

Computational Optimization

Project and Presentation

The intent of the project and presentation is for you to gain experience in the practical aspects of the implementation and application of nonlinear programming. The project is an opportunity for you to define your own problem and seek your own answers. This is research. Your grade will not depend on whether you reached the goals of your project, but rather the steps you took to accomplish your goals and the presentation of your results.

1. The project is a research project. Propose a question or idea and investigate it. Select a area of investigation relevant to nonlinear programming and find at least two research papers on that topic (one can be a book). You may select any related set of papers on nonlinear programming provided that it meets my approval (easily obtained). For example you could look at an application of nonlinear programming, an algorithm not covered in class, or a variation of an algorithm covered in class. You may use any means at your disposal to find the papers. For example, you might peruse the text or the suggested books and then check out the references given at the end of a section that interests you. You might want to browse through the many pertinent journals available in the library (try online) such as *Mathematical Programming*, *Mathematics of Operations Research*, *INFORMS Journal on Computing*, *SIAM Journal on Optimization*, *Journal of Optimization Theory and Applications*, *Mathematical Programming*, *Operations Research*, and *Math of Operations Research*. You may want to search for papers on the WWW via your favorite search engine (Google is good) or from the library site using the Web of Science search engine. . Since the goal is to gain practice implementing or applying nonlinear programming, the project must contain a large computational component that involves nonlinear optimization. Undergraduates may use any of the optimization packages available (preferably more than one). Graduate projects should include an implementation of an algorithm in Matlab or other language. Some ideas are to to implement an algorithm and compare your results with existing packages; examine an optimization package available on the net (e.g. see NEOS <http://www-fp.mcs.anl.gov/otc/Guide/>), understand what it does theoretically, and then perform an empirical study of the algorithms; or tackle an interesting application using various methods and compare the results. Feel free to propose different frameworks and wild ideas. Each project will be approved on a case by case basis. This is chance for you to explore and try a little research on your own. Feel free to choose projects directly related to your thesis research or projects for another class.
2. For the presentation (required for graduate credit, extra credit for undergraduate credit), select a topic of interest which is relevant to your project. Your task is to communicate communicate the basic concept and most important ideas of this topic in a short talk. Ideally, the talk should include the results and conclusions from your project. You must give your presentation in class or in a seminar no later than the last week of class. The length of the presentation will be approximately 15 minutes. You will be expected to prepare appropriate visual materials to accompany your presentation. Presentations may be done by more than one person, but each person will be

responsible for 15 minutes of the presentation. A sample presentation evaluation form is attached. Presentations take place outside of the usual class time in order that all students who wish to present get an opportunity.

3. Submit a one page (two if you must) project proposal preferably by March 21 and absolutely no later than March 25. The proposal should say what you hope to accomplish and your plan for doing it: Specify the questions you hope to answer and what software tools you will be using. Remember that it's okay if things don't turn out exactly like you plan because that's how research works. If you will be giving a presentation, indicate the references you will use for your presentation and how they pertain to your project. Graduate should do one project per person. Undergraduates may work in teams of two. If you are working together with anyone else in the class, you can turn in one single proposal. Up to two undergraduates can work on a project provided the work is scaled accordingly. Feel free to combine the project with your research or other class projects.
4. At the end of the semester, you will prepare a write-up of your project. Pretend it is a research paper that you are submitting to a journal or a conference. The maximum page length for this conference is eight pages. Include printouts of any code that you wrote and diaries or typescripts of sample execution of that code in an appendix. Typically such a paper includes an introduction to your problem, the approach you used to solve it, a discussion of your implementation, your computational results, and a conclusion with directions for future investigation. Remember, all rules of good grammar apply. It is okay to paraphrase idea presented in other papers or text provided they are appropriately referenced. It is not okay to directly copy passages from other texts unless then are in quotes and appropriately referenced. The final project paper is due in class on April 25. NOTE it is very important that you don't wait until the last minute to start your project, especially any computational parts! If you are having difficulties please see me sooner rather than later.

Here is the criteria used for evaluation of the presentation: Presenter's Name:

Evaluation:

1. Organization (5 pts)
(Talk had a logical framework – introduction, main points, and conclusion. Speaker organized and presented main ideas such that audience could grasp them.)

2. Delivery (5 pts)
(Visual aids used effectively. Clear speech at a reasonable pace. Used eye contact.)

3. Knowledge (5 pts)
(Speaker had good grasp of the subject. Speaker was well prepared.)

4. Overall Effectiveness of talk (5 pts)

5. Total (20 pts)

Please provide comments supporting the above ratings. What aspects of the talk did you like best? What aspects could be improved?

Guidelines for Project Research Paper

Your write-up of your project should be a research paper. Pretend like you are preparing it for submission to a journal or conference with an eight page limit (not including any appendices). A good research paper includes an abstract, an introduction, a description of the problem being investigated, the approach to solving the problem, a description of the computer implementation, computational results on the problem, and a conclusion. Feel free to put in suggestions for future work as well. The paper should be written using good grammar (complete sentences, no typos, etc) and in an appropriate research style (typed, numbered section headings, references, bibliography, figures or tables with captions). Please include printouts of any computer code that you wrote as well as sample diaries or script files illustrating the execution of that file in an appendix . The design of experiments and results of your computer testing should be summarized in the text. Hand in diaries or typescripts of sample runs of your program. You don't need to hand in a diary of every experiment. If you are having trouble with your computer implementation, please get help early! Failure to start the project in a timely manner is not an excuse. Assume that the end of the semester will be very busy and get results done early. Conflict with other end of the semester work will not be considered an excuse.

The paper will be evaluated using the following criteria:

1. Organization, Style, and Grammar (10 pts)
2. Content and Knowledge of Subject (10 pts)
3. Computer Implementation and Analysis of Results (10 pts)
4. Overall Rating of Quality of Investigation (10 pts)
5. Total