Advanced ProgrammingII

Course Presentation

Grado en Ingeniería Informática

Grado en Ingeniería del Software

Professors of the course
&
Groups of students

PARTICIPATING PROFESSORS (THEORY AND PRACTICES)

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Group A: Double Grade
                            +
          from Álvarez Gil up to le Dao, Viet Hoang
Group B: Rest of students

Course contents

- Course is divided into three blocks
  - Block 1:
    - Functional programming (Lessons 1-2)
  - Block 2:
    - Concurrent Programming (Lessons 3-7)
  - Block 3:
    - Event-Driven Programming (Lessons 8)

Course contents

- In the three blocks, we Will use the programming language **Scala** (version 3) and the IDE **IntellJ**

- It can be downloaded from
  - https://www.jetbrains.com/idea/download/

- To begin with Scala
  - https://www.jetbrains.com/help/idea/get-started-with-scala.html#new-scala-project-others

Syllabus - Block 1

Lesson 1: Introduction to Scala

1. First steps in Scala.
2. Classes and objects.
3. Packages, import and export.
4. Values, variables and control structures.
5. Lists, tuplas, sets and maps.
6. Inheritance.
7. Hierarchy of classes in Scala.
8. Asserts.

Syllabus - Block 1

Lesson 2: Functional programming in Scala

1. Pure and impure functions.
2. Benefits of functional programming.
3. Types, values, and immutable objects.
4. Functions, recursivity and tail recursión.
5. Data deconstruction and patterns.
6. Immutable lists and functions over lists.

Syllabus - Block 2

Lesson 3: Concurrent programming as an abstraction

1. A model for interleaving instructions.

2. Indeterminism and real concurrency.

3. Specification of concurrency and synchronization.

4. Correctness of concurrent programs: properties of security and liveness.

Syllabus - Block 2

Lesson 4: Concurrency support in languages and operating systems

1. Processes and threads.

2. Representing processes in programming languages.

3. Representing processes in operating systems.

4. Concurrency in Scala: class Thread, and trait Runnable

Syllabus - Block 2

Tema 5: Paradigmas de comunicación y sincronización

1. The problem of mutual exclusión.

2. Peterson´s algorithm.

3. Productores-consumidores

4. Readers / Writers.

5. Philosopher's dinner.

Syllabus - Block 2

Lesson 6.1: Communication and synchronization in shared memory

- **Semaphores**

Lesson 6.2: Communication and synchronization in shared memory

- **Monitors**

Syllabus - Block 3

Lesson 7: Introduction to Event-Driven Programming

1. Events vs concurrency
2. Events and listeners
3. Event queues
4. Event-based interaction patterns and frameworks
5. Advanced GUIs. Concurrency and events in GUIs.

Bibliography

- Functional programming in Scala; Pilquist, Michael, Bjarnason, Ruinar, Chiusano, Paul; Odersky, Martin; O'Reilly Safari Books, 2023
- Learning Concurrent Programming in Scala; A. Prokopec, Packt. 2017. Learning Scala.
- Practical Functional Programming for the JVM. J. Swartz, O'Reilly, 2014
- Practical Scala for Java Developers; Evans, Ben; Templeman, Julian; O'Reilly Media, Inc., 2016 (1st edition)
- Principles of Concurrent and Distributed Programming. M. Ben-Ari, Addison-Wesley, 2006
- The Art of Multiprocessor Programming; Maurice Herlihy, Nir Shavit, Victor Luchangco, Michael Spear; Elsevier LTD; 2nd edition 2020

Evaluation

- The course will be evaluated as follows.
  - The course is divided into 3 blocks or thematic areas, with the weights indicated below:

Bloque	Temas	Contenido	% sobre el total
1	1,2	Functional programming	30 %
2	3,4,5,6,7	Concurrency programming	60%
3	8	Event-driven programming	10%

Evaluation

- The course can be passed through continuous evaluation or in the official exam sessions.

- Each block Will be evaluated independently in every call and it will be considered as passed with a mínimum mark of 4 over 10.

