Optimization

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Content

Agenda

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Agenda

Course Content

- I. Mathematical Modeling
  - Introduction to linear programming
  - Examples of optimization problems
  - Modeling
- II. Solution Techniques
  - Graphical method
  - Simplex method
- III. Transportation Problems
  - Northwest Corner Method
  - Minimum Cost Method
- IV. Integer Programming
  - Examples of Integer and Mixed Integer Programming
  - Modeling
  - Branch & Bound Method

PISIS
Posgrado en Ingeniería de Sistemas

Evaluation criteria

Criterion	Value
Homework	40%
Midterm exam	20%
Final exam	20%
Final project	20%
Total	100%

Important remarks:

- 70% of the activities and homework must be delivered in order to present the second opportunity.
- The grade of the second opportunity will take into account 20% of your final grade and 80% of the grade obtained at the extra-ordinary exam.

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Weekly schedule

Week Number	Topics	Exercises
1 & 2	Mathematical Modeling	3, 4, and 5
3 & 4	Graphical Method	6, 7, and 10
5 & 6	Simplex Method	11, 12, 13, and 14
	MidTerm Exam	
11 & 12	Two-Phase Simplex	16, 17, and 18
13 & 14	Transportation Problem	29 and 30
15 & 16	Branch and Bound	19, 20, 21, and 22
	Final Exam	

Fundamental activities are due on week 2, 4, 6, 12, 14, and 16.

Final Project

- The final project must be delivered before the final exam
- The project must be done in team of minimum 4 and maximum 5 members
- The team will investigate a case study related to operations research
- The team should deliver in pdf a report on their case study

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Introduction to OR

The ambiguous term **operations research (O.R.)** was coined during World War II, when the British military management called upon a group of scientists together to apply a scientific approach in the study of military operations to win the battle. The main objective was to allocate scarce resources in an effective manner to various military operations and to the activities within each operation.
The first scientists who used operations research contributed to the development of effective methods for using the new radar, resulting in the triumph of British air combat.

Introduction to OR

OR means to use scientific and mathematical techniques for making decisions and solving problems. It is concerned with co-ordinating and controlling the operations or activities within an organization. It can be regarded as use of mathematical and quantitative techniques to substantiate the decisions being taken. OR helps to take decisions about operations and production. It takes tools from subjects like mathematics, statistics, engineering, economics, psychology, etc. and uses them to know the consequences of possible alternative actions.

Methodology of OR

1. Problem definition
2. Data collection
3. Model formulation
4. Model solution
5. Validation of preliminary results
6. Results analysis
7. Implementation and monitoring

Applications of OR

- Production and facilities planning
  - Factory size and location decisions
  - Estimation of the number of required facilities
  - Preparation of forecasts for the various inventory items and computation of economic order quantities and reorder levels
  - Scheduling and sequencing of production runs by proper allocation of machines
  - Transportation loading and unloading
- Products distribution
  - Estimate the fleet size needed to satisfy the customers
  - Determine the sequence in which customers must be served
  - Driver-truck allocation

Applications of OR

- Health care
  - Assessment of forecasting models for patients arrival at Emergency Department
  - Scheduling elective surgeries in hospitals
  - Kidney exchange and stable matching

Agenda

Bibliography

- Investigación de Operaciones: Aplicaciones y Algoritmos. Wayne L. Winston, Editorial Thompson, 2004 (available in english and spanish).
- Introducción a la Investigación de Operaciones. Hillier y Lieberman, Editorial McGraw-Hill, 1997.
- Investigación de Operaciones. Hamdy A. Taha, Editorial Pearson-Prentice Hall, 7ª edición, 2004.