Comprehensive Exam Syllabus for Continuous Optimization

Examiners: TBA

Suggested References:


Outline of Topics:

1. Linear programming, simplex method, duality (NW §§13.1–13.5 or refer to CO250 or CO255 lecture notes).
2. Optimality conditions: first- and second-derivative conditions for unconstrained optimization; KKT conditions for constrained optimization (NW §2.1, NW §§12.1–12.3)
3. Convex sets and supporting hyperplanes (BV §§2.1–2.3, 2.5; HL §A.1, §A.4.1, §A.4.2), affine hulls, relative interiors, tangent and normal cones (HL §A.2, §A.5).
4. Convex functions (BV §3.1, HL §B.1), sublinear functions and norms (HL §C.1), support functions (HL §C.2), differentiability and subgradient calculus (HL §B.4, §D.1, §D.4), Fenchel-Legendre conjugates and duality (BV §3.3; HL §E.1).
5. Canonical forms of convex optimization problems (BV §§4.1–4.4, 4.6).
6. Lagrange multipliers, Lagrangian duality, KKT optimality conditions, minmax theory (BV §§5.1–5.5).
8. Unconstrained optimization: basic first and second order algorithms including steepest descent and Newton’s method, quasi-Newton methods (no memorization of formulae of updates is required), conjugate gradient methods; sufficient decrease criteria convergence rates; convergence theorems for Newton’s method, line search and trust region methods (global convergence analysis) (NW pp. 21–23, §§3.1–3.3, §§4.1–4.2, Ch. 5, §§6.1–6.2).