

Universidad
Autónoma de Madrid



UNIVERSIDAD AUTÓNOMA DE MADRID

GUÍA DOCENTE



Asignatura: Data Analysis II [Análisis de datos II] (Inglés)

Código: 18152

Centro: Facultad de Psicología

Titulación: Graduado en Psicología

Nivel: Grado

Tipo: Obligatoria

Curso académico: 2016-2017



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Nº de créditos: 6

1. ASIGNATURA / SUBJECT

1.1. Nombre / Name

Análisis de datos II / Data analysis II

1.2. Código / Code

18152

1.3. Materia / Content area

Statistics

1.4. Tipo / Type

Compulsory

1.5. Nivel / Level

Grado

1.6. Curso / Year

Second year

1.7. Semestre / Semester

First

1.8. Número de créditos / Credits number or ECTS

Six (6)

1.9. Idioma en el que se imparte / Subject language

English

1.10. Requisitos previos / Previous requirements

No previous requirements are needed, but it is advisable to have previously passed ANÁLISIS DE DATOS

1.11. Objetivos y competencias que debe desarrollar el estudiante / Objectives and competitions to develop

A student passing the subject *Data Analysis in Psychology II*, should have learnt to...

1. Apply different sampling methods and data gathering techniques as a way to obtain useful information in order to achieve the aims posted in a research.
2. Process data with a computer and prepare them for analysis following those idiosyncratic conventions of frequent use databases.
3. Analyze data by way of the application of the statistical analysis tools of regular use in the field of the social sciences methodology. (This implies learning to distinguish between “differences” and “relations”, to identify the statistical tools capable of comparing groups and relating variables).
4. Manage with proficiency a statistical software and carry on those statistical tools included in the subject program. Paying special attention to the election of the adequate tool and the correct understanding of results.
5. Write technical reports about the chosen statistical tools and, particularly, about the results obtain when using it.
6. Gather relevant information, in an efficient and autonomous way, from bibliographic sources referred to data analysis.
7. Approach research reports with a critical attitude, knowing where to focus in order to find strengths and weaknesses.
8. Work out data analysis in a meticulous and organized way, as a strategy guided to self-protection from flaws, and as a procedure for embedding rigor and cautiousness on analysis conclusions.

These aims are in accordance with the following, quoted, basic (BC), general (GC), specific (SC) and module (MC) capabilities, extracted from the Grade Memoire (*Memoria de la Titulación*):

- CB3 Que los estudiantes tengan la capacidad de reunir e interpretar datos relevantes (normalmente dentro de su área de estudio) para emitir juicios que incluyan una reflexión sobre temas relevantes de índole social, científica o ética
- CG3 Que tengan capacidad para reunir e interpretar datos relevantes relativos al comportamiento humano, individual y social, y el contexto en el que se produce, para emitir juicios fundamentados sobre problemas de orden psicológico.

- CE6 Conocer los distintos diseños de investigación y los procedimientos de análisis de datos propios de la Psicología.
- CE11 Analizar e interpretar los datos cuantitativos y cualitativos procedentes de las investigaciones, informes y trabajos en Psicología.
- CM17 Comprender y saber aplicar los procedimientos de análisis de datos basados en la estadística descriptiva y en la teoría de la probabilidad.
- CM18 Conocer la estructura general de una aplicación informática de Análisis de Datos de uso habitual en psicología y ser capaz de realizar con ella los análisis estadísticos que forman parte del programa e interpretar sus resultados.
- CM25 Conocer la lógica de la inferencia estadística (estimación y contraste) y su rol en el contexto del análisis de datos y de la investigación científica
- CM30 Desarrollar actitudes de curiosidad y búsqueda acerca de los procesos de pensamiento y lenguaje, su desarrollo, sus bases biológicas y sociales.

1.12. Contenidos del programa / Program contents

The subject starts reviewing the essential contents of statistic inference (sampling, estimation and testing), which are the corner stone of the accompanying contents, and carries on with an explanation of those statistical tools of grater utility for the behavioral and health sciences.

Statistical tools are examined structured in two main blocks: those designed to compare (mainly analysis of variance models) and those designed to study relations (mainly contingency tables and regression models).

A conceptual description (their foundation and their aim) is offered on all statistical techniques, and it is explained how to apply them using a widespread statistical software in both academic and professional environments (SPSS; *Statistical Product and Service Solutions*).

