

Math 287 - Nonlinear Optimization - Spring 2008

Instructions for project

As mentioned at the beginning of the semester, you will be expected to do a project, in the form of either a term paper or a computer programming project, in this course. Overall, the project will be worth 15% of your final grade.

Projects may be done individually, or in pairs. The requirements listed below are for individual projects; more is expected from projects done in pairs.

Honor Code: You may discuss your work on the project with others, but what you actually write must be your own work. Any use of material by others should be cited appropriately. Any pre-existing software environments or packages that you use should be clearly indicated.

TERM PAPER

Subject: The 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 applied very frequently to solve integer programming problems and combinatorial optimization problems such as the travelling salesman problem). The paper should concentrate on one fairly specific application. Individual case studies are acceptable, although you would be expected to put the individual 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 actually make use of some kind of mathematical theory or technique.

The term paper requires a proposal and a final version.

Proposal: You are to submit a proposal of about 300 words, with several references (three as an absolute minimum, but at least five is preferred), describing the application of optimization you intend to study. This is due in class on Thursday, 28th February. The proposal is worth 2% of your course grade. **Before** submitting your proposal you should discuss the suitability of your topic with me.

Paper: The paper is to be approximately 3000 to 4000 words in length. It is to be typed or prepared on a computer using a word processor. All sources you used in preparing the paper should be mentioned in a bibliography at the end of the paper, and referred to at appropriate points in the text. All quotations from sources are to be clearly indicated as such.

The final version is due in class on Thursday, 17th April. It is worth 13% of your course grade.

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 ACORN on-line catalogue is one place you can look for ideas. The journal *Interfaces* contains many articles about optimization, particularly business applications, and can be found in the Management Library. Another very useful tool is provided by the various computer databases available on the Web or on CD-ROM. All of the following databases are available from the library’s ‘Research Databases’ page

<http://www.library.vanderbilt.edu/heard/artdb.shtml>

and have information on optimization:

MathSciNet, Compendex, INSPEC, Water Resources Abstracts, Business Source Premier,

EconLit, Dissertation Abstracts, ProQuest (you might want to restrict to subsets such as the Business module of the ProQuest Research Library) 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 list of databases is not exhaustive. The Management Library has one or two databases that are not available over the Web. 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, ask one of the reference librarians – their job is to help you find it.

Final comment: You are encouraged to make the paper useful and interesting to yourself by choosing an application related to your major or area of specialization, if you possibly can.

COMPUTER PROGRAMMING PROJECT

Computer programming projects may be of two kinds. First, you may implement some kind of optimization method, which may be fairly basic or as complicated as you like, in the context of some particular application. Alternatively, you may implement some kind of advanced optimization method (something we will not cover in class) in an abstract way.

Any computer language that is appropriate may be used. Software written by other people (e.g. subroutine libraries) may be used as part of the infrastructure for a project.

The computer project requires a proposal, a final submission, and a demonstration.

Proposal: You are to submit a proposal of about 300 words, describing your proposed project. Mention the computer languages or software you intend to use, and the platform on which your program will run. Give references for the algorithm you will be using and/or the problem to which you are applying optimization methods. The proposal is due in class on Thursday, 28th February. The proposal is worth 2% of your course grade. **Before** submitting your proposal you should discuss the suitability of your ideas with me.

Program: The length of your computer program may vary depending on language and so on, but roughly you should spend about the amount of effort that would be required to write a program of 5 to 7 pages (300 to 500 lines) in C, C++ or Fortran. You should provide a listing of the code for your program. Your program must be accompanied by suitable documentation: a brief user's manual (two or three pages, perhaps) and also a short description (two or three pages) of what the program does, with references. You should also submit printouts of sample runs of your program. You will be asked to provide a short (half an hour or so) demonstration of your program to me.

The final submission is due in class on Tuesday, 15th April. It is worth 13% of the grade for the course. You must make arrangements with me to demonstrate your project some time on or before Tuesday, 22nd April.

Final comment: As with the paper, you are encouraged to make the computer project useful and interesting to yourself by choosing an application related to your major or area of specialization, if you possibly can.