Math 524: Algebraic Topology (Fall 2023)

Credits 3
Time Tue+Thu 1:30–2:45 pm
Locations Sprk 333 (P), VECS 309 (V), [Zoom (ID: 989 4726 2168, Pwd: 10032)]
Instructor Bala Krishnamoorthy
Instructor location VUB 347 (Vancouver), [Zoom (ID: 360 546 9167, Pwd: Bala)]
Check-in Hours Tue, Wed 3–4 pm, or by appt
Email kbala@wsu.edu
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Description of the Course

Algebraic topology uses techniques from abstract algebra to study how (topological) spaces are connected. Most often, the algebraic structures used are groups, but more elaborate structures such as rings or modules also arise. A typical approach projects continuous maps between topological spaces onto homomorphisms between the corresponding groups. This course will introduce basic concepts of algebraic topology at the first-year graduate level.

We will follow mostly the book Elements of Algebraic Topology by James R. Munkres, and cover in a fair bit of detail the topics on homology of simplicial complexes, relative homology, cohomology, and, if time permits, the basics of duality in manifolds (selected Sections from Chapters 1–5 and 8). Another popular book is Algebraic Topology by Allen Hatcher, which could be used as a reference. We will not have the time to cover topics related to the fundamental group. We will stress geometric motivations as well as applications (where relevant) throughout the course.

Prerequisites: Some background in general topology as well as abstract algebra, both at the undergraduate level, will be assumed. In particular, familiarity with the concepts of continuous functions, connectedness, and compactness, as well as with the concepts of groups, homomorphisms, fields, and vector spaces will be helpful to follow the course. But no particularly deep theorems from these topics will be needed. Some flexibility could be afforded as far as this background is concerned—please contact the instructor if you are interested in the class, but have doubts about the background required.

Organization and Grading

The course will have around seven homework assignments, which include mostly theoretical, i.e., “pen-and-paper” problems. Each student will also be required to make a short lecture video (at most 10 minutes long). This video could be made on a topic chosen from the textbook (but not covered in class), from another book, or from 1–2 research papers. The suggested format is that of an AATRN Tutorial video. The overall grade will be assigned using the following weights: homework–75%, lecture video–25%. There will be no exams.

Students are responsible for reading and understanding all university-wide policies and resources pertaining to all courses (for instance: accommodations, care resources, policies on discrimination or harassment), which can be found in the University Syllabus.