

University of Delaware
Department of Mathematical Sciences

MATH-529 – Fundamentals of Optimization
Spring 2013

Instructor: Dr. Marco A. MONTES DE OCA
Office: 315 Ewing Hall
Phone: 302-831-7431
Email: mmontes@math.udel.edu
URL: <http://math.udel.edu/~mmontes/teaching/UD/S13-MATH529-10.html>
<https://sakai.udel.edu/portal/>
Office hours: Tuesdays 3:00pm–5:00pm or by appointment
Meetings: Mondays and Wednesdays 3:35pm–4:50pm, 330 Purnell Hall

1 About the course

The official content of this course includes maximization and minimization of functions of finitely many variables subject to constraints. Basic problem types and examples of applications; linear, convex, smooth, and non-smooth programming. Optimality conditions. Saddle points and dual problems. Overview of computational approaches.

This course is organized as follows: We will start by learning some definitions and recalling some concepts from multivariable calculus and linear algebra. Then, we will learn the basic theory of optimization of multivariable functions without constraints. After that, we will study some computational methods that can help us tackle unconstrained optimization problems. Next, we will turn our attention to the theory of optimization with constraints. Again, this will be followed by the study of some computational techniques to tackle constrained optimization problems. If there is still time, we will learn how to tackle problems with objective functions that are not differentiable using stochastic derivative-free optimization methods. In particular, I would like you to get some experience with Covariance Matrix Adaptation-Evolution Strategies, Differential Evolution, or Particle Swarm Optimization.

2 Textbook

Main text: Jorge Nocedal and Stephen J. Wright. *Numerical Optimization*. 2nd Ed. Springer USA, New York, 2006.

Other useful sources:

Alpha C. Chiang and Kevin Wainwright. *Fundamental Methods of Mathematical Economics*. 4th Ed. McGraw-Hill/Irwin 2004.

Ralph T. Rockafellar. *Fundamentals of Optimization. Lecture Notes.* 2007. <http://www.math.washington.edu/~rtr/fundamentals.pdf>

Anthony L. Peressini, Francis E. Sullivan, and J. J. Uhl, Jr. *The Mathematics of Nonlinear Programming.* Springer-Verlag, Heidelberg, Germany, 1988.

Stephen Boyd and Lieven Vandenberghe. *Convex Optimization.* Cambridge University Press, New York, 2004. <http://www.stanford.edu/~boyd/cvxbook/>

Adrzej Ruszczyński. *Nonlinear Optimization.* Princeton University Press, Princeton, NJ, 2006.

3 Assessment

To have a rough idea of your mastery of the subject matter, you will be graded based on three elements: Homeworks, exams and a team project.

3.1 Homework

Six individual homeworks will be assigned and collected throughout the term. Each homework will be graded on a scale from 0 to 100 points. These homeworks will be posted on the course website, so make sure that you check it regularly. The score corresponding to homeworks that will be considered in the calculation of the final grade is going to be the average of all your homeworks throughout the term.

The tentative homework schedule is the following:

HW #	Due Date
1	February 13
2	February 27
3	March 18
4	April 8
5	April 24
6	May 8

3.2 Exams

There will be two midterm exams and a comprehensive final exam. Each exam is graded on a scale from 0 to 100 points. Exam absences due to recognized University related activities, religious holidays, verifiable illness, and family/medical emergencies will be dealt with on an individual basis.

The exams are scheduled as follows:

Exam #	Date
1	March 4
2	April 10
Final*	May 16–23

*Check <http://www.udel.edu/exams> toward the end of the term to know the exact date and location.

3.3 Team Project

An important element of this course is that you will work in teams on a project that you will present toward the end of the term. The exact requirements, timeline, grading criteria, as well as some suggestions are provided in a separate document posted at our course website.

4 Grading Policy

The final grade composition is

Component	Weight
Homeworks	40%
Exam 1	10 %
Exam 2	10 %
Final Exam	20 %
Project	20 %

Suppose your final score is X . The scale used in this course to map your point score to a letter grade is the following: $0 < X < 60$ for F, $60 \leq X < 63$ for D-, $63 \leq X < 67$ for D, $67 \leq X < 70$ for D+, $70 \leq X < 73$ for C-, $73 \leq X < 77$ for C, $77 \leq X < 80$ for C+, $80 \leq X < 83$ for B-, $83 \leq X < 87$ for B, $87 \leq X < 90$ for B+, $90 \leq X < 93$ for A-, $93 \leq X \leq 100$ for A.

5 Expected Behavior

5.1 Attendance

You are advised to attend all the scheduled meetings. Do not expect me to give you a private lesson during office hours on topics covered in a class you missed. Please see the University's attendance policies for more information (Go to <http://academiccatalog.udel.edu> → 2012-2013 Undergraduate Programs → Academic Regulations for Undergraduates → UNIVERSITY ATTENDANCE POLICIES → Class Attendance).

5.2 Tardiness

Please arrive on time to avoid distracting your classmates (especially during exams). If you need to arrive late or leave early please inform me in advance.

5.3 Academic Honesty

All University of Delaware Policies regarding ethics and honorable behavior apply to this course. The student guide to university policies (read more at: <http://www.udel.edu/stuguide/12-13/code.html#honesty>) is very clear: "All students must be honest and forthright in their academic studies. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance."

6 Accessibility for Students with Disabilities

If you are a student with a disability and wish to request accommodations, please contact the Office of Disabilities Support Services, 325 Academy St. Suite 161, or call (302) 831-4643. Information regarding your disability will be treated in a confidential manner. Because many accommodations require early planning, requests for accommodations should be made as early as possible.

7 Disclaimer

The above schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances and/or to ensure better student learning.