- A student Will be considered as PRESENTED to the call if s/he has attended, at least, two of the continuous evaluation mid-term exams.
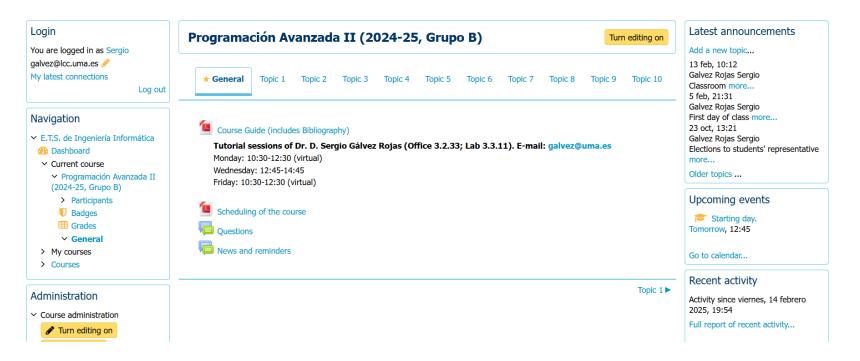
Continuous evaluation

- During the course, three mid-term exams will be developed in the laboratory
  - P1 - block 1 (Functional prog.) (30%)
  - P2 - block 2 (Concurrent-Semaphores prog.) (30%).
  - P3 - block 2 (Concurrent-Monitors prog.) (30%).

- Both in continuous evaluation and in official exams it will be required to have passed each of the blocks and to have an average greater than or equal to 5 (out of 10) to pass the course.

Evaluation

- Block 3 will be evaluated by developing a practice.

- The grades of the blocks passed will be kept in the subsequent calls of the same course:

  - The blocks passed in the continuous evaluation will be kept both in the first and the second calls,

  - and the blocks passed in the first call will be kept in the second.

Virtual Campus

- We have two entries for the course. A common room for all the "Advanced Programming II" groups where the material shared by all the groups (slides and practices) will be published in Spanish.

- An English entry with the same contents and, in addition, specific activities and information of group B.

Scheduling of the course

- The scheduling of the course's activities (class days, laboratory days, distribution of groups, etc.) is on the English entry in the VC.

- Likewise, all the slides and resources used in class will be published either in the common room (Spanish) and in the English entry (group 2º B) of the VC.

Scheduling

Scheduling of APII (English group) Classroom: 3.011. Lab group A: 3.1.4. Lab group B: 3.1.3

Date	T	P	Activity
17-2		2	Lesson 1. Welcome
19-2		2	Lesson 1. Welcome
21-2		2	Lesson 1. Welcome
24-2		2	Lesson 2
26-2		2	Lesson 2
28-2			Day of Andalusia
3-3			
5-3		2	Lesson 2
7-3			2 P1: Laboratory T2.1 (Group A)
10-3			P1: Laboratory T2.1 (Group B)
12-3			HACKER WEEK
14-3			2 P2: Laboratory T2.2 (Group A)
17-3			P2: Laboratory T2.2 (Group B)
19-3		2	Lesson 2(1 hour) -Lesson 3 (1 hour)
21-3			2 P3: Laboratory T2.3 (Group A)
24-3			P3: Laboratory T2.3 (Group B)
26-3		2	Lesson 4
28-3			2 MID-EXAM T1-2 (Functional Programming)
31-3		2	Lesson 5
2-4		2	Lesson 5
4-4			2 P4: Laboratory T4-5 (Group A)
7-4			P4: Laboratory T4-5 (Group B)
9-4			
11-4			
14-4			HOLY WEEK
16-4			
18-4			
21-4			

Date	T	P	Activity
23-4		2	Lesson 6.1
25-4		2	Lesson 6.2
28-4		2	Lesson 6.bis
30-4		2	Lesson 6.3
2-5			2 P5: Laboratory T6.1 (Group A)
5-5			P5: Laboratory T6.1 (Group B)
7-5		2	Lesson 7.1
9-5			2 P7: Laboratory T6.3 (Group A)
12-5			P7: Laboratory T6.3 (Group B)
14-5		2	Lesson 7.2
16-5			2 MID-EXAM T6 (Semaphores)
19-5			
21-5		2	Lesson 7.3
23-5			2 P6: Laboratory T7.1 (Group A)
26-5			P6: Laboratory T7.1 (Group B)
28-5		2	Lesson 8.1
30-5			2 P7: Laboratory T7.3 (Group A)
2-6			P7: Laboratory T7.3 (Group B)
4-6		2	Lesson 8.2
6-6			2 MID-EXAM T7 (Monitores-Locks)