UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Mathematics for Business Management

2526-1-F7703M008-F7703M008-2

Learning objectives

Aim of this course is to provide the student with the ability to use mathematical tools to address and solve decision-making problems in order to develop the ability to propose effective solutions to business problems.

Knowledge and understanding:
Knowledge of the fundamental concepts of mathematical modelling for decision-making problems. Understand the principles of Linear and Integer Linear Programming, their solution methods and their application in business management scenarios (e.g. production optimisation, resource allocation). Knowledge of the key concepts of network optimisation, including graph theory terminology (indirected, directed), trees, Eulerian and Hamiltonian paths, and centrality measures.

Applying knowledge and understanding:
Formulate decision-making problems typical of the business context, into specific mathematical models by identifying variables, constraints and objective functions. Apply Linear and Integer Linear Programming methods and algorithms to solve real business optimisation problems, critically interpreting the outcomes. Use optimisation tools on networks to analyse and solve logistical, flow or interconnection problems within a company (e.g. route optimisation, personnel allocation).

Making judgements
Critically evaluate the relevance and effectiveness of different mathematical modelling and optimisation approaches for specific business problems, selecting the most appropriate method. Interpret the results of quantitative analyses, recognising the limitations and assumptions of the models used and their impact on business decisions. Identify the need for additional data or insights to improve the accuracy and reliability of decisions based on mathematical models.

Communication skills
Communicate clearly and effectively the formulation of business decision-making problems in mathematical terms. Present and discuss the results of optimisation analyses, highlighting key conclusions and practical recommendations for the company. Explain the reasoning behind modelling choices and solution methods

adopted, using language appropriate to the context. Collaborate effectively in teams, exchanging ideas and knowledge relating to the application of mathematics to solve business problems.

Learning skills
Autonomously learn new mathematical optimisation techniques and algorithms relevant to the business context. Analysing new decision-making problems in the business environment, identifying opportunities for the application of modelling and optimisation. Adapt to evolving contexts, applying acquired skills to new types of problems or changes in business needs.

Contents

The course aims at studying some mathematical models, useful for formalizing and solving decisional and managerial problems in the business environment.

The first part the classical models of linear programming and integer programming are studied. Then these models are applied to solve typical management problems such as profit maximization or cost minimization. In the second part some optimization models on networks are studied.

Detailed program

Decisional problems and mathematical models: an overview.

Basic of Linear Programming: graphical solution, duality, sensitivity analysis, simplex method.

Basic of Integer Programming; general solution, Branch and bound method.

Application of linear and integer programming to business problems.

Network Optimization, Graphs, digraphs, trees. Minimum path problems, flow on networks. Greedy algorithms. Centrality measures.

Applications to business problems.

Prerequisites

Basics maths from courses in any bachelor's degree in economics

Teaching methods

Lectures in presence, with tutoring sessions in preparation for the final exam.
Lectures will take place in the traditional form. Some lessons will be held remotely (no more than 30% of the course's total hours).
A small part (approximately 10% - 3 lectures of 2 hours) of the teaching will be interactive lessons (comprehension

of the topics, interactive exercises).

Assessment methods

The written exam evaluates the knowledge of the mathematical formal language, the proficency and competencies gained during the course.
It consists of:
Five closed questions for extensive testing of the exam program.
Two (or three) open questions on all topics covered in the course. The questions will be theoretical, for extensive testing of the exam program and exercises.
A part of the exam consists of formulate a decision problem then solve it using excel, for the purpose of establishing the disciplinary problem solving skills.
There are no intermediate tests.

Textbooks and Reading Materials

L. Bellenzier, R. Grassi, S. Stefani, A. Torriero, Metodi quantitativi per il management, Esculapio Editore, Bologna, 2012

Semester

First Term

Teaching language

Italian

Sustainable Development Goals

QUALITY EDUCATION