Math 4630/6630 - Nonlinear Optimization - Spring 2021
Instructions for paper

As mentioned at the beginning of the semester, you are expected to write a short paper in this course. Overall, the paper will be worth 12% of your final grade: 2% for a proposal, and 10% for the paper itself.

Subject: Your paper is to discuss some way in which the mathematical theory of optimization (preferably nonlinear optimization, but possibly linear optimization or even discrete optimization) is applied. This can mean an application of optimization to a practical area such as engineering or business, an application of optimization to another area of mathematics, or even an application of one type of optimization to another type of optimization problem (for example, linear programming is often applied to solve combinatorial optimization problems like the travelling salesman problem). You should concentrate on one fairly specific application. Individual case studies are acceptable, although you should put the case study into context by discussing how common mathematical optimization is as a tool in the particular area under examination, and how the particular study fits into that area. It is important that the application use a mathematical theory or technique.

You should give a general statement of the problem, explain how the problem is formulated mathematically, and discuss common solution techniques. Your paper may contain some computational work illustrating the subject of your paper, but this should not be the main focus.

Proposal: You are to submit a short proposal of one or two paragraphs, with several references (at least three, but five is preferred), describing the application you plan to study. The whole proposal, including references, must fit on a **single page**. **Before** submitting your proposal you should discuss the suitability of your topic with me. The paper is worth 2% of your overall grade and is due at the beginning of class on **Thursday, 4th March**.

The proposal is **not binding**. You can change your topic later in the semester, after discussion with me.

Paper: The paper is to be **about 2,500 words in length**. Papers may lose points for being too short (less than 2,300 words) or too long (more than 2,700 words). All sources you used in preparing the paper should be listed in your bibliography in alphabetical order by author at the end of the paper, and cited at appropriate points in the text. All quotations from sources are to be clearly indicated as such. The paper is worth 10% of your overall grade and is due at the beginning of class on **Thursday, 15th April**.

Resources: There is a lot of information available on optimization. Optimization is also referred to as 'mathematical programming', and much of the field of 'operations research' is really applied optimization. Note also when doing your searches that 'optimization' may also be spelt 'optimisation', with an 's'. The online Vanderbilt Library catalogue is one place you can look for ideas (just go to the main library web page and type into the search bar). The journal *Interfaces* contains many articles about optimization, particularly business applications, and can be accessed online through the Vanderbilt Library's electronic journals web page. Also try the various computer databases available online from the Vanderbilt Library. The following databases all have some information on optimization:

Available from `https://researchguides.library.vanderbilt.edu/az.php` (the link for database searches from the library's main page) are:

MathSciNet, Engineering Village (Compendex and Inspec), Business Source Complete, EconLit, Dissertations & Theses, ProQuest Central (or perhaps the more specific ProQuest Business) and (to a lesser extent) Sociological Abstracts and PsycINFO.

The most useful terms to search on seem to be

`nonlinear programming`   and   `linear programming`.

The above is not an exhaustive list. If you work in an area other than mathematics, you should also look in your favourite database, the one for your own academic specialty, and see if you can find anything there.

If you have problems finding information, contact a librarian – their job is to help you find it.

Formatting: The following apply to both the proposal and the final paper.

Provide a title. Your material should be typed, single column, margins 1 to $1\frac{1}{2}$ inches, in a 10 to 12 point font. Line spacing should be somewhere between one-and-a-half and double spacing. Pages in multi-page documents should be numbered. Submit your document as a PDF file on Brightspace.

Your document should end with a bibliography containing a numbered list of references, in alphabetical order by author. Refer to your references in your text using numbers, e.g., 'This was proved by Euler and Gauss [1, 4].' Do not use footnotes to provide references.

A majority of your references should be formally published references: books, journal articles (electronic journals are fine), conference proceedings and so on. You may have a smaller number of references that are informally published items such as documents posted on the web.

Honor Code: You may discuss your work on the paper with others, but what you actually write must be your own work. Any material not your own should be cited appropriately and enclosed in quotes if taken verbatim.

Graduate credit: Students taking Math 6630 are expected to write a more sophisticated paper than students taking Math 4630, and papers will be graded accordingly.

General comment: You are strongly encouraged to make the paper useful and interesting to yourself by choosing an application related to your major or area of specialization.