The goal of this final project is to have you look at optimization problems or optimization results in more detail.

Each student should prepare a report on one of the topics/tasks from the following list. If you wish to propose a topic for study that is not on the list, see me to discuss it. The list below is largely only a suggestion.

No length is set for the write-up. I will appraise a project on the basis of

- how well does it use what we have already studied in class
- how well does it extend and enhance what you have learned already about convex analysis
- to what degree does it demonstrate an understanding of the material, either through explicit examples or through explanations showing insights into and motivations for results

Topics List

1. Select a research paper in your field of study and give a discussion of its main results, including the proof of at least one main result. This topic is most appropriate for students currently involved in optimization related research. Please have the paper you select approved by me and I will then suggest what aspects of the paper should be the focus of the report.

2. Corollary 20.3.1 in our text gives a special separation theorem that applies when one of the convex sets involved is polyhedral. Give a discussion of the concept of a polyhedral convex set and assemble enough of the theory of such sets that you can give an understandable proof of this separation theorem.

3. Pages 227 through 232 treat the subject of how monotonicity and continuity properties of the directional derivative of a function $f$ relate to subdifferentials. In particular, these pages discuss the special case of functions on $R$. Give a presentation of this theory, with examples.

4. What is the Legendre transformation (pg 256) and why is it important?

5. What are saddle functions (Sec 33) and how is the study of convexity extended to them? (Section 33 through Corollary 33.1.2 should be examined.)

6. Give a presentation of linear programs, and their dual programs, and relate your results to the concepts and theory that we have studied in our course.