

**Advanced programming**

Code: 100126  
ECTS Credits: 6

Degree	Type	Year	Semester
2500149 Mathematics	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

**Contact**

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**Use of Languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

**Prerequisites**

It is convenient to have learned the knowledge in basic programming in C in the first courses of the Degree or in other subjects, although it is not essential.

**Objectives and Contextualisation**

The subject has two different parts. A first objective is to achieve a good level of programming in C, so that students will be able to structure an application and to program a complex algorithm. A second objective is to achieve a training in object-oriented programming (with Java), creation of libraries and that serves as the basis for learning any object-oriented language.

The practices are based on making two games: one in C and the other in Java. The development of games as a basis for the practices of the subject provides the obligation to use many different aspects of the programming languages and makes the practices more attractive for the student. All this motivates the student to be more interested in the development of the subject.

**Competences**

- Actively demonstrate high concern for quality when defending or presenting the conclusions of ones work.
- Develop critical thinking and reasoning and know how to communicate it effectively, both in ones own languages and in a third language.
- Distinguish, when faced with a problem or situation, what is substantial from what is purely chance or circumstantial.
- Effectively use bibliographies and electronic resources to obtain information.
- Generate innovative and competitive proposals for research and professional activities.
- Recognise the presence of Mathematics in other disciplines.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.

- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Use computer applications for statistical analysis, numeric and symbolic calculus, graphic display, optimisation or other purposes to experiment with Mathematics and solve problems.
- Work in teams.

## Learning Outcomes

1. Actively demonstrate high concern for quality when defending or presenting the conclusions of ones work.
2. Be able to fully or partially implement the program product and be able to design the verification and validation methods.
3. Develop critical thinking and reasoning and know how to communicate it effectively, both in ones own languages and in a third language.
4. Effectively use bibliographies and electronic resources to obtain information.
5. Generate innovative and competitive proposals for research and professional activities.
6. Have an understanding of communication machinery and systems.
7. Know how to analyse, design and implement computer-based systems in general, using methods and techniques that guarantee their efficacy and efficiency.
8. Know how to provide scientifically valid and technologically up-to-date solutions.
9. Know the different activities implied in the phases of the life-cycle of program products and their applications.
10. Master the methodologies and tools for developing information systems, database management systems and tools for automating the development of program products.
11. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
12. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
13. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
14. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
15. Understand the architecture and specifications for operating program products, understanding their nature and the possibilities offered by different programming languages.
16. Work in teams

## Content

### First part.

1. Reminder of structured and modular programming applied to C.

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#### 1.1. Basic reminder

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1.1.1. Structures and data types

1.1.2. Sequence, control and iteration structures

1.1.3. Procedures and functions

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#### 1.2. Dynamic structures

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1.2.1 Organization of pointers and memory addresses

1.2.2. Basic structures: stacks, lists and queues.

1.2.3. Trees

1.2.4. Dynamic matrices

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2. Recursivity.

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2.1. Fundamentals of recursivity

2.2. Search algorithms using trees:

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2.2.1. Priority amplitude and priority depth.

2.2.2. Backtracking.

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## Second part

3. Object Oriented Programming

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3.1. General concepts and features.

3.2. Classes and objects

3.3. Object oriented analysis and design.

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4. Java

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4.1. Language characteristics.

4.2 Classes, loops, functions and language structures

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5. Python in Object Oriented Programming

*\*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.*

## **Methodology**

Lectures:

The concepts of the subject will be presented. Emphasis will be placed on the interpretation of the results and the relationship between these concepts and their applications. Examples will be presented in order to allow students to face autonomously how to solve problems.

The resolution of the proposed problems will be discussed.

The methodology of the subject will be absolutely practical. This implies that classes are done entirely on the computer. The theoretical concepts will be explained in each session and will be complemented with exercises proposed by the teacher, which must be programmed directly to the computer, with his supervision.

Tutoring:

The teacher will supervise and evaluate student work. Students will propose the doubts that have arisen them in the resolution of the exercises proposed.

In the first tutoring sessions, the teacher will gather information on the background of each student and will advise him on how to improve. In the rest of the tutoring sessions, doubts will be resolved and the resolution of problems will be discussed.

Autonomous activities:

The exercises and practices must be developed individually. There is no point, in this subject, to create groups of practices of more than one student to develop the work.

*\*The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures of theory, problems and practices	45	1.8	2
Type: Autonomous			
Personal study and development of practices	97	3.88	2

## Assessment

Theory and problems module (weight 33%).

Final exam, making the student answer the theoretical concepts from programming problems.

Practices module (weight 66%)

The two practices of the subject will count each one as 33% of the final grade

Examns

The maximum grade (Excellent with Honor) will not be awarded to students who must go to the resit exam.

The grade "Not assessable" will be applied to students who do not take the exam.

The resit exam is only applicable to students who have not passed the subject.

*\*Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam	33%	4	0.16	1, 3, 10, 14, 11
Practices delivery	66%	0	0	15, 9, 5, 2, 14, 13, 12, 11, 7, 8, 6, 16, 4
Resit exam	33%	4	0.16	1, 3, 10, 14, 11

## Bibliography

### C

#### **C/C++. Curso de programación. 4ª Edición.**

Fco. Javier Ceballos Sierra;Fco. Javier Ceballos Sierra

eBook | 2015

### JAVA

#### **- Learning Java : An Introduction to Real-World Programming with Java**

Marc Loy;Patrick Niemeyer;Daniel Leuck;Marc Loy;Patrick Niemeyer;Daniel Leu...

eBook | 2020

#### **- Java Cookbook : Problems and Solutions for Java Developers**

Ian F. Darwin;Ian F. Darwin

eBook | 2020

#### **- Foundational Java : KeyElements and Practical Programming**

David Parsons;David Parsons

eBook | 2020

### PYTHON

#### **- Python : an introduction to programming / James Parker**

Parker, James, autor

Llibre en línia | 2017

#### **- High Performance Python : Practical Performant Programming for Humans**

Micha Gorelick;Ian Ozsvald;Micha Gorelick;Ian Ozsvald

eBook | 2020

#### **- Python : An Introduction to Programming**

Parker, James R.;Parker, James R.

eBook | 2021

Guido van Rossum, "El Tutorial de Python" (Una introducción informal a Pyhon),

- Python 2: <http://docs.python.org.ar/tutorial/pdfs/TutorialPython2.pdf>
- Python 3: <http://docs.python.org.ar/tutorial/pdfs/TutorialPython3.pdf>
- Mark Lutz, "Learning Python", Ed. O'Reilly
- Raúl González Duque, "Python para todos", <http://mundogeek.net/tutorial-python/>
- "Python tutorial", <https://www.tutorialspoint.com/python/>

#### Other books

- "The C++ Programming Language", B.Stroustrup, 3ªed.,Addison-Wesley, 1997.
- "Java2: The Complete Reference", P.Naughton, H.Schildt, Osborne/McGraw-Hill, 2000
- "Core Java" Volumes I y II, C.S.Horstmann, G.Cornell, Sun Microsystems Press.

#### **Software**

<https://www.codeblocks.org/downloads/binaries/>

<https://www.eclipse.org/downloads/>

<https://code.visualstudio.com/download>