ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

103000368 - Models of reasoning

DEGREE PROGRAMME

10AJ - Master Universitario En Inteligencia Artificial

ACADEMIC YEAR & SEMESTER

2018/19 - Semester 1

Index

Learning guide

1. Description

1.1. Subject details

Name of the subject	103000368 - Models of reasoning
No of credits	5 ECTS
Type	Optional
Academic year ot the programme	First year
Semester of tuition	Semester 1
Tuition period	September-January
Tuition languages	English
Degree programme	10AJ - Master universitario en inteligencia artificial
Centre	10 - Escuela Tecnica Superior de Ingenieros Informaticos
Academic year	2018-19

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
Martin Molina Gonzalez (Subject coordinator)	2111	martin.molina@upm.es	W - 12:00 - 14:00

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

3. Skills and learning outcomes *

3.1. Skills to be learned

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CB9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CEIA1 - Capacidad de integrar tecnologías y sistemas propios de la Inteligencia Artificial, con carácter generalista, y en contextos más amplios y multidisciplinares

CEIA10 - Identificación de áreas de aplicación en las que se pueda utilizar las técnicas y métodos de la Inteligencia Artificial.

CEIA2 - Capacidad de conectar la tecnología puntera en Inteligencia Artificial con las necesidades de los clientes

CEIA7 - Conocimiento de las técnicas de representación del conocimiento reutilizables y modelos de razonamiento en entornos centralizados y distribuidos a utilizar en la resolución de problemas que impliquen conducta inteligente.

CG10 - Capacidad de pensamiento creativo con el objetivo de desarrollar enfoques y métodos nuevos y originales.

CG12 - Comprensión amplia de las técnicas y métodos aplicables en una especialización concreta, así como de sus límites.

CG13 - Apreciación de los límites del conocimiento actual y de la aplicación práctica de la tecnología más reciente.

CG18 - Capacidad de trabajar y comunicarse también en contextos internacionales

CG9 - Aplicación de los métodos de resolución de problemas más recientes o innovadores y que puedan implicar el uso de otras disciplinas.

CGI1 - Adquirir conocimientos científicos avanzados del campo de la informática que le permitan generar nuevas ideas dentro de una línea de investigación.

CGI2 - Comprender el procedimiento, valor y límites del método científico en el campo de la Informática, siendo capaz de identificar, localizar y obtener datos requeridos en un trabajo de investigación, de diseñar y guiar investigaciones analíticas, de modelado y experimentales, así como de evaluar datos de una manera crítica y

extraer conclusiones.

CGI3 - Capacidad para valorar la importancia de las fuentes documentales, manejarlas y buscar la información para el desarrollo de cualquier trabajo de investigación.

CGI4 - Capacidad de leer y comprender publicaciones dentro de su ámbito de estudio/investigación, así como su catalogación y valor científico.

3.2. Learning outcomes

RA93 - Conocer cuáles son los principales retos y logros sobre modos de razonamiento y su formalización mediante modelos computacionales

RA94 - Conocer las técnicas existentes para simular modos de razonamiento, entendiendo su alcance y limitaciones

RA96 - Ser capaz de buscar y manejar fuentes bibliográficas para analizar el estado del arte en el área de modelos de razonamiento

RA95 - Ser capaz de identificar áreas de aplicación en las que se puedan utilizar modelos computacionales de razonamiento

RA97 - Ser capaz de comunicar resultados de investigación sobre modelos de razonamiento, realizando exposiciones y manejando terminología adecuada

* 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.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

