270025 - LP - Programming Languages

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 723 - CS - Department of Computer Science
Academic year: 2018
Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff

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         - Jordi Petit Silvestre (jpetit@cs.upc.edu)
         - Jose Carmona Vargas (jcarmona@cs.upc.edu)
         - Jose Miguel Rivero Almeida (rivero@cs.upc.edu)

Prior skills

Prior skills on logic acquired in the course on Foundations of Mathematics (FM):
- Knowledge of basic concepts of logic propositions and predicates
- Knowledge of logical inference.

Prior programming skills acquired in the courses on Data structures and algorithms (EDA) and Programming Projects (PROP):
- Knowledge of programming.
- Knowledge of object oriented programming languages

Requirements

- Corequisite PROP

Degree competences to which the subject contributes

Specific:
CCO1.2. To demonstrate knowledge about the theoretical fundamentals of programming languages and the
associated lexical, syntactical and semantic processing techniques and be able to apply them to create, design and
process languages.

General:
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures,
results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a
technical informatics engineer.
G6. SOLVENT USE OF THE INFORMATION RESOURCES: To manage the acquisition, structuring, analysis and
visualization of data and information of the field of the informatics engineering, and value in a critical way the results
of this management.
270025 - LP - Programming Languages

Teaching methodology

Classes are divided into theory and lab sessions.

In the theory sessions the concepts of the subject will be developed. The presentation of new theoretical material is combined with the resolution of examples and the interaction with the students to promote the discussion of introduced concepts.

In the laboratory classes the introduced concepts will be put into practice and applied to specific problems and programming languages. There will be three small practices associated with the different evaluation tests.

Learning objectives of the subject

1. Knowing the different compilation steps, including lexical, syntactic and semantic.
2. Conocer herramientas para la creación de analizadores léxicos y sintácticos.
3. Knowing the differences between a compiler and an interpreter.
4. Distinguir el main features of a given programming language. Identify its strengths and weaknesses and be able to justify a choice.
5. Understand the main features of functional programming languages.
6. Learn advanced programming language concepts.
7. Being able to model and specify hardware or software problems using functional languages.
8. Learn the main features of scripting languages.
9. Ability to learn new programming languages independently.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Theory classes: 30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 30h</td>
<td>20.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 6h</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 84h</td>
<td>56.00%</td>
</tr>
</tbody>
</table>
# Content

## Introduction to programming languages.

### Degree competences to which the content contributes:

**Description:**
Turing completeness. Programming paradigms. Main features.

## Introduction to compilers.

### Degree competences to which the content contributes:

**Description:**

## Functional languages.

### Degree competences to which the content contributes:

**Description:**

## Type systems.

### Degree competences to which the content contributes:

**Description:**
Types in programming languages. Types and reliability. Type systems in functional languages and object-oriented languages.

## Higher-order programming

### Degree competences to which the content contributes:

**Description:**

## Modeling and Specification using functional languages

### Degree competences to which the content contributes:

**Description:**
**Scripting languages**

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

**Description:**
## Planning of activities

<table>
<thead>
<tr>
<th></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>Introduction to programming languages</strong></td>
<td>6h</td>
<td>2h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>4h</td>
</tr>
<tr>
<td><strong>Introduction to compilers</strong></td>
<td>22h</td>
<td>6h</td>
<td>0h</td>
<td>8h</td>
<td>0h</td>
<td>8h</td>
</tr>
<tr>
<td><strong>CL</strong></td>
<td>10h</td>
<td></td>
<td>2h</td>
<td>8h</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Functional languages</strong></td>
<td>18h</td>
<td>4h</td>
<td>0h</td>
<td>6h</td>
<td>0h</td>
<td>8h</td>
</tr>
<tr>
<td><strong>Type systems</strong></td>
<td>10h</td>
<td>4h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>6h</td>
</tr>
</tbody>
</table>

**Specific objectives:**

- Introduction to programming languages: 4, 5, 9
- Introduction to compilers: 1, 2, 3
- CL: 1, 2, 3
- Functional languages: 4, 5, 9
- Type systems: 4, 5, 9
### Specific objectives:

- 4, 5, 6, 9

### Higher-order programming

<table>
<thead>
<tr>
<th>Hours: 10h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Guided activities: 0h</td>
</tr>
<tr>
<td>Self study: 6h</td>
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</tbody>
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### Specific objectives:

- 4, 5, 6, 9

### Modeling and specification using functional languages

<table>
<thead>
<tr>
<th>Hours: 12h</th>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Guided activities: 0h</td>
</tr>
<tr>
<td>Self study: 6h</td>
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</table>

### Specific objectives:

- 5, 7

### EP

<table>
<thead>
<tr>
<th>Hours: 12h</th>
</tr>
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<tbody>
<tr>
<td>Guided activities: 2h</td>
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<tr>
<td>Self study: 10h</td>
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</table>

### Specific objectives:

- 5, 6

### Scripting languages

<table>
<thead>
<tr>
<th>Hours: 14h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 0h</td>
</tr>
<tr>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Guided activities: 0h</td>
</tr>
<tr>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

### Specific objectives:

- 3, 4, 8, 9
### Learning a new programming language

**Hours:** 10h  
Theory classes: 2h  
Practical classes: 0h  
Laboratory classes: 2h  
Guided activities: 2h  
Self study: 4h

<table>
<thead>
<tr>
<th>CT</th>
<th><strong>Hours:</strong> 7h</th>
<th>Guided activities: 1h</th>
<th>Self study: 6h</th>
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</thead>
</table>

**Specific objectives:**  
4, 9

<table>
<thead>
<tr>
<th>EF</th>
<th><strong>Hours:</strong> 15h</th>
<th>Guided activities: 3h</th>
<th>Self study: 12h</th>
</tr>
</thead>
</table>

**Specific objectives:**  
4, 5, 6, 7, 8
Qualification system

There will be three evaluation tests plus a supervised work (TD) which apart from its value in the final rank of the subject, is also used to rank the generic competences G4.3 and G6.3.

The evaluation tests CL, EP and EF have a little practical work associated to each one and called respectively PCL, PEP and PEF which must be submitted in advance.

The rank of the supervised work will be obtained from the evaluation activity CT, and will be split into three parts:

- TC1 which ranks the knowledge about the assigned programming language.
- TC2 which ranks the general competence G4.3 on the bases of a brief presentation and discussion with the teacher and other students, in addition to the submitted documentation.
- TC3 which ranks the general competence G6.3 on the bases of the given description of the consulted sources and the way they are referenced and the results obtained in TC1.

The final rank is obtained from the following four ranks

NOTA1 = 30% PCL + 70% CL
NOTA2 = 30% PEP + 70% EP
NOTA3 = 10% PEF + 90% EF
NOTA4 = TC1

using the following weighting:

FINAL NOTE NOTA1 = 20% NOTA1 + 30% NOTA2 + 40% NOTA3 + 10% NOTA4

Bibliography

Basic: