

EM 512 Mathematical Programming

Course Objective: The objective of the course is to familiarize the student with the basic tools of mathematical programming to the extent they can be applied in operational situations. The material is quite practical and will prove useful in personal decision making as well as in many types of engineering and management decisions.

Learning outcomes: (*knowledge and skills that the student will acquire at the end*)

LO 1: Mathematical modeling

LO 2: Linear programming and simplex method

LO 3: Duality and sensitivity analysis

LO 4: Transportation and assignment models

LO 5: Goal programming

LO 6: Deterministic dynamic programming

Texts:

Hillier, F.S., Lieberman, G.J., *Introduction to Mathematical Programming*, McGraw-Hill, 1995.

Taha, H.A., *Operations Research: An Introduction*, Tenth edition, Pearson, 2017.

Semester grades will be determined on the following approximate bases:

Midterm exam	40%
Final exam	<u>60%</u>
	100%

Week Nr.	Topic
1	- Introduction and organization - Overview of modeling - Introduction to linear programming - Graphical solution
2	- Linear programming model - Assumptions of linear programming - Additional modeling examples
3	- The simplex method - Standard form of linear programming - Unrestricted variables - Algebra of the simplex method - Simplex method in tabular form
4	- Artificial starting solution - The big M method - The two-phase method
5	- Special cases in simplex method application - Degeneracy - Unbounded solutions - Multiple optimal solutions - Infeasible solution - Post-optimality analysis

Week Nr.	Topic
6	- Presentation of LINDO software - Duality - Definition of the dual problem - Primal-dual relationships
7	Midterm Exam
8	- Dual simplex method - Sensitivity analysis
9	- The transportation problem
10	- The assignment problem - Goal programming
11	- Deterministic dynamic programming - Characteristics of dynamic programming problems - Principle of optimality - Selected dynamic programming applications
12	Final Exam (comprehensive)