Syllabus

Course Description

Course Title	Probability Theory and Statistics
Course Code	76411
Course Title Additional	
Scientific-Disciplinary Sector	MATH-03/B
Language	German
Degree Course	Bachelor in Informatics and Management of Digital Business
Other Degree Courses (Loaned)	
Lecturers	Prof. Werner Nutt, Werner.Nutt@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/7380 Dott. Mena Hildegard Leemhuis, Mena.Leemhuis@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/50423
Teaching Assistant	
Semester	First semester
Course Year/s	2
CP	6
Teaching Hours	40
Lab Hours	20
Individual Study Hours	90
Planned Office Hours	12
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	Wahrscheinlichkeitstheorie, Statistik, Zufallsvariablen, Wahrscheinlichkeitsverteilungen, Hypothesentests
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 combines lectures, exercise groups with instructors, and coursework assignments that are corrected and commented on by Teaching Assistants. In the lectures, the instructor introduces new concepts and techniques using board work and projected material, complemented by short in-class exercises. The assignments give students the opportunity to consolidate these concepts by applying them to selected problems. In the exercise groups, students discuss possible approaches to the assignment tasks with the instructors and compare alternative solutions. They also work on additional problems, independent of the assignments, to deepen their understanding of the material covered in the lectures.
Mandatory Attendance	Attendance is not compulsory, but strongly recommended. Students who are unable to follow all lectures and labs are encouraged to attend at least some of them. They are also encouraged to work out all the exercises given during the lectures and the labs and to submit the coursework, for which they will receive feedback and marks.

Specific Educational Objectives and Learning Outcomes	The course belongs to the type "attività formative di base – matematica-fisica". 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. Knowledge and understanding: • D1.2 - Possess solid knowledge of statistics and probability theory that support computer science and in-depth economic subjects. Applying knowledge and understanding: • D2.1 - Ability to use mathematics and statistical data analysis tools to solve computational problems. Learning skills • D5.1 - Learning ability to undertake further studies with a high degree of autonomy.
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 assessment is based on coursework assignments (30%) and a written final exam (70%). Both assignments and the exam consist of groups of questions built around a hypothetical scenario or a mathematical setting. The questions require students to explore different aspects of the scenario or to investigate properties of the setting. Assignments are intended to help students review and deepen the material covered in the lectures, while the exam assesses whether they have achieved the learning outcomes of Knowledge and understanding, Applying knowledge and understanding, and Making judgments.
Evaluation Criteria	Assignments and exams are assessed based on the correctness and clarity of the answers. For students who submit all assignments, the final grade is the weighted average of the exam mark (70%) and the assignment mark (30%). If not all assignments are submitted, the assignment component is reduced

	in proportion to the number of assignments handed in. In addition, if the mark for a question in an assignment is lower than the corresponding exam mark, the higher exam mark will apply.
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 Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it
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 kann unter folgender Adresse heruntergeladen werden: https://www.r-project.org R Studio, die IDE für die Sprache R, kann unter folgender Adresse heruntergeladen werden: https://posit.co/download/rstudio-desktop/
Sustainable Development Goals (SDGs)	Quality education