

Academic Year/course: 2022/23

26415 - Statistical and IT Analyses of Geological Data

Syllabus Information

Academic Year: 2022/23

Subject: 26415 - Statistical and IT Analyses of Geological Data

Faculty / School: 100 - Facultad de Ciencias

Degree: 296 - Degree in Geology
588 - Degree in Geology

ECTS: 6.0

Year: 2

Semester: First semester

Subject Type: Basic Education

Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, computer laboratory sessions, autonomous work and study, tutorials and assessment tasks.

This course offers a learning process based on critical reflection of concepts, not acquired by memory. In order to achieve these objectives, problem and project-based learning with geological data are used. The aim of these learning processes is to encourage personal initiative and creativity, management of documentary sources, reflection on previously learned theoretical aspects, and structuring a logical discourse from the problem statement to its resolution. The realization of group projects enhances the responsibility and commitment of each member of the group.

4.2. Learning tasks

This course is organized as follows:

- **Lectures** (15 hours) and Practice sessions (15 hours). Brief description of concepts and development of case-studies on geological data. Scripts and data sets for the practice sessions and any other appropriate material will be available on the Moodle platform (<http://moodle.unizar.es>). It comprises the study of:
 - Descriptive statistics (1.5 ECTS)
 - Basic probability concepts (1 ECTS).
 - Basic statistical inference (1.5 ECTS)
 - Analysis of geological data by means of application software (2 ECTS)
- **Computer laboratory sessions** (30 hours). 15 two-hour sessions in small groups.
- **Autonomous work and study** (90 hours). The student must take responsibility in the creation and consolidation of a structured work program. Autonomous work includes individual study, assignment preparation, teamwork and tutorial sessions.

- **Assessment tasks.** Exam for topic 1 will involve a real dataset and a report on that analysis (teamwork) and a test using Rcmdr. Topics 2 and 3 will be assessed using Rcmdr. Topic 4 will be assessed using Excel and Base.

Teaching and assessment activities will be carried out on site for as long and as much as possible. This scenario could change if safety regulations related to the covid19 crisis recommended online activities.

4.3. Syllabus

This course will address the following topics:

- **Topic 1: Descriptive statistics**
 - Objectives of descriptive statistics
 - Different types of geological data
 - Univariate analysis: frequency tables, graphs and position and variability measures
 - Bivariate descriptive data analysis
- **Topic 2: Basic concepts in probability**
 - Basic concepts
 - Some probability distributions
- **Topic 3: Statistical Inference**
 - Objectives of statistical inference
 - Point estimation of parameters
 - Confidence intervals
 - Tests of hypothesis
 - Other statistical techniques applied on Geology
- **Topic 4: Information Technology**
 - Introduction to Computer Science and basic notions
 - Spreadsheets: Computer calculations and graphical representation of results.
 - Table-based database model.
 - Database Management Systems
 - Database Query Languages.

Below are explained the skills acquired by the study of each of the aforementioned topics.

- **Descriptive Statistics**
 - To know the different types of data
 - To identify the different descriptive tools for each type of data
 - To summarize the information in a dataset using frequency tables and graphs
 - To summarize the information in a dataset using location, dispersion and shape measures
 - To analyze the relationship between two variables
 - To describe geological datasets using a statistical software (Rcmdr)
 - To interpret results of descriptive statistical analysis (tables graphs and numerical measures)
 - To write reports on basic statistical analysis of geological datasets.
- **Basic probability concepts**
 - To know and distinguish the different types of random variables
 - To know and identify the most common probability distributions
 - To solve simple probability problems and to interpret the results.
- **Basic statistical inference**
 - To distinguish the concepts of sample and population
 - To distinguish descriptive and statistical inference analysis
 - To estimate unknown parameters from a sample.
 - To calculate and interpret confidence intervals
 - To calculate and interpret hypotheses tests and how to apply them to statistical decision problems
 - To read and understand statistical inference analysis of geological datasets
 - To write a report on a simple statistical inference analysis of a geological dataset.
- **Analysis of geological data by means of application software**
 - To Know IT tools that can be used by a Geology professional.
 - To solve geological information processing problems by means of spreadsheets and databases.

- To import / export information between different IT tools.
- To develop self-learning ability to adapt to the evolution of tools specific of their professional environment.
- To assume the need and usefulness of information technologies in professional practice.

4.4. Course planning and calendar

Important dates:

- End of Topic 2: first test (continuous assessment option) and deadline to hand in the report of the group work.
- End of Topic 3: second test (continuous assessment option).

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences and Earth Sciences Department websites (<https://ciencias.unizar.es>, <https://cienciatierra.unizar.es>) and Moodle.

4.5. Bibliography and recommended resources

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=26415>