University of Puerto Rico. Mayagüez Campus
College of Engineering.
Industrial Engineering Department

Course Syllabus

General Information

Course Number: InIn 6025
Course Title: **Linear And Discrete Optimization**
Credit-Hours: Three

Course Description

Basic theory and development of the simplex method for solving mixed programming problems. Special attention is devoted to the formulation of problems with linear, integer, and nonlinear variables. Algorithms are detailed discussed for solving the formulated problems. An introduction to nonlinear optimization techniques is also discussed in this course. Special software is used to solve the formulated problems (LINGO and Matlab).

Prerequisites

Authorization of the Director of the Department

Textbook and References

- Taha, H. A., 2011, Operations Research and Introduction, 9th Edition, Prentice Hall.
- Hillier, F.S., and Lieberman, G.J., 2014, Introduction to Operations Research, 10th Edition, McGraw-Hill.
- Taha, H, A., 1975, Integer Programming: Theory, Applications and Computations, Academic Press.
- Bazaraa, M.S., Jarvis, J.J., and Sherali, H.D., 2004, Linear Programming and Network Flows, 3rd Edition, John Wiley & Sons.

Purpose

This course is mainly designed for industrial engineering graduate students that want to develop a quantitative background in the field of management science. This course provides an excellent analytical and computational support for graduate students that come from other disciplines such as chemical, civil, mechanical, electrical and computer engineering. The main purpose of this course is to develop student's skills to formulate and solve real world problems using linear and mixed integer programming. A detailed description of algorithms is provided for developing student capabilities to implement algorithm changes and create strategies for solving real world problems.

Course Goals

At the completion of the course the students will be able to:

- Identify assumptions linear programming and its implications.
- Develop the appropriate model for a given linear optimization problem.
- Identify the appropriate algorithm for solving a linear programming problem.
- Identify when an underlying optimization problem should be solved by linear, integer, dynamic or nonlinear programming.
- Use a computer package to solve real-world linear and nonlinear programming problems.

Requirements

Course Syllabus

All students are expected to come to class all the time, on time, and prepared; do all assigned readings and related homework; actively participate in class discussions; and satisfy all assessment criteria to receive credit for the course.

Department and Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies)

Absence from examinations: Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero of "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies).

Disabilities: After been identified with the professor and the institution, the students with disabilities will receive reasonable accommodations in their courses and evaluations. For more information, please contact *Student Services with Disabilities* at the Student Dean's Office at (Q-019), 787-265-3862 ó 787-832-4040 x-3250 ó 3258.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

Campus Resources

General Library and University Computer Center is available to obtain professor=s reference materials. The University=s Counseling Office has a tutorial program for students who need extra help.

General Topics

Lecture	Topic	Reading
	I – Problem Formulation	
1-3	Linear Programming Problem Formulation: industry and	Ch. 2

	government applications.	
4-9	Formulation of Integer Programming Problems	Ch. 9
	II- Mathematical Background	
10-11	Algebra of matrices and Vectors (spanning tree, convex combinations, independence, basis, determinants, matrix inversion, and solution of linear system of equation)	Appendix D
	III – Simplex Algebra	
12	The Simplex Method	Ch. 3
	IV-Advance Linear Programming	
13-14	Algebra of the Simplex Method and Revised Simplex Method	7.1, 7.2
15-17	Decomposition Algorithm	22.2
18-20	Karmarkar Interior-Point Method	22.3
	V- Integer Programming	
21-22	Pure Integer (Cutting Plane Algorithm)	9.1-9.2
23	Mixture Problem (Cutting Plane Algorithm)	9.1-9.2
24-26	Branch & Bound Algorithm	9.1--.2
27-29	0 – 1 Integer Programming	9.1-9.2
	VI- Deterministic Dynamic Programming	
30-32	Deterministic Dynamic Programming	12.1-12.3
	VII – Nonlinear Programming	
34-36	Unconstrained Optimization	20.1
37-39	Constrained Optimization	20.2
40-42	Constrained Nonlinear Algorithms	21.1