1. OVERVIEW

Subject area	Advanced Programming Techniques (APT)
Degree	Double Degree in Videogame Design and Computer Engineering
School/Faculty	Architecture, Engineering and Design
Year	Fourth
ECTS	6 ECTS
Type	Compulsory
Language(s)	Spanish
Delivery mode	On campus / Online
Semester	Second semester
Year	2022/2023
Coordinating professor	Borja Monsalve Piqueras
Teacher	Borja Monsalve Piqueras

2. INTRODUCTION

After having passed an introductory course to programming confirming a certain ability to solve problems using basic programming structures, this course will teach students how to solve more advanced problems using complex data structures. They will also develop the ability to evaluate various solutions to a given problem and choose the most efficient one. This will not only enable the development of effective solutions to specific problems but also allow for the determination of the best and quickest possible solution.

At the end of the subject area, the student will know how to evaluate the solution to a specific problem using new algorithmic approaches, rely on new data structures to support these solutions, and will be able to give reasons as to why one alternative is more beneficial than another in terms of efficiency.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- **CB3:** Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.

Specific skills (CE, by the acronym in Spanish):

- **CE3.** Ability to understand and master the basic concepts of discrete mathematics, logic, algorithmics and computational complexity, and their application to solve engineering problems.

- **CE12.** Knowledge and application of the basic algorithmic procedures of computer technologies to solve problems, analysing the suitability and complexity of the proposed algorithms.

- **CE13.** Knowledge, design and efficient use of the most appropriate data types and structures to solve a problem.

- **CE27.** Ability to assess the computational complexity of a problem, know algorithmic strategies that help to solve it, and recommend, develop and implement the strategy that guarantees the best performance according to the established requirements.

Transversal skills (CT, by the acronym in Spanish):

- **CT11:** Planning and time management: Ability to set objectives and choose the right means to fulfil them through efficient use of time and resources.

- **CT16:** Decision-making: Ability to choose between different options or methods to effectively solve varied situations or problems.

- **CT17:** Teamwork: Ability to integrate and collaborate actively with other people, departments and/or organisations in order to reach common goals.

General learning outcomes:

- **RA1.** Calculate the theoretical complexity of an algorithm and its order of magnitude, in order to argue the choice of one solution over another.

- **RA2.** Use classic algorithmic strategies (divide and conquer, greedy methods and backtracking) when implementing solutions to specific problems.

- **RA3.** Use the main linear associative data structures (hash tables) to solve specific problems and as a mechanism to obtain more optimal solutions.

- **RA4.** Use the main hierarchical data structures (trees) to solve specific problems and as a mechanism to propose more optimal solutions.

- **RA5.** Use the main relational data structures (graphs) to solve specific problems and as a mechanism to propose more optimal solutions.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CE3, CE12, CE27, CT16, CT17	RA1
CE3, CE12, CE27, CT16, CT17	RA2
CE13, CT11, CT17	RA3
CE13, CT11, CT17	RA4
CE13, CT11, CT17	RA5

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CE13, CT11, CT17	RA3
CE13, CT11, CT17	RA4
CE13, CT11, CT17	RA5

4. CONTENTS

The subject is organised into units in which the acquired theoretical knowledge will be applied:

Topic 1. Efficiency of algorithms

- **Topic 2.** Divide and conquer
- **Topic 3.** Types of data with functional structure: hash tables
- **Topic 4.** Types of data with hierarchical structure: trees
- **Topic 5.** Types of data with relational structure: graphs
- **Topic 6.** Greedy methods
- **Topic 7.** Backtracking

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Survey on aims and interests.
- Lectures, subjects of study and seminars
- Programming laboratory work
- Group research/problem-solving
- Development of solutions to specific problems.
- Fieldwork, conferences, visits to companies and institutions.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity (AF, by the acronym in Spanish)	Number of hours
Lectures	50 h
Group work	25 h
Independent working	50 h
Tutorials, academic monitoring and assessment	25 h
TOTAL	**150 h**

Online:

Learning activity (AF, by the acronym in Spanish)	Number of hours
Independent working	50 h
Group work	25 h
Independent reading of topics and discussion	50 h
Tutorials, academic monitoring and assessment	25 h
TOTAL	**150 h**

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

On campus:

Type	Assessment system	Weighting
1	Exams and tests.	30%
2	Development of articles, reports or design briefs.	30%
3	Portfolios, mind maps, peer assessment, etc.	20%
4	Fieldwork, conferences, visits to companies, discussion, etc.	5%
6	Case studies, designs, simulations and research (skill-based).	15%

Online:

Type	Assessment system	Weighting
8	Exams and tests.	60%
9	Development of articles, reports or design briefs.	10 - 20 %
10	Portfolios, mind maps, peer assessment, etc.	10 - 20 %
11	Fieldwork, conferences, visits to companies, discussion, etc.	0 - 5 %
12	Case studies, designs, simulations and research (skill-based).	10 - 20 %

On the Campus Virtual, when you open the subject area, you will find all the details of your assessable tasks and the deadlines and assessment procedures for each task.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period, you will need a grade of at least 5 out of 10 in the final grade, achieved by the weighted average of the assessable tasks carried out. In order for this to be possible, the following conditions must be met:

Each knowledge test must have a grade higher than or equal to the minimum grade indicated as “passed” in each case (normally 5 out of 10).

Each practical activity or *checkpoint* must have a grade higher than or equal to the minimum grade indicated as “passed” in each case (normally 6 out of 10).

In addition, at least 50% attendance is required to pass the subject area.
If any of the above points are not met, the maximum possible grade after applying the percentages will be 4 out of 10.

7.2. Extraordinary exam period (resits)

To pass the subject area in the ordinary exam period, you must achieve a final grade of at least 5 out of 10.
You must retake the tests that were failed or not delivered in the ordinary exam period, achieving a “passed” grade in each of them, in accordance with the same criteria of the previous exam period:

A. Knowledge tests.
B. Practice / checkpoints. For that purpose, alternative activities to those proposed in the ordinary exam period, or the corrections to errors in those activities, will be put forward.

If any of the above points are not met, the maximum grade in the ordinary exam period after applying the percentages will be 4 out of 10.
In the event that the minimum attendance requirement is not met during the ordinary exam period, regardless of the grades in activities related to section B, you will need to pass a knowledge test of all the topics in the subject area, corresponding to section A.

8. TIMELINE

The timeline with submission dates for the assessable tasks in this subject area will be indicated in this section:

Assessable tasks	Date
Test 1 - Exam (topics 1 to 3)	Weeks 10–12
Test 2 - Exam (topics 4 to 6)	Week 19
Practical test 1 + CheckPoint	Weeks 10–12
Practical test 2 + CheckPoint	Week 19
Class activities	Weeks 4–18
Fieldwork, conferences, visits to companies, discussion, etc.	Weeks 1–18

The timeline may be subject to change for logistical reasons related to the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The recommended bibliography is indicated below:

10. DIVERSITY AWARENESS UNIT

Students with special educational needs:

To ensure equal opportunities, curricular adaptations or adjustments for students with special educational needs will be outlined by the Diversity Awareness Unit (UAD, Spanish acronym).

As an essential requirement, students with special educational needs must obtain a report about the curricular adaptations/adjustments from the Diversity Awareness Unit by contacting unidad.diversidad@universidadeuropea.es at the beginning of each semester.

11. STUDENT SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degrees and the learning process.

These surveys will be available in the survey area of your campus virtual or by email.

Your opinion is essential to improve the quality of the degree.

Many thanks for taking part.