

ISE 4711/IHE 6711 – Optimization Methods

Course Description

Introductory course on Operations Research/Management Science/System Engineering. This course focuses on the deterministic models, especially linear, integer and network flow models and practical solution techniques.

Undergraduate/Graduate level – 3 credit hours

- Course project:

Undergraduate students will select application papers from leading journals such as *Interfaces* or papers related to Edelman competition. The paper should be an application-based paper but should have enough content on models. A paper can be used by only one student. You will be asked to prepare for a 15-minute presentation (e.g. Power Point).

Graduate students will be asked to implement an optimization project of your own interests. They will be asked to identify a problem, build the mathematical model, code it in EXCEL or MatLab, interpret the result, implement it if possible and finally prepare for a 15-minute presentation (e.g. Power Point).

Offered both face-to-face and online

Course Learning Objectives

Students will learn:

- Ability to analyze real-world problems and formulate linear program models
- Ability to explain the graphical representation of objective functions and feasible regions and the graphical development of the simplex technique
- Ability to explain duality and interpret dual variables for sensitivity analysis
- Be familiar with goal programming and integer programming and select applications of these types of models.
- Formulate optimization models for problems that arise in engineering design, resource allocation, operations management and in various industries
- Ability to solve models using state-of-the-art optimization software and spreadsheets

Course Learning Outcomes

After successful completion of the course, students will be able to:

- Ability to analyze real-world problems and formulate linear program models

- Ability to explain the graphical representation of objective functions and feasible regions and the graphical development of the simplex technique
- Ability to explain duality and interpret dual variables for sensitivity analysis
- Be familiar with goal programming and integer programming and select applications of these types of models.
- Formulate optimization models for problems that arise in engineering design, resource allocation, operations management and in various industries
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Tentative Weekly Schedule

1	Introduction to operations research and optimization, Examples and applications
2	Examples and applications such as facility location, production planning, staff scheduling, etc...
3	The solution of the above models using spreadsheet
4	Graphic representation of linear program Feasibility, single and multiple optimal solutions
5	Extreme points, BFS, and simplex algorithm overview Tableau form of simplex algorithm
6	Tableau form of simplex algorithm
7	Two Phase simplex algorithm
8	Sensitive analysis and duality Introduction to Goal Program
9	Exam I – Model and Simplex Algorithm Introduction to Stochastic Program
10	Stochastic Program and Examples (production planning)
11	Introduction to integer program and its relationship to LP Example and Applications
12	Special case of integer program –network flow and its relationship to LP Examples and applications (SPP, etc..)
13	From theory to Practice – solving large optimization models in practice such as AIMMS

	Spreadsheet modeling
14	Project presentations
	Final Exam