# SYLLABUS
# COURSE DESCRIPTION YEAR 2025/26

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| **COURSE TITLE** | **Probability Theory and Statistics** |
| **COURSE CODE** | 76210 |
| **SCIENTIFIC SECTOR** | MATH-03/B |
| **DEGREE** | Bachelor in Computer Science |
| **SEMESTER** | 1st |
| **YEAR** | 2nd |
| **CREDITS** | 6 |

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| **TOTAL LECTURING HOURS** | 40 |
| **TOTAL LAB HOURS** | 20 |
| **ATTENDANCE** | Attendance is not compulsory, but strongly recommended. The lectures consist of presentations on the black board, interspersed by small exercises, and discussions with the students. The goal of the course is to enable students to solve problems that require reasoning about probabilities and statistics, which is a skill that can only be acquired by training. All the material used in the lectures and labs as well as the assignments will be published on the OLE pages of the course. Students should note that slides and hand-written lecture notes are supporting material, but their study is not sufficient to reach the goal of the course. Experience shows that some students are able to acquire the intended skills without attending all lectures or all labs, but attendance and success in studies are strongly correlated. 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. |
| **PREREQUISITES** | The course requires knowledge of the convergence of sequences and series, exponential and logarithmic functions, derivatives and partial derivatives, and integration as covered in the Analysis course. |
| **COURSE PAGE** | The course page will be made available on the Microsoft Teams class for this course or on https://ole.unibz.it, as communicated by the lecturer. Additional materials can also be found in the university's Reserve Collection at https://www.unibz.it/en/services/library/new-rc/. |

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| **SPECIFIC EDUCATIONAL OBJECTIVES** | This course belongs to the type "Attività affine o integrativa" and the subject area is "Matematica-Fisica".<br><br>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. |

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| **LECTURER** | Werner Nutt (werner.nutt@unibz.it) |
| **SCIENTIFIC SECTOR OF THE LECTURER** | INFO-01/A |
| **TEACHING LANGUAGE** | German |
| **OFFICE HOURS** | Office BZ B1 5.33, Fridays 14:00–15:30, by appointment via email |
| **TEACHING ASSISTANTS** | / |
| **OFFICE HOURS** | / |
| **LIST OF TOPICS COVERED** | – Basic concepts: probability spaces, conditional probability, Bayes' Theorem, independent events<br>– Random variables: distribution, density, expectation, variance, covariance, law of large numbers<br>– Special distributions: Bernoulli, Binomial, Poisson, Exponential, Normal, Chi-Square, t-Distribution<br>– Sampling: sums of random variables, central limit theorem, sample variance<br>– Parameter Estimation: maximum likelihood estimates, interval estimates, confidence intervals<br>– Hypothesis testing: significance levels, test statistics, p-values |
| **TEACHING FORMAT** | The course includes frontal lectures, lab groups supported by teaching assistants (TAs), and coursework assignments that are corrected and commented on by the TAs. In the lectures, new concepts and techniques are introduced, both by way of presentation on the blackboard and by small exercises. In the assignments, students refine these in order to apply them to selected problems. In the lab groups, students discuss possible approaches to the tasks of the assignments with the TAs and compare different solutions. In addition, students also solve problems that are independent of the assignments to deepen the understanding of the material presented in the lectures. |

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| **LEARNING OUTCOMES** | Knowledge and Understanding<br>– D1.1 Have a solid knowledge of mathematical , algebra, numerical calculus, and elementary logic that are in support of computer science.<br>– D1.18 Have a solid knowledge of statistics and probability theory. |

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| | Applying knowledge and understanding<br>– D2.1 Be able to use the tools of mathematics and logic to solve problems.<br>– D2.21 Be able to apply the tools of statistics and probability theory to solve information technology issues<br>Ability to make judgments<br>– D3.2 Be able to work autonomously according to the own level of knowledge and understanding.<br>– D3.5 Ability to discern between various probability models and capability to find appropriate models for a given application<br>Communication skills<br>– 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.<br>Learning skills<br>– D5.1 Have developed learning capabilities to pursue further studies with a high degree of autonomy. |

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| **ASSESSMENT** | The assessment is based on coursework assignments (30%) and a written final exam (70%). To pass the course, the written exam has to be passed. The assignments consist of exercises to apply knowledge acquired in the lectures. The written final exam contains unseen questions about the material covered in the course. The aim of the written exam is to check to which degree students have mastered the following learning outcomes: 1) Knowledge and understanding, 2) applying knowledge and understanding, 3) making judgments. Students who do not submit all assignments will be assessed on the written exam and the submitted parts of the coursework. For students who submit all assignments, the final mark will be a weighted average of the exam mark (70%) and the assignment mark (30%). If students do not submit all assignments, the percentage for the assignments will be lower. Also, assignments for which the mark is lower than the mark of the written exam will not be considered. |
| **ASSESSMENT LANGUAGE** | German |
| **EVALUATION CRITERIA AND CRITERIA FOR AWARDING MARKS** | Correctness and clarity of the answers. |

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| **REQUIRED READINGS** | – Sheldon M. Ross. Introduction to Probability and Statistics for Engineers and Scientists. Academic Press, Amsterdam ; Boston, 3rd edition, July 2004. ISBN 978-0-12-598057-9. |
| **SUPPLEMENTARY** | – Joseph K. Blitzstein and Jessica Hwang. Introduction to Probability. |

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| **READINGS** | Chapman and Hall/CRC, Boca Raton, 2th edition, February 2019. ISBN 978-1-138-36991-7. |
| **SOFTWARE USED** | – R (https://www.r-project.org) |