Math 555 Final Research Project–Spring 2016–200 points
Professor Ryan Blair

Goal: Each student will explore a topic in differential 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 May 10th.

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 **April 12**.
- 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):
    - Morse Theory
    - Complex structures on manifolds and complex surfaces.
    - Classification of surfaces
    - Jordan Curve Theorem and its generalizations (Taken)
    - Geometric structures on manifolds and the Geometerization theorem for 3-maniolfds
    - Differential forms and integration on manifolds
    - The Gauss-Bonnet Theorem
    - Lie Groups
    - Milnor's proof that bridge number bounds total curvature of knots
    - The many definitions of Euler characteristic
    - The Hopf degree theorem

I. Paper Outline (20 pts):

- Due on or before **April 19th (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 **May 10th, 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 5-10 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 **April 26, April 28, May 3, May 5**
- **If you have exceptional circumstances and cannot present on one of these days, let me know. Otherwise, I will assign presentation days based on commonality of topic.**
- Remember: your classmates will be listening to MANY presentations, so try to be as creative and enthusiastic as possible
- 20 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.

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