Topological Methods in Combinatorics CO739
Fall 2022

This course will address various topics and results in which theorems, definitions and intuition from topology have had important and sometimes surprising applications to combinatorial problems. Many of the applications we will study can be formulated as questions about graphs, hypergraphs, or related structures, including independent sets, colouring and partitioning in graphs and hypergraphs, transversals in graphs and intervals, and matchings in hypergraphs. Topological tools and notions used include simplicial complexes, topological connectedness, Brouwer's theorem and related results (e.g. Sperner's Lemma, Scarf's Lemma), and Borsuk's Theorem and related results (Tucker's Lemma, Ky Fan's Lemma).

There is no required textbook for this course.

Basic knowledge of elementary graph theory will be assumed, such as the material covered in CO342. Recommended reading for this background material can be found in Sections 1.1–1.7, 2.1–2.2, 3.1 and 3.3, and 4.1–4.4 of Diestel's textbook "Graph Theory". A copy can be found at
http://diestel-graph-theory.com

In addition, a knowledge of basic metric space topology will be assumed, such as can be found in any topology textbook (e.g. Munkres Topology, Chapter 2).