

EE557 -- Computer Systems Architecture

Fall 2018

Sections 30630D and 30628D

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Office hours: Tuesday/Thursday 2 – 3 pm

Syllabus

1. Overview

The main objective of EE557 is computer architecture exploration at a more abstract level than in previous courses on architecture. Because architectures are described at a block diagram level a large number of machines, memory structures, and interconnections will be taught. In EE457, we learned how to design a simple five-stage pipeline in great details, down to the circuit level. In EE557, we assume that these implementation details are known. We will learn about computer systems as they are designed today, including processors, memories, interconnects and multi-processors. The focus of the course is not on research but on actual, commercial, existing machines.

At the end of this course students will be ready to work on research in the area of computer architecture. They will have the knowledge to design chip architecture for components of a computer system. Moreover they will have gained practical experience in using architectural design tools, such as tracing software, architecture simulators, area/complexity estimators and power/energy estimators, to design processors at the architectural level.

Besides attending two lectures and one discussion session per week students will complete five homework and three simulation projects.

2. Textbooks

1. Dubois, Annavaram and Stenström: “Parallel Computer Organization and Design” Cambridge University Press, 2012. ISBN: 978-0-521-88675-8. Purchase from the USC bookstore or from Amazon.com. **REQUIRED.**
2. Presentation slides. Purchase from the USC bookstore. **REQUIRED.**

3. Prerequisites:

1. EE457: Computer System Organization. (Either take it at USC or take the EE457 placement exam.)
2. Logic design and background in assembly/machine code/instruction sets background are also required.

4. Discussion session and Attendance:

EE-557 has two regular lectures of 110 minutes each and a 50 minutes discussion session per week, over 15 weeks. The discussion session is an opportunity to discuss the material covered in class, the homework and the exams with the TA. At times class material may be expounded during the discussion session. Attendance is not taken but attending the class and the discussion session is part of the course requirements.

There will be pop quizzes during the semester administered at random times (not applicable to students registered in DEN). The quizzes will be very short and will last no more than 5 minutes. They will ask one brief question about the material just taught in the class or in the previous class.

All material/information given out during regular class times and discussion sessions is part of the course. If you have to miss a class or a discussion session, make sure that you catch up by asking a friend to brief you up. Also stay informed of homework deadlines, changes of deadlines, potential problems with homework questions, information on exams, etc., by visiting the ee557 DEN blackboard regularly.

All quizzes and exams are open book and no electronic device is permitted besides a calculator.

5. TAs

Chao Wang, wang484@usc.edu

Office hours: Friday 2 – 4 pm, location: EEB 201 (may change to a larger room)

We do not provide information about the graders.

Per department policies, complaints about homework and project grading issues should be addressed to one of the TAs who will then interact with the graders to resolve them. If you cannot resolve a grading issue with the TA, please come to see me.

Please resolve all grading issues promptly. Do not procrastinate!

6. Course Work:

1. Homework: There will be 5 homeworks. Homeworks are assigned electronically through the DEN blackboard on a Friday. Homeworks are due two weeks from assignment, on a Friday before 5pm PST. We use paperless homework submission, grading and return. Homeworks are submitted electronically on the DEN blackboard. Your homework must be in PDF (scan it if you need to). Homework will be graded electronically and returned through the DEN blackboard. Late homework will be accepted through electronic submission until the following Sunday at 5pm PST. The penalty is 25% of the maximum grade if submitted by 5pm on Saturday and 50% of the maximum grade if submitted by 5pm on Sunday. No homework will be accepted after that. **THESE PROCEDURES AND POLICIES APPLY TO BOTH DEN AND NON-DEN STUDENTS.**
2. Simulation assignments: There will be four simulation projects. These assignments do require to use design tools under Unix and Linux and require some programming. The first and second projects use a tracing tool called PIN. The goal of the third project is to familiarize you with area and performance tools, such as SimpleScalar and Cacti. The fourth project is a microarchitecture design project using the tools. The submission and grading of projects follow the same procedure as for homework.
3. Midterm: Tuesday, October 23, 3:30 – 5:30 pm
4. Final: Tuesday, December 11, 2 – 4 pm.

Please understand that there will be NO make-up exam, except in cases of personal medical emergency certified by a physician, or of personal accident. Other requests will be denied.

7. Grading Policy

Homework: 15% (3% per homework); Simulation projects: 30% (Project 0: 2pts; Project 1: 8pts; Project 2: 10pts; Project 3: 10pts); Pop quizzes: 5%; Midterm: 20%; Final: 30%.

There is no possibility to earn extra credit in this class. PLEASE DON'T ASK! The final grade will be computed as announced. There is already a lot of work in this class! Do the best you can on each component of the course work you are graded on.

8. Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.-5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

9. Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one own academic work from misuse by others and to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Please consult http://www.usc.edu/student-affairs/SJACS/pages/students/academic_integrity.html Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty.

10. Tentative Course Schedule:

Lecture	Date	Topic--Remarks	Assign date (Friday)	Due date (Friday)
Lect 1	8/21	Introduction, Instruction sets, Static pipelines		
Lect 2	8/23	Static pipelines		
Lect 3	8/28	Dynamic pipelines-Tomasulo	Project 0	
Lect 4	8/30	Branch prediction, Speculative execution		
Lect 5	9/4	Register renaming/Speculative scheduling		
Lect 6	9/11	VLIW/Vector	Project 1	Project 0
Lect 7	9/13	Memory hierarchies/Caches		
Lect 8	9/18	DRAM controllers		
Lect 9	9/20	DRAM controllers	HWK1	
Lect 10	9/25	Virtual memory		
Lect 11	9/27	Virtual memory		
Lect 12	10/2	Multiprocessors	Project 2 & HWK 2	Project 1 & HWK1
Lect 13	10/4	Multiprocessors		
Lect 14	10/9	Multiprocessors		
Lect 15	10/11	Interconnection		
Lect 16	10/16	Synchronization	HWK3	HWK2
Lect 17	10/18	Coherence		
Lect 18	10/23	Coherence		
	10/25	Midterm		
Lect 19	10/30	Consistency		
Lect 20	11/1	Consistency	Project 3 & HWK4	HWK3 & Project 2
Lect 21	11/6	Consistency		
Lect 22	11/8	Chip multiprocessors, Transactional memory		
Lect 23	11/13	Transactional memory and thread level speculation		
Lect 24	11/15	GPU Architecture	HWK5	HWK4
Lect 25	11/20	GPU Architecture		
Lect 26	11/22	Domain-specific accelerator		
Lect 27	11/27	Storage system architecture		HWK5 & Project 3
	11/29	Thanksgiving		
	11/30	End of classes		
FINAL	12/12	2 – 4 pm		