Final Project - *prompts*

Math087 - George McNinch

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1 Project overview

For your final project, you will choose a topic whose investigation requires mathematical modeling. See Section 4 below for some ideas about choosing topics. Your project should combine:

- research into the topic
- selection of relevant mathematical models
- description of required computations

The aim of the project is to communicate a clear question, a modeling approach, and an appropriate formulation of the key aspects of the problem you are studying. Your model should include the gathering of relevant data. You should discuss how you expect that a solution (from the model) will lead you to an answer (to the motivating question).

See

2 Project proposal

(due *[2024-04-12 Fri]*)

The proposal should articulate a clearly defined goal for your analysis, and it should briefly describe how you will carry out the investigation.

- Your *project proposal* should be submitted as a `PDF` on *gradescope*. It should be a single page [1], with a second page for references if necessary.

It should include:

- a full *statement of the problem to be investigated*. This includes any constraints you may have to consider.
- Clear *statement of the goal of your investigation*.
- Concise description of what *computation(s)* you will need to do for the project.
- Brief assessment of the *interest of the problem* (to you, or to others).
- Provide a brief *literature review* by citing a few references for the ideas and/or data of your investigation.

[1] A *page* should have a font size of 10 points and one-inch margins on all sides; text on the page should be *single-spaced*.

3 Project report

(due *[2025-05-02 Fri]*)

- Your *proposal report* should be a 5-7 page PDF (not including *references* or *source code*).
- The research you report on is *not required to be original or novel*. However, it is expected that you will review the literature on the problem, discussing what has been done by others (clearly citing that work) and presenting some analysis of your study.
- Submission of your report warrants that it is written in your own words, and that you have not copied from any source without direct citation.

Your report should include the following:

- a brief *abstract* summarizing the results of your project
- a clear statement of the *problem* and your *modeling goals*
- an explanation of modeling *assumptions* and their relationship to the problem
- a description of the mathematical model used and justification for modeling choices
- a description of model testing, sensitivity analysis, computations, and error analysis
- a discussion of strengths and weaknesses of the approach described in the report
- a *literature review* including a few references of existing research on the subject

4 Examples of modeling problems

It might be useful to look at sample "modeling problems" for inspiration. You can browse a list of problems that have appeared in the *Mathematical Contest in Modeling* ("COMAP"). You should be able to see the *problems* at this link, though apparently you can't see the submissions & judges comments without a membership.

I'm including some precise links below e.g. because I found navigating this site a bit clunky and I wanted you to have quick access to some samples. There are many more problems than I've linked here.

Here are some randomly chosen examples of problems.

- '23 - drought stricken plant communities
- '23 - Masai Mara
- '23 - sailboats
- '22 - cyclists' power profile
- '22 - hydro-electric sharing

Of course, these problems don't point you to relevant *literature*, but they will perhaps inspire ideas for topics.

5 Example of reports

Here is an example of a project report on the subject of restaurant seating and workflow. This example should match the given reports specifications, except that it is slightly longer than I've asked for - it is 10 pages rather than 5-7 pages.

- proposal sample
- report sample