Universitat de les Illes Balears

Academic year	2017-18
Subject	21735 - Computer Architecture
Group	Group 1, 1S, GEIN, GIN2
Syllabus	C
Language	English

Syllabus

Subject

Name 21735 - Computer Architecture
Credits 2.4 in-class (60 hours) 3.6 distance (90 hours) 6 total (150 hours).
Group Group 1, 1S, GEIN, GIN2 (Campus Extens)
Period First semester
Language English

Lecturers

Lecturers	Office hours for students					
	Starting time	Finishing time	Day	Start date	End date	Office
Catalina Lladó Matas cllado@uib.es	13:30	14:30	Monday	11/09/2017	26/02/2018	237, AT

Context

The course Computer Architecture is a mandatory subject of the module Computer Engineering. The course takes place during the first semester of the third year. The course examines current concepts of computer architecture such as computer performance and pipelining, as well as the memory hierarchy and its relationship to performance improvement.

Requirements

Essential requirements

The requirements for this course are the subjects "Estructura de Computadors I" and "Estructura de Computadors II" which are mandatory subjects of previous years of the degree.

Skills

Specific

* CI203 – Capacity of analysing and evaluating computer architectures, including parallel and distributed platforms as well as developing and optimising software for these platforms.

Generic

* CTR01 – Capacity of analysis and synthesis, structuring, planning and decision making.
* CTR02 – Capacity of critical analysis and capacity for proposing and applying new solutions.
* CTR03 – Capacity to acquire in an autonomous way new knowledge.

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* CTR04 – Capacity to research for resources and to manage the information in the computing ambit.
* CTR07 – Capacity to communicate computing concepts orally as well as in writing, in different areas.

Basic

* You may consult the basic competencies students will have to achieve by the end of the degree at the following address: http://www.uib.eu/study/grau/Basic-Competences-In-Bachelors-Degree-Studies/

Content

Theme content

1. Fundamentals of Quantitative Design and Analysis
    - 1.1 Introduction
    - 1.2 Classes of Computers
    - 1.3 Defining Computer Architecture
    - 1.4 Trends in Technology
    - 1.5 Trends in Power and Energy
    - 1.6 Dependability
    - 1.7 Measuring Performance
    - 1.8 Quantitative Principles of Computer Design
2. Pipelining
    - 2.1 An overview of pipelining
    - 2.2 CPU overview
    - 2.3 Pipelined datapath and Control
    - 2.4 Data Hazards: Forwarding vs Stalling
    - 2.5 Control Hazards
    - 2.6 Exceptions
    - 2.7 Parallelism and Advanced Instruction Level Parallelism
3. Large and Fast: Exploiting Memory Hierarchy
    - 3.1 Introduction
    - 3.2 Memory Technologies
    - 3.3 The Basics of Caches
    - 3.4 Measuring and Improving cache performance
    - 3.5 Dependable Memory Hierarchy
    - 3.6 Virtual Machines
    - 3.7 Virtual Memory
    - 3.8 A Common Framework for Memory Hierarchy

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3.9 Using a Finite State Machine to Control A Simple Cache

3.10 Parallelism and Memory Hierarchies: Cache Coherence

Teaching methodology

The subject is explained using lectures, establishing an interactive relationship between teacher and students using examples, solving simple exercises, problems and proposing more complex problems where students can develop the knowledge and skills acquired. The exercises sessions are combined with the more theoretical ones, and give students the opportunity to really confront the problems that arise in the course. The method used consists in proposing various exercises that students must solve. Those will be collectively later corrected or will be corrected by the teacher individually.

In order to encourage autonomy and personal work of the student, the course is part of the Moodle platform, which includes the use of electronic tools to achieve a flexible and distance education. Thus, and using the Moodle platform, students will have a means of online communication and ag distance with the teacher.

