MA9M2-15 Topics in Combinatorics

26/27

Department
Warwick Mathematics Institute
Level
Research Postgraduate Level
Module leader
Rigoberto Zelada
Credit value
15
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This is a topics course, whose specific content will vary from year to year to address material of particular interest in the current year. The general aim is to present some selected topics and methods of importance in modern combinatorics and graph theory, especially those that also may be of general significance and have potential applications to other fields.

Module aims

The module generally aims to give students an overview of selected areas of combinatorics and graph theory at an advanced level.

As an example , the module will aim to concentrate on the emerging theory of the limits of discrete structures that provides a powerful and systematic way of applying the tools of measure theory, probability, functional analysis, algebra and logic to studying finite discrete structures. This connection has also been fruitful in applying combinatorial ideas and methods to other areas, so PhD students working in other fields may also benefit from the module.

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 in 2021-22 will concentrate on the emerging theory of the limits of discrete structures which, besides of being of independent interest, builds a 2-way bridge connecting combinatorics to other fields such as measure theory, probability, functional analysis, algebra, etc. The main areas will be

- graph homomorphisms and connection matrices
- graphons as limits of dense graphs, including graphon versions of the Graph Regularity, Removal and (Inverse) Counting Lemmas, finite forcibility
- flag algebras
- measure-preserving systems as limits of bounded degree graphs, including the basics of Borel graphs, various notions of graph convergence (local, local-global, convergence on right), connections to LOCAL algorithms, group actions and statistical physics
- analytic limits of other discrete structures (such as hypergraphs, permutations, etc)
- applications to
  o extremal graph theory
  o quasi-randomness in combinatorics
  o large deviation principles for various random graph models
  o property testing and parameter estimation in computer science

Learning outcomes

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

- By taking this module, PhD students will be exposed to some important developments in combinatorics and graph theory including key open problems, acquire the background and understanding needed in order to be able to read research papers on the covered topics, and be prepared to conduct their own research in these areas.

Indicative reading list

Reading lists can be found in Talis

Subject specific skills

Transferable skills: by default – nothing to if happy with this

- sourcing research material
- prioritising and summarising relevant information
- absorbing and organizing information
- presentation skills (both oral and written)

Transferable skills

- sourcing research material
- prioritising and summarising relevant information
- absorbing and organizing information
- presentation skills (both oral and written)

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (100%)
Total	30 hours

Private study description

Review lectured material.
Review lectured material.
Source and prioritise material for project. Write essay.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B

Assessment component	Weighting	Study time	Eligible for self-certification
Oral examination	100%		No

An oral exam involving a presentation by the student, followed by questions from the panel (2 members of the department)

Reassessment component is the same

Feedback on assessment

Students will receive feedback from the course instructor after the oral exam, to cover also areas

like presentation skills and use of technologies (or blackboard)

Past exam papers for MA9M2

Availability

There is currently no information about the courses for which this module is core or optional.