Combinatorics

At Birmingham, research in combinatorics is concentrated on graph theory. Graphs are very simple mathematical structures, but give rise to incredibly complex problems, that are often beyond the capacity of current computers to solve. They are used to model social networks - the vertices of a graph represent people and edges between them represent mutual acquaintances - as well as networks and structures in biology, communications, computer science, and genetics. The main research interests of the combinatorics group in Birmingham lie in extremal and probabilistic graph theory, as well random discrete structures and algorithms.

The research interests of the members of the group are given below.

Open all sections

Professor Daniela Kühn

Mason Chair of Mathematics

Daniela's research interests lie in Extremal and Probabilistic Combinatorics, in particular in Extremal Graph Theory, hypergraphs and random structures.

Recently she used probabilistic methods to solve several problems on Hamilton cycles in graphs and digraphs as well as generalized matching problems.

Profile - Professor Daniela Kühn

Professor Deryk Osthus

Professor in Graph Theory

The main research area of Deryk Osthus is Combinatorics. He currently works on random graphs, randomized algorithms, Ramsey theory and extremal graph theory. The problems studied are often computationally intractable.

So a successful approach has been to find sufficient conditions which ensure some desired structure or property. He has proved numerous results of this kind for Hamilton cycles and other spanning substructures.

Profile - Professor Deryk Osthus

Dr Nikolaos Fountoulakis

Lecturer

Nikolaos' research interests are mainly related to the area of random discrete structures, the concept of pseudorandomness and its applications to extremal combinatorics as well as algorithms for information flow on networks.

The current focus of his research is on the analysis of graph-theoretic models for real-world networks. From this perspective, his current research has to do with random geometric graphs on spaces of negative curvature, exploring them as a candidate model for social networks.

Profile - Dr Nikolaos Fountoulakis

Dr Richard Mycroft

Lecturer

Richard's research interests lie in the field of Extremal Graph Theory. A significant area of research in this field is to determine the existence of a fixed large or spanning subgraph within a graph, directed graph or hypergraph.

For example, Richard's recent work includes the use of a randomised embedding algorithm to prove Sumner's Universal Tournament Conjecture for large tournaments. This states (loosely) that any sufficiently large tournament contains any tree on roughly half the number of vertices.

More recently his focus has been on finding perfect matchings and packings in hypergraphs.

Profile - Dr Richard Mycroft

Dr Dan Hefetz

The main research area of Dan Hefetz is Combinatorics. He has worked on random and pseudo-random graphs, extremal graph theory, graph labelling (mostly via algebraic methods) and positional games.

For example (jointly with S. Ben-Shimon, A. Ferber and M. Krivelevich), he recently found the hitting time for the property of being Maker's win in the Hamilton cycle game on the edge set of the binomial random graph. This result generalises some classical results from the theory of random graphs and proves a conjecture of Stojaković and Szabó.

Profile - Dr Dan Hefetz

Dr Andrew Treglown

Andrew's primary research interests lie in extremal and probabilistic graph theory as well as in Ramsey theory.

Recently Andrew has been working on problems concerning graph decompositions including the 1-factorization conjecture. With his coauthors, he solved a classical Ramsey problem of Goodman concerning the number of monochromatic triangles in three-coloured graphs. Andrew has also worked on a number of embedding problems in the directed graph and hypergraph setting.

Profile - Dr Andrew Treglown

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