In-class work activities

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Blackboard lectures	Large group (G)	The subject is explained using lectures, establishing an interactive relationship between teacher and students using examples, solving simple exercises, problems and proposing more complex problems where students can develop the knowledge and skills acquired.	30
Practical classes	Computing Laboratory sessions	Medium group (M)	The sessions and the computing lab are done using a simulation environment of a pipelined computer.	14
Practical classes	Solving exercices lectures	Large group (G)	The exercises sessions are combined with the more theoretical ones, and give students the opportunity to really confront the problems that arise in the course. The method used consists in proposing various exercises that students must solve. Those will be collectively later corrected or will be corrected by the teacher individually.	16

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Campus Extens platform.

Distance education work activities

Modality	Name	Description	Hours
Individual self-study	Preparation for the final exam	Self-study to prepare for the final exam. This will be a combination of short answer and long answer questions.	25

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Modality	Name	Description	Hours
Individual self-study	Preparation for the partial exam	Self-study to prepare for the final exam. This will be a combination of short answer andlong answer questions.	25
Group self-study	Final practicum	Students will carry out a final practice involving the simulation of a pipelined system.	40

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

Blackboard lectures

Modality	Theory classes
Technique	Observation techniques **(non-retrievable)**
Description	The subject is explained using lectures, establishing an interactive relationship between teacher and students using examples, solving simple exercises, problems and proposing more complex problems where students can develop the knowledge and skills acquired.
Assessment criteria	Evaluating Skills:CI203, CTR07, CTR02

Final grade percentage: 5%

Solving exercices lectures

Modality	Practical classes
Technique	Short-answer tests **(non-retrievable)**
Description	The exercises sessions are combined with the more theoretical ones, and give students the opportunity to really confront the problems that arise in the course. The method used consists in proposing various exercises that students must solve. Those will be collectively later corrected or will be corrected by the teacher individually.
Assessment criteria	Evaluating Skills:CI203

Final grade percentage: 5%

Preparation for the final exam

Modality	Individual self-study
Technique	Extended-response, discursive examinations **(retrievable)**
Description	Self-study to prepare for the final exam. This will be a combination of short answer and long answer questions.
Assessment criteria	Evaluating Skills:CI203,CTR07, CTR02

Final grade percentage: 45%

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Preparation for the partial exam

Modality	Individual self-study
Technique	Short-answer tests **(non-retrievable)**
Description	Self-study to prepare for the final exam. This will be a combination of short answer andlong answer questions.
Assessment criteria	Evaluating Skills:CI203,CTR07, CTR02, CTR01

Final grade percentage: 20%

Final practicum

Modality	Group self-study
Technique	Student internship dissertation **(retrievable)**
Description	Students will carry out a final practice involving the simulation of a pipelined system.
Assessment criteria	Evaluating Skills:CI203,CTR07, CTR02, CTR01, CTR03, CTRR04

Final grade percentage: 25%

Resources, bibliography and additional documentation

Basic bibliography

* J.L Hennessy & D.A. Patterson.Computer Architecture: A Quantitative Approach. Morgan Kaufman. Lates edition: 5th. 2012
* D.A. Patterson & J.L Hennessy. Computer Organization and Design: The Hardware/Software Interface. Morgan Kaufman. Latest edition: 5th. 2014

Complementary bibliography

* W. Stallings. Computer Organization and architecture. Pearson
* D. Harris & S. Harris.Digital Design and Computer Architecture.Morgan Kaufmann
* B Jacob,S.Ng &D.Wang. Memory Systems: Cache, DRAM, Disk. Morgan Kaufmann
* DSweetman. See MIPS run.Morgan Kaufmann

References for cross skills:

* Myron H. Dembo, Helena Seli. Motivation and Learning Strategies for College Success. A Focus on Self-Regulated Learning. Taylor & Francis, 2013, 4th edition. ISBN: 978-0-415-89419-7 (hbk), 978-0-415-89420-3 (pbk), 978-0-203-81383-6 (ebk).
* Barry J. Zimmerman. Becoming a self-regulated learner: an overview. Theory into Practice, 41 (2), pp. 64-70. ISSN: 0040-5841.
* Brooke N. Moore, Richard Parker.Critical Thinking. McGraw-Hill, 2009, 9th edition. ISBN: 978-0-07-338667-6.

Other resources

* Campus Extens of the subject - Moodle tool
* Mips facebook

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