

MASTER 2 MENTION INFORMATIQUE – Parcours Recherche Opérationnelle
Descriptif des Modules

S51IR00			Introduction to informatic		
16	16	16			
X. Gandibleux			Xavier.Gandibleux@univ-nantes.fr		
Contents					
<ul style="list-style-type: none"> • Principles • Architectures • Algorithms • Programming languages 					

S51IR01			Advanced integer programming		
12	12	00			
M. EHRGOTT			Matthias.Ehrgott@univ-nantes.fr		
Contents					
<ul style="list-style-type: none"> • Theory and solution methods of integer programs • Formulations, relaxations, well solvable problems, total unimodularity • Dynamic programming, Lagrangean duality, column generation • Polyhedra, integer polyhedrons, facets, branch & cut algorithms • Polyhedral ties between linear programming and polyhedral theory • Valid inequalities, facet generating inequalities, combinatorial properties of polyhedra. 					

S51IR02			Optimization in graphs and networks		
12	12	00			
I. Rusu			Irena.Rusu@univ-nantes.fr		
Contents					
<ul style="list-style-type: none"> • Matchings • Graph coloring • Routing problems in interconnection networks • Max-cuts, multiflows, network simplex • Applications (scheduling, routing, timetabling, etc.) 					

S51IR03			Business Intelligence		
12	12	00	Knowledge Discovery in Databases		
Pascale Kuntz			Pascale.Kuntz@polytech.univ-nantes.fr		
Course goals					
<p>The aim of the course is to cover the various aspects of data-mining for decision-aiding in the context of Business Intelligence. In a first part, the course presents an overview of the main steps of a mining process and a typology of the models classically used to explore large data sets and propose new hypotheses. In a second part, it describes the basic techniques including decision trees, association rules, Bayesian networks, classification algorithms. These techniques are illustrated on experimental data as well as real-life corpuses.</p>					
Contents					
<ol style="list-style-type: none"> 1- Introduction to Business Intelligence (BI) 2- Presentation of the knowledge discovering process 3- Typology of the main models 4- Decision trees 5- Association rules 6- Bayesian networks 					

- 7- Classification algorithms
- 8- Quality validation

Bibliography

J. Darmont, O. Boussaid, *Processing and Managing Complex Data for Decision Support*, Idea Group Publishing, 2006.

J. Han J., M. Kamber, *Data Mining – Concepts and Techniques*, Morgan Kaufmann, 2001.

C. Zhang, B. E. Heymer, S. Zhang., *Association Rule Mining: Models and Algorithms*, Springer, 2002

D.J. Cook, L.B. Holder (eds), *Mining Graph Data*, Wiley-Interscience 2006

F. Guillet, H. Hamilton (eds). *Quality Measures in Data Mining*. Studies in Computational Intelligence, Springer, 2007.

D.A. Zighed et R. Rakotomalala, *Graphes d'Induction : Apprentissage et Data Mining*, Editions Hermès, 2000

S51IR04			Declarative Approaches for Optimization		
24	24	00			
Ch. Jermann, L. Granvilliers			Christophe.Jermann@univ-nantes.fr , Laurent.Granvilliers@univ-nantes.fr		
N. Jussien, N. Beldiceanu			Narendra.Jussien@emn.fr Nicolas.Beldiceanu@emn.fr		
<p>1. Advanced Global Optimization (12 12 00) Contents</p> <ol style="list-style-type: none"> 1. Rigorous global optimization (existence theorems, interval methods, rounding in relaxations) 2. Quantified constraint solving 3. Mixed-integer nonlinear programming (branch-and-bound methods, outer approximation & benders decomposition, hybrid methods) <p>2. Constraint Programming (12 12 00) Contents</p> <ol style="list-style-type: none"> 1. Principles and tools of Constraint Programming 2. Global constraints 4. Hybrid OR/CP optimization techniques 					

