

# ST222-12 Games, Decisions and Behaviour

**22/23**

**Department**

Statistics

**Level**

Undergraduate Level 2

**Module leader**

Samuel Touchard

**Credit value**

12

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

This module runs in Term 1 and is available for students on a course where it is a listed option and as an Unusual Option for students who have taken the pre-requisites.

Pre-requisites: ST115 Introduction to Probability OR ST111 Probability A.

[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? How do people perceive and evaluate probabilities and risks? Are they acting rationally or not? Which heuristics and biases come into play? Under which conditions do they occur, and how do they impact decision-making? Answer 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.

### 1. Introduction and motivation

- Examples covering all parts of the module
- Some inspiring questions
- Overview

### 1. Concepts of probability

- Axiomatic
- Propensity interpretation
- Frequentist interpretation
- Subjective probability
- Descriptive aspects of probability (empirically demonstrated aspects of perception of randomness and risk)

### 1. Normative theory for decision-making under uncertainty and ambiguity

- Preferences
- Elicitation (with explicit examples who this can be done via interviews, expert opinions etc)
- Expected utility theory

### 1. Descriptive theory for decision-making under uncertainty and ambiguity

- Empirically demonstrated confirmation of and deviation from normative theory: e.g. representativeness heuristic, anchoring, conjunction fallacy, availability heuristics, hindsight bias, ambiguity effect (Allais, Ellsberg paradox)
- Models: prospect theory (Kahneman & Tversky), bounded rationality: the adaptive toolbox (Gigerenzer & Selten)
- Discussion: model comparison, feasibility of reduction of non-normative behaviour through training

### 1. Games

- Combinatorial games (winning strategy, examples, unsolved examples)
- Zero-sum games (von Neumann's Minimax theorem, separability, domination, symmetry)
- General-sum games (Nash equilibrium, evolutionary games, signaling and asymmetric information)
- Cooperative games (Shapley value)

## Learning outcomes

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

- Describe the mathematical and philosophical basis for a number of alternative approaches to probability including subjective probability.
- Apply normative decision theory to model decision making in practical examples from a range of applications.
- Understand the foundations of and motivation for descriptive decision theory; describe and model deviations from normative theory in examples.
- Describe the elements of mathematical game theory, apply these to simple mathematical example games and suitable real world scenarios.

## Indicative reading list

[View reading list on Talis Aspire](#)

## Subject specific skills

TBC

## Transferable skills

TBC

## Study

### Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (23%)	2 sessions of 1 hour
Private study	90 hours (68%)	
Assessment	12 hours (9%)	
Total	132 hours	

### Private study description

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

### 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 D2

	<b>Weighting</b>	<b>Study time</b>
Multiple Choice Quiz 1	2%	3 hours
A multiple choice quiz which will take place during the term that the module is delivered.		
Multiple Choice Quiz 2	3%	3 hours
A multiple choice quiz which will take place during the term that the module is delivered.		
Multiple Choice Quiz 3	2%	3 hours
A multiple choice quiz which will take place during the term that the module is delivered.		
Multiple Choice Quiz 4	3%	3 hours
A multiple choice quiz which will take place during the term that the module is delivered.		
In-person Examination	90%	
The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.		

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

## Assessment group R2

	<b>Weighting</b>	<b>Study time</b>
In-person Examination - Resit	100%	
The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.		

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- Answerbook Pink (12 page)

## Feedback on assessment

Solutions and cohort level feedback will be provided for the examination.

[Past exam papers for ST222](#)

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## Availability

## Courses

This module is Optional for:

- Year 2 of USTA-G302 Undergraduate Data Science
- Year 2 of USTA-G304 Undergraduate Data Science (MSci)
- Year 2 of USTA-G305 Undergraduate Data Science (MSci) (with Intercalated Year)
- Year 2 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- Year 2 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)

This module is Option list A for:

- Year 2 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
- Year 2 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics

This module is Option list B for:

- Year 2 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 2 of UCSA-G4G3 Undergraduate Discrete Mathematics
- UMAA-G105 Undergraduate Master of Mathematics (with Intercalated Year)
  - Year 2 of G105 Mathematics (MMath) with Intercalated Year
  - Year 4 of G105 Mathematics (MMath) with Intercalated Year
- UMAA-G100 Undergraduate Mathematics (BSc)
  - Year 2 of G100 Mathematics
  - Year 2 of G100 Mathematics
  - Year 3 of G100 Mathematics
  - Year 3 of G100 Mathematics
- UMAA-G103 Undergraduate Mathematics (MMath)
  - Year 2 of G103 Mathematics (MMath)
  - Year 2 of G103 Mathematics (MMath)
  - 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-G1N2 Undergraduate Mathematics and Business Studies (with Intercalated Year)
- Year 2 of UMAA-GL11 Undergraduate Mathematics and Economics
- Year 2 of UECA-GL12 Undergraduate Mathematics and Economics (with Intercalated Year)
- UMAA-G101 Undergraduate Mathematics with Intercalated Year
  - Year 2 of G101 Mathematics with Intercalated Year
  - Year 4 of G101 Mathematics with Intercalated Year