320099 - EDOO - Data Structures and Object Orientation

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 723 - CS - Department of Computer Science
Academic year: 2019
Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6

Teaching languages: Catalan

Teaching staff

Coordinator: Pau Fernández
Others: Pau Fernández
Jordi Marco
Pepa López

Prior skills

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

Specific:
1. (ENG) Coneixements bàsics sobre l'ús i programació dels ordinadors, sistemes operatius, bases de dades i programes informàtics amb aplicació en enginyeria.

Transversal:
2. 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.

Teaching methodology

Sessions are:
- Face-to-face lecture sessions (using standard notes that are given out in advance).
- Face-to-face practical work sessions in the laboratory (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

This subject has two overall objectives:
320099 - EDOO - Data Structures and Object Orientation

- 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.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 150h</th>
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<tbody>
<tr>
<td>Hours large group:</td>
<td>30h</td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>30h</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>6h</td>
</tr>
<tr>
<td>Self study:</td>
<td>84h</td>
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</tbody>
</table>
## Content

### Efficiency of Algorithms

<table>
<thead>
<tr>
<th>Learning time: 12h</th>
</tr>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

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

**Related activities:**
- 2 type-1 activities

**Specific objectives:**
- Enumerate typical orders of growth.
- Estimate the order of growth of simple programs.

### Data Structures

<table>
<thead>
<tr>
<th>Learning time: 78h</th>
</tr>
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<tbody>
<tr>
<td>Theory classes: 10h</td>
</tr>
<tr>
<td>Laboratory classes: 14h</td>
</tr>
<tr>
<td>Guided activities: 6h</td>
</tr>
<tr>
<td>Self study: 48h</td>
</tr>
</tbody>
</table>

**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).

**Related activities:**
- 3 type-1 activities
- 1 type-2 activity
- Finishing of the type-3 activity

**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.
### 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

- **Related activities:**
  - Four type-1 activities
  - One type-2 activity

- **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.

### Learning time: 60h
- Theory classes: 16h
- Laboratory classes: 14h
- Self study: 30h
### Planning of activities

<table>
<thead>
<tr>
<th>TYPE 3: INDIVIDUAL ASSESSMENT TASK IN ATENEA</th>
<th><strong>Hours</strong>: 3h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Solving an individual exercise. Correction made by professors. During the next session will be a general reflection on the more common.</td>
<td>Self study: 3h</td>
</tr>
<tr>
<td><strong>Support materials:</strong> Notes available in ATENEA.</td>
<td></td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> Resolution of the exercises. The activities of type 3 have a weight of 10% overall.</td>
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<table>
<thead>
<tr>
<th>TYPE 1: LAB TEST</th>
<th><strong>Hours</strong>: 2h</th>
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<tbody>
<tr>
<td><strong>Description:</strong> Do an individual exercise that covers all the specific objectives of the course.</td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td><strong>Support materials:</strong> Notes prepared by the subject teacher (Athena). Statement of the year. Resolution of the year. Criteria correction (heading).</td>
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<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> Resolution of exercise. All the activities of type 1 correspond to 20% of the course (Lab).</td>
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<table>
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<tr>
<th>PROJECT IN GROUP FOR CONTINUOUS EVALUATION</th>
<th><strong>Hours</strong>: 45h</th>
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<tbody>
<tr>
<td><strong>Description:</strong> Making a project (in group) that includes all the specific objectives of the course. It is done in groups.</td>
<td>Guided activities: 6h</td>
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<tr>
<td><strong>Support materials:</strong> Notes on the subject (including exercises solved at a similar difficulty).</td>
<td>Practical classes: 39h</td>
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<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> Delivering activities, one for each phase of the project (there will be several, specified in the statement).</td>
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<tr>
<td><strong>Specific objectives:</strong> The project includes all the specific objectives of the course.</td>
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Qualification system

Mid-semester exam (P): 20%
Final exam (F): 30%
Control exams (C1, C2): 20%
Problem solving (T): 10%
Project (J): 20%

To ensure that any grade does not worsen posterior grades, the formula used to calculate the course grade is:

\[ EDOO = 0.2 \times J + 0.1 \times T + \text{MAX}(0.7 \times F, \text{MAX}(0.3 \times P, 0.2 \times P + 0.1 \times C1) + \text{MAX}(0.4 \times F, 0.3 \times F + 0.1 \times C2)) \]

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

Basic:


Complementary:


Others resources: