

Academic Year: ( 2019 / 2020 )

Review date: 25-04-2019

Department assigned to the subject: Statistics Department

Coordinating teacher: CASCOS FERNANDEZ, IGNACIO

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

## OBJECTIVES

Knowledge acquisition of: 1) random variables, elementary probability and distributions; 2) relevant probabilistic inequalities; 3) random vectors, marginal and joint distributions; 4) sequences of random variables and concepts of convergences; 5) Markov chains; 6) Poisson processes; 7) processes in continuous time; 8) univariate and multivariate simulation methods; 9) non-parametric and parametric resampling methods.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Random experiments
  - 1.1 Events
  - 1.2 Probability
  - 1.3 Conditional probability
  - 1.4 Bayes' formula
  - 1.5 Independence
  - 1.6 Combinatorics
2. Discrete random Variables
  - 2.1 Definition of random variable
  - 2.2 Probability mass function and cumulative distribution function
  - 2.3 Mean, variance, and quantiles
  - 2.4 Binomial, Geometric, Poisson, Negative Binomial, and Hypergeometric distributions
3. Continuous random variables
  - 3.1 Density mass function and cumulative distribution function
  - 3.2 Mean, variance, and quantiles
  - 3.3 Transformations of a random variable
  - 3.4 Uniform, Exponential, Normal, Gamma, and Beta distributions
4. Random vectors
  - 4.1 Joint distributions, marginal distributions, and conditional distributions
  - 4.2 Independence
  - 4.3 Transformations of random vectors
  - 4.4 Multivariate Normal and Multinomial distributions
  - 4.5 Sums of random variables
  - 4.6 Mixtures
  - 4.7 General concept of random variable
  - 4.8 Random sample
  - 4.9 Order statistics
5. Properties of the expectation
  - 5.1 Expectations of sums of random variables
  - 5.2 Covariance
  - 5.3 Conditional expectation
  - 5.4 Conditional variance
  - 5.5 Moment generating function
6. Limit Theorems
  - 6.1 Markov and Chebishev inequalities
  - 6.2 Weak Law of Large Numbers (convergence in probability)

- 6.3 Strong Law of Large Numbers (almost sure convergence)
- 6.5 Central Limit Theorem (convergence in distribution)

#### ASSESSMENT SYSTEM

<b>% end-of-term-examination:</b>	50
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	50

Partial in-class exams: 50%  
Final exam: 50%

#### BASIC BIBLIOGRAPHY

- Sheldon Ross A First Course in Probability, Pearson Prentice Hall, 2010

#### ADDITIONAL BIBLIOGRAPHY

- Charles M. Grinstead Grinstead and Snell's Introduction to Probability, University Press of Florida, 2009
- Dimitri P. Bertsekas, John N.Tsitsiklis Introduction to Probability, Athena Scientific, 2008

#### BASIC ELECTRONIC RESOURCES

- Sheldon Ross : A First Course in Probability: [http://julio.staff.ipb.ac.id/files/2015/02/Ross\\_8th\\_ed\\_English.pdf](http://julio.staff.ipb.ac.id/files/2015/02/Ross_8th_ed_English.pdf)