

MATH 377 Projects

In your final project you will pick one topic and do a deep dive into that topic.

COVID-19. This is an extremely fluid and challenging global situation we are in. I will try to support you as best I can and be as accommodating as I can, so please reach out if you need something or if, say, the dates are unreasonable.

Things you have to do:

Stage 1 – Due Mar 27th – Choose A Topic.

Stage 2 – Due April 3rd – Provide a preliminary update

Stage 3 – Due April 10th - Submit Report

Stage 1 - Choosing a topic. There are two options.

- 1) **Pick from the list.** I'm providing a list of topics you can choose from with relatively well defined problems and questions to answer. The list and descriptions are on CourseSpaces.
- 2) **Pick your own topic.** You can write your report on any topic you wish. I'd love to hear about something interesting I don't know about, particularly if you are a dual major something from your discipline would be very interesting. You want to choose a topic where the mathematics is not completely trivial, nor so challenging you can't say anything meaningful. I can see two possible subcategories
 - a. You think of something novel and want to try it out yourself. I'd be very excited to see these.
 - b. You want to take an established paper – or a couple papers – in a field and do more of an “explanatory” project where your goal is to explain all the aspects of the model that others have performed. You will be carefully citing their contributions and delineating what is your contributions and what is the paper's contribution. You will share a link to the papers so I can read it in comparison. You are graded on the value you bring explaining this complicated topic at the level of the Report Standards.

The expectation is that there is a random distribution of topics selected, so choose something DIFFERENT than what other people you know are doing. The “Pick your own topic” should all be different, but the “pick from the list” I am going to UPDATE this list to remove options after a few people have chosen a specific topic. So it is in your best interest to choose on the sooner side and submit the form with your topic choice.

When you have chosen a topic, use the CourseSpaces form to let me know. Did you recheck the Project List to make sure I haven't eliminated it due to too many people selecting it?

The due date for this is Mar 27th. You are not absolutely locked to this topic, if you investigate it further and it turns out to suck, that's fine just email me and we can change it. I will accept late submissions, up to April 17th, if you email me by April 10th explaining the reason why you can't reasonably complete by April 10th.

Working together? You may work together with ONE other friend. If you choose to work together, my standards will be a bit higher. Not twice as high, a bit higher. You're welcome to "solicit" a classmate through the online forum by saying what project you are working on. If so, your "preliminary update" should be CCed with both emails and your single report will have both names.

Stage 2 – Preliminary Update. The due date for this is April 3rd. Over this week, I want you to try and think about the contour of your project. I want to touch base with each students. You can either:

- a) Send me an email. In the email you should type a couple paragraphs telling me the big idea of the project that you have learned thus far AND any questions you have.
- b) Have an online meeting with me. We can use blackboard collaborate to have a short discussion about what you know thus far AND any questions you have. Send me an email with a few times that work for you and I'll reply with the link.

Stage 3 – The report. The report must include the following components.

Introduction: The report begins with an introduction section which explains the background of the problem. Normally, you use this section to motivate why the subject of study is important and to provide background knowledge, including prior work by yourself or others. This should be very readable and nontechnical.

Model Derivation: In this section, you will describe the derivation of the model you will use. You should discuss how you translate the problem described in the introduction into a mathematical model, stating assumptions you have made with justifications and possible limitations the model might have. You should also state the model equations explicitly, using LaTeX, Microsoft Equation, etc., along with defining all the parameters and variables in the model.

Results: In this section, you will conduct analysis and discuss the results of your analysis of the model given in the previous section. You should state the mathematical methods used to obtain your results. Your results should be stated in context of the original problem. For example, if your model shows the population goes to zero, you should state that the analysis shows that the population collapses for the specific case given. Graphs or other visuals will often be useful to aid the exposition of the analysis.

Conclusion: In this section, you will summarize your results from the two previous sections in context of the original problem. You should state the general conclusions along with assumptions made and any limitations of the current model or analysis. If relevant, your conclusion could also include a short discussion of future approaches for a more sophisticated model that addresses limitations in the current model.

Report Standards:

- Audience: Write the report as if you are writing to a classmate who knows nothing about your specific model but knows the basics of what we learned in class. You don't have to explain what Linearization is, for instance, but some new formula relevant to your model you definitely do need to explain where it comes from. Your classmate should be able to follow along through the entire report. You are welcome to share your report with a classmate – if they are working on a different problem – to see if it satisfies this test.

- The report should be typed. If you know Latex, use that, if you don't use Word or similar word processor where there is an equation editor functionality. In word, for instance, Alt + is the command to bring up equations. If there are graphics or numerical results, try to use an appropriate math software like MATLAB to draw or compute these. I'm happy to help if need be.
- Mathematical Sophistication. The mathematics involved should not be so completely trivial there is nothing of meaningful value added, nor so hard that all you can reasonably say is "other people got this result" without being able to explain how. Feel free to bring this point up with me in an email/meeting if you are unclear.

Grading:

- 5% for completing the Stage 1 and Stage 2 Check in. I will grade this on the basis of a binary "Did the student meaningfully participate in the check in".
- 20% for the Introduction
- 20% for the Model Derivation
- 25% for the Results
- 20% for the Conclusion
- 10% for "flow and polish". The four sections should work together. Everything should be neatly presented.

Note: Choosing a topic based on 1, 2a, or 2b will likely all look quite different. That's ok. My goal is to fairly evaluate regardless of these choices so I don't think either of these three is automatically "easier" or "harder".

Academic Integrity: We are all doing the best we can given COVID-19, and part of all of our role is not exploiting the challenges this poses. Specifically, the standards of academic integrity remain in place and I am hoping that this just something we don't have to think about. Nevertheless, let me be clear on two rules:

- 1) If you use a published work you must reference it. If you copy something without referencing it you will get a zero and be referred to the dean for academic dishonesty. I plan to google anything that sets off my spidey senses as possibly being copied.
- 2) Similarly, the expectation is that students – beyond the pairs that are allowed to work together – are working independently.