

UIC Department of Mechanical and Industrial Engineering
IE 576 - Nonlinear Optimization
Fall 2009

Instructor

Elodie Goodman, Department of Mechanical and Industrial Engineering
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Office hours: Monday and Wednesday 1-2pm or by appointment

Meeting times

The class meets for lecture on Mondays and Wednesdays at 3:15-4:30pm in 3290 SEL.
Please arrive on time and turn your cell phones off during the lectures.

Fall 2009 Catalog Description

4 hours. Convex analysis, line search techniques, unconstrained and constrained optimization, optimality conditions, duality, convex and nonconvex optimization, large-scale optimization, and real-world applications. Prerequisite(s): IE 471 or equivalent.

Textbook

Boyd and Vandenberghe, *Convex Optimization*, Cambridge University Press, 2004
(available at http://www.stanford.edu/~boyd/cvxbook/bv_cvxbook.pdf)

Some additional reference books are on reserve at the library:

- Bertsekas, *Nonlinear Programming*, 2nd Edition, Athena Scientific, 1999.
- Bazaraa, Sherali and Shetty, *Nonlinear Programming: Theory and Algorithms*, 3rd Edition, Wiley-Interscience, 2006.
- Mangasarian, *Nonlinear Programming*, McGraw Hill, 1994.
- Griva, Nash and Sofer, *Linear and Nonlinear Optimization*, 2nd Edition, Society for Industrial & Applied Mathematics, 2009.
- Nocedal and Wright, *Numerical Optimization*, 2nd Edition, Springer, 2000. Available electronically:
ERes URL <http://uic.docutec.com/eres/coursepass.aspx?cid=1746>
ERes - course page password: optimus

Web page

Course-related information announcements, and homework assignment and solutions can be found on Blackboard.

Homework

Homeworks are assigned on Blackboard, and are due by 6pm on the due date. You may submit your assignment electronically on Blackboard or in person as a hard copy at the lecture. A homework turned in by someone else or a late homework will not be accepted. Students with documented medical reasons may be excused. The homework solutions will be posted on Blackboard after 6pm on the due date. Students must commit not to upload the solutions or other course material on any course material-sharing or other websites. Partially graded homeworks will be returned in class the following week. Collaboration with other students is encouraged; you may discuss with your classmates possible approaches to solving the problems in the homework, but **each student should write her/his solution independently**, and you should indicate the names of the students you collaborated with. The use of Matlab will be necessary for certain assignments.

Grading

Homeworks, midterm and final exams are graded numerically. The course grade will be determined as follows:

Homework and class participation	15 %
Midterm	35 %
Final Exam	50 %

The homework and class participation grade is evaluated based on class attendance, class participation, and the average of all homework grades except the lowest one.

Tentative course outline

Week 1	Aug. 24 - 26	Introduction and motivation	
Week 2	Aug. 31 - Sep. 2	Basic notions, Convexity	HW 1 assigned on Sep. 2
Week 3	Sep. 9	Unconstrained Optimization: Optimality conditions	HW 1 due on Sep. 9 HW 2 assigned on Sep. 9
Week 4	Sep. 14 - 16	Unconstrained Optimization: Algorithms (1)	HW 2 due on Sep. 16 HW 3 assigned on Sep. 16
Week 5	Sep. 21 - 23	Unconstrained Optimization: Algorithms (2)	HW 3 due on Sep. 23 HW 4 assigned on Sep. 23
Week 6	Sep. 28 - 30	Unconstrained Optimization: Algorithms (3)	HW 4 due on Sep. 30 HW 5 assigned on Sep. 30
Week 7	Oct. 5 - 7	Constrained Optimization: Optimality conditions (1)	HW 5 due on Oct. 7
Week 8	Oct. 12 - 14	Constrained Optimization: Optimality conditions (2)	Midterm on Oct. 12 HW 6 assigned on Oct. 14
Week 9	Oct. 19 - 21	Constrained Optimization: Duality (1)	HW 6 due on Oct. 21 HW 7 assigned on Oct. 21
Week 10	Oct. 26 - 28	Constrained Optimization: Duality (2)	HW 7 due on Oct. 28 HW 8 assigned on Oct. 28
Week 11	Nov. 2 - 4	Constrained Optimization: Algorithms (1)	HW 8 due on Nov. 4 HW 9 assigned on Nov. 4
Week 12	Nov. 9 - 11	Constrained Optimization: Algorithms (2)	HW 9 due on Nov. 11 HW 10 assigned on Nov. 11
Week 13	Nov. 16 - 18	Interior Point Methods	HW 10 due on Nov. 18 HW 11 assigned on Nov. 18
Week 14	Nov. 23 - 25	Conic Optimization	HW 11 due on Nov. 25 HW 12 assigned on Nov. 25
Week 15	Nov. 30 - Dec. 2		HW 12 due on Dec. 2
	Dec. 7 - 11		Final exam

