Optimization Methods in Finance

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1 Motivating Examples

- 1. A product mix problem.
- 2. A portfolio selection problem.
- 3. A farmland use problem.
- 4. A transportation problem.

2 Fundamental Steps

- 1. Determination of the decision variables.
- 2. Formulation of the objective.
- 3. Formulation of the constraints.
- 4. The General form of a linear program.
- 5. Assumptions of the linear programming model.
- 6. Modeling the motivational examples.

3 Forms of a linear program

- 1. The General form.
- 2. The canonical forms.
- 3. The standard form.
- 4. The reduction of other forms to the standard form.
- 5. Equivalence of the feasibility and optimization problems.

4 Foundations of the Simplex Method

- 1. Graphical solution of 2-dimensional linear programs.
- 2. Convex sets and polyhedral sets.
- 3. Extreme points and optimality.
- 4. Basic Feasible solutions and Extreme points.

5 Algebra of the Simplex Method

- 1. Checking for optimality.
- 2. Determining the entering variable.
- 3. Determining the departing variable.
- 4. Optimality conditions.
- 5. Unbounded objective.
- 6. Finding an initial bfs.
- 7. Solving linear programs with Excel.

6 Topics not covered

- 1. The Simplex Tableau method.
- 2. Degeneracy and cycling.
- 3. The revised simplex method.
- 4. The bounded variables simplex method.
- 5. Decomposition.
- 6. Sensitivity analysis.

7 Alternatives to the Simplex Method

- 1. Computational Complexity.
- 2. The Klee-Minty observation about the simplex method.
- 3. Borgwardt's analysis.
- 4. The Fourier-Motzkin approach.
- 5. Khachiyan's ellipsoid approach.
- 6. The Karmarkar approach.