



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Scienze della Terra e del Mare
<b>ACADEMIC YEAR</b>	2023/2024
<b>MASTER'S DEGREE (MSC)</b>	NATURAL SCIENCES
<b>SUBJECT</b>	APPLIED STATISTICS FOR SCIENTIFIC RESEARCH
<b>TYPE OF EDUCATIONAL ACTIVITY</b>	B
<b>AMBIT</b>	50509-Discipline chimiche, fisiche, matematiche ed informatiche
<b>CODE</b>	19792
<b>SCIENTIFIC SECTOR(S)</b>	SECS-S/02
<b>HEAD PROFESSOR(S)</b>	CILLUFFO GIOVANNA      Ricercatore a tempo determinato      Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	
<b>CREDITS</b>	6
<b>INDIVIDUAL STUDY (Hrs)</b>	98
<b>COURSE ACTIVITY (Hrs)</b>	52
<b>PROPAEDEUTICAL SUBJECTS</b>	
<b>MUTUALIZATION</b>	APPLIED STATISTICS FOR ECOLOGICAL SYSTEMS - Corso: BIOLOGIA MARINA APPLIED STATISTICS FOR ECOLOGICAL SYSTEMS - Corso: MARINE BIOLOGY
<b>YEAR</b>	1
<b>TERM (SEMESTER)</b>	1° semester
<b>ATTENDANCE</b>	Not mandatory
<b>EVALUATION</b>	Out of 30
<b>TEACHER OFFICE HOURS</b>	<b>CILLUFFO GIOVANNA</b> Monday    14:00    16:30    Via Archirafi 18 Wednesday 14:00    16:30    Via Archirafi 18

<b>PREREQUISITES</b>	Basic knowledge of mathematics and some topics of mathematical analysis, i.e. the concept of derivative, limit and integral of a function and the identification of maximum/minimum of a function
<b>LEARNING OUTCOMES</b>	<p><b>KNOWLEDGE AND UNDERSTANDING</b> At the end of the course the student will have knowledge of the basic tools of probability, of descriptive statistics and of the first rudiments of inferential statistics.</p> <p><b>ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING</b> To distinguish the different types of data; recognize the nature of the data available to process them correctly; use the main statistical summary indices; to study the dependence between two variables, to make decisions in elementary conditions of uncertainty.</p> <p><b>AUTONOMY OF JUDGMENT</b> The student will be able to collect, organize, analyze data relating to a phenomenon under study and to interpret the results of appropriate statistical analyzes.</p> <p><b>COMMUNICATION SKILLS</b> Knowing how to transmit the results of a descriptive statistical analysis or a basic inferential analysis through simple reports; know how to present the results obtained orally, justifying the use of the procedures used from a theoretical point of view.</p> <p><b>LEARNING ABILITY</b> The student will have learned the principles of the statistical scientific method and will be able to analyze the results of statistical surveys through the use of the open source statistical software R.</p>
<b>ASSESSMENT METHODS</b>	<p>An entry test is carried out to assess the initial preparation of students. The assessment is based on an optional intermediate written test which involves solving three exercises to which a maximum of 10 points are assigned. For the student who accepts the outcome of the intermediate test, the final written test will focus on the second part of the course, not the subject of the intermediate test, and will consist of three exercises. The final grade is awarded taking into account the average of the marks (out of thirty) obtained in the intermediate and final tests.</p> <p>If the student intends to refuse the outcome of the intermediate test or does not want to take the intermediate test, the final test will consist of a written test (compulsory) on the entire course program. The written test involves the resolution of 6 exercises which are assigned a maximum of 5 points each. The exercises require the application of the most appropriate statistical indices of univariate and bivariate analysis. Pen, ruler, pocket calculator and computer can be used for the written test. During the written tests the student can withdraw.</p> <p>The oral exam is optional for all students who having acquired a score of at least 18/30 after the the written tests (or only the final written test),. The oral exam is compulsory for all students who acquire a score of at least 15 and less than 18 out of thirty. The final assessment aims to assess whether the student has knowledge and understanding of the topics, has acquired interpretative competence and autonomy of judgment of concrete cases. The following criteria will be used for the exam assessment: Excellent (30-30 cum laude). Excellent knowledge of the topics, excellent language skills, good analytical skills, the student is able to apply the knowledge to solve the proposed problems. Very good (26-29). Good mastery of the topics, full property of language. The student is able to apply his/her knowledge to solve proposed problems. Good (24-25). The student reached a basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the his/her knowledge to the solution of the proposed problems. Satisfactory (21-23). The student does not have full mastery of the main topics of teaching, but it possesses the knowledge, satisfactory property language, poor ability to independently apply the acquired knowledge. Sufficient (18-20). The student has a minimum basic knowledge of the main topics and technical language issues, very little or no ability to independently apply the acquired knowledge. Insufficient - The student does not have an acceptable knowledge of the contents of the topics covered in the course.</p>

	The maximum score of the written test is 30. The "honors" can be assigned to those who decide to take the oral test with a written evaluation of at least 25/30.
<b>EDUCATIONAL OBJECTIVES</b>	At the end of the course, the student must have knowledge of the basic tools of statistics, of probability calculus and in general of the scientific method of approach to real problems. Furthermore, the student must be able to statistically analyze a dataset.
<b>TEACHING METHODS</b>	Frontal lectures, classroom exercises, laboratory exercises.
<b>SUGGESTED BIBLIOGRAPHY</b>	Agresti, Finlay. Metodi statistici di base e avanzati per le scienze sociali, v ed., Pearson. Cicchitelli, D'urso, Minozzo. Statistica. Principi e metodi 4/Ed, Pearson. Triola, Triola. FONDAMENTI DI STATISTICA. Per le discipline biomediche - 2Ed. Pearson Materiale didattico fornito dal docente

## SYLLABUS

<b>Hrs</b>	<b>Frontal teaching</b>
6	Introduction to statistics. Classification of statistical characters. Frequency distribution for nominal and ordinal qualitative variables and for discrete and continuous quantitative variables. Absolute, relative, percentage and cumulative frequencies. Graphic representations adapted to the nature of the variable.
12	The average values, the simple and weighted arithmetic average. The indices of median position and quantiles. The indices of variability and the indices of heterogeneity. Asymmetry
8	The discrete random variables of Bernoulli and Poisson, the continuous random variable of Gauss. Theoretical and empirical moments for discrete and continuous variables. Asymmetry and kurtosis
14	Double entry tables. Conditional and marginal synthesis measures. Analysis of the association between two characters (index X <sup>2</sup> ). Measure of the dependence of a quantitative character, independence on average (X <sup>2</sup> ). Linear interdependence between continuous quantitative variables (Bravais-Pearson linear correlation index). The simple linear regression model. Interpretation of parameters alpha and beta. The coefficient of determination. Hypothesis testing.
<b>Hrs</b>	<b>Workshops</b>
3	Introduction to open source software R. Exercises on the construction of frequency tables and graphical representations of statistical characters.
3	Exercise on position, variability, dispersion and heterogeneity indices.
4	Exercise on the association measures between characters, on the measure of independence on average and on the measure of linear interdependence. Estimation of a linear regression model through statistical software and interpretation of the results.
2	hypothesis testing