# COURSE DESCRIPTION – ACADEMIC YEAR 2023/2024

**Course title**: Mathematics and Statistics for Data Science  
**Course code**: 73065  
**Scientific sector**: MAT/06  
**Degree**: Master in Computing for Data Science (LM-18)  
**Semester**: 1  
**Year**: 1  
**Credits**: 6  
**Modular**: No  

<table>
<thead>
<tr>
<th><strong>Total lecturing hours</strong></th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total lab hours</strong></td>
<td>20</td>
</tr>
</tbody>
</table>

**Attendance**: Generally, attendance is not compulsory, but recommended. Non-attending students have to contact the lecturer at the start of the course to agree on the modalities of the independent study.

**Prerequisites**: Although the basic concepts and calculation techniques of integral and differential calculus and linear algebra are reviewed at the beginning of the course, it is necessary for the student to be familiar with the fundamental methodologies, methods and definitions of calculus and linear algebra.

**Course page**: [https://ole.unibz.it/](https://ole.unibz.it/)

**Specific educational objectives**: The course belongs to the type "affini o integrative – formazione affine".

The main objective of the course is to provide students with a solid theoretical foundation in probability and statistics and the ability to solve problems in these two disciplines.

The course consists of three parts.

1) The **first part** revise the concepts and mathematical tools of linear algebra and mathematical analysis necessary to understand the concepts and solve the problems of probability and statistics.
2) In the **second part** the course will cover the basic topics of probability, and
3) In the **third part** the course will deal with the basic topics of statistics.

The course is preparatory to advanced courses in probability and statistics and is a support to other courses requiring knowledge in basic calculus, probability and statistics.

At the end of the course, the student will have

- **revised** the foundations of mathematical calculus necessary to approach probability and statistics problem  
- **acquired** the foundations of mathematical calculus, probability and statistics that will allow him/her to solve the
most common problems of statistical **data processing and interpretation** that are common to many scientific fields such as computer science and software engineering, artificial intelligence, and data processing in numerous applications of these fields (e.g., biology, medicine and social sciences, etc.).

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Paola Lecca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td><a href="mailto:Paola.Lecca@unibz.it">Paola.Lecca@unibz.it</a>, +39 0471 016162</td>
</tr>
<tr>
<td>Scientific sector of lecturer</td>
<td>INF/01</td>
</tr>
<tr>
<td>Teaching language</td>
<td>English</td>
</tr>
<tr>
<td>Office hours</td>
<td>Tuesday 9:00-10:00, Faculty of Engineering, Piazza Domenicani 3, Office P1.04 (appointment is requested by e-mail at least one day before).</td>
</tr>
<tr>
<td>Lecturing Assistant (if any)</td>
<td>Same as lecturer.</td>
</tr>
<tr>
<td>Contact LA</td>
<td>LA-</td>
</tr>
<tr>
<td>Office hours LA</td>
<td>LA-</td>
</tr>
</tbody>
</table>

### List of topics
- Fundamentals of differential and integral calculus
- Fundamentals of linear algebra
- Probability theory
- Data distribution models and analysis
- Hypothesis tests
- Regression analysis

### Teaching format
Frontal lectures and labs with theoretical exercises.

### Learning outcomes
**Knowledge and understanding**
- Have a solid knowledge of the mathematical foundations of probability and statistics that are in support of the applications in computational data science.

**Applying knowledge and understanding**
- Be able to use the tools of mathematics to solve problems in data analysis.

**Making judgments**
- Be able to solve problems from a theoretical point of view, which is an indispensable prerequisite for later acquiring autonomy, discernment and judgement, as well ability to innovate in the use and implementation of problem-specific software solutions.

**Communication skills**
- Acquire the mathematical language to formalise the problem to be solved.

**Ability to learn**
- Ability to study and understand theoretical notions in order to recognize their applications.

### Assessment
Two intermediate written tests during the course or final examination in the usual winter, summer and autumn sessions.
Two intermediate written tests will be held during the course: the first one will be held towards the middle of the course and will cover the topics of the first and second part of the course (calculus and probability); the second one will be held at the end of the course and will cover the topics covered in the third part of the course (statistics).

Achievement of at least 18/30 in both intermediate tests will exempt the student from the final examination. The intermediate tests will contain exercises and theoretical questions on the topics covered during the course. The final grade will be the average of the grades obtained in the two tests.

Otherwise, for those students who do not pass both tests or for those who do not wish to take them, there will be an examination in the winter, summer, and autumn sessions.

The final exam will be a written exam with exercises and theoretical questions and will cover 100% of the syllabus.

This modalities (participation at intermediate tests or finale exam) hold both for attending and non-attending students.

<table>
<thead>
<tr>
<th>Assessment language</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Typology</td>
<td>Monocratic</td>
</tr>
<tr>
<td>Evaluation criteria and criteria for awarding marks</td>
<td>Final pass mark. The minimal threshold to pass the exam is 18/30. These evaluation criteria hold both for attending and non-attending students</td>
</tr>
</tbody>
</table>

Required readings

The course includes topics from different disciplinary areas of mathematics that are unlikely to be contained in a single textbook. It is therefore advisable that the student follows the notes and the didactical material that the lecturer will make available at each lecture and laboratory. However, there are textbooks that the student can refer to for the various parts and topics of the course, for example:

for the part I of the course:

- James, E. Gentle, Matrix Algebra: Theory, Computations and Applications in Statistics (Springer Texts in Statistics) 2nd ed. 2017

for the part II of the course:

<table>
<thead>
<tr>
<th><strong>Subject Librarian:</strong> David Gebhardi, <a href="mailto:David.Gebhardi@unibz.it">David.Gebhardi@unibz.it</a></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supplementary readings</strong></td>
</tr>
<tr>
<td><strong>Software used</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>