



Midterm Exam Outline

Math 132A: Optimization
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- Optimization problems (formulation and conditions)
 - o Formulations of optimization problems
 - unconstrained over $\mathbb{R}^n$.
 - set constrained.
 - o Definition of local and global minimizers.
 - o Definition of feasible directions.
 - o Definition of Gradient, Hessian.
 - o Definitions of convexity
 - convex sets
 - convex functions.
 - o Conditions for local minimizers
 - First Order Necessary Conditions (FONCs).
 - Second Order Necessary Conditions (SONCs).
 - Second Order Sufficient Conditions (SOSCs).
 - o Application of conditions FONCs, SONCs, SOSCs for basic unconstrained and constrained optimization problems.
- One Dimensional Search Methods
 - o Fixed Proportional Interval Methods
 - Golden Section Method.
 - o Varying Proportional Interval Methods
 - Fibonacci Method.
 - o Bisection Method.
 - minimization formulation.
 - o Newton's Method.
 - minimization formulation.
 - zero-finding formulation.
 - o Secant Method.
 - minimization formulation.
 - zero-finding formulation.
 - o Convergence rates of above methods.

- Gradient Methods
 - o Steepest Descent Methods.
 - o Fixed-step Descent Methods.
 - o Variable-step Descent Methods.
 - o Quadratic objective functions: $f(x) = \frac{1}{2} x^T Q x - b^T x$.
 - definition of positive semi-definiteness.
 - canonical formulation, $f(x) = \frac{1}{2} y^T Q y$.
 - definition of condition number of $k(Q)$.
 - behaviors for large condition number (eigenvalue ratio large).
 - o Theory of convergence for quadratic objective functions
 - general conditions on γ_k .
 - conditions for steepest descent to converge.
 - conditions for fixed-step methods $\alpha_k = \alpha_0$ to converge.
 - o Stopping criteria.