

EC513/Computer Architecture

Fall 2020

Lecture: Mon-Wed 10:10 am-11:55 am in PSY B55

Recitation/Lab: Friday 12:20 pm-2:05 pm in PSY B55

Number of credits: 4, Prerequisites: EC 413, EC605 or equivalent

Course Objective

The goal of this course is to learn the design of modern computer system architecture and develop a strong platform that could be leveraged to design future computer systems.

Course Description

This course is a graduate course on computer architecture with an emphasis on a quantitative approach to cost/performance design tradeoffs. The course covers:

1. Fundamentals of classical and modern processor design
2. Evaluation metrics and trends, performance and cost issues
3. ISAs (instruction set architectures)
4. Datapath and pipelining (including branch prediction)
5. Memory hierarchies, caches, and virtual memory (and virtual machines)
6. Overview of semiconductor technology and energy/power
7. Parallelism:
 - (a) Instruction-level Parallelism
 - (b) Thread-level Parallelism
 - (c) Data-level Parallelism

Staff Information

Instructor:

Ajay Joshi

Email: joshi@bu.edu (Include EC513 in the subject line).

Office Hours: Monday 4:30 pm to 5:30 pm and Friday 9 am to 10 am via Zoom.

Grader/Lab Assistant:

Margaret Bauman

Email: msbauman@bu.edu (Make sure you include EC513 in the subject line)

Office Hours: Tuesday 5:30 pm to 6:30 pm via Zoom.

Textbooks and Class Material

1. TextBook (strongly recommended): J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach, 6th edition. Morgan Kaufmann. (5th edition is acceptable and is available online via BU Library site).
2. TextBook (optional): D.M. Harris and S.L. Harris. Digital Design and Computer Architecture, 2nd edition. Morgan Kaufmann, 2012.

Assignments, announcements, course material, and other useful links will be posted on Blackboard (<http://learn.bu.edu>) and/or Piazza (<https://piazza.com/>). Please use Piazza for asking questions.

Evaluation

Grading

One mid-term exam: 25%, One final exam: 25%, Project: 20%, Homeworks: 30% (5% per Homework).

Exams

The mid-term exam will be during class time. The Final exam will be on TBD.

Project

We will do a group project at the end of the semester. Each group will consist for 2 students. Details of the project will be provided at a later date.

Homeworks

Homework assignments will consist of a pencil-paper component and/or a lab component. Homeworks are to be submitted before the beginning of the class on the date specified. You can discuss your work in abstract with other students in the class, but you should write-up the solutions on your own.

Course Policies

Pencil-Paper Component of the Homework:

The pencil-paper component of the homework assignments must be the result of your individual work. You may discuss the contents and general approach to a problem with your classmates but not the detailed solution. You are expected to formulate your approach and write the solutions of homework problems by yourself. Copying the solution and/or answer from another student is considered cheating. Two identical homeworks with same mistakes are considered cheating. No extensions on homeworks will be provided.

Lab Component of the Homework:

The lab component of the homework assignments must be the result of your work. You can discuss your approach for completing the lab component with others, but not the detailed solution. Note that all lab components are to be submitted via github. We will compare each lab submission with other lab submissions. If we come across two solutions that are identical or closely match each other, then that will be considered cheating. No extensions on labs will be provided.

Makeup exams:

Makeup exams will be provided if the student takes prior permission from the instructor. Emergencies

will be dealt on a case-by-case basis. Note that oversleeping, being not ready, overload due to projects or coursework in other classes are not valid excuses for requesting a makeup exam.

Exam/Home Grade discussion:

Grade discussion/corrections should be done within one week after the graded exam or homework is distributed. No grade changes will be made after one week, or after the last day of class.

I and W grades:

As per University policy.

Academic Integrity and Honor Code:

- Your submission of the homework assignments must be the result of your individual work. You may discuss the contents and general approach to a problem with your classmates but not the detailed solution. You are expected to formulate your approach and write the solutions by yourself. Copying the solution and/or answer from another student or source is considered cheating.
- Clearly reference any sources you used in your work: books, Internet, and your collaborators!
- Boston University’s academic code of conduct will be strictly applied.
- Boston University’s computing ethics will be strictly applied.

Course Schedule (subject to change)

Lecture Number	Date	Lecture Topic	Text Reference (H&P)	Homework Due
1	Sep 2	Introduction	Chapter 1	
2	Sep 9	Technology, Power, Energy, Cost Trends	Chapter 1	
3	Sep 14	Performance	Chapter 1	
4	Sep 16	ISAs	Appendix A	
5	Sep 21	Memory Hierarchy	Chapter 2	Hw 1
6	Sep 23	Instruction-Level Parallelism	Chapter 3	
7	Sep 28	Instruction-Level Parallelism	Chapter 3	
8	Sep 30	Instruction-Level Parallelism	Chapter 3	Hw 2

Lecture Number	Date	Lecture Topic	Text Reference (H&P)	Homework Due
9	Oct 5	Instruction-Level Parallelism	Chapter 3	
10	Oct 7	Instruction-Level Parallelism	Chapter 3	
11	Oct 13	Instruction-Level Parallelism	Chapter 3	Hw 3
12	Oct 14	Caches	Appendix B	
13	Oct 19	Caches	Appendix B	
14	Oct 21	Caches	Appendix B	Hw 4
15	Oct 26	Exam 1		
16	Oct 28	Network microarchitecture	Appendix F	
17	Nov 2	Network microarchitecture	Appendix F	
18	Nov 4	Network microarchitecture	Appendix F	
19	Nov 9	Thread-Level Parallelism	Chapter 5	
20	Nov 11	Thread-Level Parallelism	Chapter 5	Hw 5
21	Nov 16	Thread-Level Parallelism	Chapter 5	
22	Nov 18	Data-Level Parallelism	Chapter 4	
23	Nov 23	Data-Level Parallelism	Chapter 4	Hw 6
24	Nov 30	Data-Level Parallelism	Chapter 4	
25	Dec 2	Miscellaneous Topics		
26	Dec 7	Miscellaneous Topics		
27	Dec 9	Project Presentation		Project Due
	TBD	Final Exam		