MATH-529 – Fundamentals of Optimization
Spring 2013

Project Guidelines

Marco A. Montes de Oca

In this document, I describe the main expectations and minimum requirements that your project should satisfy. I expect **you** to propose a project; however, if you need help to get started we can meet and discuss possibilities based on your interests.

This document also contains a list of deliverables and a timeline that should be followed in order to successfully complete this assignment. Finally, I present a breakdown of the main criteria that I will use for evaluation and their weight.

1 Minimum Requirements

The term project is a team effort. Teams should have at least three members and at most four. Each team will submit a single proposal. The project's level of complexity should be commensurate with the size of the team.

The structure of the proposal should at least have the following sections:

- Abstract. A short description of the problem, your motivation for working on it, and anticipated results.
- Introduction. A detailed description of the problem, including a description of the context in which the problem arises, and an explanation of why should anyone care about it.
- Problem statement. A more or less formal statement of the problem to be tackled. If available, present a mathematical model of the problem. Introduce nomenclature, objective function, decision variables, and constraints. If part of the problem is to find explicit formulas that describe the relations among variables, use generic functions (e.g., $x_1 = f(x_2, x_3)$), and explain how you expect to find an explicit form for, or at least calculate, f.
- Workload for each member of the team. Present a breakdown of the anticipated activities necessary to complete the project. The workload should be evenly distributed among the team members. I also need you to name a team representative that will serve as interface between the team and me.
- References. Cite all the sources you use. Use an APA-like citation format (e.g., (Dupont, 1980)). At the end of the document, all the references should appear in alphabetical order and each entry should include the authors' names, the article's title, publisher, year, and page numbers.

2 Types of Projects

Most projects will fall into one of the following categories:

2.1 Applications

These projects use optimization as a tool for tackling a problem of practical relevance. A project of this kind will typically involve modeling the problem of interest and attempting its solution using the tools that you will learn during the course, or other techniques that you could learn on your own. For example, your problem might be stochastic and therefore you would need to research methods for tackling stochastic optimization problems. If the problem has already been tackled in the past, then you should compare your model and results with those previously published.

2.2 Research

A research project can be theoretical or computational (or both), pure or applied. A purely theoretical project (a strange kind of project considering that optimization is a branch of applied mathematics) could be, for instance, the discovery of optimality conditions for a class of problems that satisfy some condition. In any case, the goal of a research project should be to answer questions about problems, algorithms, or both. You might get some ideas from recent research papers published in specialized journals such as the Journal of Global Optimization, Soft Computing, the IEEE Transactions on Evolutionary Computation, the IEEE Transactions on Systems, Man and Cybernetics, Part B: Cybernetics, the SIAM Journal on Optimization, and so on.

2.3 Educational

These projects seek to develop tools for helping others learn concepts related to optimization. For example, a tool for visualizing the trajectories followed by different optimization algorithms in a problem's feasible space would help students better understand the underlying ideas behind the design of optimization algorithms.

3 Deliverables and Timeline

Document	Description	Length	Due Date
Initial Proposal	The initial proposal may have to go through an iterative improvement phase until acceptance. At the very least, this document should contain the title of the project, description (what are you going to do?), motivation (why is it interesting?), goals (what do you expect to achieve?), team members (who is involved?) and work load (Who does what?).	2–3 pages	02/20
Final Proposal	This document should reflect all the changes made to the initial proposal. It will be used as a reference in order to evaluate the degree of achievement of the initial goals	2–3 pages	03/04
Progress Report 1	In this document you should describe any eventual deviations from the original plan (explaining why) and present your first results	8–10 pages	03/20
Progress Report 2	Incremental report of advancement presented in final format and structure. If any difficult has arisen or is foreseen at this point, you should present your alternative approach(es). Close to final results should be presented.	12–15 pages	04/17
Final Report	Final description of the work done and of the results obtained. If software is produced, it must be well-documented.	12–15 pages	05/06
Presentation	In-class 20-25 minutes presentation (including questions) of your project	-	05/06 – 05/13

4 Evaluation Criteria

For evaluating your projects, I will consider the following criteria:

- Proposal. {20 points}
  - {5 points} Completeness. Does the proposal meet the minimum requirements mentioned above?
  - {5 points} Presentation. Is the proposal logically organized? Is the proposal well-written?
  - {5 points} Originality. Does the project have potential for publication (if finished successfully)?
  - {5 points} Planning. Are the responsibilities well-distributed among the team members?
- Development (based on progress reports and meetings) {50 points}
  - {30 points} Technical correctness. Is the project based on and presenting technically correct ideas/results?
  - {10 points} Depth of research. Have you consulted relevant sources?
  - {5 points} Organization. Are the reports logically organized?
  - {5 points} Style. Are the reports well-written?

- Presentation/Final report {30 points}
  - {10 points} Achievement of goals. How well do the final results match the initial goals?
  - {10 points} Talk/Demo. Complete, well-organized, well-delivered?
  - {10 points} Presentation. Is the final report logically organized? Is it well-written?