Math 170 : Linear Programming

California State University, Sacramento · Department of Mathematics & Statistics

Theory of linear programming, the simplex method, duality, sensitivity analysis, and applications.

Catalog Description

Theory of linear programming, duality, simplex method, integer programming, applications. **Graded**: Graded Student. **Units**: 3.0.

Prerequisites

Math 31 and either Math 35 or Math 100.

Course Outline

I. Definition of linear program, examples, and history of linear programming (3 weeks)

   A. Variables, constraints, and objective functions
   B. Geometric interpretation and solution
   C. Diet, product mix, allocation, transportation, scheduling, and dynamic planning problems

II. The simplex method (4 weeks)

   A. Standard form, slack variables, the simplex tableau, and pivoting
   B. Unbounded problems
   C. Artificial variables, the big M and two phase methods, and infeasible problems
   D. Unique verses multiple optimal solutions
   E. Degeneracy, cycling, and Bland's rules
   F. The fundamental theorem of linear programming

III. Duality Theory (3 weeks)

   A. Motivation-finding upper bounds on the optimal value
   B. Primal and dual problems
   C. The fundamental theorem of duality
   D. Relationships between the primal and dual problems
   E. The Tucker duality theorem and complementary slackness

IV. Sensitivity Analysis (3 weeks)

   A. The dual simplex method and dealing with infeasibility
   B. Changing the right hand side in a constraint
   C. Changing the objective function
   D. Adding a new constraint
   E. Adding a new variable

V. The efficiency of the simplex method (1 week)

   A. The number of variables verses the number of constraints
   B. Alternate pivoting rules
   C. The Klee-Minty problems
   D. Practical verses theoretically satisfactory algorithms
   E. The Khachian and Karmarker algorithms

VI. Optional topics

   A. Integer programming
   B. Game theory
   C. Transportation and assignmnet problems
   D. Network analysis