Syllabus

Course Description

Course Title	Probability Theory and Statistics
Course Code	76210
Course Title Additional	
Scientific-Disciplinary Sector	MATH-03/B
Language	German
Degree Course	Bachelor in Computer Science
Other Degree Courses (Loaned)	
Lecturers	Prof. Werner Nutt, Werner.Nutt@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/7380
Teaching Assistant	
Semester	First semester
Course Year/s	2
CP	6
Teaching Hours	40
Lab Hours	20
Individual Study Hours	90
Planned Office Hours	18
Contents Summary	- Basic concepts: probability spaces, conditional probability, Bayes' Theorem, independent events - Random variables: distribution, density, expectation, variance, covariance, law of large numbers - Special distributions: Bernoulli, Binomial, Poisson, Exponential, Normal, Chi-Square, t-Distribution - Sampling: sums of random variables, central limit theorem, sample variance - Parameter Estimation: maximum likelihood estimates, interval estimates, confidence intervals - Hypothesis testing: significance levels, test statistics, p-values

Course Topics	The course offers an overview of the theory of probability in connection to its use in computer science and the use of statistics in analysing and understanding empirical data.
Keywords	probability theory, statistics, random variables, probability distributions, hypothesis testing
Recommended Prerequisites	Students should be familiar with basic mathematical objects such as sets and functions and be able to manipulate them. In particular, they should be familiar with the convergence of sequences and series, exponential and logarithmic functions, derivatives and partial derivatives, and integration at the level of the introductory course Analysis.
Propaedeutic Courses	
Teaching Format	The course consists of lectures, instructor-led exercises, and homework assignments that are discussed in the exercise groups. In the lectures, the lecturer introduces new concepts and methods using the board, projected materials, and short t in-class exercises. Regular written quizzes assess students' progress and give them feedback on their learning. The homework assignments help students consolidate their understanding by applying the concepts to selected problems. In the tutorials, students discuss possible approaches to the homework problems with their instructors and compare alternative solutions. They also work on additional exercises to deepen their understanding of the material covered in the lectures.
Mandatory Attendance	Attendance is not mandatory but strongly recommended. The lectures combine visual presentations (board and projection), exercises, and discussions aimed at developing problem-solving skills in probability and statistics through practice. All materials and assignments are available on the OLE page, but slides and notes alone are not sufficient to master the course. Regular attendance, active participation in exercises, and timely submission of coursework are essential for success.
Specific Educational Objectives and Learning Outcomes	Knowledge and Understanding - D1.1 Have a solid knowledge of mathematical analysis, algebra, numerical calculus, discrete mathematics and elementary notion of logic that are in support of computer science. - D1.15 Have a solid knowledge of statistics and probability theory

	in support to computer science. Applying knowledge and understanding - D2.1 Be able to use the tools of mathematics and logic to solve problems. - D2.14 Be able to apply the tools of statistics and probability theory to solve information technology issues Ability to make judgments - D3.2 Be able to work autonomously according to the own level of knowledge and understanding. Communication skills - D4.1 Be able to use one of the three languages English, Italian and German, and be able to use technical terms and communication appropriately. Learning skills - D5.1 Have developed learning capabilities to pursue further studies with a high degree of autonomy. - D5.3 Be able to follow the fast technological evolution and to learn cutting edge IT technologies and innovative aspects of last generation information systems.
Specific Educational Objectives and Learning Outcomes (additional info.)	Use of software tools: Students will be able to use R and Java for basic statistical computations. Application of statistical concepts: Students will be able to apply probabilistic and statistical methods to simple real-world scenarios, such as determining sample sizes for surveys, calculating posterior probabilities for diagnostic tests, or assessing the applicability of the central limit theorem in a given situation.
Assessment	The quizzes account for 30% of the final grade, and the written final exam accounts for 70%. The quizzes use basic questions to check students' understanding of the concepts covered in the course. Both the quizzes and the final exam consist of sets of questions, each based on a hypothetical scenario or a mathematical problem. The questions ask students to investigate different aspects of the

	scenario or analyse the properties of the mathematical setting. The question sets in the quizzes are less complex and assess how well students have grasped the material currently being taught. The final exam assesses whether students have achieved the learning outcomes in three areas: knowledge and understanding, applying knowledge and understanding, and making judgements.
Evaluation Criteria	Quizzes and exams are assessed based on the correctness and clarity of the answers. For students who complete all quizzes, the final grade is the weighted average of the exam mark (70%) and the overall quiz mark (30%). If a student completes only some of the quizzes, the quiz weighting is reduced in proportion to the fraction of quizzes completed. If a student's mark on a quiz question is lower than the mark on the corresponding exam question, the higher exam mark is used in its place.
Required Readings	Sheldon M. Ross. Introduction to Probability and Statistics for Engineers and Scientists. Academic Press, London, England. 6th, 2021. ISBN : 0-12-817747-0
Supplementary Readings	Joseph K. Blitzstein, Jessica Hwang. Introduction to Probability. Chapman and Hall/CRC, Boca Raton, USA. 2nd edition, 2019. ISBN : 978-1-1383-6991-7
Further Information	R can be downloaded from: https://www.r-project.org R Studio, the IDE for the R language, can be downloaded from: https://posit.co/download/rstudio-desktop/
Sustainable Development Goals (SDGs)	Quality education