HIGH PERFORMANCE COMPUTING

Master in Engenharia Informática

Code: 26207

Main Scientific Area: Computer Architecture, Distributed Systems and Cybersecurity

Lecturer: Nuno Alberto Ferreira Lopes

Language of Instruction: Portuguese

Regime: S2

Contact Hours: 30h Total Workload: 130h

ECTS: 6,0

Objectives

This course aims to provide students with the essential knowledge to the development of concurrent and distributed applications. In particular the main techniques used for concurrent programming, their problems and possible approaches.

Learning Outcomes

At the end of the course, students will be able to develop applications with capabilities bidders, i.e. take advantage of multiple processors (cores) in the existing computers, as well as developing distributed applications, i.e. applications that run on multiple machines.

Course Contents

Concurrent Programming Paradigms
Flynn's Taxonomy
Memory Sharing and Message Passing
Foster's Methodology
Concurrency in Shared Memory

Thread Model
Critical sections, Race Conditions, Mutual Exclusion Mechanisms
Execution progress failures: deadlocks and starvation
Classic synchronisation problems: producer-consumer, philosophers' dinner.
Parallel Programming Libraries

Message Passing Interface (MPI)
OpenMP
Pthreads
Application Performance Evaluation

Performance evaluation theories
Tools for performance measurement

Recommended Bibliography

Peter Pacheco. (2011) An Introduction to Parallel Programming, Morgan Kaufman.

Learning and Teaching Methods

The development of applications able to take advantage of multi-core processors requires knowledge of concurrent programming techniques, which is the main topic covered in this program. Additionally, communication between distributed applications require other techniques which in turn are part of the program, specifically on the distributed programming.

Assessment Methods

The methodology used to evaluate students will consist in one online test (50%) and a practical assignment (50%), to be made during the lecture period.

All evaluation components have a minimum required score of 7 on a 20 scale for approval.

The delivery of the practical assignment outside the normal lecturing period will have a penalty of 5 values.