Math 654: Algebraic Topology I

Fall 2017
CB 345
MWF 11-11:50

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Many fundamental questions in topology are very difficult to answer. For example, it can be difficult to determine if two topological spaces are homeomorphic. The idea of algebraic topology is to transform these questions to questions in algebra that may be easier to answer. The slogan for this class is *topology is hard and algebra is easy.*

There are many ways to convert topology to algebra. In this class we will focus on homology and cohomology. The main topics for this semester are:

- Simplicial, singular, and cellular homology and cohomology,
- The Mayer-Vietoris sequence,
- The cup product,
- The Universal coefficients and Künneth theorems,
- Poincaré duality.

Prerequisites: The content of MA 551 and 651 will be assumed for this class. Compactness and continuity will be especially important. We will also make significant use of cell complexes, CW complexes and manifolds. (We will primarily work with these types of "nice" topological spaces.)

We will also use a lot of (homological) algebra. Specific familiarity with homological techniques is not assumed, but general comfort with algebra is.

Assessment: There will be two types of assessment in this class.

(1) Students will be provided with an outline of the topics to be discussed and each student will be assigned specific proofs to present. Proof assignments will be posted in the course outline. Students are free to exchange assignments and are encouraged to consult the resources below and consult with each other to prepare for their presentations.

Presentations will be evaluated based on the rubric below and they will be 80% of the final grade.

3	You were prepared and well organized. If there were problems along the way, you were able to finish the proof with help from your classmates.
2	You were prepared, but it was hard to understand your solution. If there were problems along the way, it was difficult for your classmates to help you.
1	You had thought about the proof a little, but not enough to be prepared to present it well.
0	You were not prepared.

(2) There will be written assignments collected approximately every two weeks. Homework will be due **in class**. Assignments and due dates will be posted on the course website.

I **strongly** encourage you to discuss assignments with other students, but your solutions must be written up independently. *Copying a written solution from another student and submitting it as your own will be considered cheating.*

All assignments should be neat, legible, and written in complete sentences. Written assignments will be 20% of the final grade.

Texts: The primary text for this class is

- *Algebraic Topology* by Hatcher.

It is available on the author's website. If you are interested in additional references the following texts may be helpful:

- *Algebraic topology* by Edwin Spanier.
- *Algebraic topology* by Tammo tom Dieck.
- *Algebraic topology from a homotopical viewpoint* by Marcelo Aguilar, Samuel Gitler, and Carlos Prieto.

Attendance: Class attendance is expected of all students.

Classroom Demeanor: Turn off all cell phones or other electronic devices prior to entering the classroom. An attitude of respect for and civility towards other students in the class and the instructor is expected at all times.

Excused Absences: Students need to notify the professor of absences prior to class when possible. Senate Rules 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding major religious holidays may be obtained through the Ombud (http://www.uky.edu/Ombud/ForStudents_ExcusedAbsences.php., 859-257-3737)

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy.

Per Senate Rule 5.2.4.2, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.

Verification of Absences: Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness, or death in the family. Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.

Academic Integrity: Per University policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the University may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Senate Rules 6.3.1 (see http://www.uky.edu/Faculty/Senate/ for the current set of Senate Rules) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work, which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone.

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Accommodations due to disability: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at drc@uky.edu. Their web address is http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/.

August 11, 2017