



## Course guide

# 320099 - EDOO - Data Structures and Object Orientation

**Last modified:** 19/04/2023

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 723 - CS - Department of Computer Science.

**Degree:** BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

### LECTURER

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**Coordinating lecturer:** Xhafa Xhafa, Fatos  
Vellido Alcacena, Alfredo

**Others:** König, Caroline Leonore  
Lopez Herrera, Josefina  
Martin Prat, Angela  
Xhafa Xhafa, Fatos  
Vellido Alcacena, Alfredo

### PRIOR SKILLS

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It is considered very convenient to have passed the course on Foundations of Computer Science the first semester.

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

**Generical:**

CG03-ESAUD. Knowledge of basic subjects and technologies, which enables learning of new methods and technologies, as well as providing great versatility to adapt to new situations.

**Transversal:**

CT04 N1. Teamwork - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Basic:**

CB2. That students can apply their knowledge to their work or vocation in a professional manner and possess the competencies typically demonstrated through the development and defense of arguments and problem-solving within their field of study.



## TEACHING METHODOLOGY

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Sessions are:

- Face-to-face lecture sessions (using standard notes) and practical work sessions (following a script interspersed with exercises).
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding.

Practical class work will be covered in three types of sessions:

- a) Sessions in which students will carry out practical activities interspersed with exercises and the lecturer will try to answer the students' queries.
- b) Sessions in which students give presentations of group work.
- c) Examination sessions

Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set, whether by hand or with the help of a computer.

Students will work on a programming project in groups of two or three.

## LEARNING OBJECTIVES OF THE SUBJECT

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This subject has two overall objectives:

- To provide students with tools to control complexity in constructing programs (through object orientation).
- To teach students how to design efficient data structures to solve a variety of programming problems.

## STUDY LOAD

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Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	60,0	40.00

**Total learning time:** 150 h

## CONTENTS

### Classes and Objects

**Description:**

- 1.1. Abstraction barriers
- 1.2. Abstract data types (ADTs)
- 1.3. Specification and implementation
- 1.4. Members: attributes and methods
- 1.5. Member accessibility
- 1.6. Types of methods: constructor, destructor, query, modifier and operator
- 1.7. Method overloading
- 1.8. Dynamic memory management

**Specific objectives:**

- Design a series of operations for an ADT.
- Determine the constructors required for a specific class.
- Distinguish between the different types of methods.
- Implement constructors for simple and aggregate classes.
- Detect member access errors.
- Identify the chosen method in an overloaded call.
- Correctly implement an ADT.
- Create objects in dynamic memory.

**Related activities:**

All activities, from T1 to T7

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

CT04 N1. Teamwork - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Full-or-part-time:** 60h

Practical classes: 24h

Self study : 36h

### Efficiency of Algorithms

**Description:**

- 2.1. Orders of growth.
- 2.2. Asymptotic notation.
- 2.3. Analysis of algorithms.

**Specific objectives:**

- Enumerate typical orders of growth.
- Estimate the order of growth of simple programs.

**Related activities:**

All activities, from T1 to T7

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

CT04 N1. Teamwork - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Full-or-part-time:** 30h

Practical classes: 12h

Self study : 18h



## Data Structures

### Description:

- 3.1. Sequential structures: vector, list, stack and queue.
- 3.2. Sets.
- 3.3. Associative structures (Associative tables).
- 3.4. Structure implementations.
- 3.5. Efficiency of typical operations.
- 3.6. Comparison between structures.
- 3.7. Algorithms on data structures.
- 3.8. Data structure libraries (STL).

### Specific objectives:

- Declare data structures of any type.
- Efficiently access elements in a data structure.
- Efficiently insert, erase and modify elements in any data structure.
- Efficiently search and iterate elements in any data structure.
- Efficiently use iterators for every data structure.
- Appropriately choose a data structure for specific problem.
- Develop programs using a data structure library.

### Related activities:

Type T1 activities  
Type T2 activity  
Finishing of the type T3 activity

### Related competencies :

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)  
CT04 N1. Teamwork - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

### Full-or-part-time: 60h

Practical classes: 24h

Self study : 36h

## ACTIVITIES

### T1: Presential theoretical/practical learning

#### Description:

Teaching of theoretical topics interspersed with resolution of practical problems.

#### Specific objectives:

Learning the basics of algorithmics and structured programming in C++.

#### Material:

Notes and videos of the course.

#### Related competencies :

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

#### Full-or-part-time: 52h

Practical classes: 52h



## T2: LAB TEST

**Description:**

Do an individual exercise that covers all the specific objectives of the course.

**Material:**

Notes prepared by the subject teacher (Athena). Statement of the year. Resolution of the year. criteria correction (heading).

**Delivery:**

Resolution of exercise. All the activities of type 1 correspond to 10% of the course (Lab).

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

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

Practical classes: 2h

## T3: GROUP PROJECT FOR CONTINUOUS EVALUATION

**Description:**

Design and delivery of a project (in groups) that includes all the specific objectives of the course. It is carried out in groups and assessed by the lecturers.

**Specific objectives:**

The project includes all the specific objectives of the course.

**Material:**

Notes on the subject (including solved exercises of similar difficulty).

**Delivery:**

Delivering activities, one for each phase of the project (there will be several, specified in its statement).

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

CT04 N1. Teamwork - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

**Full-or-part-time:** 45h

Self study: 45h

## T4: midterm exam

**Description:**

Midterm exam of the course

**Specific objectives:**

Midterm course assessment.

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

**Full-or-part-time:** 3h

Practical classes: 3h



#### T5: Final exam

**Description:**

Final exam of the course

**Specific objectives:**

Final course assessment.

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

**Full-or-part-time:** 3h

Practical classes: 3h

#### T6: CONTINUOUS EVALUATION TASKS

**Description:**

Asynchronous individual solving of programming problems proposed by lecturers.

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

**Full-or-part-time:** 5h

Self study: 5h

#### T7: Autonomous learning

**Description:**

Student's asynchronous and autonomous learning.

**Related competencies :**

CE02-ESAUD. Basic knowledge of computer use and programming, operating systems, databases, and software applications with engineering applications. (Basic training module)

**Full-or-part-time:** 40h

Self study: 40h

## GRADING SYSTEM

Mid-semester exam (P): 20%

Final exam (F): 30%

Control exams (C1, C2): 20%

Problem solving (T): 10%

Project (J): 20%

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.



## BIBLIOGRAPHY

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### Basic:

- Stroustrup, B. The C++ programming language. 3rd ed. Reading: Addison-Wesley, 1997. ISBN 0201889544.
- Josuttis, Nicolai M. The C++ standard library. 2nd ed. Massachusetts: Addison-Wesley, 2012. ISBN 0201379260.

### Complementary:

- Meyers, Scott. Effective STL : 50 specific ways to improve your use of the Standard Template Library. Boston: Addison-Wesley, 2001. ISBN 0201749629.

## RESOURCES

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### Other resources:

- STL documentation: <http://www.sgi.com/tech/stl>
- Course notes at Atenea & UPCommons
- Course videos: <http://www.minidosis.org/#/cursos/EDOO>