

CS 2410–Computer Architecture

2022 Spring

Schedule

	Class
Time:	MW, 11:00am – 12:15pm
Room:	Zoom: https://pitt.zoom.us/j/95166511970 Room: SENSQ 5313
Webpage:	Canvas

Contact Information

Instructor: Xulong Tang		Grading TA: Weizheng Xu	
Office:	6115 SENSQ	Office:	Virtual
Email:	tax6@pitt.edu	Email:	wex43@pitt.edu
Office Hours:	Mon 12:20pm – 1:20pm Wed 12:20pm – 1:20pm	Office Hours:	Thu 11:00am – 1:00pm
Zoom	https://pitt.zoom.us/j/95506025905 Valid till 27th Jan. Remote office hour by appointment after 27 th Jan 2022	Zoom	https://pitt.zoom.us/j/6327445850

Description

This course focuses on basic (and some advanced) concepts in modern computer architecture and the major subsystems of high performance computers. Particular emphasis will be given to the exploration of parallelism at the instruction, data and thread levels. The course assumes students have basic knowledge of computer architecture from CS 1541.

Textbooks

Computer Architecture: A Quantitative Approach; John Hennessy and David Patterson. Sixth Edition - Morgan & Kaufmann.

Reference book if you need review some basics of computer architecture (CS 1541): Computer Organization and Design - The Hardware/Software Interface By David Patterson and John Hennessy Fifth Edition - Morgan & Kaufmann.

Class Policies

Exams: There will be a midterm and a final. The exams will be **close-note, in-class, in-person, syn-chronize exams**. If you cannot attend the exam, please contact the instructor as early as possible to discuss the reasons. If the reasons are acceptable, please coordinate with the instructor to schedule a conflict exam before the deadline. Cheating on exams will not be tolerated. Anyone caught cheating will be given a zero for the test and reported to the department following University procedures.

Project: There will be one course project. The logistics and details of the project will be given during class.

Homework: There will be homeworks that are meant to check your understanding of the course material. Totally, there will be 4 homeworks. Homeworks are individual work, so you are forbidden from sharing your solutions with your peers. Discussion is allowed and encouraged. Please list your discussion peers in your homework.

Reading: There will be two reading assignments to understand computer architecture research works. Each assignment will have 2 research papers published in top architectural venues. You are required to write a summary for each paper. The detailed structure of the summary will be given with the first reading assignment.

For all the above, no late submission is acceptable. These are meant to be your own work; anyone found to be cheating and copying will be disciplined in accordance to University policy. Cheating means (but is not limited to): using code/answers from previous terms, other universities, your friends, finding it on the Internet, getting help from unapproved forums, or outsourcing it. For project, we will be using Moss, a tool from Stanford for determining inappropriate collaboration.

Grading

Midterm Exam	20%
Final Exam	25%
Project	20%
Homeworks	20%
Reading	10%
Attendance	5%
Total	100%

Academic Integrity

Include repercussions for academic integrity violations.

Students in this course will be expected to comply with the [University of Pittsburgh's Policy on Academic Integrity](#). Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

To learn more about Academic Integrity, visit the [Academic Integrity Guide](#) for an overview of the topic. For hands-on practice, complete the [Understanding and Avoiding Plagiarism tutorial](#).

Disability Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and [Disability Resources and Services](#) (DRS), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Statement on Classroom Recording

To ensure the free and open discussion of ideas, students **cannot** record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Term Schedule

The daily topics are subject to change depending on our pace. They are there to assist you in reading the textbook so you can focus on those concepts prior to class. (R: reading assignment, HW: homework, Proj: Project)

*Assignment dates and due dates listed below are approximate, and subject to change.

Date	Topic (Exact dates subject to dynamic scheduling)	Recommended Reading chapters	Assignments start	Assignments Due
1/10	Course introduction and overview	Chapter 1	Quiz (no credit)	
1/12	Instruction set principles	Appendix A		Quiz (no credit)
1/17	No class. (Dr. Martin Luther King's birthday observance)			
1/19	Review of Pipelining	Appendix C		
1/24	Review of Pipelining (continued)			

1/26	ILP: Instruction Level Parallelism	Chapter 3		
1/31	Branch prediction		HW1	
2/2	Dynamically scheduled pipeline			
2/7	Tomasulo's algorithm and Hardware-based speculation		R1	
2/9	Multiple issue processors			HW1
2/14	SMT		HW2	
2/16	Review of memory hierarchy	Appendix B		
2/21	Memory hierarchy			R1
2/23	Advanced cache optimizations	Chapter 2		
2/28	Main Memory			HW2
3/2	In-Class mid-term exam			
3/7	No class (Spring recess)			
3/9	No class (Spring recess)			
3/14	Thread Level Parallelism and review of exam	Chapter 5	HW3	
3/16	Cache coherence		Proj	
3/21	Directory-based coherence		R2	
3/23	No class: self-care day			
3/28	MESI protocol and the basics of Synchronization	Chapter 4		HW3
3/30	Data level parallelism			
4/4	Data level parallelism (continued)		HW4	R2
4/6	Introduction to Interconnection Networks			
4/11	Interconnection Networks			
4/13	Introduction to GPUs			HW4
4/18	Programming GPUs			
4/20	In-class final exam			
4/25				Proj

Your Well-being Matters

College/Graduate school can be an exciting and challenging time for students. Taking time to care for yourself and seeking appropriate support can help you achieve your academic and professional goals. You are encouraged to maintain a healthy lifestyle by eating a balanced diet, exercising regularly, avoiding drugs and alcohol, getting enough sleep, and taking time to relax.

It can be helpful to remember that we all benefit from assistance and guidance at times, and there are many resources available to support your well-being while you are at Pitt. If you or anyone you know ex-

periences overwhelming academic stress, persistent difficult feelings and/or challenging life events, you are strongly encouraged to seek support. In addition to reaching out to friends and loved ones, consider connecting with a faculty member you trust for assistance connecting to helpful resources. The [University Counseling Center](#) is also here for you. You can call 412-648-7930 at any time to connect with a clinician.

If you or someone you know is feeling suicidal, please call the University Counseling Center at any time at 412-648-7930. You can also contact Resolve Crisis Network at 888-796-8226. If the situation is life threatening, call Pitt Police at 412-624-2121 or dial 911.