King Fahd University of Petroleum and Minerals

Department of Mathematics and Statistics

Syllabus (101) (Semester I, 2010-2011)

Dr. Slim Belhaiza

Course #: Math 480 (3-0-3)

Course Title: Linear and Nonlinear Programming

Prerequisite: Math 280, ICS 101 or ICS 102.

Textbook: Linear and Nonlinear Programming by E.G. Luenberger, 2nd Edition (1994).

Classes: SMW 10:00 to 10:50, Building 7, Room 119.

Office Hours: SMW 9:00 to 9:50, Building 7, Room, 109 (may change).

Objectives

The course deals with the basic ideas of mathematical programming (linear and nonlinear). We shall see how simple mathematics lays a significant role in the development of these ideas. The students will be asked to work out the computational implementation of a numerical algorithm for solving a Nonlinear Program (NLP).

Current Catalogue description

Formulation of linear programs. Basic properties of linear programs. The Simplex method. Duality theory. Necessary and sufficient conditions for unconstrained problems. Minimization of convex functions. A method to solve unconstrained problems. Equality and inequality constrained optimization. The Lagrange multipliers. The Kuhn –Tucker conditions. A method to solve constrained problems.

Week	Sections	Topics
1	2.1,2.2	Introduction, Examples of linear programs (LP)
2	2.3, 2.4	Basic solutions, The fundamental theorem of (LP)
3	2.5,3.1	Relation to convexity, Pivots
4	3.2,3.3	Adjacent extreme points, Determining a minimum feasible solution
5	3.4,3.5	Computational procedure-Simplex method, Artificial variables
6	3.7,3.8, 3.10	Matrix form of the Simplex Method, The revised simplex decomposition
7	4.1, 4.2, 4.3	Dual Linear Programs, The Duality Theorem, Relations to the Simplex Procedure
8	4.4, 4.5	Sensitivity and Complementary Slackness, The Dual Simplex Method
9	6.1, 6.2, 6.3	First Order Necessary conditions, examples of Unconstrained Problems second order condition
10	6.4, 6.5	Convex and Concave functions, Minimization and Maximization of convex functions
11	7.6, 7.8, 8.1, 8.2, 8.6, 9.1	The method of steeped descent, Newton's Method, Conjugate directions, Extension to Non-Quadratic problems, Modified Newton's Method.
12	10.1-10.3	Constraints, Tangent Plane, First Order necessary conditions (Equality constraints)
13	10.5-10.6,10.8	Second-Order conditions, Eigenvalues in tangent subspace, Inequality constraints
14	12.1, 12.2	Penalty methods, Barrier Methods, Properties of penalty and barrier functions
15	14.1, 14.2, 14.4	Quadratic Programming, Direct Methods, Modified Newton's Methods

Grading Policy

Major 1: 15%

Major2: 15%

Homewrok: 5%

Quizzes: 10%

Project: 15%

Final: 40%