IB3J3-15 Mathematical Game Theory: Combinatorial and Search Games

26/27

Department
Warwick Business School
Level
Undergraduate Level 3
Module leader
Richard White
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This is an elective module available for students on the MORSE or MMORSE joint degree or Non-WBS students on mathematical courses*. To apply for this module, log in to my.wbs.ac.uk using your normal IT login details and apply via the my.wbs module application system. Once you've secured a place on my.wbs you should apply via your home department's usual process, which usually takes place via eVision. Note that you do not require the module leader's permission to study a WBS module, so please do not contact them to request it.

*Please note that while there are no formal pre-requisites for this module it is strongly recommended that students have a strong mathematical background and are on an appropriate/relevant course (e.g. Mathematics, Economics or Computer Science). If in doubt, please contact the module leader.

Module web page

Module aims

The module presents game theory from a mathematical perspective, with rigorous proofs and

connections with other branches of mathematics.

By completing this module, students will have a firm grasp of search theory and in particular the antagonistic version known as search games. They should be able to identify to problems that could be modelled by this theory, and to some extent have a start on how to attack such models. They should be able to extend our use of dynamic programming in search problems to other areas. Their ability to prove general theorems should be enhanced.

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.

Syllabus(by weeks):

1. The Game of Nim
2. Combinatorial Games I
3. Combinatorial Games II
4. Game of Hex and variations
5. Proof of Brouwer Fixed-Point Theorem using Hex
6. Search Theory: Introduction
7. Search Games I: Immobile Hider on a Tree
8. Search Games II: Immobile Hider on Weakly Eulerian Network
9. Search Games III: Mazes
10. Review
    Note: these topics have been chosen so that there is virtually no overlap with courses in game.

Learning outcomes

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

- Understand game theoretic models and methods used to analyse them.
- Critically assess the relevance and limitations of the methods.
- Determine which real world problems are game theoretic and which are not.

Indicative reading list

Reading lists can be found in Talis

Subject specific skills

Use game theory to analyse conflict situations.
Suggest strategies appropriate to the problems.

Transferable skills

Formulate business and other game problems in a structured form (trees, matrices) suited to game theoretic analysis. Apply these techniques to the solution of the problems.
Interpret the results of the solution techniques in terms of the original problems faced by the players.
Apply search algorithms to find objects and efficiency.

Study

Study time

Type	Required
Lectures	10 sessions of 3 hours (20%)
Private study	48 hours (32%)
Assessment	72 hours (48%)
Total	150 hours

Private study description

No private study requirements defined for this module.

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 B4

Assessment component	Weighting	Study time	Eligible for self-certification
Centrally-timetabled examination (On-campus) Exam	100%	72 hours	No

---

	Weighting	Study time	Eligible for self-certification

- Answerbook Pink (12 page)

Reassessment component is the same

Feedback on assessment

Each week there will be a problem set and these will be marked (possibly not all questions) and returned to students. Depending\r\non the precise hourly schedule, the assignment will be handed in prior to the lecture/problem session and returned in the\r\nlecture/problem session; or possibly handed in one week and returned the next week in the lecture/problem session. These\r\ngrades are meant only to provide students with feedback as to their understanding of the course and will not be part of the final\r\nassessment.\r\n

Past exam papers for IB3J3

Availability

Pre-requisites

Please note that while there are no formal pre-requisites for this module it is strongly recommended that students have a strong mathematical background and are on an appropriate/relevant course (e.g. Mathematics, Economics or Computer Science). If in doubt, please contact the module leader.

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-G300 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics
  - Year 3 of G30A Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream)
  - Year 3 of G30J Master of Maths, Op.Res, Stats & Economics (Data Analysis Stream)
  - Year 3 of G30B Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream)

    - Year 3 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
    - Year 3 of G30C Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream)
    - Year 3 of G30D Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
    - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
    - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
    - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
- USTA-G301 Undergraduate Master of Mathematics,Operational Research,Statistics and Economics (with Intercalated
    - Year 4 of G301 BSc Master of Mathematics, Operational Research, Statistcs and Economics (with Intercalated Year)
    - Year 4 of G30E Master of Maths, Op.Res, Stats & Economics (Actuarial and Financial Mathematics Stream) Int
    - Year 4 of G30K Master of Maths, Op.Res, Stats & Economics (Data Analysis Stream) Int
    - Year 4 of G30F Master of Maths, Op.Res, Stats & Economics (Econometrics and Mathematical Economics Stream) Int
    - Year 4 of G30G Master of Maths, Op.Res, Stats & Economics (Operational Research and Statistics Stream) Int
    - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
- 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
- Year 4 of USTA-Y603 Undergraduate Mathematics,Operational Research,Statistics,Economics (with Intercalated Year)