ANX-PR/CL/001-01
LEARNING GUIDE

SUBJECT
103000610 - Cognitive Systems

DEGREE PROGRAMME
10AN - Master Universitario en Ingenieria Informatica

ACADEMIC YEAR & SEMESTER
2020/21 - Semester 1
# Index

**Learning guide**

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1. Description

1.1. Subject details

<table>
<thead>
<tr>
<th>Name of the subject</th>
<th>103000610 - Cognitive Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of credits</td>
<td>4.5 ECTS</td>
</tr>
<tr>
<td>Type</td>
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</tr>
<tr>
<td>Academic year of the programme</td>
<td>First year</td>
</tr>
<tr>
<td>Semester of tuition</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Tuition period</td>
<td>September-January</td>
</tr>
<tr>
<td>Tuition languages</td>
<td>English</td>
</tr>
<tr>
<td>Degree programme</td>
<td>10AN - Master Universitario en Ingenieria Informatica</td>
</tr>
<tr>
<td>Centre</td>
<td>10 - Escuela Tecnica Superior de Ingenieros Informaticos</td>
</tr>
<tr>
<td>Academic year</td>
<td>2020-21</td>
</tr>
</tbody>
</table>

2. Faculty

2.1. Faculty members with subject teaching role

<table>
<thead>
<tr>
<th>Name and surname</th>
<th>Office/Room</th>
<th>Email</th>
<th>Tutoring hours *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alejandro Rodriguez Gonzalez</td>
<td>4302</td>
<td><a href="mailto:alejandro.rg@upm.es">alejandro.rg@upm.es</a></td>
<td>Sin horario. contact the professor</td>
</tr>
<tr>
<td>Ernestina Menasalvas Ruiz</td>
<td>4303</td>
<td><a href="mailto:ernestina.menasalvas@upm.es">ernestina.menasalvas@upm.es</a></td>
<td>Sin horario. contact the professor</td>
</tr>
</tbody>
</table>

(Student coordinator)
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
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.
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 Knowledge Discovery in Databases
   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, aggregation, ?.

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
### 6. Schedule

#### 6.1. Subject schedule*

<table>
<thead>
<tr>
<th>Week</th>
<th>Face-to-face classroom activities</th>
<th>Face-to-face laboratory activities</th>
<th>Distant / On-line</th>
<th>Assessment activities</th>
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| 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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<thead>
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<th>Duration</th>
<th>Activity</th>
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<td>6</td>
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<td>Problem-solving class</td>
</tr>
<tr>
<td>6</td>
<td>01:00</td>
<td>Lecture</td>
</tr>
<tr>
<td>6</td>
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<td>Problem-solving class</td>
</tr>
<tr>
<td>7</td>
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<td>Lecture</td>
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<tr>
<td>7</td>
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<td>7</td>
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<td>Lecture</td>
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<tr>
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<td>Problem-solving class</td>
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<td>Lecture</td>
</tr>
<tr>
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<td>8-9</td>
<td>02:00</td>
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<td>8-9</td>
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<td>Problem-solving class</td>
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<td>Lecture</td>
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<td>13</td>
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<td>15</td>
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<tr>
<td>16</td>
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<td>Lecture</td>
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</table>

**Evaluation First Assignment**
- Group presentation
- Continuous assessment
- Presentential
- Duration: 02:00

**Evaluation Second Assignment**
- Group presentation
- Continuous assessment
- Presentential
- Duration: 02:00

**Exam**
- Written test
- Continuous assessment
- Presentential
- Duration: 02:00
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.
### 7. Activities and assessment criteria

#### 7.1. Assessment activities

##### 7.1.1. Continuous assessment

<table>
<thead>
<tr>
<th>Week</th>
<th>Description</th>
<th>Modality</th>
<th>Type</th>
<th>Duration</th>
<th>Weight</th>
<th>Minimum grade</th>
<th>Evaluated skills</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>Evaluation First Assignment</td>
<td>Group presentation</td>
<td>Face-to-face</td>
<td>02:00</td>
<td>25%</td>
<td>4 / 10</td>
<td>CG10, CG14, CE1, CE8</td>
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<tr>
<td>15</td>
<td>Evaluation Second Assignment</td>
<td>Group presentation</td>
<td>Face-to-face</td>
<td>02:00</td>
<td>30%</td>
<td>4 / 10</td>
<td>CG10, CG14, CE1, CE8</td>
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<tr>
<td>16</td>
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<td>Written test</td>
<td>Face-to-face</td>
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<td>45%</td>
<td>4 / 10</td>
<td>CG10, CG14, CE1, CE8</td>
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##### 7.1.2. Final examination

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<th>Modality</th>
<th>Type</th>
<th>Duration</th>
<th>Weight</th>
<th>Minimum grade</th>
<th>Evaluated skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Exam</td>
<td>Written test</td>
<td>Face-to-face</td>
<td>02:00</td>
<td>100%</td>
<td>5 / 10</td>
<td>CG10, CG14, CE1, CE8</td>
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</table>

##### 7.1.3. Referred (re-sit) examination

<table>
<thead>
<tr>
<th>Description</th>
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<th>Type</th>
<th>Duration</th>
<th>Weight</th>
<th>Minimum grade</th>
<th>Evaluated skills</th>
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</thead>
<tbody>
<tr>
<td>Exam in July</td>
<td>Written test</td>
<td>Face-to-face</td>
<td>02:00</td>
<td>100%</td>
<td>5 / 10</td>
<td>CG10, CG14, CE1, CE8</td>
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</table>
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 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. 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 assignments students must obtain a minimum of 40%.

Final score will be calculated as follows:

- 45% Practical assignment (divided between the two assignments)
- 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.
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 responsibility and taking advantage of the learning process, knowledge acquisition 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 initiation 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

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moodle</td>
<td>Web resource</td>
<td><a href="http://moodle.upm.es">http://moodle.upm.es</a></td>
</tr>
<tr>
<td>IBM Watson - How it works</td>
<td>Web resource</td>
<td><a href="http://www.youtube.com/watch?v=_Xcmh1LQB9I">http://www.youtube.com/watch?v=_Xcmh1LQB9I</a></td>
</tr>
<tr>
<td>&quot;MySQL Administrator?s Bible&quot;. Sheeri K. Cabral and Keith Murphy. Wiley</td>
<td>Bibliography</td>
<td></td>
</tr>
</tbody>
</table>
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 platform will be used for online sessions.