



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica
ACADEMIC YEAR	2021/2022
MASTER'S DEGREE (MSC)	MATHEMATICS
SUBJECT	UNCERTAIN REASONING AND PROBABILITY
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20947-Attività formative affini o integrative
CODE	21942
SCIENTIFIC SECTOR(S)	MAT/06
HEAD PROFESSOR(S)	SANFILIPPO GIUSEPPE Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
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.ta%20conversations?groupId=d07526b2-8d64-4ab6-bce0-442348453e65&tenantId=bf17c3fc-3ccd-4f1e-8546-88f0c0e0-442348453e65 Si prega di prenotare il ricevimento tramite email Thursday 09:00 10:00 DMI, Via archirafi 34, secondo piano. Prenotare il ricevimento per email

PREREQUISITES	Combinatorics. Analytic geometry. Linear systems. Set theory. Sequences and series. Differential and integral calculus. Complex numbers. Real functions. Elements of probability theory.
LEARNING OUTCOMES	KNOWLEDGE AND UNDERSTANDING. The student will be able to know and understand some methods of probabilistic reasoning under uncertainty and/or partial knowledge. The student will be able to read and understand some books on probability and applications; He/she will be able to consult selected research articles related with the topics covered in the course. The student will be able to use the specific languages in the field of probabilistic research and its applications. ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING The student will be able to autonomously recognise, and organise the necessary elements for the deepening of a topic covered in the course. The student will be able to formalise problems in mathematics and to elaborate proofs by using techniques in the suggested literature. AUTONOMY OF JUDGEMENT The student will be able to comment and criticize scientific books which use the notion of probability. He/she will be able to check proofs and to propose conjectures for some new related problems. COMMUNICATION SKILLS. The student will be able clearly explain the main topics of the course. He/she will be able to explain and discuss the topics covered in the report. LEARNING ABILITY. He/she will be able to attend, by exploiting the basic knowledge acquired during the course, specialised course and talks in the field of probability, uncertain reasoning and some aspects of artificial intelligence.
ASSESSMENT METHODS	The final test is composed by the presentation of a report and by an oral test. In the report students will illustrate, eventually by using a suitable software, some theoretical results related with the topics covered in the course. To the report will be given a score which will be expressed out of thirty. The oral exam will cover all the parts of the program. The score of the oral exam will be also expressed out of thirty. The final score is the average of the two scores and it is given by taking into account the following conditions: Description of evaluation methods - Excellent score: 30-30 cum laude. The student has excellent knowledge of course topics, excellent language skills, good analytical skills, the student is able to apply theoretical knowledge to solve the proposed problems. - Very good score: 26-29. The student has good knowledge of course topics, good language skills, good analytical skills, the student is able to apply theoretical knowledge to solve the proposed problems. - Good score: 24-25. The student has basic knowledge of course topics, discrete language skills, discrete analytical skills, the student is able to apply theoretical knowledge to partially solve the proposed problems. - Satisfactory Score: 21-23. The student has partial knowledge of course topics, satisfactory language skills, satisfactory analytical skills, the student is able to apply theoretical knowledge only to partially solve the proposed problems. - Sufficient Score: 18-20. The student has sufficient knowledge of course topics, sufficient language skills, sufficient analytical skills, the student is not always able to apply theoretical knowledge to solve the proposed problems and may need some help. - Insufficient Score. The student does not have an acceptable knowledge of course topics, the student is not able to apply theoretical knowledge to solve the proposed problems.
EDUCATIONAL OBJECTIVES	The student will learn some deepening in probability theory and its applications. He/she will learn basic concepts of stochastic process. The student will be able to describe and represent some theoretical and real random problems through suitable probabilistic models, by eventually using suitable software (eg., R, Matlab). The student will also learn how to give a probabilistic interpretation to some concepts of nonmonotonic reasoning in the framework of artificial intelligence the default rules of nonmonotonic reasoning and their probabilistic interpretation. Finally, The student will be able to write a short scientific report of selected topics covered in the course.
TEACHING METHODS	Lectures and practicals. Usually, theory will be explained in the lecture and then applied and tested in the practical class. An English paper on probability or a book chapter will be shared with the students.
SUGGESTED BIBLIOGRAPHY	-S. Ross, Introduction to Probability Models, Academic Press, 12th Edition, 2019, eBook ISBN: 9780128143476, Hardcover ISBN: 9780128143469 (other editions are welcome as well). -F. Lad, Operational Subjective Statistical Methods: A Mathematical, Philosophical, and Historical Introduction, Wiley, 1996, ISBN 978-0-471-14329-1 -Teacher notes

	Further references -V. Kulkarni, Introduction to Modeling and Analysis of Stochastic Systems, Springer 2011, ISBN 978-1-4419-1772-0 -G. Coletti and R. Scozzafava, Probabilistic Logic in a Coherent Setting, Springer 2002, ISBN 978-94-010-0474-9 -B. de Finetti, Theory of Probability: A critical introductory treatment, Wiley, 2017 (reprint version), ISBN 978-1119286370 - Selected scientific articles.
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SYLLABUS

Hrs	Frontal teaching
8	Preliminary notions on probability. The different approach to probability: classical, frequentist, subjective, axiomatic. Sum of random quantities. Characteristic function. Different type of convergence and limit theorems. Bayesian inference. Conjugate distributions. Exchangeability.
8	Introduction to stochastic Processes. Poisson process. Markov chain. Classification of states. Gambler's ruin problem. Bernoulli process.
8	Subjective conditional probability. Coherence for conditional events. Betting scheme. Algorithms for coherence checking and propagation. Penalty criterions and proper scoring rules. Elicitation of probability. Entropy and Bregman divergence.
8	Human reasoning and coherence-based probability logic. On the uncertainties transmitted from premises to the conclusion. Probabilistic non-monotonic reasoning and default rules. Probabilistic interpretation of categorical syllogisms. Degrees of belief on conditionals (if A then B), compound of conditionals, and iterated conditionals. Logical operation among conditional events and probabilistic properties.
Hrs	Practice
6	Some probability practice problems, by also using a suitable software (R and/or Matlab).
6	Some practice problems on stochastic processes. Transition matrix and applications in matlab. Chapman-Kolmogorov equation.
6	Exercises on coherence for conditional events. Algorithms for coherence checking. The program CkC-Check Coherence package
6	Probabilistic interpretation of selected default rules of non-monotonic reasoning and categorical syllogisms. Probabilistic propagation rules. Probabilistic properties of some compound and iterated conditionals. Applications in the field of artificial intelligence and in the framework of psychology of uncertain reasoning.