The course Models of Reasoning presents computational models of reasoning proposed in artificial intelligence, that have practical applicability to the design and construction of intelligent systems. The course describes different types of models with a progressive complexity. Initially, an introduction presents basic concepts about knowledge representation and reasoning. This part shows mainly symbolic reasoning techniques (logic-based models, satisfability models, etc.). Next, the course describes more complex models for common sense reasoning. This type of reasoning is presented as one of the important challenges of artificial intelligence, showing difficulties and partial solutions applicable to real problems. This part of the course shows for example methods of reasoning about actions and their effects (physical reasoning, default reasoning, temporal reasoning, etc.) together with usual representation techniques. The course also describes models of reasoning with a higher level of complexity for building autonomous systems that make safely and efficiently decisions in dynamic complex environments. We discuss approaches (that can be applied, for example, for building autonomous robots) with reflective, deliberative and reactive reasoning. This part of the course ends with additional approaches related to intelligent autonomous behavior (e.g., autonomous learning). In order to have a practical view that complements the theoretical descriptions, the course presents detailed examples of real applications related to interactive applications (e.g., question-answering systems) and autonomous robots (e.g., aerial robotic vehicles) together with software tools and specific programming languages for building intelligent systems.

4.2. Syllabus

1. Introduction
    1.1. Course introduction
2. Knowledge representation and reasoning
    2.1. Symbolic knowledge representation
    2.2. Knowledge representation methods
    2.3. Artificial intelligence systems
3. Common sense reasoning
    3.1. Common sense knowledge bases
    3.2. Common sense reasoning methods

4. Models of reasoning for intelligent automous behavior

4.1. Behavior-based autonomous systems

4.2. Multilayer architectures for autonomous systems

4.3. Autonomous learning

5. Schedule

5.1. Subject schedule*

Week	Face-to-face classroom activities	Face-to-face laboratory activities	Other face-to-face activities	Assessment activities
1	**Lecture on Unit 1** Duration: 02:00 Lecture			
2	**Lecture on Unit 2** Duration: 02:00 Lecture			
3	**Lecture on Unit 2** Duration: 02:00 Lecture			
4	**Lecture on Unit 2** Duration: 02:00 Lecture			
5	**Lecture on Unit 3** Duration: 02:00 Lecture			
6	**Lecture on Unit 3** Duration: 02:00 Lecture			
7	**Lecture on Unit 3** Duration: 02:00 Lecture			
8	**Lecture on Unit 4** Duration: 02:00 Lecture		**Group tutoring session** Duration: 02:00 Cooperative activities	
9	**Lecture on Unit 4** Duration: 02:00 Lecture		**Group tutoring session** Duration: 02:00 Cooperative activities	
10	**Lecture on Unit 4** Duration: 02:00 Lecture		**Group tutoring session** Duration: 02:00 Cooperative activities	**Continuous assessment of week assignements** Individual work Continuous assessment Duration: 00:00
11	**Oral presentation by the students. Discussion topics in group. Answers by the professor to student questions.** Duration: 02:00 Additional activities		**Group tutoring session** Duration: 02:00 Cooperative activities	
12	**Oral presentation by the students. Discussion topics in group. Answers by the professor to student questions.** Duration: 02:00 Additional activities			

13	**Oral presentation by the students. Discussion topics in group. Answers by the professor to student questions.** Duration: 02:00 Additional activities			
14	**Oral presentation by the students. Discussion topics in group. Answers by the professor to student questions.** Duration: 02:00 Additional activities			
15	**Oral presentation by the students. Discussion topics in group. Answers by the professor to student questions.** Duration: 02:00 Additional activities			
16	**Oral presentation by the students. Discussion topics in group. Answers by the professor to student questions.** Duration: 02:00 Additional activities			**Assessment of oral presentation** Group presentation Continuous assessment Duration: 00:00 **Submission of written assignement for assesment** Group work Continuous assessment Duration: 00:00 **Continuous assessment of attendance and participation in class** Other assessment Continuous assessment Duration: 00:00
17				**Written exam** Written test Final examination Duration: 02:00 **Submission of written assignement for assesment** Group work Final examination Duration: 00:00 **Assessment of week assignements** Individual work Final examination Duration: 00:00

The independent study hours are training activities during which students should spend time on individual study or individual assignments.

