Philadelphia University
Department of Basic Sciences and Mathematics

Summer Semester **Course Syllabus** **2011/2012**

Course Title	Linear Programming
Course Code	250373
Lecturer	
Office Room	
Office Hours	
E−mail	
Webpage	

Course Description

This course will be an introduction to mathematical programming, with an emphasis on techniques for the solution and analysis of deterministic linear models. The primary types of models to be addressed will be linear programming: applications and advances. However, the course will touch on more complex models. The main emphasis will be on solution techniques and on analysis of the underlying mathematical structure of these models. As a supporting theme, the course will also emphasize the use of mathematical solvers such as LINGO.

Topics by the Week

Week	Topics
1	**Ch 3: Introduction to Linear Programming.** What is a Linear Programming Problem? The Graphical Solution of Two-Variable Linear Programming Problems. Special Cases.
2	**Ch 4: The Simplex Algorithm and Goal Programming.** How to Convert an LP to Standard Form. Preview of the Simplex Algorithm. The Simplex Algorithm. Using the Simplex Algorithm to Solve Minimization Problems. Alternative Optimal Solutions. Unbounded LPs. The LINDO Computer Package.
3	Degeneracy and the Convergence of the Simplex Algorithm. The Big M Method. The Two-Phase Simplex Method. Unrestricted-in-Sign Variables. Karmarkar's Method for Solving LPs.
4	**Ch 6: Sensitivity Analysis And Duality.** A Graphical Introduction to Sensitivity Analysis. Some Important Formulas. Sensitivity Analysis. Sensitivity Analysis When More Than One Parameter is Changed: The 100% Rule. Finding the Dual of an LP.
5	Economic Interpretation of the Dual Problem. The Dual Theorem and Its Consequences. Shadow Prices. Duality and Sensitivity Analysis.
6	**Ch 10: Advanced Topics In Linear Programming.** The Revised Simplex Algorithm. The Product Form of the Inverse. Using Column Generation to Solve Large-Scale LPs.
7	The Dantzig-Wolfe Decomposition Algorithm. The Simplex Methods for Upper-Bounded Variables. Karmarkar's Method for Solving LPs.
8	*Final Exam.*

Course Objectives The goals of this course are for students to:

- Improve their ability to rigorously prove mathematical statements.
- Cultivate an ability to analyze the structure of and mathematically model various complex systems occurring in industrial applications.
- Develop knowledge of the mathematical structure of the most commonly used deterministic linear optimization models.
- Develop an understanding of the techniques used to solve linear optimization models using their mathematical structure.
- Develop knowledge of existing solvers for linear optimization.

Learning Outcomes

- To instill in the student an ability to recognize potential linear programming problems, formulate such problems as linear programming models and employ the proper computational techniques to solve these problems
- To identify and solve problems. Work with given information and handle mathematical calculations based on mathematical formulas.
- Encourage the students to be self starters (creativity, decisiveness, initiative) and to finish the mathematical problems properly (flexibility, adaptability). Also to improve general performance of students through the interaction with each other in solving different Mathematical problems.
- Gaining knowledge and experience of working with many applied mathematical problems and models.

Assessment Distribution

Students will be assessed based on a 100 total marks, which are distributed as follows.

Exam Type	Expected Time	Points Allocated
First		20%
Second		20%
Homeworks		20%
Final		40%

Textbook and Supporting Materials

– Wayne L. Winston, **Operations Research: Applications and Algorithms, 4th Edition**, Brooks/ Cole 2004. Call number in PU library: 519.7 WIN.

– Hamdy A. Taha, **Operations Research: An Introduction, 9th Edition**, Prentice Hall. 2011. Call number in PU library: 658.4034 TAH.

Class Attendance

Attendance is expected of every student. Being absent is not an excuse for not knowing about any important information that may have been given in class. Under the University's regulations, a student whose absence record exceeds 15% of total class hours will automatically fail the course. Students who in any way disrupt the class will be expelled from the classroom and will not be allowed to return until the problem has been resolved.

Late Exams

Late (make-up) exams will be given only to students who have a valid excuse and are able to provide a written document for its verification. The level of difficulty of a late exam is about 50% higher than that of the corresponding regular exam. All late exams will be conducted during the last week of the semester. Each student is allowed only one make-up in a semester, either for the first exam or the second, but not both. There is no make-up for a late exam.

Dishonesty

Any form of dishonest conduct will be strictly punished. A student who is caught cheating, or attempting to do so in an exam will be given a zero for the exam and a report will be written to the Dean for further action. A student who helps another student or is seen communicating with another student in an exam will be given the same penalty stated in the previous point. Students with different exam forms are not exempt from the above rules. Repeat offenders will be expelled permanently and banned from future courses.