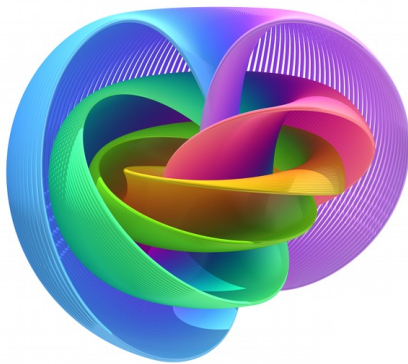# AS.110.360.13 - Hitchhiker's Guide to Algebraic Topology

This is a 'fun' exploratory course meant to expose students to the mysterious world of algebraic topology. Topology studies 'shapes' of objects and algebraic topology attempts to describe these shapes using algebraic data. Apart from being of immense mathematical importance, the language of topology has also found several applications in physics[1], computer graphics and very recently in data analysis.

Some of the topics covered in this course will be: topological properties of surfaces, topology of sets, non-orientable surfaces, simplicial complexes, knots and their invariants, 'proofs' by pictures, cutting and pasting methods, metric spaces, etc.

We'll try to answer questions like, what does it mean for surfaces to have only one side? How to describe spheres in higher dimensions? How to tell if a knot can be untangled without breaking? What is the meaning of life, the universe and everything?

Prerequisites

The course is inevitably abstract and would rely on Set theory. As such, students are required to have taken some course introducing them to the language of sets, such as, Discrete Maths, Mathematical Logic, Linear Algebra, any honors maths course, etc.

Text

The internet has been around for more than two decades now and has evolved into an intricate beast. We'll rely on online resources for most of the course. In addition, I will be posting course notes and problem sets daily.

However, if like me you prefer reading books, I'd recommend the following texts:
Alice's Adventures in Wonderland by Lewis Caroll
What is Mathematics? by Herbert Robbins and Richard Courant
Topology by Munkres

Grading

This is a pass-fail course. The first hour everyday will be a flipped classroom where students are required to present either solutions to problems from problem sets or interesting things that they've read by themselves or have been assigned in class. Class participation is mandatory.

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[1] The 2016 Nobel prize in Physics was awarded for the discovery of topological phases of matter (which I know nothing about)

Image credits: Niles Johnson