Boston University
College of Arts and Sciences
Computer Science Department

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CLA CS-550
Advanced Computer Architecture
Spring 1997

Instructor: Azer Bestavros

- **Office:** MCS-276
- **Office Hours:** Fri 1:00 – 3:00pm, or by appointments arranged through Email
- **Email:** best@cs.bu.edu
- **Phone:** 353-9726

Meeting Place: MCS 148

Meeting Time: Mon & Wed (4:00pm – 5:30pm)

Web Home Page: `http://www.cs.bu.edu/faculty/best/crs/cs550/S97`

Overview:

CS-550 overviews the concepts underlying the design of high-performance computer architectures, with an emphasis on quantitative evaluation and the interplay between computer architecture and the design of compilers and operating systems. Topics include: pipelined, superscalar, vector, and parallel processors; hard-wired scheduling and branch prediction; cache and virtual memory-hierarchy design; shared-memory and message-passing scalable multiprocessors. Case studies including RISC/CISC and SIMD/MIMD architectures. This course counts for 4 credits and assumes basic knowledge of computer systems.

Textbook:

- *Computer Architecture: A quantitative approach* John Hennesy and David Patterson, Morgan Kaufmann Publishers Inc., Second Edition 1995.

Other References:

- ◇ *High-Performance Computer Architecture* Stone, Addison Wesley., Third Edition.
- ◇ *Computer System Architecture* Mano, Prentice Hall, Third Edition.
- ◇ *Advanced Computer Architecture: Parallelism, Scalability, Programmability* Kai Hwang, McGraw-Hill Series in Computing Science, 1993.
- ◇ *A collection of papers from various journals and conference proceedings – to be distributed.*

Class participation:

- ◇ Class participation is vital for a full understanding and appreciation of the material to be covered. This must be complemented with a consistent and thorough reading of the assigned portions of the textbook for a given lecture.

Homeworks and Tests:

- ◇ There will be a number of homeworks (≈ 6) spread out throughout the course. Some will be short and direct (one-week homeworks); others will be long and more like design projects (two-week homeworks).
- ◇ In addition to the homeworks there will be a final exam.
- ◇ The class grade will be based on homeworks (50%) and on the final exam (50%).

Policy on Collaboration:

- ◇ There is nothing wrong in principle about discussing the topics covered in the course with your peers. However, there are severe consequences to presenting their work as if it were yours (*e.g.*, copying their homework solutions, or not acknowledging their help if main ideas about homework solutions were communicated orally). This is nothing less than **plagiarism** and will be punished accordingly.

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Syllabus & Schedule

Class	Topic	Readings
1/13	First class meeting: Motivation and Overview	Ch. 1
1/15	Performance and Cost: Measures and Trends	Ch. 1
1/22	Basic Computer Organization: A review	Mano
1/27	Instruction Set Design: A review	Ch. 2
1/29	Instruction Set Design: Alternatives and Case studies	Ch. 2
2/03	Instruction Set Design: Relationship with software technology	Ch. 2
2/05	Pipelining: Introduction and basic concepts	Ch. 3
2/10	Pipelining: Basic concepts and designs	Ch. 3
2/12	Pipelining: Basic concepts and designs	Ch. 3
2/18	Pipelining: Instruction Level Parallelism	Ch. 4
2/19	Pipelining: Dynamic scheduling	Ch. 4
2/24	Pipelining: Dynamic scheduling	Ch. 4
2/26	Pipelining: Superscalar and VLIW pipelines	Ch. 4
3/03	Pipelining: Vector Processing	App. B
3/05	Pipelining: Vector Processing	App. B
3/17	Memory-hierarchy design: Basic concepts	Ch. 5
3/19	Memory-hierarchy design: Caching	Ch. 5
3/24	Memory-hierarchy design: Main and virtual memory	Ch. 5
3/26	Input-Output: Basics	Ch. 6
3/31	Input-Output: Interconnection Networks	Ch. 7
4/02	Multiprocessors: Introduction	Ch. 8
4/07	Multiprocessors: Interconnection Topologies	Ch. 8
4/09	Multiprocessors: Centralized Shared Memory	Ch. 8
4/14	Multiprocessors: Distributed Shared Memory	Ch. 8
4/16	Multiprocessors: Synchronization and Consistency	Ch. 8
4/21	Multiprocessors: Dataflow Architectures	
4/23	ALU Design: Computer Arithmetic	App. A
4/28	Slack	
4/30	Conclusion	
5/05	Final Exam (4:00pm - 6:00pm).	

* *Changes to this schedule will be announced if need be.*