Separability, dominance, iterated strict domination.
11. Mixed and pure strategies. Von Neumann minimax theorem.
12. Pareto optimality.
13. Nash equilibrium, Nash solvable.

Learning outcomes

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

- analyse and compare the underlying mathematical and philosophical basis for a number of alternative approaches to probability including subjective probability.
- describe the main features of normative decision theory and analyse models of decision-making in practical examples from a wide range of applications.
- use mathematical game theory to analyse mathematical toy example games as well as to understand the limits of game theory when used on 'real world' scenarios.
- communicate solutions to problems accurately with structured and coherent arguments.

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

- Demonstrate knowledge of key mathematical and statistical concepts, both explicitly and by applying them to the solution of mathematical problems.
- Create structured and coherent arguments communicating them in written form.
- Analyse problems, abstracting their essential information formulating them using appropriate

mathematical language to facilitate their solution.

Transferable skills

- Written communication skills: Students develop probabilistic arguments that require precise and unambiguous communication in the manner and style expected in mathematical sciences.
- Verbal communication skills: Students are encouraged to discuss and debate formative assessment and lecture material within small-group tutorials sessions. Students can continually discuss specific aspects of the module with the module leader. This is facilitated by statistics staff office hours.
- Problem-solving skills: The module requires students to solve problems with complex solutions and this requirement is embedded in the module's assessment.

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (20%)
Private study	63 hours (63%)
Assessment	17 hours (17%)
Total	100 hours

Private study description

Weekly revision of lecture notes and materials, wider reading, working on practice exercises and preparing for examination.

Other activity description

Revision support.

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 D1

	Weighting	Study time	Eligible for self-certification
Computer-based assessments	10%	15 hours	No
A set of small computer based assessments which will take place during the term that the module is delivered.			
Centrally-timetabled examination (On-campus)	90%	2 hours	No
You will be required to answer all questions on this examination paper. The study time noted refers to the length of the exam in hours.			

- Students may use a calculator
- Answerbook Pink (12 page)

Assessment group R1

	Weighting	Study time	Eligible for self-certification
Examination	100%		No
You will be required to answer all questions on this examination paper.			

- Answerbook Pink (12 page)
- Students may use a calculator

Feedback on assessment

Computer-based assessment provides immediate feedback after the submission deadline. Cohort-level feedback will be available on the exam.

Students are actively encouraged to make use of office hours to build up their understanding, and to view all their interactions with lecturers and class tutors as feedback.

Past exam papers for ST234

Availability

Post-requisite modules

If you pass this module, you can take:

- EC301-15 Mathematical Economics 2: Dynamics, Uncertainty & Asymmetrical Information

Courses

This module is Optional for:

- USTA-G302 Undergraduate Data Science
  - Year 2 of G302 Data Science
  - Year 2 of G302 Data Science
- Year 2 of USTA-G304 Undergraduate Data Science (MSci)
- UCSA-G4G1 Undergraduate Discrete Mathematics
  - Year 2 of G4G1 Discrete Mathematics
  - Year 2 of G4G1 Discrete Mathematics
- UCSA-G4G3 Undergraduate Discrete Mathematics
  - Year 2 of G4G1 Discrete Mathematics
  - Year 2 of G4G3 Discrete Mathematics
- Year 3 of UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
- USTA-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 2 of G30A Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream)
  - Year 2 of G30J Master of Maths, Op.Res, Stats & Economics (Data Analysis Stream)
  - Year 2 of G30B Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream)
  - Year 2 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
  - Year 2 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
  - Year 2 of G30D Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
  - Year 2 of G300 Mathematics, Operational Research, Statistics and Economics
  - Year 2 of G300 Mathematics, Operational Research, Statistics and Economics
  - Year 2 of G300 Mathematics, Operational Research, Statistics and Economics
- UMAA-G100 Undergraduate Mathematics (BSc)
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 2 of G100 Mathematics
  - Year 2 of G103 Mathematics (MMath)
  - Year 2 of G103 Mathematics (MMath)
  - Year 3 of G100 Mathematics

    - Year 3 of G103 Mathematics (MMath)
    - Year 3 of G103 Mathematics (MMath)
- UMAA-G106 Undergraduate Mathematics (MMath) with Study in Europe
    - Year 2 of G106 Mathematics (MMath) with Study in Europe
    - Year 3 of G106 Mathematics (MMath) with Study in Europe
- Year 2 of UMAA-G1NC Undergraduate Mathematics and Business Studies
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
    - Year 2 of GG14 Mathematics and Statistics
    - Year 2 of GG14 Mathematics and Statistics
- Year 4 of UMAA-G101 Undergraduate Mathematics with Intercalated Year
- USTA-Y602 Undergraduate Mathematics,Operational Research,Statistics and Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics
    - Year 2 of Y602 Mathematics,Operational Research,Stats,Economics