ANX-PR/CL/001-01

LEARNING GUIDE

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SUBJECT

103000610 - Cognitive Systems

DEGREE PROGRAMME

10AN - Master Universitario en Ingenieria Informatica

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

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Learning guide

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1. Description

1.1. Subject details

Name of the subject	103000610 - Cognitive Systems
No of credits	4.5 ECTS
Type	Compulsory
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AN - Master Universitario en Ingenieria Informatica
Centre	10 - Escuela Tecnica Superior de Ingenieros Informaticos
Academic year	2020-21

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Alejandro Rodriguez Gonzalez	4302	alejandro.rg@upm.es	Sin horario. contact the professor
Ernestina Menasalvas Ruiz (Subject coordinator)	4303	ernestina.menasalvas@upm.es	Sin horario. contact the professor

Maria Covadonga Fernandez Baizan		mariacovadonga.fernandez@upm.es	Sin horario. contact the professor
Antonio Jesus Diaz Honrubia	4302	antoniojesus.diaz@upm.es	Sin horario. contact the professor
Luis Mengual Galan	4302	luis.mengual@upm.es	Sin horario. contact the professor

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Databases

- relational data model

- SQL

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4. Skills and learning outcomes *

4.1. Skills to be learned

CE1 - Capacidad para la integración de tecnologías, aplicaciones, servicios y sistemas propios de la Ingeniería Informática, con carácter generalista, y en contextos más amplios y multidisciplinares.

CE8 - Capacidad para analizar las necesidades de información que se plantean en un entorno y llevar a cabo en todas sus etapas el proceso de construcción de un sistema de información.

CG10 - Conocimiento y comprensión de la informática necesaria para la creación de modelos de información, y de los sistemas y procesos complejos

CG14 - Capacidad de trabajar y comunicarse también en contextos internacionales

4.2. Learning outcomes

RA135 - To be able to design, create and exploit data repositories, and integrate them with applications from the information system, being it decisional or operational.

RA136 - To be able to design adequate solutions to implement database systems in centralized or distributed environments, determining and applying the best DBMS configuration to satisfy the performance, access security, and optimization requirements.

* 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.

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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.

Consequently the course will start with the analysis of data sources in an organization and very briefly analyzed data base management systems. Emphasis will be put on the ethical aspects regarding data management and knowledge extraction.

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: i) business undertanding, 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, techiques, algorithms and tools.

The course will end with use cases in different domains.

5.2. Syllabus

1. Introduction
   1.1. Course description.
   1.2. Data Science and Data Scientist Skills.
   1.3. The Value hidden in data.
2. Operational Data bases Vs Decisional databases
   2.1. The BIG Data Value Chain.
   2.2. Data Warehouse.
   2.3. Data Lakes
3. The process of Knowlegde Discovery in Databases
   3.1. CRISP-DM

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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. Data 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. Ethics

   9.1. GDPR and implications in Data Science

10. Extraction of knowledge from data in different domains

   10.1. Data Science in the medical domain

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6. Schedule

6.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Distant / On-line	Assessment activities
1	**Unit 1** Duration: 02:00 Lecture		**Unit 1** Duration: 02:00 Lecture	
2	**Unit 2** Duration: 01:00 Lecture **Unit 2** Duration: 02:00 Problem-solving class		**Unit 2** Duration: 02:00 Problem-solving class **Unit 2** Duration: 01:00 Lecture	
3	**Unit 3** Duration: 01:00 Lecture **Unit 3** Duration: 02:00 Problem-solving class		**Unit 3** Duration: 02:00 Problem-solving class **Unit 3** Duration: 01:00 Lecture	
4	**Unit 4** Duration: 01:00 Lecture **Unit 5** Duration: 02:00 Problem-solving class		**Unit 4** Duration: 02:00 Problem-solving class **Unit 4** Duration: 01:00 Lecture	
5	**Unit 5** Duration: 01:00 Lecture **Unit 5** Duration: 02:00 Problem-solving class		**Unit 5** Duration: 02:00 Problem-solving class **Unit 3** Duration: 01:00 Lecture	
6	**Unit 6** Duration: 01:00 Lecture **Unit 6** Duration: 02:00 Problem-solving class		**Unit 6** Duration: 02:00 Problem-solving class **Unit 6** Duration: 01:00 Lecture	
7	**Unit 6** Duration: 01:00 Lecture **Unit 6** Duration: 02:00 Problem-solving class		**Unit 6** Duration: 02:00 Problem-solving class **Unit 6** Duration: 01:00 Lecture	

