COURSE OUTLINE

Ημερομηνία: 9 Νοε 2022

A. INFORMATION FOR THE COURSE

A1. School	School of Science and Technology of Information
A2. Department	Department of Statistics
A3. Master Programme	
A4. Course Code	6116
A5. Title of the Course	PROBABILITY THEORY

Lecturers

Name	Rank	Specialization
PAVLOPOULOS CHARALAMPOS (HARRY)	Associate Professor	Statistics

B. TYPE OF COURSE

B1. Year of Study	3
B2. Semester	6th
B3. Level of Course (if applicable)	1st Cycle
B4. Type of course	Elective
B5. Field	Scientific Field
B6. ECTS credits allocated (ECTS)	8.00
B7. Is the Course in the Syllabus?	Yes
B8. If yes, which is the reference Page?	29-68
B9. Is there a site for the course?	Yes https://www.dept.aueb.gr/el/stat-courses

C. INSTRUCTION

C1. Lectures Include:	Classroom lectures: Yes Distance learning lectures: No Seminars: No Laboratory exercises: No Field training exercise: No Literary analysis: Yes Tutorial: Yes Interactive teaching: No Educational visits: No Project: No Essays/reports: No Independent study: Yes Lectures given by scientists: No Internship: No
C2. Scheduled Hours for Lectures per week	4.00
C3. Scheduled Hours for Tutorials per week	
C4. Scheduled Hours for Workshops per week	
C5. Scheduled Hours for Case Studies per week	
C6. Scheduled Hours for Other Activities per week	
C7. Scheduled Hours for Lectures per semester	26
C8. Scheduled Hours for Tutorials per semester	
C9. Scheduled Hours for Workshops per semester	
C10. Scheduled Hours for Case Studies per semester	
C11. Scheduled Hours for Other Activities per semester	
C12. Mode of Delivery	Face to Face
C13. Student’s Evaluation	Written examination at the end of the semester: Yes Oral examination: No Midterm exam: No Homework: No Project: No Public Presentation: No Laboratory exercises: No Practical exercises: No Exempt work: No

C14. Language of Instruction	Greek

D. PREREQUISITE COURSES

Πιθανότητες Ι, Πιθανότητες ΙΙ, Μαθηματικός Λογισμός Ι, Μαθηματικός Λογισμός ΙΙ, Εισαγωγή στη Μαθηματική Ανάλυση

E. COURSE CONTENTS (Syllabus)

Necessity of measurability for the foundation of the concept of an event and its probability. σ-algebra of events, probability space, Borel measurable sets. Extension theorem of a probability measure from a semi-algebra to the derived complete σ-algebra of Caratheodory-Lebesgue events with respect to the corresponding outer-measure. Random variables as Borel measurable functions, stochastic independence, Borel-Cantelli lemma, continuity of probability measures, Kolmogorov's 0-1 law. Integration of a random variable with respect to a probability measure, mathematical expectation, monotone convergence theorem, Markov-Chebychev inequalities, strong and weak laws of large numbers, dominated convergence theorem, convergence under the condition of uniform integrability. Distributions of random variables as induced probability measures, change of variable theorem, distribution of a convolution of independent random variables, product probability measure space, Fubini theorem. Weak convergence, characteristic functions, central limit theorem. Lebesgue decomposition of probability measures, Radon-Nikodym theorem, conditional probability and conditional expectation.

F. LEARNING OUTCOMES

Upon successful completion of the course, students should be able:

- o to determine the probability space of a random experiment with an uncountable set of elementary events,
- o to apply advanced calculus of probabilities according to the axioms of Kolmogorov in a given probability space,
- o to manage random variables as measurable functions mapping a given probability space to the Borel real line,
- o to identify the type of a random variable according to the kind of probability distribution which it induces (discrete, absolutely continuous, singular continuous, mixed) on the Borel real line,
- o to calculate the mathematical expectation of a given random variable as a Lebesgue integral with respect to the induced probability distribution on the Borel real line,
- o to distinguish among the possible kinds of convergence (almost sure, in probability, in mean squared deviation, in distribution) of a sequence of random variables,
- o to apply the Laws of Large Numbers and the Central Limit Theorem.

G. LITERATURE

G1. Use of Multiple Literature	Yes
G2. Recommended or required reading	Yes