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<tr><th colspan="3">Programme of “Operational Research”</th></tr>
<tr><th colspan="3">Number of ECTS credits: 6 (workload is 150 hours; 1 credit = 25 hours)</th></tr>
<tr><td colspan="3">Compulsory/Optional
LM-77: 2nd Cycle degree in Management, Economics and Finance - 1st year, 1st semester
Teacher: Marco Castellani</td></tr>
<tr><td>1</td><td>Course objectives and Learning outcomes</td><td>Aim of this course is to introduce the student to the formulation of basic optimization problems, particularly linear optimization problems, and train him/her to the related solution algorithms. Learn algorithmic techniques for some combinatorial optimization problems. Being able to formulate and solve combinatorial optimization problems using suitable methods.</td></tr>
<tr><td>2</td><td>Dublin descriptors</td><td>Topics of this course include:
Optimization problems: decision variables, objectives and constraints; modeling techniques and model classification
Geometry of linear programming and the simplex method
Duality theory in linear programming, the dual interpretation of the simplex method and the dual simplex method
Integer linear programming. Unimodular and totally unimodular matrices. Branch and bound method
Problems on network and solution methods
The minimum spanning tree problem and the Kruskal’s algorithm
The shortest path problem and the Dijkstra’s algorithm
The Hitchcock-Koopmans transportation problem and the primal-dual algorithm
The assignment problem and the Hungarian method
The maximum-flow problem and the Ford-Fulkerson method
On successful completion of this module, the student should:
Acquire the knowledge of optimization problems and of the mathematical modeling techniques for complex decisions
Be able to recognize optimization problems and develop mathematical models of decision-making problems
Acquire the ability of computing solutions of linear programming problems.
Be able to hold a conversation and to read texts on topics related to the modeling of decision problems and Linear Programming.
Acquire the ability of upgrading flexible knowledge and skills in the field of optimization and related problems that arise in various areas, such as mathematics, computer science and management science.</td></tr>
<tr><td>3</td><td>Prerequisites and learning activities</td><td>Prerequisities provide in “Matematica Generale”
vector space
scalar product
matrix product
inverse matrix
determinant and rank of a matrix
solvability of a linear system
Gauss-Jordan method
Rouché-Capelli Theorem</td></tr>
<tr><td>4</td><td>Teaching methods and language</td><td>Lectures and exercises
Language: English
Text book: R.J. Vanderbei, Linear programming: Foundations and extensions, Kluwer Academic Publishers, 1998
Some didactic material will be distributed among the students during the course in order to facilitate the understanding of the lectures.</td></tr>
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5	**Assessment methods**	**Pre-Assessment.** There is no formal pre-assessment, but the abovementioned pre-requisites are fundamental. **Formative assessment.** The students are involved in discussions and comments in short Q&A sessions. The active participation is supported also by many exercises and practice problems in classroom. Some homeworks are requested to specific topics. **Summative assessment.** Two midterms written exams (in order to help the students to split the workload), a written(*) final examination. The written test (2 hours) consists in 8 exercises concerning with different topics: • The primal/dual simplex method • The geometrical primal simplex method • The branch and bound method for a discrete linear problem • The Kruskal's algorithm • The Dijkstra's algorithm • The primal/dual method for a transportation problem • The Hungarian method for the assignment problem • The Ford-Fulkerson method for the maximum flow It is designed to verify the ability of the students in the application of methods and algorithms presented during the Course. Criteria of evaluation will be the level of knowledge and practical ability; the property of use of the technical/mathematical language; the completeness of the presentation. Each exercise is assigned with a number of points contributing to the final mark. (*) The midterm written exams might substitute (subjected to a positive teacher's evaluation) the final written exam.