

Math 414 – Linear Programming (3)

Techniques of mathematical programming. Topics may include linear programming, integer programming, network analysis, dynamic programming and game theory.

Pre: 307 or 311 or consent.

0. Review of prerequisite material (3 hours)

Gaussian reduction restated in linear programming terminology. Linear independence, row and column rank. Hyperplanes, polyhedra and convexity. Introduction to the software used for matrix manipulation (MatLat, LinSolve, or a spreadsheet augmented with macros).

1. Linear Programming (11 hours)

Building linear programming models. Geometric solutions. Standard and canonical forms. The simplex method. The artificial basis technique. Degeneracy.

2. Duality (8 hours)

The dual of a primal problem. The duality theorem. Complementary slackness. Economic interpretations of dual and slack variables. The dual simplex method.

3. Integer Programming (5 hours)

Cutting plane methods. Branch and bound methods. Applications.

4. Special types of linear programming problems (5 hours)

Transportation and transshipment problems; assignment problems.

5. Dynamic programming and shortest route problems (2 hours)**6. Network problems (4 hours)**

Graphs and networks. Maximal flow problems. Minimal spanning tree problems. The critical path method.

7. Additional topics as time permits

- a. Parametric programming and sensitivity.
- b. Game theory. Two-person zero-sum games. Transformation to linear programming problems.
- c. Nonlinear programming methods. Quadratic programming.

Course Objectives:. Upon successful completion, the student will have a foundation in the basic topics of the theory of Linear Programming (and related programming techniques) listed above in the syllabus. The student will also have an understanding of where and how linear programming is applied in other sciences and in industry.

Program Objectives:. The need to find optimal or near optimal solutions to problems with enormous numbers of variables motivated the development of linear programming, and related theories. In this senior level course students learn this important mathematical subject, and they learn how to apply mathematics to other fields.