



Programme of Integrated course "Networks And Decision Models"

This course is composed of 2 Modules: 1) Decision Models, 2) Networks

Programme of Module "Decision Models"

- Code: DT0342
- Type of course unit: Compulsory (Master Degree in Applied Data Science curriculum Data for Smart City), Compulsory (Master Degree in Applied Data Science curriculum Data for Life Science)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Master Degree in Applied Data Science) 6 (workload 150 hours)

Teachers: Claudio Arbib (Claudio.Arbib@univaq.it)

1	Course objectives	Understand the role of combinatorial optimization models in technical-scientific applications. Formulate and solve combinatorial optimization problems in terms of 01 linear optimization. Get familiar with some fundamental algorithms for specific problems.
2	Course content and learning outcomes (dublin descriptors)	<p>Topics of the module include:</p> <ul style="list-style-type: none"> • Decision processes: definitions and phases • Deciding and valuing: relations and numbers, preferences as relations, utilities as values, Pareto curves. • Representation of individual decisions: alternatives, decision matrices, zero-sum games, Stackelberg games. • (Integer) Linear Programming models and algorithms. • Decision making under uncertainty/ignorance: stochastic, Bayesian and robust models. • Social decision theory. • Decision modello and data analysis: single-multi decision maker, single-multi objective. Descriptive, predicative and prescriptive models, examples. Linear and non-lineare regression as a linear optimization problem, the minimum square method. Classification problems (p-median, p-centre). Separation and Overlap.
3	Course prerequisites	Basics of Linear Algebra. Linear operators, finite-dimensional matrices and vectors.
4	Teaching methods and language	Lectures, exercises, seminars Language: English
5	Assessment methods	Written test (possibly divided into two intermediate tests) + oral test

Programme of Module "Networks"

- Code: DT0341
- Type of course unit: Compulsory (Master Degree in Applied Data Science curriculum Data for Smart City), Compulsory (Master Degree in Applied Data Science curriculum Data for Life Science)
- Level of course unit: Postgraduate Degrees
- Semester: 2

Number of ects credits: (Master Degree in Applied Data Science) 6 (workload 150 hours)

Teachers: Giovanni Stilo (giovanni.stilo@univaq.it)

1	Course objectives	The student will be able to manage and analyze networks from several aspects.
2	Course content and learning outcomes (dublin descriptors)	<p>Topics of the module include:</p> <ul style="list-style-type: none"> • Fundamentals of graph theory and Notation • Linear Algebra and Norms • Node Similarity Measures and algorithms • Network Generators • Key Players of a Network and Centralities measures • Networks and communities: algorithms and metrics.

		<p>On successful completion of this module, the student should :</p> <ul style="list-style-type: none"> • On successful completion of this course, the student should: Understand: • Where graphs are, why they are important, and what are new applications; • The main challenges from data mining perspective: <p>Learn: • Analyze networks to understand the properties and the behaviors of individuals • Think in a research perspective (novelty, clarity,...) • Solve practical problems</p>
3	Course prerequisites	- Knowing at least one Programming Language. - Notions of linear algebra.
4	Teaching methods and language	<p>Language: English</p> <p>Reference textbooks</p> <ul style="list-style-type: none"> • Chakrabarti, D. and Faloutsos, C., <i>Graph mining: laws, tools, and case studies..</i> 2012. • Aggarwal, C.C. and Wang, H. eds, <i>Managing and mining graph data.</i> Springer. 2010. • Easley, D. and Kleinberg, J., <i>Networks, crowds, and markets: Reasoning about a highly connected world.</i> Cambridge University Press. 2010.
5	Assessment methods	Project, oral presentation of the project and discussion of course topics.