Aplicacions de Còmput d'Altes Prestacions de Ciència i Enginyeria 2012/2013

Code: 42232
ECTS Credits: 6

Degree	Syllabus	Type	Year	Semester
4313133 Còmput d'Altes Prestacions, Teoria de la Informació i Seguretat / High Performance Computing, Information Theory and Security	1094 Còmput d'Altes Prestacions, Teoria de la Informació i Seguretat / High Performance Computing, Information Theory and Security	P	1	0

Contact

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Use of languages

Principal working language: anglès (eng)

Prerequisites

Compulsory modules of the master.

Objectives and Contextualisation

The main objective of this module is to apply the knowledge obtained during the first semester of this master regarding both, how to think and program in parallel and which are the main architectures of current parallel systems. For this purpose, in this module one analyzes different kind of scientific and engineering applications with high performance computing requirements.

Skills

- Analyse and evaluate parallel and distributed computing architectures, as well as develop and optimise advanced software for them.
- Analyse, synthesise, organise and plan projects related to information theory, security and high performance computing.
- Apply the methodology of research, techniques and specific resources for investigating and producing innovative results in a certain specialised field.
- Assure, guarantee, manage, certify and investigate the quality of advanced computing developments, processes, systems and products.
- Direct innovation and research projects and work teams in the area of information theory, security and high performance computing.
- Innovate in the search for new spaces / areas in one's field of work.
- Possess and comprehend knowledge that offers the basis and opportunity to be original in the development and/or application of ideas, frequently in a research context.
- Recognise the human, economic, legal and ethical dimensions of professional exercise.
- Students must possess learning abilities to enable them to continue studying in a way that will to a large extent have to be self-managed and autonomous.

Learning outcomes

1. Analyse, synthesise, organise and plan projects related with information theory, security and high performance computing
2. Apply the methodology of specific research, techniques and resources for investigating and producing

innovative results in a certain specialised field
3. Determine the most adequate architecture for a high performance computier application
4. Determine the most adequate platforms for running high performance data intensive applications
5. Develop the parallel solution for a computing problem by choosing the most adequate tools
6. Identify sources of parallelism in a computing problem
7. Innovate in the search for new spaces / areas in one's field of work
8. Interpret the information provided by performance analysis tools and transform it into actions that improve the parallel application
9. Plan and develop research projects with content related to the analysis of applications in the fields of science and engineering
10. Possess and comprehend knowledge that offers the basis and opportunity to be original in the development and/or application of ideas, frequently in a research context
11. Recognise the human, economic, legal and ethical dimensions of professional exercise
12. Students must possess learning abilities to enable them to continue studying in a way that will to a large extent have to be self-managed and autonomous
13. Use the right tools for analysing the performance of an application

Content

1. Introduction to the course

- Course Content and working Methodology.

1. Introduction to Applications vs. Architecture

- Identify/Classify different kind of applications (computational intensive and/or data intensive) with high performance computing requirements;
- Evaluating the tandem application/architecture.

1. Study cases:

- Forest Fire Spread Simulation;
- Meteorological Models and Simulation;
- BSC-Applications;
- Car crash impact simulation;
- Digital Animation.
- Bio-informatics applications

1. Discussion and work presentation

Methodology

The methodology applied to the student work will combine master classes (some of them will be done by external experts), independent and assisted work of the students, and the presentation of group small project where students apply the received knowledge.

A Virtual platform will be used to discuss different topic related to the module and it also will be use as a repository place for all the material used in this module.

Individual presentations for each student of a work developed around a given either scientific or engineering application with high performance computing requirements.

Activities

Title	Hours	ECTS	Learning outcomes

Type: Directed			
Lectures	24	0.96	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13
Type: Autonomous			
Parallel Application Analysis	120	4.8	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13

Evaluation

Attending lectures and activities is mandatory.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Learning group-activities	30%	2	0.08	1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13
Learning self-activities - individual presentation	70%	4	0.16	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

Bibliography

References:

- Parallel Programming : Techniques and Applications using Networked Workstations and Parallel Computers. Barry Wilkinson. Prentice Hall, 1999.
- Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering. Ian Foster . Addison Wesley,1995.
- Introduction to Parallel Computing. A. Grama et alter. Addison Wesley, Second Edition, 2003.
- Parallel Program Development For Cluster Computing: Methodology, Tools and Integrated Environments. Edited by J. C. Cunha, P. Kacsuk, S. C. Winter. Nova Science Publishers, Inc., 2001.