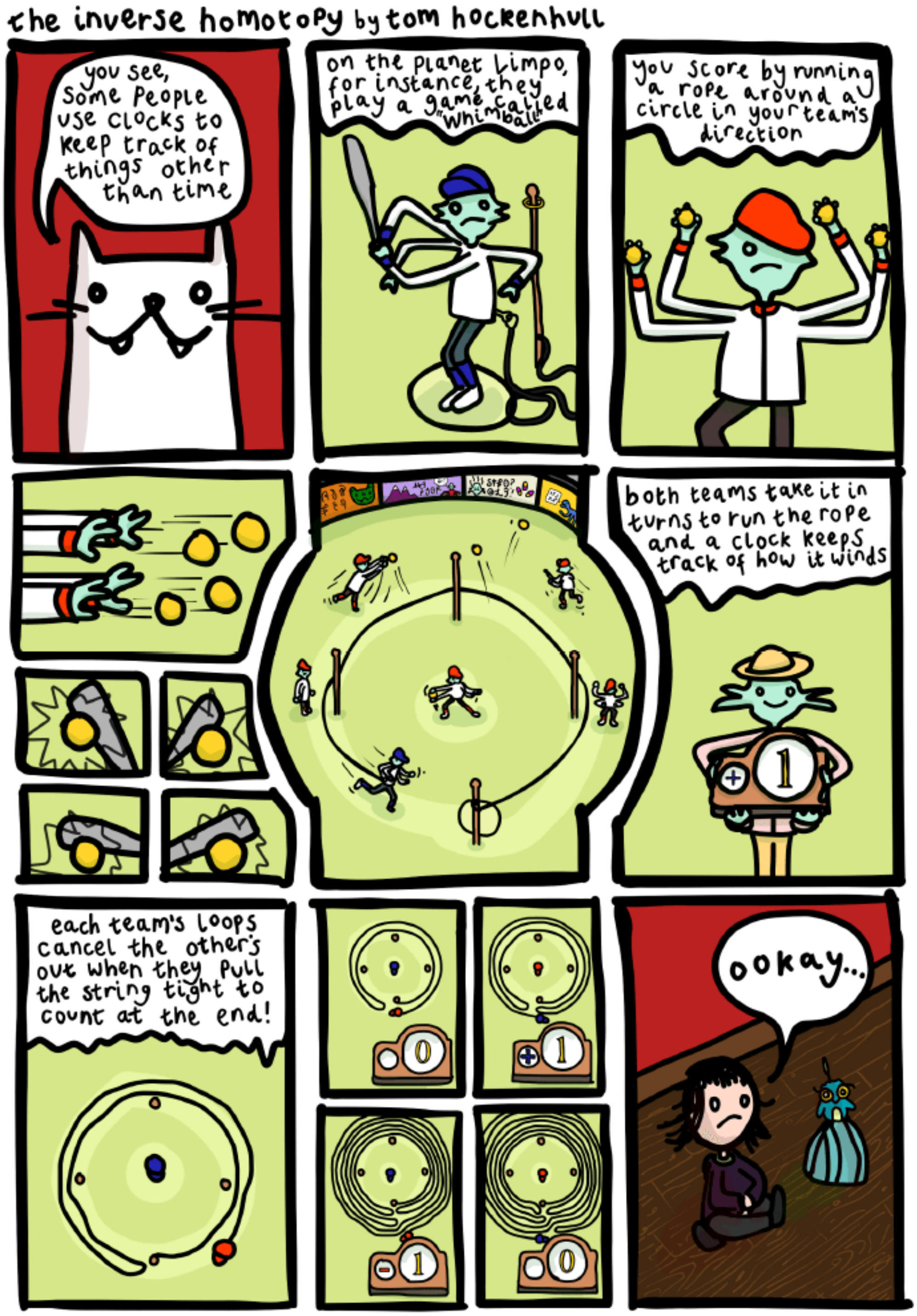

Algebraic Topology

[Math 427/527](https://www.math.ubc.ca/~liam/Math527/)

Winter 2020

This course covers some essential elements of algebraic topology. This will be covered, very broadly, in three parts:

Part 1: Homology

Part 2: Cohomology

Part 3: Selected topics drawing on duality, infinite cyclic covers, characteristic classes

Please note that Math 426 (or similar) is an essential prerequisite. In particular, familiarity with the fundamental group will be assumed.

The image on the right was borrowed from *The Inverse Homotopy* by Tom Hockenhull (with permission); read the entire comic strip here.

- **Instructor**
  Liam Watson
  liam(at)math(dot)ubc(dot)ca
  Office hours TBA in Mathematics 219.

- **Where, when...**
  The class meets Wednesdays and Fridays from 8:35 to 9:50 in Math 203.

- **Evaluation**
  Your final grade will be calculated according to:
  Homework (40%)
  Final (60%)

- **Suggested references**
  Algebraic Topology by Allen Hatcher, available here.
  Basic Category Theory by Tom Leinster, available here.

  A word about supporting material for the course: The references listed above have been designated as *optional*, but **this does not mean that seeking supporting material for the course is not required**. There are many great references for topology, and it is up to you to find the materials you need to complement the lectures and succeed in the course. This search may be done in consultation with me; I am more than happy to help. I will endeavour to provide clear notes in class, summarise lectures below, and point to references for additional reading.

Lecture summaries

- **Lecture 1: Introduction (January 6)**
  I like this quote from Tom Leinster: "A category is a system of related objects. The objects do not live in isolation: there is some notion of map between objects, binding them together." Today we reviewed some basics of category theory, particularly functors between categories, and used this to formailze a

proof of the Brower fixed point theorem.

- **Lecture 2: Euler charactreistic (January 8)**
  Our aim is to compute a suite of functors called homology groups. These will be relatively easy to work with, but the cost is a somewhat lengthy definition. To motivate the objects we'll require, We looked at the Euler characteristic of a surface, which suggests a notion of celular decomposition (to be formalized). Our goal, ultimately, is to find a categorical lift of the Euler characteristic.