

Project Guidelines

Project Proposal (Due 4/10/23 11:59pm).

- Choose your teams (one, two, or three students in each team).
- Choose your topics!
- Fill in the Project proposal notebook and turn it in as a pdf. (Each student in the group must submit one, and everyone in the group must submit the same one.)
- There is no restriction on topic choice. A list of suggested topics is provided below but you are encouraged to come up with your own topics.
- Your proposal will be checked to make sure your project idea sounds reasonable. You'll receive feedback about your proposal within a week of the proposal due date.
- There will be no grade associated with the proposal, only with the final project.

Project Report (Due 5/5/23 11:59pm). The report, which you will submit as a group, will be an IJulia notebook. Use the Julia notebook file supplied as a template. *You will submit both the .ipynb file AND the PDF version of this file, as we will be running your code.*

Groups of 2 or 3 students will naturally be expected to undertake a significantly more substantial project than a group of 1. Group size and its relation to the substantiveness and quality of the project will be a consideration in grading.

Your report will contain the following sections. (Percentage of grade for each section in parentheses.)

- Introduction (15%): The first few sentences should give an overview of the entire project. Elaborate with a description of the problem that will be solved, a brief history (with citations) of how the problem came about, why it's important/interesting, and any other interesting facts you'd like to talk about. You should address and explain where the problem data is coming from (research? the internet? synthetically generated?) Also give an outline of the rest of the report. This section should be 300-600 words long and accessible to a student who **has not** taken the course.
- Mathematical model (20%): A discussion of the modeling assumptions made in the problem (e.g. is it from physics? economics? something else?). Explain the decision variables, the constraints, and the objective function. Finally, show the optimization problem written in standard form. Discuss the model type (LP, QP, MIP, etc.). Equations should be formatted in LaTeX within the IJulia notebook; see the template for some examples of how to do this. This section should be accessible to a student that **has** taken the course
- Solution (25%): Here, you should code up your model in Julia / JuMP and solve it. Your code should be clean, easy to read, well annotated and commented, and it should compile! You are not allowed to use other programming languages — I should be able to run the code in my environment. I suggest having multiple code blocks separated by text blocks that explain the various parts of your solution. You may also solve several versions of your problem with different models/assumptions.
- Results and discussion (25%): Here, you display and discuss the results. Show figures, plots, images, trade-off curves, or whatever else you can think of to best illustrate your results. The discussion should explain what the results mean, and how to interpret them. You should also explain the limitations of your approach/model and how sensitive your results are to the assumptions you made.
- Conclusion (5%): Summarize your findings and your results, and talk about at least one possible future direction; something that might be interesting to pursue as a follow-up to your project. Be specific enough with your follow-up idea to show that you have given it some thought and that you think it's actually doable!

- *The remaining 10% of the grade will be awarded at my discretion for originality, creativity, and final report quality. Bonus if you can make your report interactive!*
- Note: you don't need to come up with your own idea to be creative/original. It's about where you take it. Make your report easy to read by using nice Markdown and LaTeX code.

Example Topics. These are only suggestions! You are encouraged to come up with your own ideas and to draw inspiration from your work, your research, your other classes, your everyday life, or your imagination!

- Examples from class or homework may be used as starting points provided you expand the topic significantly. Ideas:
 - Planning problems (cf. house building example). What if we have a limited number of workers? What if certain equipment is required for certain tasks and that equipment has limited availability? What if certain tasks cannot be worked on simultaneously?
 - Scheduling meetings. What if we had to schedule multiple people on the same day? What if only certain subsets of people needed to meet with certain visitors? What if different people had different meeting duration requirements?
 - Vehicle control (cf. hovercraft problems). Investigate vehicles with more complicated dynamics such as a car or bicycle. These vehicles have non-holonomic constraints (direction they can move in depends on which way they're pointing), and they also have turning radius constraints. Optimal way to parallel-park a car?
 - Portfolio optimization (cf. portfolio problem from class). The example seen in class is a very basic version using a simple mean-variance tradeoff. What about more complicated models of risk?
- Examples covered in classes at other schools may also be used as starting points. Always cite your sources! Ideas:
 - Examples from EE364a at Stanford: examples
 - Examples from EE236a at UCLA: structural optimization or control applications.
- Problems with integer variables. We will see more of these in the coming weeks, and they might provide many starting point for class projects.