SUBJECT TEACHING GUIDE

319 - Parallel Programming

Master's Degree in computing engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Master's Degree in computing engineering			Type and Year	Optional. Year 1
Faculty	Faculty of Sciences				
Discipline	Optional Subjects				
Course unit title and code	319 - Parallel Programming				
Number of ECTS credits allocated	3	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERÍA INFORMÁTICA Y ELECTRÓNICA
Name of lecturer	JOSÉ LUIS BOSQUE ORERO
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Other lecturers	

3.1 LEARNING OUTCOMES
- Know and understand the models of parallel and vector architectures.
- Being able to analyze, design and implement efficient algorithms and parallel applications on different parallel architectures.
- Knowing how to evaluate the performance of a parallel algorithm, identifying design and implementation factors that most impact on performance, and be able to solve them using parallel computing techniques.
- Know and use the most common algorithmic schemes and patterns in the development of parallel software.

4. OBJECTIVES

The objectives of this subject focus on training students in the programming of parallel architectures, specifically systems based on multiprocessor clusters. The student must be able to carry out a complete parallelisation of an application in this type of architecture, tackling problems such as performance analysis, workload balancing and energy consumption analysis.

6. COURSE ORGANIZATION

CONTENTS	
1	Lesson 1. Models of Parallel Programming
2	Lesson 2: Parallel Message Passing Programming: MPI 2.1 Message Passing Programming Paradigm 2.2 MPI: Message Passing Interface 2.3 Point-to-Point Communication Functions 2.4 Collective Functions 2.5 Non-Blocking Communication 2.6 Communicators 2.7 Derived and Packet Data Types
3	Lesson 3: Parallel Programming Methodology
4	Lesson 4: Dynamic Work Load Balancing
5	Lesson 5: Analysis of Parallel Algorithms
6	Lesson 6. SLURM Queue Manager 6.1 Concept of Queue Manager 6.2 SLURM Architecture 6.3 System Modelling 6.4 Job Modelling 6.5 Basic Commands 6.6 Creating a Job

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
There will be a laboratory practice that will include hybrid parallel programming (OpenMP+MPI), performance and scalability analysis and workload balancing algorithms.	Laboratory evaluation	Yes	Yes	100,00
TOTAL				100,00

Observations

Both sides will be recoverable. There is a unique annual call.

Observations for part-time students

Part-time students can chosee between the ordinary continuous assessment or a single test that will include an examination of theory plus practical examination in the laboratory. It is essential to pass the course deliver all exercises held throughout the course condition.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Francisco Almeida, Domingo Giménez, José Miguel Mantas, Antonio M. Vidal: “Introducción a la Programación Paralela”. Editorial Paraninfo. 2008
Michael J. Quinn. "Parallel Programming in C with MPI and OpenMP". McGraw-Hill, 2003