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8	**Unit 6** Duration: 01:00 Lecture **Unit 6** Duration: 02:00 Problem-solving class		**Unit 6** Duration: 02:00 Problem-solving class **Unit 6** Duration: 01:00 Lecture	
9	**Unit 7** Duration: 01:00 Lecture **Unit 7** Duration: 02:00 Problem-solving class		**Unit 7** Duration: 02:00 Problem-solving class **Unit 7** Duration: 01:00 Lecture	
10	**Unit 7** Duration: 01:00 Lecture **Unit 7** Duration: 02:00 Problem-solving class		**Unit 7** Duration: 02:00 Problem-solving class **Unit 7** Duration: 01:00 Lecture	**Evaluation First Assigment** Group presentation Continuous assessment Presential Duration: 02:00
11	**Unit 7** Duration: 01:00 Lecture **Unit 7** Duration: 02:00 Problem-solving class		**Unit 7** Duration: 02:00 Problem-solving class **Unit 7** Duration: 01:00 Lecture	
12	**Unit 8** Duration: 01:00 Lecture **Unit 8** Duration: 02:00 Problem-solving class		**Unit 8** Duration: 02:00 Problem-solving class **Unit 7** Duration: 01:00 Lecture	
13	**Unit 8-9** Duration: 02:00 Lecture **Unit 8-9** Duration: 01:00 Problem-solving class		**Unit 8-9** Duration: 01:00 Problem-solving class **Unit 8-9** Duration: 02:00 Lecture	
14	**Unit 10** Duration: 01:00 Lecture		**Unit 10** Duration: 01:00 Lecture	
15				**Evaluation Second Assigment** Group presentation Continuous assessment Presential Duration: 02:00
16				**Exam** Written test Continuous assessment Presential Duration: 02:00 **Exam** Written test Final examination Presential Duration: 02:00

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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.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

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7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous 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	CG10 CG14 CE1 CE8
15	Evaluation Second Assigment	Group presentation	Face-to-face	02:00	30%	4 / 10	CG10 CG14 CE1 CE8
16	Exam	Written test	Face-to-face	02:00	45%	4 / 10	CG10 CG14 CE1 CE8

7.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
16	Exam	Written test	Face-to-face	02:00	100%	5 / 10	CG10 CG14 CE1 CE8

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	CG10 CG14 CE1 CE8

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7.2. Assessment criteria

The "only final exam" evaluation will only be offered if the UPM "Normativa Reguladora de los Sistemas de Evaluación" requires so in the academic year 2015-2016, and the procedure to opt in will be as stated by the head of studies.**Continuous evaluation:**The course will be evaluated by:

- 2 practical assignments,
- 1 exam

.Attendance is mandatory (It is allowed not to attend up to 6 hours without proper justification)

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

Final score will be calculated as follows:

- 45% Practical assignment (divided between the two assigments)
- 10% Oral presentation
- 45% Final exam

Final exam evaluation Those students whose extraordinary circumstances cannot perform the continuous evaluation, and having done the final exam evaluation written petition during the first 15 days of the course, will perform the final exam evaluation without having the opportunity to do the continuous evaluation;

Those students failing to attend 85% of of the lectures will also do the final evaluation.

In these premises, the final exam evaluation will consist of an exam as stated by the head of studies.

Measures against copies and fraud Rights and duties of college students are gathered on the statues of the

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Universidad Politécnica de Madrid (BOCM de 15 de noviembre de 2010) and in the statutes of the college student (RD 1791/2010 de 30 de diciembre).Article 124 a) of EUPM fixes the duty of the student... "to follow with responsability and taking advantage of the learning process, knowledge adquisition correspondent to its condition of college student"... and the article 13 of the statutes of the college student in its point d) also specifies as duty of the college student "abstain from the use or cooperation in fraudulent procedures in the evaluation assessments, in the assignments developed or in the official documents of the university".In the case that in the development of the evaluation assessments it is appreciated a breach in the duties as college student, the subject coordinator may communicate the headmaster as established in the article 74 (n) of EUPM to have the competences to "propose the initation of a disciplinary procedure to any College member, by its own initiative or as instance from the "Comisión de Gobierno"" to the Rector, pursuant to the statutes and rules of application.

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, 3nd 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)
IBM Watson - How it works	Web resource	http://www.youtube.com/watch?v=_XcmhLQB9I
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	

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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, 3nd Edition, Morgan Kaufmann, ISBN 978-0-12-374856-0, 2011.	Bibliography	

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9. Other information

9.1. Other information about the subject

lessons will be online

sessions will be recorded so students can access the content later

the university platfom will be used for online sessions