

CSC 456/591-005/591-605 Computer Architecture and Multiprocessors

Course Description:

CSC456 — Computer Architecture and Multiprocessors will cover major components of digital computers and the organization of these components into systems. Begins with single processor systems and extends to homogeneous and heterogeneous parallel systems for multiprocessing. Topics include computer system performance, instruction set design, cache memory, modern processor design, multiprocessors, GPUs and FPGA programming. Recent developments in PC and desktop architectures are also studied.

By the end of this course, the students will be able to:

1. Obtain a complete overview of interactions among different components in computer systems
2. Identify the performance issue of computer systems.
3. Optimize the performance of applications.
4. Create high-performance code that can utilize heterogeneous computing resources, including GPUs and FPGAs.
5. Create hardware accelerators.

Instructor:

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Textbook:

Computer Organization and Design: The Hardware Software Interface: ARM Edition (The Morgan Kaufmann Series in Computer Architecture and Design) 1st Edition.
David A. Patterson, John L. Hennessy

ResponseWare or a TurningPoint Clicker

Course webpage: <https://moodle-courses1718.wolfware.ncsu.edu/course/view.php?id=5529>

Discussion Forum: <https://piazza.com/class/jbx0ed77h77k2>

Grading:

5% participation
10% reading quiz
25% homework and midterm (CSC456 students do not need to take the midterm)
30% final
30% project

Tentative Schedule:

Week	Topics	Reading	Previe w Slides	Slides	Note
1/9/2018	Intro				

Week	Topics	Reading	Preview Slides	Slides	Note
1/11/2018	Recap on ISA	H&P Chapter 2.1-2.10 & 2.12-2.14			Reading quiz due
1/16/2018	Recap on ISA & Performance	H&P Chapter 1.5-1.10			Reading quiz due
1/18/2018	Recap on Performance				
1/23/2018	Identifying performance bottleneck & basic processor design	H&P Chapter 4.1-4.6			Reading quiz due
1/25/2018	Recap on Pipelined processor				
1/30/2018	Tutorial on DE1 SoC	H&P Chapter 4.7-4.8			Reading quiz due
2/1/2018	Recap on Pipeline hazards				
2/6/2018	Introduction to Memory Hierarchy	H&P Chapter 5.1-5.4			Reading quiz due
2/8/2018	Cache & Memory hierarchy II				
2/13/2018	Optimizing memory-intensive applications	H&P Chapter 4.10 & 5.8			Reading quiz due
2/15/2018	SuperScalar & Dynamic instruction scheduling				
2/20/2018	Introduction to multithreaded architecture	H&P Chapter 6.4-6.5			Reading quiz due
2/22/2018	Optimizing multithreaded programs				
2/27/2018	Introduction to GPUs and Heterogeneous Computing	H&P 6.6, A.12, B.2-B.6			Reading quiz due
3/1/2018	OpenCL Programming Model I				
3/6/2018	Spring break				
3/8/2018	Spring break				
3/13/2018	Midterm Due — no lecture				Project Proposal Due

Week	Topics	Reading	Previe w Slides	Slides	Note
3/15/2018	OpenCL Programming Model II				
3/20/2018	OpenCL Programming Model III				
3/22/2018	CUDA Programming Model I				Reading quiz due
3/27/2018	CUDA Programming Model II				
3/29/2018	Branch prediction				
4/3/2018	Revisiting multithreaded architecture				
4/5/2018	Revisiting multithreaded architecture				
4/10/2018	Storage & I/O				Reading quiz due
4/12/2018	Storage & I/O (II)				
4/17/2018	Project presentations				Project due
4/19/2018	Project presentations				
Finals	Take home final				