Markov Chains and applications

Course title - Intitulé du cours	Markov Chains and applications
Level / Semester - Niveau /semestre	M1 / Semestre 1
School - Composante	TSE
Teacher - Enseignant responsable	FAUGERAS_OLIVIER
Other teacher(s) - Autre(s) enseignant(s)	
Other teacher(s) - Autre(s) enseignant(s)	
Other teacher(s) - Autre(s) enseignant(s)	
Other teacher(s) - Autre(s) enseignant(s)	
Other teacher(s) - Autre(s) enseignant(s)	
Lecture Hours - Volume Horaire CM	15
TA Hours - Volume horaire TD	/
TP Hours - Volume horaire TP	/
Course Language - Langue du cours	Anglais
TA and/or TP Language - Langue des TD et/ou TP	

Teaching staff contacts - Coordonnées de l'équipe pédagogique :
olivier.Faugeras@ut-capitole.fr MF217

Course's Objectives - Objectifs du cours :
Observed data are often modelled as correlated random variables evolving along time. Markov chains in discrete time are one of the main fundamental kind of stochastic processes, where the future state of the system depends (randomly) only on the "proximate past" states. They are useful in modelling various dynamical systems, e.g. the price of a stock on a financial market or the surplus process for insurance companies. The aim of this course is to give an introduction to Markov chains in discrete time on a countable state space, their basic properties and some of their applications (Gambler's ruin, Life insurance, etc..), depending on time constraints/interests of the audience.In order to account for the heterogeneity of the background of the students, the course will be structured into two parts/levels: the first part, aimed at being accessible for a wide audience, will present the basic properties and calculations, together with some concrete exemple (Games, Insurance). The second level, aimed more specifically for students with a good mathematical background, will be more demanding and will delve deeper into the proofs of the main theorems of Markov chains, so that students can have a better understanding of the key concepts and their subtleties.

Prerequisites - Pré requis :
As all courses made by a member of the mathematics departement, a decent level in Mathematics is expected, especially for the more demanding second part of the course. (A first course in probability and Linear algebra up to Diagonalization are a prerequisite). However, in discrete time and on a countable state space, Markov chains can be studied with elementary (conditional) probability (without the complications arising from Measure theory) and Linear Algebra (including Matrix calculus).

Grading system - Modalités d'évaluation :
Final Exam.Mostly on the first level of the course (the less mathematically demanding)

Bibliography/references - Bibliographie/références :
Most probability books have chapters on Markov chains.We suggest:Resnick, A probability path. Norris, Markov chains. Brémaud, Markov Chains. Gibbs Fields, Monte Carlo Simulation, and Queues.Baldi, Mazliak, Priouret, Martingales et chaînes de Markov.

Session planning - Planification des séances :
TBA