Option Mathematics and decision

Specifics Modules Mathematics and decision option

MATHÉMATIQUES ET DÉCISION

MATHEMATICS AND DECISION

Lecturers:

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

Specialisation
Decision making

AIDE À LA DÉCISION POUR L'ENTREPRISE

DECISION SUPPORT FOR BUSINESS

Lecturers: **Sylvie MIRA, Delphine BILLOUARD, Grégory VIAL**
| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study   Objectifs :

Méhodes :

Core texts

Assessment

SIMULATION DE DÉCISIONS OPÉRATIONNELLES
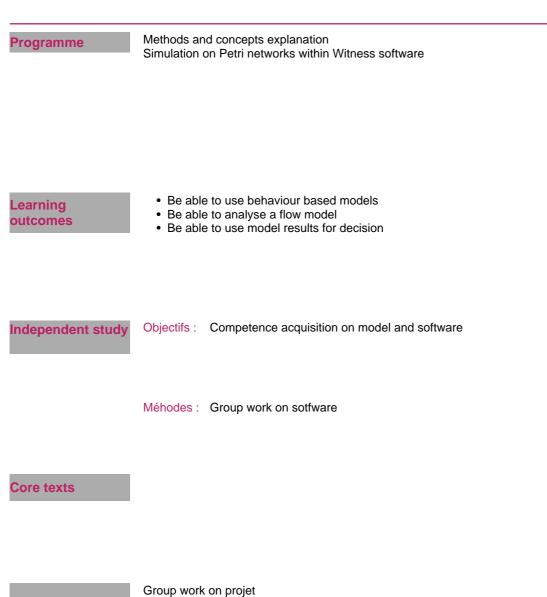
PROCESS SIMULATION

Lecturers: **Sylvie MIRA, Emmanuel BOUTLEUX**

| Lecturers : 12.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 32.0 | Project : 0.0 | Language : FR

Objectives

The main objective is to model information flows within an organization (production system, logistics platform, administration, communication network, ...). Whether designing or analyzing an organization, the evaluation phase is an unavoidable step. Indeed, before making often heavy investments, it is imperative to ensure that the solutions envisaged meet the objectives. This course provides training on both the principles and tools of mathematical analysis and simulation tools for the specification, modeling and evaluation of information flows.
This course will focus on practical applications of Petri nets modeling and event simulation software such as

Keywords : Information flows analysis, operationnal simulation and optimisation

Programme	Methods and concepts explanation Simulation on Petri networks within Witness software
Learning outcomes	• Be able to use behaviour based models • Be able to analyse a flow model • Be able to use model results for decision
Independent study	Objectifs : Competence acquisition on model and software Méhodes : Group work on sotfware
Core texts	
Assessment	Group work on projet

FINANCE ET MARKETING

MARKETING AND FINANCES

Lecturers: **Sylvie MIRA**

| Lecturers : 12.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 24.0 | Project : 0.0 | Language : FR

Objectives

The course aims to bring deep insights of commercial and financial key performance indicators and competencies to design decision support tools for financial and commercial strategy

Keywords : key performance indicators, customer relationship management, corporate strategy

| **Programme** | - Corporate finance
- Commercial strategy |

| **Learning outcomes** | • Be able to design key performance indicators (KPI)
• Be able to understand KPI to plan actions |

| **Independent study** | Objectifs : Group work on KPI for corporate decision making |

Méhodes : Case studies

Core texts

| **Assessment** | Case studies |

PILOTAGE ET MANAGEMENT

DECISION SUPPORT SYSTEMS

Lecturers: **Sylvie MIRA**

| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The course aims to place the students in a situation of decision-making in a company by working on their cognitive process and to give them the keys to designing and implementing management systems.

Keywords : Cognitive process, risks, management

| **Programme** | - Cognitiv process
- Risk / decision anaysis
- Management and dashboard |

| **Learning outcomes** | • Understand cognitive process activated in decision making
• Design a financial dashboard
• Assess financial impact of strategic decision |

| **Independent study** | Objectifs :   Work group to understand analysed processes |

Méhodes :   Case studies

| **Core texts** | SELMER, C., *CONCEVOIR LE TABLEAU DE BORD*, DUNOD, 2015 |

| **Assessment** | Case studies |

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PROJET ADE

PROJECT

Lecturers: Sylvie MIRA
| Lecturers : 0.0 | TC : 50.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme   Customised program to each project

Learning outcomes
- Be able to analyse an company's issue
- Be able to collect relevant data from technical aspects, markets and context
- Be able to implement a prospectiv anaysis
- Be able to communicate clear and justified solutions

Independent study   Objectifs :   Be able to bring within 3 monts a solution to a company's issue

Méhodes :   Group work

Core texts

Assessment

Specialisation Mathematical engineering

MATHÉMATIQUES ET INGÉNIERIE DU RISQUE

MATHEMATICS AND RISK ANALYSIS

Lecturers: **Marie-Christophette BLANCHET**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : FR

Objectives

The third year specialization « Applied mathematics and risk engineering » is devoted to mathematical modeling and numerical simulation of problems arising in engineering.Students study a wide range of stochastic and deterministic methods concerning ordinary and partial differential equa-tions, optimization problems, discrete and time-continuous stochastic processes, statistics., together with the associated numerical methods.Opportunity is given to the best students to complete their formation with a master degree in one of the three following fields : applied mathematics, fInance / insurance, biomathematics / biostatistics.

