

Math 550B Final Research Project–Fall 2014–200 points

Professor Ryan Blair

Goal: Each student will explore a topic in algebraic topology of their choosing and present their research to the class during an oral presentation. In addition, each student will submit a final paper to me by midnight on December 16th.

I. Paper Topic:

- Each student must contact me via email to suggest a topic that I will consider for approval.
- Each student must choose an approved topic by **Nov. 6**.
- Although I am happy to consider other topics here is a preapproved list of topics
- Preapproved student topics (these will be assigned on a first come first serve basis):
 - The braid group
 - Higher Homotopy groups (Taken)
 - Eilenberg-MacLane spaces
 - The Wirtinger presentation of the knot group.
 - Classification of covering spaces
 - CW-complexes
 - Jordan Curve Theorem
 - Classification of surfaces (Taken)
 - The fundamental group of a graph (Taken)
 - Borsuk Ulam Theorem (Taken)
 - The Hom functor and cohomology
 - The cup product on cohomology
 - Axioms of homology and the equivalence of simplicial, singular and cellular cohomology
 - Lie Groups (Taken)
 - Homology as the categorification of Euler characteristic
 - **NEW** the proof of van Kampen's theorem
 - **NEW** "The fundamental group of the circle is trivial" by Florian Deloup

I. Paper Outline (20 pts):

- Due on or before **Nov 20 (in class)**.
- Length 1 page, word-processed, single-spaced, 12 font in Times/Times New roman, 1" margins on all 4 sides
- Open format (e.g., bulleted ideas, table, small paragraph explanation)

Your outline should accomplish the following:

- Clearly communicate the **topic, background, theorems** and **open questions** you will discuss in the paper, and
- Provide a preliminary list (at least 3) of all references that you anticipate using for your paper

II. Paper (120 pts):

- Due on or before **Dec 16, at midnight**.
- Length 5-10 pages, primarily word-processed, double-spaced, 12-font in Times or Times New Roman, 1" margins on all 4 sides
- Additional pages (e.g., figures, calculations, tables) are allowed but should not be included in the 5-10 pages

Final product should contain:

5 pts	COVER SHEET: Provide a cover sheet with name, date, class, and title of project.
10 pts	EDITING: Paper is well edited (e.g., grammar, syntax), properly formatted, and meets all guidelines.
15 pts	BACKGROUND: All new concepts are defined and an effort has been made to frame the topic in terms of concepts we have studied in class.
60 pts	MATHEMATICAL UNDERSTANDING: A clear understanding of underlying mathematical topics is demonstrated.
20 pts	CONNECTIONS AND QUESTIONS: If applicable, connections to other areas of mathematics have been discussed. Major open questions related to the topic have been discussed
10 pts	FORMATTED REFERENCE LIST: Complete reference list (in addition to the 6-8 pages) containing at least 3 references (one must be other than an internet URL); include all references cited, as well as those used for research.

III. Presentation (60 pts):

- In class on **Dec. 2, Dec. 4, Dec. 9, Dec. 16**
- **If you have exceptional circumstances and cannot present on one of these days, let me know. Otherwise, I will assign presentation days randomly.**
- Remember: your classmates will be listening to MANY presentations, so try to be as creative and enthusiastic as possible
- 15 minutes
 - Use this time to discuss the important aspects of your topic (major theorems, connections to the class, open questions)
 - Make sure to give the appropriate background and aim your talk at your fellow students.

20 pts	Presents appropriate background
20 pts	Clearly communicates an overview of important aspect(s) of the topic.
20 pts	Questions are reasonably answered to the satisfaction of the audience.