EC513/Computer Architecture
Spring 2025
Lecture: Tue and Thu 1:30 pm to 3:15 pm in IEC B10
Recitation/Lab: Fri 1:25 pm to 2:15 pm in PHO 202
Number of credits: 4, Prerequisites: EC413, 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 (Make sure you include EC513 in the subject line).
Office Hours: Friday 9 am to 10 am in PHO 334.

Teaching Assistant:
Sina Karimi
Email: sikarimi@bu.edu (Make sure you include EC513 in the subject line)
Office Hours: Monday and Wednesday 6:30 pm to 7:30 pm in PHO 307.

Grader:
Shamir Legaspi
Email: slegaspi@bu.edu (Make sure you include EC513 in the subject line)

Textbooks and Class Material

1. TextBook (strongly recommended): J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach, 6th edition. Morgan Kaufmann. The 5th edition is acceptable and is available online via the BU Library site.

2. TextBook (optional): D.M. Harris and S.L. Harris. Digital Design and Computer Architecture, 2nd edition. Morgan Kaufmann, 2012.

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

Evaluation

Grading

Mid-term exam: 20%, Final exam: 30%, Project: 20%, Six homeworks: 30% (5% per homework).

Exams

The mid-term exam will be during class time. The final exam time will be during final exam week. The exact date and time are TBD.

Project

We will do a group project at the end of the semester. 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 by the specified deadline. No extensions on homeworks will be provided.

Course Policies

Makeup exams:

Makeup exams will be provided if the student takes prior permission from the instructor. Emergencies will be dealt with on a case-by-case basis. Note that oversleeping, not being ready, overloaded due to projects or coursework in other classes are not valid excuses for requesting a makeup exam.

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 to homework problems by yourself. Copying the solution and/or answer from another student is considered cheating. Two identical homeworks with the same mistakes are considered cheating. Clearly reference any sources you used in your work: books, Internet, and your collaborators!

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. Clearly reference any sources you used in your work: books, Internet, and your collaborators!

Exam/Homework 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:

- 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	Jan 21	Introduction	Chapter 1	
2	Jan 23	Technology, Power, Energy, Cost Trends	Chapter 1	
3	Jan 28	Performance	Chapter 1	
4	Jan 30	ISAs	Appendix A	
5	Feb 4	Memory Hierarchy	Chapter 2	Hw 1
6	Feb 6	Instruction-Level Parallelism	Chapter 3	
7	Feb 11	Instruction-Level Parallelism	Chapter 3	
8	Feb 13	Instruction-Level Parallelism	Chapter 3	Hw 2
9	Feb 20	Instruction-Level Parallelism	Chapter 3	
10	Feb 25	Instruction-Level Parallelism	Chapter 3	
11	Feb 27	Instruction-Level Parallelism	Chapter 3	Hw 3

Lecture Number	Date	Lecture Topic	Text Reference (H&P)	Homework Due
12	Mar 4	Caches	Appendix B	
13	Mar 6	**Exam 1**	Appendix B	
14	Mar 18	Caches	Appendix B	
15	Mar 20	Caches		
16	Mar 25	Network microarchitecture	Appendix F	Hw 4
17	Mar 27	Network microarchitecture	Appendix F	
18	Apr 1	Network microarchitecture	Appendix F	
19	Apr 3	Thread-Level Parallelism	Chapter 5	Hw 5
20	Apr 8	Thread-Level Parallelism	Chapter 5	
21	Apr 10	Thread-Level Parallelism	Chapter 5	
22	Apr 15	Data-Level Parallelism	Chapter 4	Hw 6
23	Apr 17	Data-Level Parallelism	Chapter 4	
24	Apr 23	Data-Level Parallelism	Chapter 4	
25	Apr 25	Miscellaneous Topics		
26	Apr 29	Miscellaneous Topics		
27	May 1	Project Presentation		Project Due