CONTENTS

1. INTRODUCTION TO STATISTICAL INFERENCE: Review of essential concepts: population, sample, parameter, statistic. Sampling: sampling methods. Sampling distributions: definition, mean sampling distribution, proportion sampling distribution. Statistical inference logic. PARAMETER ESTIMATION: point estimation, interval estimation, mean confidence interval, proportion confidence interval. HYPOTHESIS TESTING: null

hypothesis, test statistic and its sampling distribution, decision rule, type I and type II errors, statistical power, effect size.

2. ONE VARIABLE INFERENCE. Test on one proportion. Goodness of fit test. Test on the center of the distribution. Test on the distribution shape.
3. INFERENCE ON TWO CATEGORICAL VARIABLES. Relating them: Pearson χ^2 test, risk indexes, association measures. Comparing them: McNemar test.
4. INFERENCE ON TWO CUANTITATIVE VARIABLES: Relating them: T test for related samples and Wilcoxon test. Comparing them: Pearson correlation coefficient, Spearman correlation coefficient.
5. INFERENCE ON TWO CUANBTITATIVE VARIABLES. With two groups: T test for independent samples (Mann-Whitney U test).
6. ANOVA I. ONE FACTOR. The general linear model. Introduction to analysis of variance: ANOVA models, ANOVA rationale. One factor ANOVA. Model assumptions. Planed or *a priori* comparisons. *Post hoc* or *a posteriori* comparisons. Kruskal-Wallis H test.
7. ANOVA II. TWO OR MORE FACTORS. Between-factors interaction. Two facto analysis of variance. *Post hoc* or *a posteriori* comparisons.
8. ANOVA III. ONE REPEATED MEASURES FACTOR. Repeated measures designs. One factor model. Multiple comparisons.
9. ANOVA IV. TWO REPEATED MEASURES FACTORS. Two factor model with repeated measures in one of them. Two factor model with both repeated measures. Multiple comparisons.
10. LINEAR REGRESSION ANALYSIS. Simple regression: the regression line, goodness of fit, tests on the regression line slope. Regression in ANOVA format. Multiple regression: the regression equation, goodness of fit, regression coefficients significance, variables relative importance, stepwise regression. Linear regression model assumptions. Outliers and leverage cases.

1.13. Referencias de consulta básicas / Basic references of consultation, recommended bibliography

The subject is based in the two following manuals (in Spanish):

Pardo A, Ruiz MA y San Martín R (2015). *Análisis de datos en ciencias sociales y de la salud* (vol I, 2ª ed). Madrid: Síntesis.

Pardo A y San Martín R (2015). *Análisis de datos en ciencias sociales y de la salud* (vol II, 2ª ed). Madrid: Síntesis.

The following manual will be used as reference in English:



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Howell DC (2002). *Statistical methods for psychology* (5th ed). Belmont, CA: Thomson Wadsworth.

Additionally, the student may obtain more detailed information on different topics covered by the course, as well as practice exercises, in the following manuals:

Field A (2005). *Discovering statistics using SPSS* (2nd ed). Thousand Oaks, CA: Sage.

Hays WL (1994). *Statistics* (5^a ed). Belmont, CA: Wadsworth.

Keppel G y Wickens ThD (2004). *Design and analysis: A researcher's handbook* (4th ed). Englewood Cliffs, NJ: Prentice-Hall.

Kirk RE (2013). *Experimental design. Procedures for the behavioral sciences* (4th ed). Belmont, CA: Brooks/Cole.

Maxwell SE y Delaney HD (2004). *Designing experiments and analyzing data. A model comparison perspective* (2nd ed). Mahwah, NJ: Lawrence Erlbaum Associates.

Myers JL y Well AD (2003). *Research design and statistical analysis* (2nd ed). Mahwah, NJ: LEA.

Pardo A y San Martín R (1998). *Análisis de datos en psicología II* (2nd ed). Madrid: Pirámide.

2. Datos del profesor / Professor data

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2.1. Centro / Departament o centre

Facultad de Psicología. Departamento de Psicología Social y Metodología.

2.2. Horario de tutoría / Prof.'s consultations timetable

It will be published during the first week of classes as well as in the subject web page.

