UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Operations Research and Resource Planning

2425-3-E3101Q128

Aims

Operations research (OR) is the study of scientific tools that deals with the application of advanced analytical methods to help make better decisions. It is a key branch of applied mathematics with applications in a wide spectrum of areas including computer science, engineering and economics.The goal of this course is to teach students to formulate mathematical models that represent real-world problems and to recognize approaches and tools to solve these models.

Namely, we will cover nonlinear, linear, network flow and integer optimization problems, with applications in planning, economics, business, and engineering.

Contents

A. Linear programming
B. Linear integer programming
C. Non linear programming

Detailed program

Introduction to Mathematical Programming

A. Linear Programming
1. Introduction to Linear Programming (LP): poperties and modelling strategies
2. Graphical solution method
3. Geometry of LP and the simplex method

4. Duality

B. Integer Linear Programming
1. Introduction to integer linear programming (ILP)
2. Properties and modelling strategies
3. Branch and Bound

C. Non Linear Programming
1. Oprimizing non linear functions of a single variable
2. Oprimizing non linear functions of multiple variables
3. Optimizing constrained non linear functions, Karush-Kuhn-Tucker conditions

Prerequisites

- Linear Algebra; vector, matrix, sistem of linear equations, ...
- Function; of one variable, of more variables, convex, derivative, gradient, hessian, ...

Teaching form

Lectures, exercises and demo using sw
The course will be delivered in Italian.

- 32 lectures of theory of 2 hours each in presence of erogative nature
- 20 excercise lectures of 2 hours each in presence of erogative nature
- 24 laboratory lectures of 2 hours each (of which 3 hours of interactive lectures in presence and a maximum of 3 hours of interactive lectures on line)

Textbook and teaching resource

Main textbook

- Frederick S. Hillier and Gerald J. Lieberman, Ricerca Operativa, McGraw-Hill, 9th edition, 2010.

Additional textbooks

- Dimitris Bertsimas and John Tsitsiklis, Introduction to Linear Optimization, Belmont, Massachusetts, 2008.
- Mokhtar S. Bazaraa, John J. Jarvis, Hanif D. Sherali, Linear Programming and Network Flows, Wiley, 4th edition, 2010.
- Mokhtar S. Bazaraa, Hanif D. Sherali, C. M. Shetty, Nonlinear Programming: Theory and Algorithms, Wiley, 3th edition, 2006.

Software

- Python + Libreria PuLP: https://www.python.org/ + https://pypi.org/project/PuLP/

Additional Material

Slides of the lectures and some solved exercises will also be available

Semester

I semester

Assessment method

Two alternatives

1. During lecturing period - INTERMEDIATE EXAMS

- two intermediate exams, each one awards a maximum of 15 points,
- the dates will be communicated during the first lecturing week
- intermediate exams take place in the Università di Milano-Bicocca laboratories
- the access to the second intermediate exam is allowed to students awarded with at least 6 points in the first intermediate exam, in case this condition is not met refer to exam form 2)
- the second intermediate exam is valid only if the student is awarded at least 6 points, if thi is not the case please refer to exam form 2)
- the final grade is the aritmetinc sum of the grades awarded in the two intermediate exams
- the exam is passed only if the final grade is at least equal to 18
- the oral exam is facoltative and allowed only to a student awarded at least 18 points, it awars a maximum of 3 points tto be added to the base grade
- if the oral exam is particular bad then it may be the case the base grade is lowered of a maximum of 3 points

2. When the lecturing period is over - STANDARD EXAM

- the exam takes place at the Università di Milano-Bicocca laboratories
- the exam consists of two phases
- phase 1 consists of 10 closed-form quizzes about course pre-requisites
- phase 2 happens only if you have been awarded at least 6 points (at least 6 quizzes are corret) at phase 1
- Phase 2 awards a maximum of 30 points
- Phase 1 and Phase 2 happen in strinct sequence, without any temporal lag
- the exam is successful if the student is awarded at least 18 points
- the oral exam is facoltative and allowed only to a student awarded at least 18 points, it awars a maximum of 3 points tto be added to the base grade
- if the oral exam is particular bad then it may be the case the base grade is lowered of a maximum of 3 points

Office hours

Fabio Stella by appointment
Guglielmo Lulli by appointment
Enza Messina by appointment
Mauro Passacantando by appointment

Sustainable Development Goals