

# Algebraic Topology

## Math 4152b/9052b

### Winter 2018

Algebraic topology is the study of topological spaces using tools of an algebraic nature, such as homology groups, cohomology groups and homotopy groups. It is one of the major cornerstones of mathematics and has applications to many areas of mathematics and to other fields, such as physics, computer science, and logic. This is a first course in algebraic topology which will introduce the invariants mentioned above, explain their basic properties and develop geometric intuition and methods of computation.

**Course outline:** Homotopy, fundamental group, Van Kampen's theorem, covering spaces, simplicial and singular homology, homotopy invariance, long exact sequence of a pair, excision, Mayer-Vietoris sequence, degree, Euler characteristic, cell complexes, projective spaces. Applications include the fundamental theorem of algebra, the Brouwer fixed point theorem, division algebras, and invariance of domain.

- **Instructor:** Dan Christensen
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- **Office:** Middlesex 103b.
- **Office Phone:** 519-661-2111 x86530.
- **Office Hours:** Mondays, 11:30-noon.
- **Class times and location:** MWF 10:30-11:30, MC107, starting on Monday, January 8 and ending on Wednesday, April 11.
- **Prerequisites:** Group Theory (Math 3120) and General Topology (Math 3132 or Math 4121). Students are responsible for verifying that they have the correct prerequisites; please contact me if unsure.
- **Web page:** This page is available at <http://jdc.math.uwo.ca/M9052>, where you should also check for course announcements and updates.

**Text:** The text for the course is *Algebraic Topology*, by Allen Hatcher. Published by Cambridge University Press. ISBN 0-521-79540-0. The book will be available at the UWO bookstore, and is also available [online](#). The book's webpage also contains a list of errata for the printed copy.

We will cover parts of chapters 0, 1 and 2, and possibly some of 3. The textbook is a valuable resource that gives more examples and details than can be given during lecture. Students are expected to **read the text book, going over what we have covered, reading ahead to what comes next, and studying additional examples.**

Here is a [list of other reading material](#). None of these are required, but you might find them interesting. Most of these are available in the library. I haven't put them on reserve, so share with other students.

**Homework:** Homework will be due every two weeks, at the start of class. Doing problems and talking about the material are both essential for learning the material in this course, so you are encouraged to **discuss** the problems with classmates and with me. But you must write up the solutions **on your own** and must not look at other students' written solutions nor should you attempt to find solutions to problems online or in textbooks. Your solutions should be **clear** and **carefully written** and you should give **credit** to those who helped you and to any references you used. Homework will be graded based on both correctness and clarity. Late problem sets will not be accepted unless arranged in advance for a good reason.

**Copying solutions** from other students, online sources, textbooks, etc., or showing your work to other students constitutes a scholastic offense and will result in a grade of **negative 100%** for the assignment and in some cases expulsion from the program. All academic offenses are added to your student record.

**Presentations:** Each student will give a presentation on a topic related to the course. See [the presentations page](#) for more details.

**Final exam:** There will be a final exam on Wednesday, April 18, 12:30-3:30.

**Evaluation:** Evaluation will be based on homework, presentations, and the final exam, with equal weight. Graduate students will be assigned more challenging presentation topics.

**Medical Accommodation:** If you are unable to attend the final exam due to *illness* or other serious circumstances, you must provide valid medical or other supporting documentation to your Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor. For further information please see [this link](#) and the [Student Services](#) web site.

A student requiring academic accommodation due to illness should bring a [Student Medical Certificate](#) with them when visiting an off-campus medical facility and use a Record Release Form for visits to Student Health Services.

If **homework** is missed and sufficient documentation is provided, the homework can be handed in later. If an **exam** is missed and sufficient documentation is provided, a *make-up exam* will be offered.

Failure to follow these rules may result in a grade of zero.

**Scholastic offences:** Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web sites:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_grad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf) and [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

**Accessibility:** Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact [Services for Students with Disabilities \(SSD\)](#) at 519-661-2111 x82147 for any specific question regarding an accommodation.

**Support Services:** Learning-skills counsellors at the [Student Development Centre](#) are ready to help you improve your learning skills. Students who are in emotional/mental distress should refer to [Mental Health@Western](#) for a complete list of options about how to obtain help. Additional student-run support services are offered by the [USC](#). The website for Registrarial Services is <http://www.registrar.uwo.ca>.

**Eligibility:** You are responsible for ensuring that you have successfully completed all course prerequisites and that you have not taken an antirequisite course. Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

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