Math 661 Optimization

Fall 2016, UAF

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Times & Room: MWF 1:00 -- 2:00 pm Duckering 406
CRN: 76565
Text: Nocedal & Wright, *Numerical Optimization*, 2nd ed., Springer 2006

Course Content and Topics:

Continuous optimization ("programming" in the old sense), both nonlinear and linear. Iterative methods for unconstrained problems including linear algebra aspects. Line search and trust region methods. Convergence theorems for these methods. Simplex method. Constrained problems and Karush-Kuhn-Tucker conditions. Practical work with the computer. Examples from applications.

Goals and Outcomes:

Optimization is one of the essential mathematical technologies for scientific, engineering, economics, and finance. The goal of this applied mathematics course is to be able to understand optimization problems as they arise in applied contexts, select algorithms, and apply optimization software based on understanding of theory and examples.

Examples in lecture, and homework, will use Matlab/Octave both as a "supercalculator" and as a programming language. (Other languages are accepted from students but are not instructor-supported.) Help will be given to learn Matlab/Octave; it is well-suited to the numerical computations in optimization algorithms. The course includes a project (below); a substantial portion of the project will involve Matlab/Octave use. In any case, increased student competence with scientific computing is a goal of the course.

Assigned Work:

Weekly homework forms 50% of your score for the class. The homework consists of by-hand computations, construction/comprehension of numerical algorithms, implementation of numerical algorithms in Matlab/Octave, basic computer visualization of functions and constraints, rigorously-justified examples and counter-examples, and some proofs.

Homework assignments, and their due dates, will be regularly posted at the Course Website bueler.github.io/M661F16/. The site also has a daily schedule of topics which will be updated on an ongoing basis to reflect what topics were actually covered each day.

How Your Grade is Determined:

There will be **one in-class Midterm Exam** covering basic concepts and definitions. A **take-home Final Exam**. A **project in two parts**, with the first part due midsemester and the second due before final exams:

Work	**Percent of Grade**	**Dates**
Homework	50%	weekly
Project part I	5%	*due* Friday 4 November, noon
Project part II	10%	*due* Monday 12 December, noon
Midterm Exam	15%	*in class*, Monday 24 October
Final Exam	20%	*due* Thursday 15 December, noon

Based on your raw (homework, project, and exams) total, I guarantee grades according to the following schedule:

90 **-** 100 % = **A**, 79 **-** 89 % = **B**, 68 **-** 78 % = **C**, 57 **-** 67 % = **D**, 0 **-** 56 % = **F**.

This schedule is a guarantee. I reserve the right to increase your grade *above* this schedule based on the actual difficulty of the work and/or upon average class performance.

Policies:

The Dept of Mathematics and Statistics has reasonable policies on incompletes, late withdrawals, early final examinations, etc.; see www.uaf.edu/dms/policies. You are covered by the UAF Student Code of Conduct. I will work with the Office of Disabilities Services (208 WHIT, 474-5655) to provide reasonable accommodation to student with disabilities.

Prerequisites:

Officially: *Knowledge of calculus, linear algebra and computer programming.*

In terms of UAF courses this translates to *MATH 253 Calculus III, MATH 314 Linear Algebra, and either MATH 310 Numerical Analysis or CS 201 Computer Science I.*

As a pragmatic matter, students for this course come from math, computer science, physics, geophysics, engineering, and indeed all over the technical subjects at UAF. I am aware of this! I will devote substantial class time to the task of collecting together the many bits of prequisite knowledge needed to do this applied/computational mathematics at the introductory graduate level. In these aspects, this course is similar to MATH 614 Numerical Linear Algebra and MATH 615 Numerical Analysis of Differential Equations.