FINANCIAL OPTIMIZATION AND ASSET MANAGEMENT (6 cfu) – Federica Ricca
a.y. 2023-2024

PART I: Optimization models and techniques
Operations Research, Optimization, and Mathematical Programming
Systems of relations, Feasibility problems
Mathematical Programming and Linear Programming

LINEAR PROGRAMMING
Examples of Linear Programs: financial problems
Equivalent systems: two Reference Forms and the Standard Form
Theorems for Linear Programming

Geometrical interpretation of a Linear Program

Local search algorithms
The Simplex Method and its geometrical interpretation
Duality and sensitivity analysis in Linear Programming

INTEGER LINEAR PROGRAMMING
Integer Linear Programming
Geometrical representation of ILPs and difficulties in solution procedures
Integer and Mixed Integer Programs
Examples of Integer Linear Programs: financial problems

GRAPH AND NETWORKS
Graphs and Networks
Network optimization models

1. Minimum Cost Flow
2. Transportation Problem
3. Shortest Path models
4. Generalized Network Flows

Financial Applications

PART II: Applications in finance
Short-term financing problems

1. Asset Liability Management
2. Cash-flow matching models: Dedicated Portfolios

Capital Budgeting and Project Financing
Portfolio Selection

1. Mean-Variance Markowitz optimization models
2. Additional constraints
3. Other risk-return optimization models

PART III: Computational Finance with Excel
Excel solver tool for optimization problems – Financial LP problems: short-term financing and fund allocation problems – ALM with Generalized network Flows – Data preparation and model solution for portfolio selection problems by applying Markowitz mean-variance models – Empirical construction of the Efficient Frontier of non-dominated portfolios.

References

G. Cornuéjols, J. Peña, R. Tütüncü, Optimization Methods in Finance, Cambridge University Press, 2018.

P. Rardin, Optimization in Operations Research, Upper Saddle River, Prentice-Hall, 1998.

F. Cesarone, Computational Finance MATLAB oriented modelling, Giappichelli Editore, 2020

E. J. Elton, M. J. Gruber, Modern Portfolio Theory and investment analysis, John Wiley and Sons, 1995 (2014).