UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica
ACADEMIC YEAR	2016/2017
BACHELOR'S DEGREE (BSC)	COMPUTER SCIENCE
SUBJECT	PROBABILITY THEORY
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10701-Attività formative affini o integrative
CODE	01736
SCIENTIFIC SECTOR(S)	MAT/06
HEAD PROFESSOR(S)	SANFILIPPO GIUSEPPE Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	05880 - PROGRAMMING AND LABORATORY - INTEGRATED COURSE 16448 - MATHEMATICAL METHODS FOR COMPUTER SCIENCE
MUTUALIZATION	PROBABILITY THEORY - Corso: MATHEMATICS PROBABILITY THEORY - Corso: MATEMATICA
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**SANFILIPPO GIUSEPPE** Wednesday 17:30 19:30 Canale Teams, https://teams.microsoft.com/l/team/19%3a743165a223bc4c069089c244ea5a0756%40thread.tac conversations?groupId=d07526b2-8d64-4ab6-bce0-442348453e65&tenantId=bf17c3fc-3ccd-4f1e-8546-88f Codice jtpx2f0 Si prega di prenotare il ricevimento tramite email Thursday 09:00 10:00 DMI, Via archirafi 34, secondo piano. Prenotare il ricevimento per email

DOCENTE: Prof. GIUSEPPE SANFILIPPO

PREREQUISITES	Calculus; combinatorial Analysis; linear systems; cartesian geometry; cardinality of a set; complex numbers.
LEARNING OUTCOMES	1) KNOWLEDGE AND UNDERSTANDING The student should know the following topics: - Elements of logic and combinatorics; - Various concepts od probability - Setting of Coherence - Elementary Probability; - Events and conditional events; - Random quantities and probability distributions; - Summary statistics; - Classical problems of probability. - Random vectors, joint and marginal probability distributions; - Functions of random quantities and of random vectors; - Different relations among random quantities; - Some limit theorems. 2) APPLYING KNOWLEDGE AND UNDERSTANDING The student should know how to exploit probabilistic tools to reasoning under uncertainty. In particular, the student should be able to: - Describe the uncertainty; - Check the coherence of a probability assessment on an arbitrary finite family of events; - Apply Bayes' rule and compound probability theorem; - Solve classical problems of probability; - Select the suitable probability distribution to the describe some standard random problems; - Apply limit theorems; - Obtain marginal probability distributions from joint probability distributions. - Solve problems involving functions of random quantities. 3) MAKING JUDGEMENTS Being able to motivate the right probabilistic tools and models which can be used to solve problem under partial knowledge. 4)COMMUNICATION. The student should know how illustrate in a clear and coherent way the description and analysis of a random problem to both expert and non-expert people. 5) LIFELONG LEARNING SKILLS. Being able to exploit the power of self-discovery, exploration, learning and mastery. In particular the student should be able to deep some well-known notions in probability theory and to discover new notions by studying from other research books or from research articles.
ASSESSMENT METHODS	The exam is composed by an oral test preceded by a written test or by two intermediated written tests. The written tests are designed in order to evaluate the degree of knowledge and the ability of the student to solve problems similar to those illustrated during the lectures and during practicals. The first intermediated written test (of one hour and a half), will be composed of al most of three main questions mainly concerning topics of discrete probability. The second intermediate written test will be composed of at most three questions mainly concerning topics of probability in continuous problems, limit theorems and functions of random vectors. The final written test will contain at most six questions concerning the whole course. The evaluation of the written test will be made by means of a 30-point scale: non passing from 0 to 17; passing from 18 to 30. Oral Test • During the written test the it will be announced the meeting for the the oral test. • By starting from a deepening on the written test, the oral test, through the formulation of at least two questions, will be used to FINALIZE and / or improve the grade obtained in the written tests The final evaluation concerns the following three aspects: i) knowledge and understanding; ii) Communication iii) Applying knowledge and understanding to solve given problems. The final grade will be given by using the following table, where A=Excellent/ Very good, B=Good/fairly good, C= Satisfactory/Acceptable, D=Not acceptable 29-30 e lode: AAA 27-28: AAB 25-26: ABB or AAC 23-24: ABC or BBB 21-22: BBC or ACC 19-20: BCC 18: CCC Less than 18: Dxx (at least a D)
EDUCATIONAL OBJECTIVES	Being able to describe and represent some theoretical and real random problems through suitable probabilistic models. In particular, the student should

	be able to: motivate the choice probabilistic distribution; provide the summary statistics; properly assess degree of believe to (conditional or simple) events; update probability; exploit theoretical results for the study and analysis of function random vectors. Moreover, by means of the basic notions the student should know how to solve some "paradoxes" of probability.
TEACHING METHODS	Teaching is organized in classroom lectures.
SUGGESTED BIBLIOGRAPHY	Testi consigliati - Sheldon Ross; Calcolo delle Probabilita' 3a ed.; Apogeo, 2013; (English version: A first course in Probability, 8th edition, Pearson) - Romano Scozzafava; Incertezza e Probabilita; Zanichelli, 2003; - Paolo Baldi; Calcolo delle Probabilita; McGraw-Hill, 2011; Approfondimenti (Further bibliography) - Bruno de Finetti; Teoria delle Probabilita; Giuffre, 2005 (ristampa); (English version of the book: Theory of probability vol1, vol2) - Giorgio Dall'Aglio; Calcolo delle Probabilita; Zanichelli, 2001; - Luciano Daboni; Calcolo delle Probabilita' ed Elementi di Statistica; Utet. Dispense Materiale didattico curato dal docente disponibile (Notes provided by the Teacher and available at: www.unipa.it/sanfilippo Social Gruppo facebook (Facebook group): https://www.facebook.com/groups/cdp.dmi.unipa

SYLLABUS

Hrs	Frontal teaching
3	Historical note. Classical problems. Events, logical operations and relations. De Morgan's Law. Basic notions on combinatorial Analysis. Power set. Finite partition
3	The main Interpretations of probability: classical, axiomatic, frequency, subjective. Betting criterion and coherence principle. Probability and measure theory
2	Constituents associated with a family of n events. Decomposition formula. Events logically independent. Properties of probability and coherence principle. Coherence checking. Probability and (decimal) odds gambling.
6	Conditional events and conditional probability. Compound probability theorem. Disintegration law. Bayes' rule. Stochastic independence of events.
6	Simple Random quantities. Urn problems. Binomial distribution. Hypergeometric distribution. Mixture of distributions. Expected value and variance. Exchangeability.
6	Discrete probability. Poisson and geometric distribution. Property of memoryless of the geometric distribution. Pascal Distribution. Markov's inequality. Chebyshev's inequality.
6	Infinity and probability. Continuous random quantities. Density, cumulative distribution function, expectation, variance. Property of continuous random quantities. Some continuous distributions: Uniform, Exponential, Normal, Gamma, Beta, Chi-square, Laplace, Power law, etc. Hazard rate function. Survival function. Memoryless proprery.
8	Discrete and continuous random vectors. Cdf, joint distribution functions, marginal distributions, conditional distributions. Independence. Property of expectation. Covariance. Covariance matrix. Linear regression. Normal distribution. Distribution of function of random quantities.
4	Characteristic function (or in alternative moment generating function) and properties. Sum of random quantities. Convolution operator. General Chi-square distribution.
4	Convergences of random quantities. Limits theorem. Legge dei grandi numeri. Central limit theorem. Normal approximation of binomial distribution.