

CSC 456/591-010/591-601 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:

Discussion Forum:

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	Note
1/7/2019	Intro		
1/9/2019	Recap on Performance	H&P Chapter 2.1-2.10 & 2.12-2.14	Reading quiz due
1/14/2019	Recap on ISA & Performance	H&P Chapter 1.5-1.10	Reading quiz due

Week	Topics	Reading	Note
1/16/2019	Performance, power and energy		
1/23/2019	Recap on Pipelined processor	H&P Chapter 4.1-4.6	Reading quiz due
1/28/2019	Tutorial on DE1 SoC		
1/30/2019	Structural & Data hazards	H&P Chapter 4.7-4.8	Reading quiz due
2/4/2019	Control hazards		
2/6/2019	Introduction to Memory Hierarchy	H&P Chapter 5.1-5.4	Reading quiz due
2/11/2019	Memory Hierarchy (II)		
2/13/2019	Memory Hierarchy (III)	H&P Chapter 4.10 & 5.8	Reading quiz due
2/18/2019	Optimizing memory-intensive applications		
2/20/2019	Introduction to parallelism	H&P Chapter 6.4-6.5	Reading quiz due
2/25/2019	Parallelism (II)		
2/27/2019	FPGA & OpenCL programming model	H&P 6.6, A.12, B.2-B.6	Reading quiz due
3/4/2019	OpenCL		
3/6/2019	Introduction to GPUs		
3/18/2019	CUDA Programming Model		
3/20/2019	Modern pipeline processors: SuperScalar & Dynamic instruction scheduling		Project Proposal Due
3/25/2019	Modern pipeline processors: SuperScalar & Dynamic instruction scheduling (II)		
3/27/2019	Modern pipeline processors: SuperScalar & Dynamic instruction scheduling (III), SMT		
3/29/2019	Advanced memory hierarchy		Reading quiz due
4/1/2019	Advanced memory hierarchy (II)		
4/3/2019	Storage systems		
4/8/2019	Data Storage, Hardware Accelerators and Datacenters		
4/10/2019	Data Storage, Hardware Accelerators and Datacenters (II)		
4/15/2019	Non-volatile memory		Reading quiz due
4/17/2019	Potpourri		
4/22/2019	Project presentation		Project due
4/24/2019	Project presentation		
Finals	Take-home final		