3. Métodos Docentes / Educational methods

In order to meet the subject aims and to develop the abilities proposed in 1.11, several teaching methods should be applied:

1. *Theoretical and practice sessions.* They are taught with the whole group in a regular classroom. In these sessions, the teacher explains the theory for each topic and, following the explanation, proposes practical exercises, needed to ensure the proper understanding of theoretical concepts. Objectives worked out in this kind of sessions are: 1, 3, 5, 6, 7 and 8.
2. *Paper and pencil practice sessions.* They are taught with the entire group in a regular classroom. They involve solving review exercises specifically designed for the student to strengthen the theoretical concepts learnt. Objectives worked out in this kind of sessions are, mainly: 3, 5 and 8.
3. *Computer aided practice sessions.* Depending on the final size of the group, these sessions will be taught split in a computer classroom: In this sessions the student learns how to use a statistical software (IBM-SPSS), to apply and to understand the statistical technics covered in the study plan. Objectives worked out in this kind of sessions are: 2, 4, y 5.
4. *Practice work using SPSS.* A practice work which students should complete in small groups (2 to 4 students). It is worked out during the second half of the quarter. Each group should solve a series of questions derived from analyzing a data base using SPSS. These questions require identifying,

implementing and grasping most of the statistical tools approached during theoretical and practice sessions. Objectives worked out in this practice are: 2, 4, 5, and 8.

5. *Group tutorials.* They are directed towards a direct tracing on the SPSS practice. In these sessions, students have the opportunity to get feedback about how they are working out their group practice y they will have the opportunity to solve any doubts. Objectives worked out in this kind of sessions are: 2, 4, 5, y 8.
6. *Personal tutorials.* Personal tutoring is a fundamental resource for students to ask any unclear point about any of their study duties. Personal tutorials help to reinforce theoretical-practice classroom explanations, to assist solving doubts on each topic review exercises, to monitor the group practice, to solve questions on SPSS usage, etc. In this activity, all objectives may be worked out.
7. *Teacher web page.* All teachers of this subject have web pages available for the students, in which they can find materials (study plan, biography, review exercises, forms, data files, etc.), guidelines on the duties to be carried out, timetable, etc.

Besides the teaching methodology used, it should be taken into account that meeting the subject objectives may only be accomplished through the *constant work of the student*. In such work, reviewing those materials presented in the classroom and working through the proposed exercises play an essential role.

4. Tiempo estimado de trabajo del estudiante / Estimated work task student time

The estimated total student work time for an average student should be 150 hours, spread along the quarter. The following table shows the estimated number of hours for each type of activity:

| Activity | Type | Group Size | Activity Locale | # hours |
|--------------------------|----------|------------|-----------------|---------|
| Theory-practice sessions | On-site | 75 | Classroom | 30 |
| Paper & pencil sessions | On-site | 25 | Classroom | 10 |
| Computer sessions | On-site | 25 | Computer room | 10 |
| SPSS practice work | Distance | 2-4 | Computer room | 15 |
| Group tutorials | On-site | 75 | Classroom | 2 |



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|--------------------|----------|----|---------------------------------|------------|
| Personal tutorials | On-site | 1 | Office | 5 |
| Personal homework | Distance | -- | -- | 75 |
| Assessment | On-site | 75 | | 3 |
| | | | Total hours on-site | 60 |
| | | | Total hours distance | 90 |
| | | | Total hours (6 ECTS x 25 hours) | 150 |

5. Métodos de evaluación y porcentaje en la calificación final / Evaluation methods and percentage in the final qualification

Students will have to accomplish to duties in order to pass the subject: *a final exam* and a *control on the group practice*. Optionally, students may present additional duties which will be recorded in their personal portfolio.

