

General information	
Academic subject	Statistics and Data Science
Degree course	Environmental Science
Academic Year	I
European Credit Transfer and Accumulation System (ECTS)	8
Language	Italian
Academic calendar (starting and ending date)	2nd semester: March 4, 2022 – June 10, 2022
Attendance	Optional

Professor/ Lecturer	
Name and Surname	Marcello De Giosa
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Department and address	Department of Mathematics
Virtual headquarters	
Tutoring (time and day)	Friday, 3 pm - 5 pm, upon reservation by e-mail.

Syllabus	
<b>Learning Objectives</b>	<p><b>Knowledge and understanding:</b> Acquisition of the basic methodologies of statistics and data science most common in the environmental field. The tools of the scientific method applied to the understanding of the aforementioned methodologies are provided. The course is divided into theoretical lessons, exercises and laboratory with the use of open-source software R, in order to increase the student's ability to identify the most suitable approach for solving environmental problems.</p> <p><b>Ability to apply knowledge and understanding:</b> Acquisition of skills related to the application of theoretical and practical concepts for the solution of concrete environmental problems. The acquisition of these skills must be the result of practical experiences and laboratory exercises.</p> <p><b>Autonomy of judgment:</b> Acquisition of the ability to deduce conclusions useful for solving environmental problems from the results obtained.</p> <p><b>Communication skills:</b> Acquisition of the ability to discuss the fundamental concepts of the study topics in a clear and exhaustive way, using an appropriate scientific language. The discussions during the theoretical lessons, the exercises and the laboratory contribute to the achievement of this objective.</p> <p><b>Learning ability:</b> Acquisition of the ability to integrate basic knowledge through personal in-depth courses with rigorous scientific material.</p>

<b>Course prerequisites</b>	To achieve the educational objectives, it is useful for the student to possess, albeit not in depth, the basic concepts contained in the course of Mathematics and generic skills in scientific subjects. Possession of these prerequisites would also be useful for working and non-attending students.
<b>Contents</b>	A brief introduction to R. Installation. The console. Classes of objects. Vector, data.frame and factor. Function. Exploratory methods. Rank. Average. Median. Variance and Standard Deviation. Dotchart. Boxplot. Frequency and density. Chance. Estimation of a Probability. Histograms. Probability density and estimation. Distributions: Normal, lognormal, student's t. Verify the distribution of provenance of a sample. Estimation of an average: punctual, confidence intervals, hypothesis tests. Estimation of the difference of two means: punctual, confidence intervals, hypothesis tests. The linear model. Definition, parameter estimation, partitioning of the dispersion, estimation of a new observation.
<b>Books and bibliography</b>	Notes from the lectures and material provided by the teacher. S.M. Ross (2014). Probability and statistics for engineering and science. Apogeo. Daniel, W.W. ; Cross, C.L. (2019). Biostatistics. Edises. R manuals at <a href="http://cran.r-project.org">cran.r-project.org</a>
<b>Additional materials</b>	The notes distributed during the course are fundamental additions to the reference books.

<b>Work schedule</b>			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
<b>Hours</b>			
212	36	30+30	116
<b>ECTS</b>			
8	4	2+2	
<b>Teaching strategy</b>			
Frontal teaching is the main teaching method as regards the theoretical aspects. The ability to apply knowledge is acquired by carrying out classroom exercises concerning the application of the methodologies presented in the course to examples and concrete data of mainly environmental origin. All exercises and examples are carried out with the use of the R. The course is not delivered in e-learning mode.			
<b>Expected learning outcomes</b>			
<b>Knowledge and understanding on:</b>	<ul style="list-style-type: none"> <li>○ The student will acquire mastery of the statistical concepts covered during the course.</li> </ul>		
<b>Applying knowledge and understanding on:</b>	<ul style="list-style-type: none"> <li>○ The student will learn how to apply the theoretical statistical concepts acquired in the course to concrete issues of interest and environmental origin with the use of the R.</li> </ul>		
<b>Soft skills</b>	<ul style="list-style-type: none"> <li>● <i>Making informed judgments and choices</i> <ul style="list-style-type: none"> <li>○ The student will learn to independently identify the statistical methodologies suitable for answering the questions posed.</li> </ul> </li> <li>● <i>Communicating knowledge and understanding</i></li> </ul>		

	<ul style="list-style-type: none"> <li>○ The student will acquire the ability to fully communicate the concepts learned and the results of the statistical analyses carried out with the use of correct scientific language.</li> <li>● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> <li>○ The student will acquire the tools to enrich his knowledge also through individual or group in-depth courses.</li> </ul> </li> </ul>
<b>Assessment and feedback</b>	
Methods of assessment	Laboratory test with the use of the R software concerning the solution of questions through skills and methods learned in the various parts of the course. The laboratory test is integrated by an oral interview concerning the theoretical aspects of the methods used in the laboratory test.
Evaluation criteria	<ul style="list-style-type: none"> <li>● <i>Knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ The student must demonstrate mastery of the statistical concepts covered during the course.</li> </ul> </li> <li>● <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ The student must demonstrate that he is able to apply the theoretical statistical concepts acquired in the course to concrete issues of interest and environmental origin, with the use of the R software.</li> </ul> </li> <li>● <i>Autonomy of judgment</i> <ul style="list-style-type: none"> <li>○ The student must be able to independently identify the statistical methodologies suitable for answering the questions posed.</li> </ul> </li> <li>● <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> <li>○ The student must have acquired the ability to fully communicate the concepts learned and the results of the statistical analyses carried out with the use of correct scientific language.</li> </ul> </li> <li>● <i>Communication skills</i> <ul style="list-style-type: none"> <li>○ The student must have acquired the ability to fully communicate the concepts learned and the results of the statistical analyses carried out with the use of correct scientific language.</li> </ul> </li> <li>● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> <li>○ The student must demonstrate that he has acquired the tools to enrich his knowledge also through individual or group in-depth courses.</li> </ul> </li> </ul>
Criteria for assessment and attribution of the final mark	<p>The final mark is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. The final mark will result from the grade assigned to the laboratory test, integrated on the basis of the mastery of the theoretical aspects demonstrated in the oral interview. To achieve a high evaluation, the student must have developed autonomy of judgment and adequate capacity for argumentation and presentation.</p>
<b>Additional information</b>	

Bari: September 14, 2022

*Massimo Moretti*