Universitat Autònoma de Barcelona

Parallel Programming 2016/2017

Code: 43481
ECTS Credits: 6

Degree	Type	Year	Semester
4313136 Modelling for Science and Engineering	OB	0	1

Contact

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Use of languages

Principal working language: english (eng)

Teachers

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Prerequisites

There are no prerequisite

Objectives and Contextualisation

The objective of the module is to:

- Develop C programs
- Identify difficulties related to parallel programming
- Apply an adequate methodology for the development of parallel applications
- understand the differences of parallel programming approaches: Shared memory, message passing
- Determine the most convinient parallel programming approach to develop a particular application
- Develop parallel applications
- Evaluate parallel application performance and collect necessary measurements to tune the application in order to improve its performance

At the end of this module, students should have enough knowledge, methods and technical skills to develop parallel applications using an adequate programming model and to evaluate the application performance.

Skills

- Analyse and evaluate parallel and distributed computer architectures, and develop and optimise advanced software for these.
- Analyse, synthesise, organise and plan projects in the field of study.
- Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialisation.
- Continue the learning process, to a large extent autonomously.
- Look for new areas to open up within the field.
- Safeguard, manage, audit and certify the quality of advanced developments, processes, systems and software.

- Take part in research projects and working groups in the field of information engineering and high-performance computation.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Learning outcomes

1. Analyse, synthesise, organise and plan projects in the field of study.
2. Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialisation.
3. Continue the learning process, to a large extent autonomously.
4. Design the parallel solution to a computational problem taking the characteristics of the hardware available into account.
5. Develop the parallel solution to a computational problem by choosing the most appropriate tools.
6. Identify sources of parallelism in a computational problem.
7. Interpret information from performance-analysis and use this in actions that improve the parallel application.
8. Look for new areas to open up within the field.
9. Plan and develop research projects with content related to parallel programming.
10. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
11. Use appropriate tools to analyse the performance of an application.

Content

1. Introduction to the course

1. C programming

1. OpenMP programming

1. CUDA

1. MPI Programming

1. Final Exam

Methodology

Lectures and lab sessions

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Attending lectures	18	0.72	2, 4, 5, 6, 9, 10
Lab practices	8	0.32	4, 5, 7, 9
Type: Autonomous			
Design and development of practical exercises	36	1.44	1, 3, 4, 5, 6, 7, 9, 10, 11
Study	76	3.04	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Evaluation

There are 4 marks corresponding to C programming, OpenMP programming, CUDA programming and MPI programming. There is also a final exam including all the course topics.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
C lab exercise	10	2	0.08	3, 10
Cuda Lab	20	2	0.08	4, 5, 6
Final Exam	40	4	0.16	3, 4, 5, 6, 10
MPI Lab exercise	20	2	0.08	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
OpenMP Lab exercise	10	2	0.08	1, 2, 4, 6, 8, 9

Bibliography

An intorduction to Paralle Programming. Peter S. Pacheco. Morgan Kaufmann Publishers.