



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieros
Informáticos

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000863 - Data Analysis

DEGREE PROGRAMME

10AZ - Master Universitario En Innovación Digital

ACADEMIC YEAR & SEMESTER

2025/26 - Semester 1

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1. Description

1.1. Subject details

Name of the subject	103000863 - Data Analysis
No of credits	4.5 ECTS
Type	Optional/elective
Academic year of the programme	Second year
Semester of tuition	Semester 3
Tuition period	September-January
Tuition languages	English
Degree programme	10AZ - Master Universitario en Innovación Digital
Centre	10 - E.T.S. De Ingenieros Informáticos
Academic year	2025-26

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Antonio Jesus Diaz Honrubia	4302	antoniojesus.diaz@upm.es	Sin horario. contact the professor
Ernestina Menasalvas Ruiz (Subject coordinator)		ernestina.menasalvas@upm. es	Sin horario. contact the profesor
Alejandro Rodriguez Gonzalez	4302	alejandro.rg@upm.es	Sin horario. contact the professor

Lucia Prieto Santamaria	4302	lucia.prieto.santamaria@upm .es	Sin horario. contact the professor
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.3. External faculty

Name and surname	Email	Institution
Rafael Artiñano Muñoz	rafael.artinano.munoz@upm.es	ETSI Informáticos
Andrea Alvarez Perez	andrea.alvarezp@upm.es	UPM
David Gomez Ortiz	da.gomez@upm.es	UPM

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

- Data Processes

3.2. Other recommended learning outcomes

- big data basics
- data bases
- machine learning
- data bases, basics of machine learning

4. Skills and learning outcomes *

4.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB07 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio

CB08 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios

CG01 - Que los estudiantes sean capaces de predecir y controlar la evolución de situaciones complejas mediante el desarrollo de nuevas e innovadoras metodologías de trabajo adaptadas al ámbito científico/investigador, tecnológico o profesional concreto, en general multidisciplinar, en el que se desarrolle su actividad.

CG02 - Que los estudiantes desarrollen la autonomía suficiente para participar en proyectos de investigación y colaboraciones científicas o tecnológicas dentro su ámbito temático explorando y generando nuevas ideas sistemáticamente, en contextos interdisciplinares y, en su caso, con una alta componente de transferencia del conocimiento.

CG03 - La capacidad de usar la lengua inglesa de manera competente, es decir, con capacitación para tareas complejas de trabajo y estudio.

CG07 - Capacidad de trabajar y comunicarse también en contextos internacionales.

4.2. Learning outcomes

RA18 - Apply techniques for modelling the context of use

RA35 - Ser capaz de procesar datos masivos.

RA17 - Acquire specialized knowledge from innovative fields of studies

RA34 - Conocer cómo se aplican las técnicas de computación científica en algún campo específico de ciencia o ingeniería.

RA50 - apply data analysis techniques on data streams

RA49 - apply IA techniques in real data scenarios

RA14 - Apply the acquired knowledge in real contexts

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

In this course we will deepen on the importance of data for an organization. In fact, the course is centered on the process of extraction of knowledge from databases as a support for decision making.

This course will be adapted depending on the students profile but main goal will be to deepen on the importance of data for an organization and deepen on the data lifecycle applying the methods learnt in real scenarios with special emphasis on techniques for data stream mining and complex network analysis

Consequently the course will start proposing a real scenario in which it will be required to proceed with the analysis of data sources in an organization and very briefly analyzed data base management systems.

Later students will understand the data value chain and will go deep into the process of knowledge extraction. At this stage CRISP-Dm methodology will be used.

The course will follow on the different phases of the process applied to the proposed scenario: i) business understanding, ii) data understanding, iii) data preparation, iv) modeling v) evaluation and vi) deployment.

Through all the phases the main emphasis will be on students getting hands on the different steps, techniques, algorithms and tools.

Before finishing the course will cover basic aspects of the GDPR and the implications on the process of knowledge extraction in a company

5.2. Syllabus

1. Introduction

1.1. Course description.

1.2. Data Science and Data Scientist Skills.

2. Data challenges

3. The process of discovery applied to the use case

3.1. CRISP-DM

4. Business Understanding

4.1. Goal of BU.

4.2. Planning of a DataScience project.

5. Data Understanding

5.1. Understanding data.

5.2. Nulls and outliers detection.

5.3. Correlation analysis

6. Data Preparation

6.1. Preparing data for mining: dealing with problems encountered in understanding, transforming data, discretization, data reduction, agregation, ?.

