UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: PROGRAMMING METHODOLOGY
Code: 42316
Type: CORE COURSE
ECTS credits: 6
Degree: 406 - UNDERGRADUATE DEGREE IN COMPUTER SCIENCE AND ENGINEERING (AB)
Academic year: 2022-23
Center: 604 - SCHOOL OF COMPUTER SCIENCE AND ENGINEERING (AB)
Group(s): 10 11 12
Year: 2
Duration: C2
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: N
Web site:
Bilingual: Y

Lecturer: **JUAN ANTONIO GUERRERO ABENZA** - Group(s): **11**

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2. Pre-Requisites

- Polynomials roots calculating
- Limits calculating
- Successions and series
- Iterative and Recursive programming strategies
- Identifying and using the appropriate data structure that implements any algorithm

3. Justification in the curriculum, relation to other subjects and to the profession

- It provides appropriate methodology for solving complex / real problems that require more abstract approaches than those provided by the subjects of Programming Fundamentals.
- It contributes to get specific skills [BA3, CO6, CO7]
- It follows the learning program developed in both "Programming Fundamentals" and "Data Structures", and will be followed by both "Design of algorithms" and "Software Engineering" subjects

4. Degree competences achieved in this course

Course competences

Code	Description
BA03	Ability to understand basic concepts about discrete mathematics, logic, algorithms, computational complexity, and their applications to solve engineering problems.
CO06	Knowledge and application of basic algorithms in digital technologies for the development of solutions, analysing their appropriateness and complexity.
CO07	Knowledge, design, and efficient use of types of data and structures which arise as most appropriate in problem solving.
INS01	Analysis, synthesis, and assessment skills.
INS04	Problem solving skills by the application of engineering techniques.
SIS01	Critical thinking.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Resolution of problems throughout basic techniques of algorithm design.

Design of solutions for problems by the analysis of appropriateness and complexity of suggested algorithms.

Additional outcomes

Sorting algorithms according to their complexity

Choosing and implementing the computationally cheapest methodology that solves a given problem

6. Units / Contents

Unit 1: Algorithmic complexity

Unit 1.1 Definition. Temporal complexity

Unit 1.2 Asymptotic complexity orders

Unit 1.3 Basic calculations

Unit 1.4 Real examples and Recursive Equations: Characteristic Ecuation. Non-homogeneus equations. Variable changes. Domain changes.

Unit 2: Greedy Algorithms

Unit 2.1 Overall technique

Unit 2.2 Basic features

Unit 2.3 Examples: Coins, the knapsack problem, scheduling, minimum spanning tree, single-course shortest paths problem

Unit 3: Dynamic Programming

Unit 3.1 Overall technique

Unit 3.2 Basic features

Unit 3.3 Examples: Coins, the knapsack problem, banks, optimal binary search trees, all-pairs shortest path problem, optimal binary search trees, disk space, ...

Unit 4: Backtracking

Unit 4.1 Overall technique

Unit 4.2 Basic features

Unit 4.3 Examples: Generation of combinatorial objects, chess, graph colorings, cliques, Hamiltonian cycles, Sudoku, ...

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Progress test [ON-SITE]	Assessment tests	BA03 CO06 CO07 INS01 INS04 SIS01	0.2	5	Y	N	[EVA] Tests of theory (individual)
Final test [ON-SITE]	Assessment tests	BA03 CO06 CO07 INS01 INS04 SIS01	0.12	3	Y	N	[EVA] Extraordinary assessment test.
Class Attendance (theory) [ON-SITE]	Lectures	BA03 CO06 CO07 SIS01	1	25	N	-	[MAG] Strategies for analyzing the resolution of the problem and the theoretical basis necessary for its resolution are provided
In-class Debates and forums [ON-SITE]	Project/Problem Based Learning (PBL)	BA03 INS01 SIS01	0.4	10	N	-	[PRO] The correction and/or suitability of the proposed solutions is analyzed in class (in groups)
Class Attendance (practical) [ON-SITE]	Project/Problem Based Learning (PBL)	BA03 CO06 CO07 SIS01	0.8	20	N	-	[LAB] The problems of the subject are solved on paper and the solutions are verified through their implementation/correction in the laboratory (in groups)
Writing of reports or projects [OFF-SITE]	Project/Problem Based Learning (PBL)	BA03 INS01 INS04	0.8	20	N	-	[RES] Theoretically unsolvable problems arise with the competences that are supposed to the student and their resolution is entrusted to them (in a group)
On-line debates and forums [OFF-SITE]	Group tutoring sessions	BA03 INS01 SIS01	0.4	10	N	-	[TUT] Forum where the correctness and suitability of the proposed solutions is discussed, both from a theoretical point of view and its implementation in the laboratory (individual)
Writing of reports or projects [OFF-SITE]	Combination of methods	BA03 CO06 CO07 INS01 INS04 SIS01	0.8	20	Y	N	[RES] Practical works are elaborated on the methodologies described in the chapters 2, 3 and 4 (in group)
Study and Exam Preparation [OFF-SITE]	Combination of methods	BA03 CO06 CO07 INS01 INS04 SIS01	1.48	37	N	-	[EST] Preparation/study of theory and practical tests (individual)
		Total:	**6**	**150**			
		Total credits of in-class work: 2.52					**Total class time hours: 63**
		Total credits of out of class work: 3.48					**Total hours of out of class work: 87**