1. *Final exam*. Consists of two parts: *theory & practice*. In the theory part, emphasis is made on the understanding of the subject essential concepts; it entails a series of questions which should be solved by the student without the aid of any material. The practice part intends to assess the abilities on selecting, applying and understanding the statistical tools contained in the programme; it includes practice exercises which may solved with the help of any personal material. The final exam is fulfilled in a standard classroom at the end of the quarter. It represents 70% of the final grade.
2. *Group practice control*. Allows assessing the practice work solved in groups. The group practice assessment implies two different aspects: presenting the group-work form and undergoing the personal control. Given that participation of the different group members in the practice could be imbalanced; this control allows the personalized assessment of the accomplishment level on the capabilities involved. Only those presenting the practice form will be able to access to the control. The control is fulfilled in the computer room. It represents 30% of the final grade.
3. *Personal portfolio* (optional). It entails a series of additional works which may be accomplished by the student during the quarter. This works will be agreed advance and oversight by the lecturer, and will always be aimed towards developing those capabilities mentioned in section 1.11 of this student guide (deepening in any of the present topics by reading books, articles or internet materials; commentaries on the use of statistical tools or published research reports, etc.). It also will be taken into account solving paper and pencil exercises and defending them in the classroom, as far as this task is in accordance with the form settled by the teacher. The portfolio may raise the grade 1 point at most.

The “*not assessed*” mark may only be attained when a student did not attend the final exam. The score in the extraordinary calls will be based on the *final exam* score alone (100% score). Being this so, there will be no group practice controls in extraordinary calls; nevertheless, the exam might contain questions regarding the group practice.

6. Cronograma de Actividades / Activities cronogram PRESENCIAL

In the following Schedule, a 17 week academic calendar is assumed: 14 teaching weeks and 3 assessment weeks. Nevertheless, due to unavoidable bank holidays, it is more realistic to adapt the schedule to 12 actual weeks. It is also assumed that the subject will be given in 3 hour classes per week during 14 teaching weeks. From these 3 teaching classes, the student will attend 2 of them with the whole group and 1 with the group split.

Three types of activities are covered: (A) theory-practice sessions (whole group at standard classroom), (B) paper & pencil practice sessions and (C) compute practice sessions (split group at the computer room). (D) Meaningful dates for presenting works and assessment are also covered.

Week 1

- A. Subject presentation. Review of essential concepts.
- A. Introduction to inferential statistic.
- A. Point estimation. Interval estimation. Confidence intervals for means and proportions.

Week 2

- A. Hypothesis testing.
- A. Type I and type II errors. Statistical power. Effect size.
- B. Review exercises.

Week 3

- A. Inference with on dichotomous variable: the binomial test. Inference with a polytomous variable: X^2 test on goodness of fit.
- A. Inference with a quantitative variable: T test for a single sample. (Wilcoxon test, Sign test, Kolmogorov-Smirnov test).
- C. SPSS: binomial, X^2 , T, Wilcoxon, Signs, Kolmogorov-Smirnov.

Week 4

- A. Inference with two categorical variables: Independence X^2 test and association measures.
- A. McNemar test.
- C. SPSS: Pearson X^2 , conditional distributions, standardized residuals, association measures.

Week 5

- A. Inference with two categorical variables: relative risk ratio and *odds ratio*.
- B. Review exercises.
- C. SPSS: Two categorical variables: McNemar test, relative risk, *odds ratio*.

Week 6

- A. Two quantitative variables: two paired samples *T* test.
- A. Two quantitative variables: Pearson correlation coefficient and Spearman correlation coefficient.
- C. SPSS: Two quantitative variables: *T*, Wilcoxon, signs, Pearson, Spearman.
- D. Description of the data file to be used in the group practice with SPSS.

Week 7

- A. One categorical variable and one quantitative variable: two independent *T* test.
- A. One factor ANOVA.
- C. SPSS: two independent samples *T* test.

Week 8

- A. Multiple comparisons. Planned comparisons.
- A. Post hoc comparisons.
- C. SPSS: one factor ANOVA and multiple comparisons. Kruskal-Wallis *H* test.

Week 9

- A. Two factor ANOVA.
- A. Multiple comparisons: simple effects, interaction effect.
- C. SPSS: two factor ANOVA and multiple comparisons.

Week 10

- A. One factor ANOVA with repeated measures.
- A. Two factor ANOVA with repeated measures in one of them.
- C. SPSS: repeated measures ANOVAs.

Week 11

- A. Simple linear regression.
- A. Multiple linear regression.
- C. SPSS: linear regression.
- D. Deadline date for presenting the group practice using SPSS.



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Week 12

- A. Linear regression: categorical variables, stepwise regression.
- A. Linear regression: assumptions, outliers and leverage cases.
- C. SPSS: linear regression.
- D. Group practice control.

Depending on the date for the final exam, the student will have available between one and three weeks of personal work (with standard timing for personal tutorials) in order to prepare the final exam.