DEPARTMENT OF MATHEMATICS
SYLLABUS

Course # & Name: 258A Numerical Optimization

Recommended Text(s) & Price: 1. Nocedal/Wright, Numerical Optimization, 2nd edition, available for free on SpringerLink
2. Boyd/Vandenberghe, Convex Optimization, available for free from Boyd's homepage

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Approval Date:

Prerequisites: 25 and 167, or consent of the instructor

Lectures	Sections	Comments/Topics
0.5	NW 1	Introduction
0.5	NW 2.1	Unconstrained optimization: Optimality conditions
0.5	NW 2.2, 3.1	Line search
1.5	NW 3.2—3.3	Convergence of line search. Linear convergence of steepest descent, local quadratic convergence of Newton.
0.5	BV 9.6	Self-concordant analysis of Newton.
2.5	NW 6.1—6.4 NW 7.2	Superlinear convergence of quasi-Newton methods. DFP, BFGS, Broyden, restricted Broyden, global convergence. Limited-memory BFGS (L-BFGS).
3	NW 12.1—12.7	Constrained optimization: First- and second order optimality conditions.
1	NW 12.9 BV 5.1—5.5	Lagrangean duality. Dual of convex quadratics.
1	BV 2.6, 4.4.2 BV 4.6, 5.9	Generalized inequalities: Conic, semidefinite, LMI. Their Lagrangean duality.
1.5	NW 16.1—16.5	Active-set methods for convex quadratic optimization.
1	NW 18.1—18.4	Sequential quadratic programming
1	NW 17.1—17.3	Penalty functions
0.5	NW 15.4, 18.3	Merit functions
1.5	NW 14.1—14.2	Primal-dual path-following interior point methods for linear optimization
1	NW 19.1—19.5	Interior point algorithms for general nonlinear optimization problems; line search vs. trust region
2	*	Application: Compressive sensing. Conditions for the equivalence of l_0 and l_1 optimization. Numerical aspects, such as the LASSO algorithm and/or l_1 minimization via interior point methods.

Additional Notes:

The indicated number of lectures refers to 80-minute lectures.

The syllabus accounts for 19.5 of 20 lectures of one quarter. Recommended are take-home midterms or individual/group projects rather than in-class midterms.

* Source for compressed sensing: the paper
http://www.acm.caltech.edu/~emmanuel/papers/RIP.pdf
and probably some more sources