

## COURSE DESCRIPTION – ACADEMIC YEAR 2021/2022

<b>Course title</b>	<b>Advanced Statistics</b>
<b>Course code</b>	73064
<b>Scientific sector</b>	MAT/06
<b>Degree</b>	Master in Computational Data Science (LM-18)
<b>Semester</b>	2
<b>Year</b>	1
<b>Credits</b>	6
<b>Modular</b>	No

<b>Total lecturing hours</b>	40
<b>Total lab hours</b>	20
<b>Attendance</b>	Attendance of classes and labs is not compulsory but highly recommended.  Non-attending students have to contact the lecturer at the start of the course to agree on the modalities of the independent study.
<b>Prerequisites</b>	The knowledge provided by a course in calculus and one in probability and statistics. Basic knowledge of the software R.
<b>Course page</b>	<a href="https://ole.unibz.it/">https://ole.unibz.it/</a>

<b>Specific educational objectives</b>	<p>The course belongs to the type "affini o integrative – formazione affine" in the curriculum "Data Analytics".</p> <p>A second course in statistics on selected topics of statistical inference, time series and computational statistics. Topics discussed include Montecarlo methods and the bootstrap; maximum likelihood and Bayesian estimation, likelihood ratio testing. ARMA and regression modelling for time series data and forecasting. Techniques for dealing with missing data. Nonparametric density estimation and goodness of fit testing (optional).</p> <p>The course alternates front classes and lab activity where the methodology discussed is applied on real and simulated data. The software R will be used.</p> <p>This course, by combining theory and computer simulations and applications, aims at providing deep understanding and operational knowledge of some core techniques of statistical analysis which can be exploited either for applied data analysis or theoretical research.</p>
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<b>Lecturer</b>	<a href="#">Emanuele Taufer</a>
<b>Contact</b>	Piazza Domenicani 3, Room 1.04, <a href="mailto:Emanuele.Taufer@unibz.it">Emanuele.Taufer@unibz.it</a>
<b>Scientific sector of lecturer</b>	SECS-S/01
<b>Teaching language</b>	English
<b>Office hours</b>	Friday 16:00 - 17:00, arrange beforehand by email.
<b>Lecturing Assistant (if any)</b>	<a href="#">Alessandro Gianola</a>
<b>Contact LA</b>	Piazza Domenicani 3, Room 2.01, <a href="mailto:gianola@inf.unibz.it">gianola@inf.unibz.it</a>
<b>Office hours LA</b>	Arrange beforehand by email.
<b>List of topics</b>	<ul style="list-style-type: none"> <li>Parameter estimation: maximum likelihood methods</li> </ul>

	<ul style="list-style-type: none"> <li>• Parameter estimation: Bayesian inference</li> <li>• Time series: components and forecasting</li> <li>• Time series: causal relationship tests</li> <li>• Missing data</li> <li>• Elements of statistics for Big Data</li> </ul>
<b>Teaching format</b>	Frontal lectures, theoretical exercises and exercises on computer.
<b>Learning outcomes</b>	<p>Knowledge and understanding:</p> <ul style="list-style-type: none"> <li>• D1.1 - Knowledge of the key concepts and technologies of data science disciplines</li> <li>• D1.8 - Knowledge of the mathematical-statistical principles required for data analysis</li> </ul> <p>Applying knowledge and understanding:</p> <ul style="list-style-type: none"> <li>• D2.1 - Practical application and evaluation of tools and techniques in the field of data science</li> <li>• D2.2 - Ability to address and solve a problem using scientific methods</li> <li>• D2.7 - Practical application of mathematical-statistical tools and methods from the field of data science</li> </ul> <p>Making judgments</p> <ul style="list-style-type: none"> <li>• D3.2 - Ability to autonomously select the documentation (in the form of books, web, magazines, etc.) needed to keep up to date in a given sector</li> </ul> <p>Communication skills</p> <ul style="list-style-type: none"> <li>• D4.1 - Ability to use English at an advanced level with particular reference to disciplinary terminology</li> </ul> <p>Learning skills</p> <ul style="list-style-type: none"> <li>• D5.3 - Ability to deal with problems in a systematic and creative way and to appropriate problem solving techniques.</li> </ul>
<b>Assessment</b>	<p>The exam will be held in the lab and will include theoretical questions and exercises to be worked out by the students as well as computational exercises to be solved with R.</p> <p>The exam will be the same for attending and non-attending students</p>
<b>Assessment language</b>	English
<b>Assessment Typology</b>	Monocratic
<b>Evaluation criteria and criteria for awarding marks</b>	<p>The exam is evaluated with a score expressed in 30/30. The minimum threshold for passing the exam is 18/30.</p> <p>The theoretical questions and exercises will account for the 50% of the grade. The exercises to be solved by R will account for the remaining 50%.</p>
<b>Required readings</b>	Randall Pruim, 2018, <i>Foundations and Applications of Statistics An Introduction Using R</i> . American Mathematical Society, Providence. ISBN 9781470428488. From this book we discuss topics from chapters 4 and 5.

	<p>Robert Shumway and David Stoffer, 2019. <i>Time Series: A Data Analysis Approach Using R</i>. CRC Press, Boca Raton. ISBN 9780367221096. From this book we discuss chapters 1 to 4 and some optional topics from chapters 5 and 8.</p> <p>Subject Librarian: David Gebhardi, <a href="mailto:David.Gebhardi@unibz.it">David.Gebhardi@unibz.it</a></p>
<b>Supplementary readings</b>	Additional material and readings provided in class by the lecturer.
<b>Software used</b>	--