

**Course title - Intitulé du cours**: Markov Chains and applications CM

**Level / Semester - Niveau /semestre**: M1 / S1

**School - Composante**: Ecole d'Economie de Toulouse

**Teacher - Enseignant responsable**: Jean-Paul IBRAHIM

**Lecture Hours - Volume Horaire CM**: 15

**TA Hours - Volume horaire TD**: 0

**TP Hours - Volume horaire TP**: 0

**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:**

E-mail : jean-paul.ibrahim@ut-capitole.fr

Office : MC002 If you have questions, you may drop by my office at any time but it is better to make an appointment before. You can also send me e-mails.

**Course’s Objectives - Objectifs du cours:**

This course is an introduction to the Markov chains on a discrete state space. At the end of the course, students must be able to:

- Understand the notion of a random process.
- Give the definition of a Markov chain on a discrete state space.
- Recognize any experiment or any real-life situation that can be modeled using Markov chains.
- Give the transition matrix of a given Markov chain.
- Recognize homogenous Markov chains.
- Deal with closed and open communicating classes and then with irreducibility.
- Deal with transient and recurrent states.
- Determine, when it exists, an invariant distribution.
- Write the system that allows to compute the probability to hit a state j starting from state i.
- Write the system that allows to compute the expected time to hit a state j starting from state i.
- Understand the link between the long-run proportion of time spent in a given state, the expected return time to this state and the invariant distribution.
- Understand the definition of an aperiodic Markov chain and the convergence to equilibrium.
- Applications: Gambler's ruin, life insurance, Penney's Game.

**Prerequisites - Pré requis:**

Probability basis: Sample space (finite or countably infinite), conditional probability, random variables, convergence in distribution. Linear algebra: basic operations on matrices, diagonalization.

**Grading system - Modalités d’évaluation:**

One final exam.
Bibliography/references - Bibliographie/références:

Please check the moodle workspace for more information about references.