

University Of Pennsylvania
Department of Electrical and Systems Engineering
ESE304 – Optimization Theory & Analysis (Course Outline)

Instructor: Dr. Michael A. Carchidi

Textbook: (Required) 1.) *Introduction to Mathematical Programming* by Wayne L. Winston, and Munirpallam Venkataramanan (Thomson, Brooks/Cole, 4th Edition @2003, ISBN: 0-534-35964-7)
2.) *Class Notes* by Michael A. Carchidi

| Week | Topics Covered |
|-------------|---|
| 1 | Introduction to Model-Building, the Seven-Step Model-Building Process, A Review of Basic Linear Algebra: For Reading (Chapters 1 and 2) |
| 2 | Linear Programming, Graphical Methods for Two-Variable LP problems, Numerous Examples of LP Problems (Chapter 3) |
| 3 | Converting an LP to Standard Form, A Preview of The Simplex Algorithm, Direction of Unboundedness, the Simplex Algorithm (Sections 4.1 – 4.5) |
| 4 | Minimization LP Problems, Alternate Optimal Solutions, Unbounded LPs, The LINDO and LINGO Computer Package (Sections 4.6 – 4.10) |
| 5 | Degeneracy, The Big M Method, The Two-Phase Method, Unrestricted in Sign Variables, Goal Programming (Sections 4.11 – 4.16) |
| 6 | Sensitivity Analysis: A Geometric Approach, The Computer and Sensitivity Analysis, Shadow Prices (Chapter 5) |
| 7 | Sensitivity Analysis: An Algebraic Approach, Basic Formulas and The Dual of An LP Problem (Sections 6.1 – 6.5) |
| 8 | The Dual Theorem, Shadow Prices, Complementary Slackness, The Dual Simplex Method (Sections 6.6 – 6.11) |
| 9 | Basic Formulas and The Revised Simplex Method (Section 10.1) |
| 10 | Integer Programming, Formulating IP Problems (Sections 9.1 & 9.2) |

| Week | Topics Covered |
|-------------|--|
| 11 | The Branch and Bound Method, Enumeration Methods, The Cutting Plane Method (Sections 9.3 – 9.8) |
| 12 | Nonlinear Programming, Review of Differential Calculus, Convex and Concave Functions, Solving NLP Problems with One Variable (Sections 12.1 – 12.5) |
| 13 | Unconstraint Nonlinear Optimization with Several Variables, Lagrange Multipliers and Constraint Nonlinear Optimization with Several Variables (Sections 12.6 – 12.8) |
| 14 | Kuhn-Tucker Conditions and Quadratic Programming (Sections 12.9 & 12.10) |

General Information about the ESE304 Course

1.) **Official Class Time:** From 3:00 PM to 4:30 PM on Tuesdays and Thursdays.

2.) **Prerequisites:** Some Calculus and Linear Algebra

3.) **Instructor:** Dr. Michael A. Carchidi
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Office Phone: 215-898-8342 (Towne 208)
Office Hours: By Appointment

TA/Grader: See The Electronic Blackboard at
<https://courseweb.library.upenn.edu/>

4.) **Grading Policy:** A total of 6 to 8 homework assignments will be assigned for collection and grading. These will be problems taken from the text as well as problems that I will create. The average of these will count for 25% of the final grade. PLEASE NO THAT LATE HOMEWORKS WILL NOT BE ACCEPTED. Two in-class exams and a final exam will count for the remaining 25% + 25% + 25% of the final grade.

5.) **Textbook/Notes:** The textbook for the course serves as a guide to the material we will cover this semester. You are required to purchase the textbook, even though my notes (which will be posted on the Electronic Blackboard) follow the textbook very closely. However, the textbook and my notes do not replace class time and you are expected to attend class and keep up with the reading of the textbook. My notes will be posted on Blackboard.
