Optimization Methods in Finance

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1 Review of Concepts

1. Convex sets, convex functions and linear functions.
2. Local optimum and global optimum for a convex function over a convex set.
3. Convexity of polyhedral sets.
4. Chief ideas underlying the Simplex method.
5. Local optimality conditions.
6. Finding an initial basis.
7. Other methodologies.

2 Duality

1. A motivating example.
2. Dual of the canonical form.
3. The weak duality theorem.
4. Unboundedness and infeasibility.
5. Strong duality.
6. Complementary slackness with example.
7. Geometric interpretation of optimality conditions.
8. Farkas' Lemma.

3 Applications to Finance

1. Short-term financing with example.
2. Dedication (Cash flow matching).
3. Derivative securities.
4. Arbitrage.
5. Replication.
6. Risk neutral probabilities.
7. The fundamental theorem of asset pricing.
8. Currency arbitrage.