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

II. 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:
<table>
<thead>
<tr>
<th>5 pts</th>
<th><strong>COVER SHEET</strong>: Provide a cover sheet with name, date, class, and title of project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 pts</td>
<td><strong>EDITING</strong>: Paper is well edited (e.g., grammar, syntax), properly formatted, and meets all guidelines.</td>
</tr>
<tr>
<td>15 pts</td>
<td><strong>BACKGROUND</strong>: All new concepts are defined and an effort has been made to frame the topic in terms of concepts we have studied in class.</td>
</tr>
<tr>
<td>60 pts</td>
<td><strong>MATHEMATICAL UNDERSTANDING</strong>: A clear understanding of underlying mathematical topics is demonstrated.</td>
</tr>
<tr>
<td>20 pts</td>
<td><strong>CONNECTIONS AND QUESTIONS</strong>: If applicable, connections to other areas of mathematics have been discussed. Major open questions related to the topic have been discussed.</td>
</tr>
<tr>
<td>10 pts</td>
<td><strong>FORMATTED REFERENCE LIST</strong>: 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.</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>20 pts</th>
<th>Presents appropriate background</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 pts</td>
<td>Clearly communicates an overview of important aspect(s) of the topic.</td>
</tr>
<tr>
<td>20 pts</td>
<td>Questions are reasonably answered to the satisfaction of the audience.</td>
</tr>
</tbody>
</table>