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Final test	0.00%	80.00%	A comprehensive regular examination will be scheduled for those students who have not followed the continuous assessment.
Practicum and practical activities reports assessment	30.00%	20.00%	[INF 15%]: Various aspects related to the activities done in the computing labs will be evaluated.
Test	70.00%	0.00%	[ESC] There will be 2 theory tests (continuous assessment).
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

- There's no final exam. The mark of the ordinary call will be the result of the continuous assessment (Controls + Lab). To pass is not required minimum grade anywhere, but the sum may not be less than 50% the highest score achievable.

- By default, all students are enrolled in the continuous assessment mode. Those who wish to change to non-continuous evaluation must indicate it through the following link https://www.esiiab.uclm.es/alumnos/evaluacion.php before the end of the corresponding academic term, as long as 50% of the subject has not been evaluated, as established in the Student Evaluation Regulations.

Non-continuous evaluation:

- A comprehensive regular examination will be scheduled for those students who have not followed the continuous assessment. The grade of the ordinary exam will be the result of the "Ordinary Examination + Lab". No minimum score is required anywhere, but the sum may not be less than 50% of the highest score achievable.
- By default, all students are enrolled in the continuous assessment mode. Those who wish to change to non-continuous evaluation must indicate it through the following link https://www.esiiab.uclm.es/alumnos/evaluacion.php before the end of the corresponding academic term, as long as 50% of the subject has not been evaluated, as established in the Student Evaluation Regulations.

Specifications for the resit/retake exam:

Tests/activities will be scheduled to enable all parts of the subject to be recovered.
To pass, the same conditions apply as in the ordinary call.

Specifications for the second resit / retake exam:

The same conditions apply as for the extraordinary call.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Progress test [PRESENCIAL][Assessment tests]	3
Final test [PRESENCIAL][Assessment tests]	37
Class Attendance (theory) [PRESENCIAL][Lectures]	3
On-line debates and forums [AUTÓNOMA][Group tutoring sessions]	20
Writing of reports or projects [AUTÓNOMA][Combination of methods]	10
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	20

General comments about the planning: This course schedule is APPROXIMATE. It could vary throughout the academic course due to teaching needs, bank holidays, etc. A weekly schedule will be properly detailed and updated on the online platform (Campus Virtual). Note that all the lectures, practice sessions, exams and related activities performed in the bilingual groups will be entirely taught in English. This tentative scheduling could be modified due to unexpected issues The subject is taught in three weekly sessions of 1.5 hours.

Unit 1 (de 4): Algorithmic complexity

Activities	Hours
Progress test [PRESENCIAL][Assessment tests]	2
Class Attendance (theory) [PRESENCIAL][Lectures]	10
In-class Debates and forums [PRESENCIAL][Project/Problem Based Learning (PBL)]	4
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	5

Unit 2 (de 4): Greedy Algorithms

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
In-class Debates and forums [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	5

Unit 3 (de 4): Dynamic Programming

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
In-class Debates and forums [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	5

Unit 4 (de 4): Backtracking

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
In-class Debates and forums [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	5

Global activity

Activities	hours
Progress test [PRESENCIAL][Assessment tests]	5
Class Attendance (theory) [PRESENCIAL][Lectures]	28
In-class Debates and forums [PRESENCIAL][Project/Problem Based Learning (PBL)]	13
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	20
On-line debates and forums [AUTÓNOMA][Group tutoring sessions]	20
Writing of reports or projects [AUTÓNOMA][Combination of methods]	10
Study and Exam Preparation [AUTÓNOMA][Combination of methods]	20
Final test [PRESENCIAL][Assessment tests]	37
Total horas:	153

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Aho, Alfred V.	The design and analysis of computer algorithms	Addison-Wesley		0-201-00029-6	1974	
Brassard, Gilles	Fundamentos de algoritmia	Prentice-Hall		978-84-89660-00-7	2006	
Guerequeta García, Rosa	Técnicas de diseño de algoritmos	Servicio de Publicaciones e Intercambio		84-7496-784-8	2000	

Horowitz, Ellis	Fundamentals of computer algorithms	Científ Computer Science Press	0-914894-22-6	1978
Kernighan, Brian W.	La práctica de la programación	Pearson Educación	968-444-418-4	2000
Parberry, Ian	Problems on algorithms	Prentice-Hall	0-13-433558-9	1995
Sedgewick, Robert (1946-)	An introduction to the analysis of algorithms	Addison-Wesley	978-0-321-90575-8	2013