270207 - COM - Computers

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 701 - AC - Department of Computer Architecture
Academic year: 2018
Degree: BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 7,5 Teaching languages: Catalan

Prior skills

Basic programming

Degree competences to which the subject contributes

Specific:
- CE4. Use current computer systems, including high performance systems, for the process of large volumes of data from the knowledge of its structure, operation and particularities.

Generic:
- 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.
- CG4. Identify opportunities for innovative data-driven applications in evolving technological environments.

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.

Teaching methodology

The course is based on classroom theory and laboratory. The lectures follow the program set out in this syllabus, are usually based on material provided through slides.

On the lectures, the course promotes a dialogue between teacher and students by providing activities carried out jointly based on particular aspects of the current topic.

Laboratory classes follow the same subjects and are based on documentation provided, explaining how to develop the current practice.

Learning objectives of the subject

1. Know about the objectives of the course
2. Work with different types of data, natural, integer, floating point, and their grouping
3. Demonstrate knowledge and understanding of the fundamentals of computers and on the basic structure of a computer.
4. Describe and work with the program execution environment.
5. Knowledge on the structure of programs, and be able to work with their analysis and management tools.
6. Know about the basic principles of the programming languages.
7. Knowledge and work with the operating system services
8. Knowledge and work with libraries
9. Know and work with the program compilation tools
10. Know and work with parallel programming models
11. Know and work with basic techniques of performance analysis
12. Know and work with the input/output tools provided by the execution environments
13. Know and work with the storage systems

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>45h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 187h 30m</td>
<td>Hours small group:</td>
<td>30h</td>
<td>16.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>7h 30m</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>105h</td>
<td>56.00%</td>
</tr>
</tbody>
</table>
# Content

## Data representation

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

**Description:**
Know and work with the different data types and their representation in computers. Binary encoding, characters, integers, strings, floating point values, and their grouping in classes, structures, and unions.

## Computer elements

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

**Description:**
Description of the elements that constitute a computer: processors, memory hierarchy, input/output components, data storage and the way they are interconnected.

## System libraries

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

**Description:**
This chapter presents the functionalities offered by the system libraries. Shows the format of executable files, and how and which information can be obtained from them.

## Compilation environment

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

**Description:**
It presents the tools performing compilation and interpretation of programming languages. It describes the compilation and optimization options offered by compilers. It completes the structure of the executable files, with symbol table, and debugging information.

## Operating System

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

**Description:**
Describes the objectives of the Operating System in an execution environment. This chapter presents the basic OS abstractions and its interface. System calls, interrupts, exceptions.

## Programming foundations
Introduction to parallelism

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

**Description:**
Parallelism and concurrency. Processes and threads. Synchronization. Programming models

Basic techniques of performance analysis

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

**Description:**
Performance of applications, metrics, sources of the information, performance counters, high resolution timers. Performance analysis, Gflops, bandwidth.

Input/output subsystem

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

**Description:**
It introduces the input/output subsystem of the execution environment, channels, terminals, files, pipes.

Storage systems

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

**Description:**
It describes the physical components of the Input/Output system to store data: disks, and filesystems. It provides a view of the fault tolerance mechanisms, based on redundant disks systems and logical volumes.
## Planning of activities

<table>
<thead>
<tr>
<th>Course presentation</th>
<th>Hours: 0h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 0h 30m</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 0h</td>
<td></td>
</tr>
</tbody>
</table>

Specific objectives:
1

<table>
<thead>
<tr>
<th>Data representation</th>
<th>Hours: 4h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h 30m</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 0h</td>
<td></td>
</tr>
</tbody>
</table>

Specific objectives:
2

<table>
<thead>
<tr>
<th>The computer and its elements</th>
<th>Hours: 11h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 4h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 1h</td>
<td></td>
</tr>
</tbody>
</table>

Specific objectives:
3

<table>
<thead>
<tr>
<th>Libraries and compilation</th>
<th>Hours: 7h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 3h</td>
<td></td>
</tr>
<tr>
<td>Practical classes: 0h</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
</tr>
<tr>
<td>Self study: 2h</td>
<td></td>
</tr>
</tbody>
</table>

Specific objectives:
8, 9
<table>
<thead>
<tr>
<th>Topic</th>
<th>Hours</th>
<th>Theory classes</th>
<th>Practical classes</th>
<th>Laboratory classes</th>
<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating System</strong></td>
<td>12h</td>
<td>5h</td>
<td>0h</td>
<td>2h</td>
<td>0h</td>
<td>5h</td>
</tr>
<tr>
<td><strong>Partial control</strong></td>
<td>7h</td>
<td></td>
<td></td>
<td></td>
<td>3h</td>
<td>4h</td>
</tr>
<tr>
<td><strong>Fundamentals of programming</strong></td>
<td>11h</td>
<td>6h</td>
<td>0h</td>
<td>4h</td>
<td>0h</td>
<td>1h</td>
</tr>
<tr>
<td><strong>Parallelism</strong></td>
<td>16h</td>
<td>6h</td>
<td>0h</td>
<td>6h</td>
<td>0h</td>
<td>4h</td>
</tr>
<tr>
<td><strong>Performance analysis</strong></td>
<td>9h 30m</td>
<td>4h</td>
<td>0h</td>
<td>4h</td>
<td>0h</td>
<td>1h 30m</td>
</tr>
</tbody>
</table>
### Input/ output and communications

**Specific objectives:**

11

**Hours:** 11h  
Theory classes: 6h  
Practical classes: 0h  
Laboratory classes: 4h  
Guided activities: 0h  
Self study: 1h

### File systems

**Specific objectives:**

12

**Hours:** 7h  
Theory classes: 6h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 1h

### Laboratory test

**Specific objectives:**

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

**Hours:** 4h  
Guided study: 2h  
Self study: 2h

**Description:**  
Laboratory test of the course, consisting of a laboratory session, with a specific wording, done in an individual way. It is performed during a particular lab session.

### Final exam

**Specific objectives:**

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

**Hours:** 3h  
Guided activities: 3h  
Self study: 0h

**Description:**  
Final exam of the course, consisting of theoretical questions related to all subjects explained in both theoretical classes and laboratory sessions
Qualification system

The final mark of the course comes from

- The partial theory control (15%)
- The final theory exam (60%)
- The lab test (15%)
- The competences Solvent Usage of Information Resources (5%) and Autonomous Learning (5%). The marks come from a homework deliverable (to be defined during the course) and from the lab deliveries, respectively.

Reassessment: Only the students that fail the course can go to the Reassessment exam (only theory exam). Then, the final mark of the course will be the maximum between the Reassessment mark and replacing only the mark of the final theory exam with the Reassessment mark.

Bibliography

Basic:


Others resources:

Hyperlink

http://docencia.ac.upc.edu/FIB/GCED/COM