# Project Guidelines

**Project Proposal (Due November 14).**

- Fill in the Project proposal form and turn it in. (Turn in just one form per group.)
- 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. Youll receive feedback about your proposal within a week.
- There will be no grade associated with the proposal.

**Project Report (Due December 18).** The report, which you will submit as a group, will be an IJulia notebook. Use the file supplied as a template. *You will not be submitting a PDF this time; you will be submitting the .ipynb file for your notebook.* More details to come later! The report should contain the following sections:

- Introduction (15%): The first few sentences should give a quick overview of the entire project. Then, elaborate with a description of the problem that will be solved, a brief history (with citations) of how the problem came about, why its important/interesting, and any other interesting facts youd 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. 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 or DCP packages such as convex.jl. I will be running your code. 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 its 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 dont need to come up with your own idea to be creative/original. Its about where you take it. Make your report pretty by brushing up on your Markdown and your LaTeX.

**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 (cf. doodle problem). 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 theyre 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.
  - Examples from our convexity material. These examples already contain code (Python + cvxpy). If you choose one of these ideas, you must write your own Julia + JuMP code and you cannot simply duplicate the provided examples!
- Problems with integer variables. We will start looking at this topic after spring break and we will cover many examples that might serve as starting points for class projects.