EBGN552 - Nonlinear Programming

Spring 2013

Lectures: Monday, Wednesday 9:30am - 10:45am 211 Engineering Hall
Instructor: A. M. Newman
Office: 319 Engineering Hall
Office Hours: Monday 10:45am-11:15am
Tuesday 8:00am-9:00am; 5:00pm-8:00pm
Wednesday 10:45am-11:15am
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Teaching Assistant: Timo Lohmann
Office: 126 Engineering Hall
Office Hour: Monday 3:00pm-4:00pm

GENERAL INFORMATION

• Textbooks: (recommended)
  * Optimization in Operations Research, Rardin.

• Assignments: There will be a weekly assignment due Wednesday (the following week). The TA will grade the homework, so direct homework grading questions to him. Do not send email to the TA!!

• Project: There will be a project involving formulating, solving and analyzing a challenging problem, writing code, and/or performing a literature review. The project group may consist of between one and four students. The project will be due during finals week.
• **Exams:** There will be a midterm and a final examination. Both are open book. You must wait 48 hours after the exam has been handed back to ask (me) any grading questions.

• **Grading:**
  
  ⋆ Class Participation: 5%
  ⋆ Homework Assignments: 20%
  ⋆ Project: 25%
  ⋆ Midterm: 20%
  ⋆ Final: 30%

Grading is done on a curve where 90% is sufficient but not necessarily necessary for an A-, 80% is sufficient but not necessarily necessary for a B-, etc.

**COURSE OUTLINE**

⋆ **I. Nonlinear Programming Formulations**
  · Unconstrained problems
  · Constrained problems

⋆ **II. Mathematical Structure of Nonlinear Programs**
  · Review of linear programming
  · Difficulty of finding solutions for nonlinear programs
  · Well-behaved nonlinear programs (convex sets, convex functions, convex regions)

⋆ **III. Solution Techniques for Unconstrained Problems**
  · Optimality conditions
  · Rate of convergence
  · Steepest Descent and Line search
  · Newton’s method

⋆ **IV. Solution Techniques for Constrained Problems**
  · Karush-Kuhn-Tucker optimality conditions
  · Lagrangian methods
  · Penalty and Barrier methods
  · Methods of feasible directions, e.g., reduced gradient

⋆ **(V. Mixed Integer Nonlinear Programming)**

1Time permitting
· Formulation
· Solution techniques

**Computer Implementation**

· Model implementation will be emphasized throughout the course (using AMPL or GAMS as a modeling language – as in EBGN555, 556, and 557). However, as time permits, we will explore how to “fine-tune” state-of-the-art software (e.g., MINOS) to achieve the “best” results (in terms of solution quality or solution time) possible.

**RULES**

★ Please do not send email regarding homework problems; come to office hours instead.
★ Statute of limitations for questions about grading is one week from the student’s receipt of the graded work.
★ I do not want to see or hear your cell phone. Ever. This includes during office hours.
★ No rudeness of any kind towards anyone in the class will be tolerated.
★ Do not talk to your neighbor during class.
★ You may confer with others regarding the homework and project, but the work you hand in must be your own. Please ensure it is done neatly.
★ Attendance in class is required. Be on time.
★ Any alternate arrangements for exams must be submitted in writing at least one week in advance of the exam. Any additional arrangements regarding disabilities must be *formally* and *legally* documented and approved.

A minor infraction of the above rules will result in a warning. A major infraction will result in expulsion from the class.