



# Course guide

## 270706 - PAR - Planning and Approximate Reasoning

Last modified: 21/07/2022

**Unit in charge:** Barcelona School of Informatics  
**Teaching unit:** 1042 - URV - Universitat Rovira i Virgili.

**Degree:** MASTER'S DEGREE IN ARTIFICIAL INTELLIGENCE (Syllabus 2017). (Compulsory subject).

**Academic year:** 2022    **ECTS Credits:** 5.0    **Languages:** English

### LECTURER

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**Coordinating lecturer:** AÍDA VALLS MATEU

**Others:** Primer quadrimestre:  
AÍDA VALLS MATEU - 11, 12

### PRIOR SKILLS

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Some experience in programming is recommended.

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.  
CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.  
CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.

**Generical:**

CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.

**Transversal:**

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

### TEACHING METHODOLOGY

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Oral exposition fo the teacher  
Practical exercises with software tools.

### LEARNING OBJECTIVES OF THE SUBJECT

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- 1.Know the fundamental basis of Approximate Reasoning and Planning methods
- 2.Support the implementation with the use of programming languages user manuals.
- 3.Identify the possibilities and limitations of Artificial Intelligence
- 4.Apply the model of search space to decompose a problem.
- 5.Be able to discuss the results obtained on the basis of the theoretical models studied.
- 6.Formalize a problem in terms of fuzzy logic and apply reasoning methods on this uncertainty model.

## STUDY LOAD

Type	Hours	Percentage
Hours small group	8,0	6.40
Self study	80,0	64.00
Hours large group	16,0	12.80
Hours medium group	16,0	12.80
Guided activities	5,0	4.00

**Total learning time:** 125 h

## CONTENTS

### Approximate reasoning

**Description:**

- 1.1 Probabilistic models
- 1.2 Fuzzy Logic and Fuzzy expert systems
- 1.3 Models based on the Theory of Evidence

### Planning techniques

**Description:**

- 2.1 PDDL language
- 2.2 STRIPS
- 2.3 Linear planners
- 2.4 Graphplan
- 2.5 MDP
- 2.6 Reinforcement Learning

## ACTIVITIES

### Exam with questions and exercises. Exam focused mainly on Approximate Reasoning.

**Specific objectives:**

1, 3, 5, 6

**Related competencies :**

CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.

CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.

CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.

CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

**Full-or-part-time:** 2h

Guided activities: 2h



### Exercise about design and development of a fuzzy expert system, using specific software tools.

**Specific objectives:**

2, 4, 5, 6

**Related competencies :**

CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.

CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

**Full-or-part-time:** 12h

Guided activities: 2h

Self study: 10h

### Practical exercise to solve a case study using a planner.

**Specific objectives:**

2, 4, 5

**Related competencies :**

CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.

CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

**Full-or-part-time:** 17h

Guided activities: 2h

Self study: 15h

### Lectures and lab practise about Approximate Reasoning

**Description:**

Weakly, 2 hours theoretical lecture and 1 h practise in laboratories.

**Full-or-part-time:** 42h

Theory classes: 14h

Laboratory classes: 7h

Self study: 21h

### Lectures and exercises about Planning.

**Description:**

Weakly, 2 hours theoretical lecture and 1 h practise in laboratories.

**Full-or-part-time:** 43h

Theory classes: 14h

Laboratory classes: 8h

Self study: 21h



### Exam with questions and exercises about Planning.

**Specific objectives:**

1, 3, 4, 5

**Related competencies :**

CG3. Capacity for modeling, calculation, simulation, development and implementation in technology and company engineering centers, particularly in research, development and innovation in all areas related to Artificial Intelligence.

CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.

CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.

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CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

**Full-or-part-time:** 2h

Guided activities: 2h

### Short activities

**Description:**

Home work about to solve a short problem on an specific topic.

**Specific objectives:**

3, 4, 5, 6

**Related competencies :**

CEP1. Capability to solve the analysis of information needs from different organizations, identifying the uncertainty and variability sources.

CEA2. Capability to understand the basic operation principles of Planning and Approximate Reasoning main techniques, and to know how to use in the environment of an intelligent system or service.

CEP8. Capability to respect the surrounding environment and design and develop sustainable intelligent systems.

CT6. REASONING: Capability to evaluate and analyze on a reasoned and critical way about situations, projects, proposals, reports and scientific-technical surveys. Capability to argue the reasons that explain or justify such situations, proposals, etc..

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

**Full-or-part-time:** 10h

Self study: 10h

## GRADING SYSTEM

The student must do 2 exams, 30% each.

The student must solve 2 practical exercises, 40%



## BIBLIOGRAPHY

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### Basic:

- Russell, S.J.; Norvig, P. Artificial intelligence: a modern approach. 4th ed., global ed. Harlow: Pearson Education Limited, 2022. ISBN 9781292401133.
- Ghallab, M.; Nau, D.S.; Traverso, P. Automated planning: theory and practice. Elsevier/Morgan Kaufmann, 2004. ISBN 1558608567.
- Klir, G.J.; Yuan, B. Fuzzy sets and fuzzy logic: theory and applications. Prentice Hall, 1995. ISBN 0131011715.
- Ross, T.J. Fuzzy logic with engineering applications. 4th ed. Chichester: John Wiley & Sons, 2017. ISBN 9781119235866.

## RESOURCES

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### Hyperlink:

- <http://moodle.urv.cat>