Stochastic Processes

Academic Year: (2019 / 2020) **Review date: 26-04-2019**

Department assigned to the subject: Statistics Department

Coordinating teacher: D AURIA , BERNARDO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

An elementary course of Probability and Statistics

OBJECTIVES

To acquire basic rudiments of the theory of stochastic processes.
Modeling real problems through Markov processes and Martingales.
To solve problems using the appropriate stochastic methodologies and techniques.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Discrete-time Markov chains
- Definition and basic computations
- Classification of states
- Limiting and stationary distributions
- Limit theorems
- ML estimation of transition probabilities

2. Markov chain Monte Carlo
- The Metropolis-Hastings algorithm
- The Gibbs sampler
- MCMC diagnosis

3. Poisson process
- Definition
- Inter-arrival times
- Infinitesimal probabilities
- The connection with the uniform distribution
- Thinning and superposition
- Non-homogeneous Poisson processes

4. Continuous-time Markov chains
- Introduction
- Transition function and transition rates
- Long-term behaviour
- Time-reversibility

5. Brownian motion and Gaussian processes
- Brownian Motion
- Transformations and Properties
- Extensions of the Brownian Motion
- Gaussian processes

LEARNING ACTIVITIES AND METHODOLOGY

Every week there is a class. In each class, the theoretical concepts are usually introduced, numerical and simulated exercises are shown to better understand them and examples of models that can be used in more specific applications are made.

ASSESSMENT SYSTEM

Continuous evaluation through two deliveries of exercises (70%) and final exam (30%).
To pass the course it is need a minimum grad of 4.5 in the final exam.

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- Norris, J.R. Markov Chains, Cambridge University Press, 1997
- S.M. Ross Introduction to probability models, Academic Press, 2007