270208 - AP2 - Algorithmics and Programming II

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 723 - CS - Department of Computer Science
Academic year: 2019
Degree: BACHELOR’S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 7,5  Teaching languages: Catalan, English

Prior skills

Those acquired at the course AP1-GCED.

Degree competences to which the subject contributes

**Basic:**
CB5. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy

**Specific:**
CE2. To be able to program solutions to engineering problems: Design efficient algorithmic solutions to a given computational problem, implement them in the form of a robust, structured and maintainable program, and check the validity of the solution.

**Generical:**
CG1. To design computer systems that integrate data of provenances and very diverse forms, create with them mathematical models, reason on these models and act accordingly, learning from experience.
CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.
CG5. To be able to draw on fundamental knowledge and sound work methodologies acquired during the studies to adapt to the new technological scenarios of the future.

**Transversal:**
CT5. Solvent use of information resources. Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty and critically evaluate the results of such management.
CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.
CT7. Third language. Know a third language, preferably English, with an adequate oral and written level and in line with the needs of graduates.

Teaching methodology

The syllabus is presented in a very practical way, through the presentation of many examples.

The theory classes introduce all the necessary concepts and techniques, which are put into practice in the classes of problems and laboratory through a collection of problems and exercises in an automatic judge.

Every week, there are two hours of theory classes, one hour of problems and two hours of laboratory.

The course uses C++ and Python as programming languages.

Learning objectives of the subject

1. Being able to design, analyze, implement algorithms that solve problems using algorithmic and programming
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Techniques.

**Study load**

<table>
<thead>
<tr>
<th>Description</th>
<th>Duration</th>
<th>Percentage</th>
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<tbody>
<tr>
<td><strong>Total learning time</strong>: 187h 30m</td>
<td>45h</td>
<td>24.00%</td>
</tr>
<tr>
<td>Theory classes:</td>
<td>30h</td>
<td>16.00%</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>112h 30m</td>
<td>60.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>112h 30m</td>
<td>60.00%</td>
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</table>
# Content

## Abstract Data Types.

**Degree competences to which the content contributes:**

**Description:**

## Algorithm analysis.

**Degree competences to which the content contributes:**

**Description:**

## Divide and conquer.

**Degree competences to which the content contributes:**

**Description:**

## Memory management.

**Degree competences to which the content contributes:**

**Description:**
Representation of data in memory. Pointers and references. Dynamic memory management (vector class). Memory layout of a program (code, stack, heap).

## Basic containers.

**Degree competences to which the content contributes:**

**Description:**
Operations, usage and implementations of stacks, queues, priority queues and lists.

## Graphs.

**Degree competences to which the content contributes:**
Description:

Sets and dictionaries.

Degree competences to which the content contributes:
Description:
# Planning of activities

| Development of content 1 | Hours: 16h  
Theory classes: 5h  
Practical classes: 0h  
Laboratory classes: 3h  
Guided activities: 0h  
Self study: 8h |
<table>
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<tbody>
<tr>
<td>Specific objectives:</td>
<td>1</td>
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| Partial examination (with computer) | Hours: 2h  
Guided activities: 2h  
Self study: 0h |
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<tbody>
<tr>
<td>Specific objectives:</td>
<td>1</td>
</tr>
</tbody>
</table>

| Final examination (on paper) | Hours: 2h  
Guided activities: 2h  
Self study: 0h |
| --- | --- |

| Final examination (with computer) | Hours: 2h  
Guided activities: 2h  
Self study: 0h |
| --- | --- |

| Project delivery | Hours: 9h  
Guided activities: 0h  
Self study: 9h |
| --- | --- |

| Development of content 2 | Hours: 20h  
Theory classes: 4h  
Practical classes: 0h  
Laboratory classes: 4h  
Guided activities: 0h  
Self study: 12h |
<table>
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<tbody>
<tr>
<td>Specific objectives:</td>
<td>1</td>
</tr>
</tbody>
</table>
## Development of content 3

**Hours:** 35h  
- Theory classes: 9h  
- Practical classes: 0h  
- Laboratory classes: 6h  
- Guided activities: 0h  
- Self study: 20h

**Specific objectives:** 1

## Development of content 4

**Hours:** 11h  
- Theory classes: 3h  
- Practical classes: 0h  
- Laboratory classes: 2h  
- Guided activities: 0h  
- Self study: 6h

**Specific objectives:** 1

## Development of content 5

**Hours:** 27h 30m  
- Theory classes: 7h  
- Practical classes: 0h  
- Laboratory classes: 5h  
- Guided activities: 1h  
- Self study: 14h 30m

**Specific objectives:** 1

## Development of content 6

**Hours:** 35h  
- Theory classes: 9h  
- Practical classes: 0h  
- Laboratory classes: 5h  
- Guided activities: 1h  
- Self study: 20h

**Specific objectives:** 1
The grade of the course is calculated based on a grade obtained from two laboratory projects (NL), a partial exam on the computer (NP), and a final exam consisting of two tests: one on paper (NF1) and the other on the computer (NF2).

The final grade is the maximum of:

* 0.2 NL + 0.25 NP + 0.25 NF1 + 0.3 NF2
* 0.2 NL + 0.4 NF1 + 0.4 NF2

Re-evaluation:
Only those students that have attended the exams and who have not passed the course are eligible for the re-evaluation exam. The exam consists of two tests similar to the final exam: one on paper (R1) and the other on the computer (R2).
In case of not attending any of the tests, the corresponding mark of the final exam will be maintained (NF1 or NF2).

In the case of re-evaluation, the final grade of the course is calculated as 0.2 NL + 0.4 R1 + 0.4 R2

<table>
<thead>
<tr>
<th>Development of content 7</th>
<th>Hours: 28h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
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<td></td>
<td>Practical classes: 0h</td>
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<tr>
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<td>Laboratory classes: 5h</td>
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<tr>
<td></td>
<td>Guided activities: 1h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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</tbody>
</table>
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Bibliography

Basic:


Complementary:


Others resources:

Hyperlink

https://jutge.org

http://www.cs.upc.edu/~jordic/Teaching/AP2