

Course content for MT5454, Combinatorics

Prerequisites:

An undergraduate course in discrete mathematics

Aims:

To introduce some standard techniques and concepts of combinatorics, including methods of counting including the principle of inclusion and exclusion; generating functions; probabilistic methods; permutations, Ramsey theory.

Learning outcomes:

1. Perform simple calculations with generating functions;
2. Understand Ramsey numbers and calculate upper and lower bounds for these (where practical);
3. Calculate sets by inclusion and exclusion and understand the applications to number theory;
4. Use simple probabilistic tools for solving combinatorial problems.
5. Demonstrate independent learning skills

Course content:

Enumeration: Binomial identities. The Principle of Inclusion-Exclusion with applications to

number theory. Rook polynomials.

Generating functions: Linear recursion. Power series and ordinary generating functions.

Singularities.

Ramsey Theory: Monochromatic subsets, Ramsey numbers and Ramsey's Theorem.

Probabilistic methods: First-moment method, Lovász local lemma.