S51IR05			Multi-Criteria Decision Making		
24	24	00			
M. EHRGOTT			Matthias.Ehrgott@univ-nantes.fr , Xavier.Gandibleux@univ-nantes.fr		
X. Gandibleux					
<p>1. Multi-objective Optimization (12 12 00) Contents</p> <ul style="list-style-type: none"> • Theory and methodology of optimization problems with vector-valued objective functions • Domination structures • Generating efficient solutions • Solving multicriteria decision-making problems • Noninteractive and interactive methods with applications <p>2. Multi-objective Metaheuristics (12 12 00) Contents</p> <ul style="list-style-type: none"> • Approximated non-dominated points, bounds and bound sets, quality measures • Neighborhood search algorithms (MOSA, MOTS) • Evolutionary algorithms (VEGA, NSGA, SPEA) • Hybrid multiobjective metaheuristics for combinatorial optimization 					

S51IR06			Control and Optimization in Production Systems and Supply Chain		
24	24	00			

J.J Loiseau P. Dejax, P. Lemaire, F. Lehuédé	Jean-jacques.loiseau@irccyn-ecn.fr , {pierre.dejax ; pierre.lemaire ; fabien.lehuede}@emn.fr
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1. Control of discrete event systems (12|12|00)

Course goals

This unit aims at introducing the modern approaches for the modeling and control of discrete event systems. The focus is on the applications in production systems and transportation networks. The content is twofold. The first part is devoted to the use of idempotent algebras, the second part to the supervisory control theory.

Contents

A. Dioid algebra

Ordered algebraic structures. Residuation, linear equations, fix point equations, spectral theory. Applications to the modeling, performance evaluation, feedforward control and feedback control of production systems and other discrete event systems.

B. Supervisory control

Transition systems, languages and automata. Supervisory control, controllable languages, algorithms. Extensions, control under partial observation, modular control, hierarchical control. Applications to production systems and transportation networks.

2. Mathematical Methods in Transportation and Logistics Management (12|12|00)

Contents

- localization problems and supply-chain optimization
- vehicle routing problems
- inverse logistics
- industrial applications (road/rail/air transportation, multimodal transportation, assignment, ...)
- vehicle softwares

S51IR07			Operational Solutions for Real-World Optimization Problems
24	0	24	

P. Lemaire, F. Lehuédé, X. Gandibleux, A. Przybylski, Ch. Jermann, L. Granvilliers, I. Rusu, G. Fertin	{Pierre.Lemaire ; Fabien.Lehuede}@emn.fr {Xavier.Gandibleux ; Anthony.Przybylski ; Christophe.Jermann ; Laurent.Granvilliers ; Irena.Rusu ; Guillaume.Fertin }@univ-nantes.fr
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Solving of a real world problem under realistic constraints:

- Problem modeling ;
- Algorithm design ;
- Software implementation ;
- Collaborative work and project management.

Situations:

Computer-aided and engineering design problems; Molecular design problems
(Ch. Jermann, L. Granvilliers) 06CM+06TP

Planning, scheduling and supply chain management
(P. Lemaire, F. Lehuédé) 06CM+06TP

Multicriteria decision aid
(X. Gandibleux, A. Przybylski) 06CM+06TP

Bioinformatic
(I. Rusu, G. Fertin) 06CM+06TP:

S51IR08			Conferences and Seminars
0	0	24	
academic or professional guests		N.C@univ-nantes.fr	
<p>1. Decision Support Systems</p> <ul style="list-style-type: none"> - Optimization softwares - Information systems, - Enterprise Resource Planning (ERP) systems <p>2. Advanced topics in Optimization</p> <ul style="list-style-type: none"> - Location, - timetabling, - routing, - preferences modelling - stochastic programming - fuzzy sets programming 			

S52IR01			Master Thesis (TFCR) or period in a company (TFCP)
6			
months			
<p>The master thesis / period in a company is an important personal work. The nature of the topic chosen by the student and the location where the work will be made (in a research team or in a company departement) will guide the student toward a research activity (PhD thesis) or an active life after the master degree.</p>			