

Course guide

270644 - CHPC - Compilers for High Performance Computers

Last modified: 15/02/2023

Unit in charge: Barcelona School of Informatics
Teaching unit: 701 - DAC - Department of Computer Architecture.

Degree: MASTER'S DEGREE IN INNOVATION AND RESEARCH IN INFORMATICS (Syllabus 2012). (Optional subject).

Academic year: 2022 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: JOSE FRANCISCO LLOSA ESPUNY

Others: Segon quadrimestre:
MARC GONZÁLEZ TALLADA - 10
JOSE RAMON HERRERO ZARAGOZA - 10
JOSE FRANCISCO LLOSA ESPUNY - 10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

Generical:

CG2. Capability to lead, plan and supervise multidisciplinary teams.

Transversal:

CTR5. APPROPRIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.

Basic:

CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

TEACHING METHODOLOGY

The classes consist of lectures intermixed with practical exercises and homework. In addition, some advanced topics will be selected by the students on demand. Each student will make a presentation of his selected topic to the rest of the class.

LEARNING OBJECTIVES OF THE SUBJECT

1. Know the most common machine independent optimizations.
2. Know scheduling techniques and register allocation for exploiting Instruction Level Parallelism
3. Know the most common memory locality optimizations.
4. Learn the concept and compiler techniques for exploiting Data Level Parallelism
5. Compiler techniques and tools for exploiting Thread Level Parallelism
6. Make a technical report on some advanced compiler technique
7. Make a presentation so that the other students learn some advanced compiler technique



STUDY LOAD

Type	Hours	Percentage
Hours large group	54,0	36.00
Self study	96,0	64.00

Total learning time: 150 h

CONTENTS

Introduction

Instruction Level Parallelism

Memory Hierarchy Optimizations

Data Level Parallelism

Thread Level Parallelism

ACTIVITIES

Introduction

Full-or-part-time: 2h

Theory classes: 2h

Instruction Level Parallelism

Specific objectives:

1, 2

Related competencies :

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

Full-or-part-time: 39h

Theory classes: 24h

Self study: 15h



Memory Hierarchy Optimizations

Specific objectives:

3

Related competencies :

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

Full-or-part-time: 10h

Theory classes: 6h

Self study: 4h

Data Level Parallelism

Specific objectives:

4

Related competencies :

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

Full-or-part-time: 3h

Theory classes: 2h

Self study: 1h

Thread Level Parallelism

Specific objectives:

5

Related competencies :

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

Full-or-part-time: 32h

Theory classes: 20h

Self study: 12h

Deliverable

Specific objectives:

1, 2, 3, 4, 5, 6

Related competencies :

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

CTR5. APPROPRIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.

CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

Full-or-part-time: 23h

Guided activities: 3h

Self study: 20h

Presentation

Specific objectives:

1, 2, 3, 4, 5, 7

Related competencies :

CG2. Capability to lead, plan and supervise multidisciplinary teams.

CEE4.2. Capability to analyze, evaluate, design and optimize software considering the architecture and to propose new optimization techniques.

CTR5. APPROPRIATE ATTITUDE TOWARDS WORK: Capability to be motivated by professional achievement and to face new challenges, to have a broad vision of the possibilities of a career in the field of informatics engineering. Capability to be motivated by quality and continuous improvement, and to act strictly on professional development. Capability to adapt to technological or organizational changes. Capacity for working in absence of information and/or with time and/or resources constraints.

CB7. Ability to integrate knowledges and handle the complexity of making judgments based on information which, being incomplete or limited, includes considerations on social and ethical responsibilities linked to the application of their knowledge and judgments.

Full-or-part-time: 23h

Guided activities: 3h

Self study: 20h

GRADING SYSTEM

The evaluation of this course will take into account three different items

- A deliverable of a class assignment will account for 40% of the grade
- The presentation in class of a related topic will account for 40% the grade
- Attendance and participation in class will account for 20% of the grade.

BIBLIOGRAPHY

Basic:

- Muchnick, S.S. Advanced compiler design implementation. Morgan Kaufmann, 1997. ISBN 1558603204.
- Aho, A.V. [et al.]. Compilers: principles, techniques, and tools. 2nd ed. Addison-Wesley, 2007. ISBN 0321491696.
- Allen, R.; Kennedy, K. Optimizing compilers for modern architectures: a dependence-based approach. Morgan Kaufmann Publishers, 2002. ISBN 1558602860.