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 subject schedule is based on a previous theorical planning of the subject plan and might go to through experience some unexpected changes along throughout the academic year.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Continuous assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
10	Continuous assessment of week assignements	Individual work	No Presential	00:00	25%	/ 10	CG18 CEIA2
16	Assessment of oral presentation	Group presentation	Face-to-face	00:00	25%	/ 10	CG18
16	Submission of written assignement for assesment	Group work	No Presential	00:00	25%	5 / 10	CG10 CGI2 CEIA7 CGI3
16	Continuous assessment of attendance and participation in class	Other assessment	Face-to-face	00:00	25%	/ 10	CG18

6.1.2. Final examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Written exam	Written test	Face-to-face	02:00	50%	5 / 10	CG18 CEIA2
17	Submission of written assignement for assesment	Group work	No Presential	00:00	25%	5 / 10	CG10 CGI2 CEIA2 CEIA7 CGI3
17	Assessment of week assignements	Individual work	No Presential	00:00	25%	/ 10	CG18 CEIA2

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
Written exam	Written test	Face-to-face	02:00	50%	5 / 10	CEIA2 CG18

Submission of written assignement for assesment	Group work	Face-to-face	00:00	25%	/ 10	CG10 CGI2 CEIA2 CEIA7 CGI3
Assessment of week assignements	Individual work	Face-to-face	00:00	25%	/ 10	CG18 CEIA2

6.2. Assessment criteria

CONTINUOUS ASSESSMENT

The following partial qualifications are obtained during continuous assessment (grades from 0 to 10):
N1: Qualification for week assignements. The student will be assessed whether they answer correctly on every week assignement.
N2: Qualification for the paper about the student project. The work will be assessed, in terms of conclusions made, argumentation, comparison and literature. The organization, expression, clarity and appropriateness of the examples used will be assessed additionally.
N3: Qualification for oral presentation about the student project. The content of the presentation will be evaluated, regarding statements made, argumentation, comparison and literature. The organization, expression, clarity and appropriateness of the examples used will be additionally evaluated.
N4: Qualification for participation. This qualification evaluates whether the student attends class regularly and whether they participate in discussions.

The final grade is obtained as follows: N = 0,25 x (N1 + N2 + N3 + N4). To pass the course it is required that N >= 5 and N2>=5.

ONLY FINAL ASSESSMENT

Only final assessment and continuous assessment are mutually exclusive. Students who want to follow only final assessment must inform the coordinator (martin.molina@upm.es) at the beginning of the course (in the first two weeks of the course). Otherwise, continuous assessment is followed.

The following partial qualifications are obtained in the final assessment (grades from 0 to 10):
N1: Qualification for the written examination. The student will be assessed whether they answer correctly on questions regarding techniques, applications, argued correctly and using suitable terminology.

N2: Qualification for the paper about the student project. The work will be assessed, in terms of conclusions made, argumentation, comparison and literature. The organization, expression, clarity and appropriateness of the examples used will be assessed additionally.
N3: Qualification for week assignements. The student will be assessed whether they answer correctly on every week assignement.

The final grade is obtained as follows: N = 0,25 x (2 x N1 + N2 + N3). To pass the course it is required that N >= 5, N1>=5 and N2> =5.

EXTRAORDINARY ASSESSMENT

Students who want to follow the extraordinary assessment must submit to the coordinator (martin.molina@upm.es) the paper about the student project at least one week before the day established for the written examination. The student will be allowed to take the written examination only if the student has presented in advance the paper about the student project.

The following partial qualifications are obtained in the extraordinary assessment (grades from 0 to 10):

N1: Qualification for the written examination. The student will be assessed whether they answer correctly on questions regarding techniques, applications, argued correctly and using suitable terminology.

N2: Qualification for the paper about the student project. The work will be assessed, in terms of conclusions made, argumentation, comparison and literature. The organization, expression, clarity and appropriateness of the examples used will be assessed additionally.

N3: Qualification for week assignements. The student will be assessed whether they answer correctly on every week assignement.

The final grade is obtained as follows: N = 0,25 x (2 x N1 + N2 + N3). To pass the course it is required that N >= 5, N1>=5 and N2> =5.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Moodle UPM	Web resource	
Bibliography	Bibliography	Selected bibliography (papers and text books)