7. Data mining/data modeling

7.1. Type of problems found: analysis of the aata nature , data problems and possible algorithms.

7.2. Classification, association and clustering

8. Evaluation and Deployment

8.1. Evaluation of the models.

8.2. Deployment of the models

9. Application of DS to real problems

6. Schedule

6.1. Subject schedule*

Week	Type 1 activities	Type 2 activities	Distant / On-line	Assessment activities
1	Unit 1 Duration: 02:00 Lecture			
2	Unit 2 Duration: 02:00 Lecture			
3	Unit 3 Duration: 03:00 Lecture			
4	Unit 4 Duration: 02:00 Lecture			
5	Unit 5 Duration: 03:00 Lecture			
6	Unit 6 Duration: 03:00 Lecture			
7	Unit 6 Duration: 01:00 Lecture			
8	Unit 6 Duration: 03:00 Lecture			
9	Unit 7 Duration: 03:00 Lecture			
10	Evaluation 1st assigment Duration: 02:00 Additional activities			Evaluation First Assigment Group presentation Progressive assessment Presential Duration: 02:00
11	Unit 8 Duration: 03:00 Lecture			
12	Unit 9 Duration: 03:00 Lecture			
13	Unit 9 Duration: 03:00 Lecture			

14	Unit 9 Duration: 03:00 Lecture			
15	Evaluation 2nd assigment Duration: 02:00 Additional activities			Evaluation Second Assigment Group presentation Progressive assessment Presential Duration: 02:00
16	Exam Duration: 02:00 Additional activities			Exam Written test Global examination Presential Duration: 02:00 Exam Written test Progressive assessment Presential Duration: 02:00
17				

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
10	Evaluation First Assigment	Group presentation	Face-to-face	02:00	25%	4 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07
15	Evaluation Second Assigment	Group presentation	Face-to-face	02:00	25%	4 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07
16	Exam	Written test	Face-to-face	02:00	50%	4 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07

7.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Exam	Written test	Face-to-face	02:00	100%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07

7.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Exam in July	Written test	Face-to-face	02:00	100%	5 / 10	CB06 CB07 CB08 CG01 CG02 CG03 CG07

7.2. Assessment criteria

The course will be evaluated by:

2 practical assignments: They are recoverable. This means that the student will have an exam of the assignment in the exam in case they did not follow them along the course.

1 exam (in case the student has not passed the assignments the exam will have a part for those students so they can recover that part)

Final exam

In the final exam if the student has to go for it the exam will include examination for the practical assignments

Practical assignments will be done in groups among those enrolled in the course at the beginning of the academic year (nature and number of components will be established at the beginning of the course, depending on the number of students enrolled).

In order to pass the course in the fall semester the requirements are:

1. 1. To obtain a minimum of 50 points out of 100 in the added evaluation.
2. 2. It is MANDATORY to do the exam and do the practical assignment.
3. 3. In the exam and on the practical assignments students must obtain a minimum of 40%.

Final score will be calculated as follows:

1. 50% Practical assignment (divided between the two assignments)
2. 50% Final exam

Action procedures against fraudulent behavior

All exams and lab deliverables must be done individually, unless specified otherwise by the teaching staff. If any non-conformity with this criteria is detected (copy, plagiarism, etc.), according to article 13 of the assessment regulations, it will be considered as academic fraud.

According to this same article, all students involved in the fraud will be graded with 0 points (out of 10) in the corresponding call and professors may prepare a special exam only for them in the next official call to assess the learning results of the course.

To this end, all students involved in the fraud are considered accountable, and the above actions will be taken against both active and passive agents.

If a student is involved in a fraudulent behaviour, their marks will not be kept for the extraordinary call. Additionally, no marks will be kept between calls of future academic years.

The above actions do not exclude other actions covered by the normative and laws.

8. Teaching resources

8.1. Teaching resources for the subject

Name	Type	Notes
Moodle	Web resource	http://moodle.upm.es
Data Mining book	Bibliography	Ian Witten, Eibe Frank, Mark Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann, ISBN 978-0-12-374856-0, 2011.
Smart Machines book	Bibliography	Smart Machines: IBM's Watson and the Era of Cognitive Computing. Columbia University Press (October 15, 2013)
Database Systems: The Complete Book (DS:CB), by Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom	Bibliography	
"MySQL Administrator's Bible". Sheeri K. Cabral and Keith Murphy. Wiley	Bibliography	
Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Addison Wesley (May, 2005).	Bibliography	
Ian Witten, Eibe Frank, Mark Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann, ISBN 978-0-12-374856-0, 2011.	Bibliography	

9. Other information

9.1. Other information about the subject

teaching will be online.

Platform of the university will be used.

Sessions will be recorded for students to access them anytime.