Algebraic Topology (M24)

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Algebraic Topology permeates modern pure mathematics and theoretical physics. This course will focus on (co)homology, with an emphasis on applications to the topology of manifolds. We will cover singular homology and cohomology and its main calculational devices (homotopy invariance, Mayer–Vietoris, relative homology and excision), products in cohomology, the Künneth theorem, vector bundles and the Thom Isomorphism theorem, and the cohomology of manifolds up to Poincaré duality.

Pre-requisites

Basic topology: topological spaces, compactness and connectedness, at the level of Sutherland's book. The course will not assume any knowledge of Algebraic Topology, but will go quite fast in order to reach more interesting material, so some previous exposure to simplicial homology or the fundamental group would be helpful. The Part III Differential Geometry course will also contain useful, relevant material.

Hatcher's book is especially recommended for the course, but there are many other suitable texts.

Literature

1. Hatcher, A. *Algebraic Topology.* Cambridge Univ. Press, 2002.
2. May, P. *A concise course in algebraic topology.* Univ. of Chicago Press, 1999.
3. Sutherland, W. *Introduction to metric and topological spaces.* Oxford Univ. Press, 1999.

Additional support

The course will emphasise examples and computations; it will be accompanied by four question sheets with associated Examples Classes, which will again involve applying the general theory to do explicit calculations and solve geometric problems. There will be a one-hour revision class in the Easter term.