Math 5160: Final Project Guidlines

Your final task this semester is a small project. You will pick a topic related to, but yet, a little beyond what was covered in class. Then you will create a nice handout and record a short presentation where you teach us about your topic.

Due Date: Your handout and recorded presentation are due by **Wednesday, May 6^{th} at noon**.

Here is what I expect from you (and what you will be graded on):

Project Proposal Pick out a topic and outline what you plan to study. Then talk to me about it. I will give you some suggestions (possible examples, problems, theorems to consider).

Due: No later than **Friday, April 24^{th}**.

A Handout You should create a nice handout to go with your topic and presentation. For your topic, you are the teacher.

- Your handout should be *at least* one page front and back. If it gets to be a bit longer, that's ok. Please don't go overboard.
- This should be typed up nicely in LaTeX.
- Your classmates are your audience. Make sure your handout is understandable from what we've learned in class.
- You should include some sort of references. Did you get this from Gamelin? Fisher? Wikipedia? Make sure you cite your sources. Make it so classmates can easily find more information about your topic. Example: "This was drawn from Gamelin IX.4 pages 1234–9999. You can find loads of terrific information at `https://billcookmath.com`." If you state theorems without proof, give a SOLID citation (i.e., peer reviewed paper or textbook – not Wikipedia) where one can find a proof.
- Your handout should inlcuded relevant definitions and important results/theorems. It should also provide good, illustrative examples or applications. The exact content and flow of your handout will greatly depend on the topic you choose. For example: If I were presenting Morera's theorem, I'd probably give historical background, sketch a proof, and give a few corollaries. On the other hand, if I were presenting an Introduction to Residues, I'd probably give a few basics propositions and then get to doing a bunch of examples and maybe an application.

The Presentation Everyone should record a 10 minute (*approximately*) presentation about their topic. Teach it to us. Maybe give us some homework. [We won't do it though, so don't be disappointed.] Create a some slides. You can either use LaTeX or Powerpoint or whatever looks good. Don't just read your handout. The handout isn't the presentation, it is there is help supplement your presentation.

Random Topic Suggestions!!!

Here are some suggested topics. Your don't have to pick from this list, these are just random suggestions. By the way, if you pick a topic closely related to someone else's topic, please feel free to coordinate your handouts and presentations — you still have to write up your own stuff, but you can build off each other's background.

Many of these topics are basically just sections in Gamelin or Fisher that we either skipped or didn't get to. Flip through our books or Google some of these names...

- The Zeta function and related topics like the Riemann hypothesis and prime number theorem.
- Periodic and doubly periodic functions, elliptic functions, modular forms, the Weierstrauss P-function
- How to generalize the factorial? The Gamma function, Beta function, and other special functions
- The Castorati-Weierstrass theorem
- The Mittag-Leffler theorem
- More on conformal mappings and the Schwartz lemma
- Infinite products and an infinite product formula for sine.
- Fourier series and other Fourier stuff like Fourier transforms
- Relationships between residues, Laplace transforms, and their inverses
- Riemann surfaces
- The Uniformization theorem
- The Dirichlet problem
- Winding numbers and ties to algebraic topology
- Fractals
- Applications to physics, engineering, or other ugly things.

...Don't see anything that strikes your fancy? Come talk to me, maybe I can help find a topic for you.