Keywords :

Programme

Learning outcomes

- Up to date mathematical technics
- Tools for scientific monitoring
- Necessary background for an applied mathematics PhD

Independent study

Objectifs :

Méhodes :

Core texts

Assessment

PARCIMONIE ET GRANDE DIMENSION

SPARE AND LARGE

Lecturers: **Marie-Christophette BLANCHET, Alexandre SAIDI, Céline HARTWEG-**

| Lecturers : 22 | TC : 4 | PW : 0.0 | Autonomy : 0.0 | Study : 4 | Project : 0.0 | Language : FR

Objectives

Sparsity and convexity are ubiquitous notions in Machine Learning and Statistics. In this course, we study the mathematical foundations of some powerful methods based on convex relaxation: L1-regularisation techniques in Statistics and Signal Processing; Nuclear Norm minimization in Matrix Completion. These approaches turned to be Semi-Definite representable (SDP) and hence tractable in practice. The theoretical part of the course will focus on the guarantees of these algorithms under the sparsity assumption. The practical part of this course will present the standard solvers of these learning problems.

Keywords : L1-regularization; Matrix Completion; Semi-Definite Programming; Proximal methods;

Programme

Learning outcomes

Independent study

Objectifs :   This activity is not concerned with framed autonomy activities outside personal work.

Méhodes :   This activity is not concerned with framed autonomy activities outside personal work.

Core texts

Christophe Giraud, *INTRODUCTION TO HIGH-DIMENSIONAL STATISTICS*, Chapman and Hall/CRC
Martin J. Wainwright *HIGH-DIMENSIONAL STATISTICS: A NON-ASYMPTOTIC VIEWPOINT*, Cambridge University Press
Simon Foucart and Holger Rauhut*A MATHEMATICAL INTRODUCTION TO COMPRESSIVE SENSING*

Assessment

PROCESSUS DE MARKOV ET PROCESSUS GAUSSIENS POUR LA MODÉLISATION DE

MARKOV AND GAUSSIAN PROCESSES FOR MODELING TEMPORAL AND SPATIAL

Lecturers: **Marie-Christophette BLANCHET, Alexandre SAIDI, Céline HARTWEG-**

| Lecturers : 18 | TC : 2 | PW : 0.0 | Autonomy : 0.0 | Study : 10 | Project : 0.0 | Language : FR

Objectives

This course is oriented towards the modeling of random phenomena depending on time or space. The first part will be devoted to Markovian processes, processes involved in the modeling of temporal phenomena. Both theoretical modeling tools and numerical aspects will be presented. Their use will be seen through models from ecology, the environment or finance. The second part will be mainly devoted to regression by Gaussian processes. This tool also known as kriging and historically introduced for the
modeling and forecasting of spatial quantities, is now widely used to model complex numerical experiments. We will also present the techniques of uncertainty quantification and Bayesian optimization.

Keywords : Markov process, Kolmogorov equation, Feymann-Kac formula, kriging, regression by
Gaussian processes, Bayesian optimization, sensitivity analysis, computer experiments.

Programme	1/ Continuous Time Markov Chain 2/ MArkov processes in continuous time 3/ Kriging model for spatial data 4/ Kriging in the context of approximation of expensive codes: Bayesian optimization and uncertainty quantification.
Learning outcomes	• Modeling and simulation of Markovian processes. Know how to make the link between stochastic processes and partial differential equations. • Implementation of a kriging forecast from spatial data • Implementation of a global optimization approach based on a regression model using Gaussian processes.
Independent study	Objectifs : This activity is not concerned with framed autonomy activities outside personal work. Méhodes : This activity is not concerned with framed autonomy activities outside personal work.
Core texts	TJ Santner, BJ Williams, WI Notz, BJ Williams, *THE DESIGN AND ANALYSIS OF COMPUTER EXPERIMENTS*, Springer, 2003 Noel A. C. Cressie *STATISTICS FOR SPATIAL DATA, REVISED EDITION*, John Wiley & Sons, Inc., 1993 Thomas M. Liggett*CONTINUOUS TIME MARKOV PROCESSES : AN INTRODUCTION*, Providence R.I. : American Mathematical Society, 2010
Assessment	Final mark =60% Knowledge + 40% Know-how Knowledge= 100% final exam Know-how= 100% continuous assessment

MÉTHODES VARIATIONNELLES POUR LES PROBLÈMES INVERSES EN IMAGERIE MÉDICALE

INTRODUCTION TO INVERSE PROBLEMS

Lecturers: **Marie-Christophette BLANCHET, Alexandre SAIDI, Laurent SEPPECHER**

| Lecturers : 20.0 | TC : 2.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : FR

Objectives

Keywords :

Programme

Learning outcomes

Independent study

Objectifs : This activity is not concerned with framed autonomy activities outside personal work.

Méhodes : This activity is not concerned with framed autonomy activities outside personal work.

Core texts

Assessment

PROJET IM

PROJET IM

Lecturers: **Marie-Christophette BLANCHET**

| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8 | Project : 50 | Language : FR

Objectives

Through this project, students will identify mathematical problems/ barriers, propose solutions and implement them. They will also improve their communication skills to present the results (in written and oral forms).

Keywords : Modelization, Analysis, Simulations.

Programme

Learning outcomes

- Build a model
- Analyzis of a determnistic or random model
- Use of an appropriated software to perform simulation

Independent study

Objectifs :   rite a report, build a presentation.

Méhodes :   Group Work, pair work.

Core texts

Assessment

Report and defense