Testi del Syllabus

Docente	**GIORGI ROBERTO**	Matricola:	**005709**

Anno offerta:	**2014/2015**
Insegnamento:	**109156D - HIGH PERFORMANCE COMPUTER ARCHITECTURE**
Corso di studio:	**IG005 - COMPUTER AND AUTOMATION ENGINEERING – INGEGNERIA INFORMATICA E DELL'AUTOMAZIONE**
Anno regolamento:	**2014**
CFU:	**9**
Settore:	**ING-INF/05**
Tipo attività:	**B - Caratterizzante**
Partizione studenti:	**-**
Anno corso:	**1**
Periodo:	**Primo Semestre**

Testi in italiano

Tipo testo	*Testo*
Lingua insegnamento	ENGLISH
Contenuti	Introduction to parallel computing. Multicore and multithreaded processors. Scaling and Law of Amdhal. Branch Prediction. Speculative execution. Superscalar Architecture. Out-of-order execution. Introduction to VLIW architectures. Ordering of memory accesses. Multimedia/Vector Operations. Parallel programming. Programming for application-specific processors and graphics (GPU). Introduction to reconfigurable logic. Programming in distributed environments (OpenMP and MPI). Datacenters.
Testi di riferimento	* MAIN TEXT: M. Dubois, M. Annavaram, P. Stenstrom, "Parallel Computer Organization and Design", Cambridge University Press, 2012, ISBN: 978-0-521-88675-8 * J.L. Hennessy, D.A. Patterson, "Computer Architecture: A Quantitative Approach" 5th Edition, Morgan Kaufman/Elsevier, 2012, ISBN: 978-0-12-383872-8. * D. Culler, J.P. Singh, A. Gupta, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufman/Elsevier, 1998, ISBN-10 1558603433. * M.J. Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Jones and Bartlett Publishers, Inc., 1995, ISBN 0867202041 * David B. Kirk and Wen-mei W. Hwu, "Programming Massively Parallel Processors: A Hands-on Approach", Morgan Kaufmann (February 5, 2010) ISBN 0123814723.
Obiettivi formativi	Knowledge of the techniques for supporting the parallelism in computer systems. Ability to implement parallel applications.
Prerequisiti	Computer Architecture. Programming Fundamentals.
Metodi didattici	The course includes a theoritical part and a practical part (about 50%). A large part of the hours will be carried out in laboroatory to experience the possibility of estimating the performance through simulators.
Altre informazioni	Both in the written and oral exams (but also in the projects) the student is mainly required to show his/her detailed understanding of the topic, at least at the level shown by the teacher during the lesson. It's greatly appreciated the capacity of reasoning on the problem, rather then a mechanical (pedant) description of the topic. In case of written exercise, we mainly look at the correctness of the solution (in terms of numbers) and a very short justification of the chosen way to carry out the exercise (lengthy general wording is completely unnecessary). In case of oral question, the topic is typically one of the concepts illustrated during the lesson. Elements that are required are, for instance: the proof of the concept/theorem, precise schematic of the system, detailed behavior and functioning, reasons why this solution is used in the real-world.
Modalità di verifica dell'apprendimento	the admission mark to the oral part is composed of: for 50% by the marks of mid-terms/final tests for 50% by the mark of the PROJECT and overall committment The admission mark is considered "sufficient" if not less than 18/30. With an admission mark less than 18/30 and not less than 15/30 it is

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	necessary to perform the oral part of the exam. With an admission mark less than 15/30 and not less than 12/30, the student can perform the oral part "with condition" (the condition is passed if the student responds well to the first question). If the admission mark is satisfactory to the student, it can be directly confirmed as the final mark for the exam (without taking the oral part). It's always possible to take the oral part either by choice or to recover any insufficient mid-terms/final in which it has been obtained the desired result. In any case the PROJECT should always be submitted.
Programma esteso	* Introduction, Pipeline review. * Dynamic Instruction Scheduling * Tomasulo: An Efficient Algorithm for Exploiting Multiple Arithmetic Units * Branch Prediction: speculation of branch condition and branch target. * Predictor types, Bimodal, BHSR, BHT, PHT, 2-level adaptive, GAg, PAg, PAs. Other predictors (gshare, gselect, tournament). * Introduction to Superscalar Processor: general scheme and Renaming. * Full-System Simulator for single-core and multi-core systems. * Superscalar execution example: Re-Order Buffer and Instruction Window. Case studies: MIPS, Alpha, AMD, Pentium. * Software methods to extract Instruction Level Parallelism. * Introduction to multiprocessor systems, Flynn's taxonomy, UMA, NUMA, COMA systems, programming models * Coherence Protocols: Write Update, Write Invalidate, Hybrid. Snoopy based protocols: the MESI and DRAGON protocols * Memory Consistency Models: Sequential Consistency and Relaxed Consistency * Introduction to parallel programming. * Parallelsim and Performance * CUDA Architecture and Programming Elements * Advanced topics: reconfigurable computing; datacenters.

Testi in inglese

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