CS929-15 Algorithmic Game Theory

21/22

Department
Computer Science
Level
Taught Postgraduate Level
Module leader
Marcin Jurdzinski
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The focus of the module is on algorithmic and computational complexity aspects of game-theoretic models.

Module aims

To familiarise students with formal methods of strategic interaction, as studied in game theory. One of the aims will be to give a flavour of current research and most recent advances in the field of algorithmic game theory.

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.

Game models: Strategic form, extensive form, games of incomplete information (eg auctions), succinct representations, market equilibria, network games, co-operative games;
Solution concepts: Nash equilibria, subgame perfection, correlated equilibria, Bayesian equilibria, core and Shapley value;
Quality of equilibria: Price of anarchy, price of stability, fairness;

Finding equilibria: Linear programming algorithms, Lemke-Howson algorithm, finding all equilibria;
Complexity results: Efficient algorithms, NP-completeness of decision problems relating to set of equilibria, PPAD-completeness;
Some parts of the module will be research-led, so some topics will vary from year to year.

Learning outcomes

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

- Understand a variety of advanced algorithmic techniques and complexity results for computing game-theoretic solution concepts (equilibria).
- Apply solution concepts, algorithms, and complexity results to unseen games that are variants of known examples.
- Understand the state of the art in some areas of algorithmic research, including new developments and open problems.
- Understand the fundamental concepts of non-cooperative and co-operative game theory, in particular standard game models and solution concepts.

Indicative reading list

Osborne and Rubinstein, A Course in Game Theory;
Roughgarden, Selfish Routing and the Price of Anarchy;
Nisan, Roughgarden, Tardos and Vazirani (eds), Algorithmic Game Theory;
Selected research papers.

Subject specific skills

Advanced algorithmic techniques;

Transferable skills

Problem Solving;
Communication skills

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Seminars	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 hours

Private study description

private reading and revision

Costs

No further costs have been identified for this module.

Assessment

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

Students can register for this module without taking any assessment.

Assessment group D1

	Weighting	Study time	Eligible for self-certification
Coursework 1 question sheet 1 - peer assessed.	5%		Yes (waive)
coursework 2 question sheet	15%		Yes (extension)
In-person Examination CS929 examination	80%		No

- Answerbook Gold (24 page)

Assessment group R1

	Weighting	Study time	Eligible for self-certification
In-person Examination - Resit CS929 resit paper	100%		No

- Answerbook Gold (24 page)

Feedback on assessment

Written comments and marks.

Past exam papers for CS929

Availability

Pre-requisites

Students must have studied the material in CS260 or equivalent relevant content.

Courses

This module is Optional for:

- Year 1 of TCSA-G5PD Postgraduate Taught Computer Science
- Year 1 of TCSA-G5PA Postgraduate Taught Data Analytics
- Year 1 of TMAA-G1PF Postgraduate Taught Mathematics of Systems