Lecture 1	Aug. 24	Introduction and motivation (1)	
Lecture 2	Aug. 26	Introduction and motivation (2)	
Lecture 3	Aug. 31	Basic notions	
Lecture 4	Sep. 2	Convexity	HW1 assigned
Lecture 5	Sep. 9	Unconst. Opt.: Optimality conditions	HW1 due; HW2 assigned
Lecture 6	Sep. 14	Unconst. Opt.: Gradient methods	
Lecture 7	Sep. 16	Unconst. Opt.: Steepest descent	HW2 due; HW3 assigned
Lecture 8	Sep. 21	Unconst. Opt.: Newton's method	
Lecture 9	Sep. 23	Unconst. Opt.: Conjugate Gradient (1)	HW3 due; HW4 assigned
Lecture 10	Sep. 28	Unconst. Opt.: Conjugate Gradient (2)	
Lecture 11	Sep. 30	Const. Opt.: Optimality conditions (1)	HW4 due; HW5 assigned
Lecture 12	Oct. 5	Const. Opt.: Optimality conditions (2)	
Lecture 13	Oct. 7	Const. Opt.: Optimality conditions (3)	HW5 due
Midterm	Oct. 12		
Lecture 14	Oct. 14	Const. Opt.: Optimality conditions (4)	HW6 assigned
Lecture 15	Oct. 19	Const. Opt.: Duality (1)	
Lecture 16	Oct. 21	Const. Opt.: Duality (2)	HW6 due; HW7 assigned
Lecture 17	Oct. 26	Const. Opt.: Duality (3)	
Lecture 18	Oct. 28	Const. Opt.: Generalized programming (1)	HW7 due; HW8 assigned
Lecture 19	Nov. 2	Const. Opt.: Generalized programming (2)	
Lecture 20	Nov. 4	Const. Opt.: penalty/ barrier methods (1)	HW8 due ; HW9 assigned
Lecture 21	Nov. 9	Const. Opt.: penalty/ barrier methods (2)	
Lecture 22	Nov. 11	Interior Point Methods (1)	HW9 due; HW10 assigned
Lecture 23	Nov. 16	Interior Point Methods (2)	
Lecture 24	Nov. 18	Interior Point Methods (2)	HW10 due; HW11 assigned
Lecture 25	Nov. 23	Conic Optimization (1)	
Lecture 26	Nov. 25	Conic Optimization (2)	HW11 due; HW12 assigned
Lecture 27	Nov. 30	Conic Optimization (3)	
Lecture 28	Dec. 2		HW12 due
Final exam	Dec. 7 - 11		

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Name:.....

Did you take IE 471 (or equivalent Operations Research I course)? YES NO

Did you take IE 472 (or equivalent Operations Research II course)? YES NO

Did you take MATH 310 (or equivalent Applied Linear Algebra course)? YES NO

Please list other courses you are enrolled in or where you serve as a TA and their meeting times (including lab):

Please provide other days of the week/times you CANNOT be on campus (due to conferences, research trips etc.):