



CS/CPE 488 Computer Architecture

CS/SES
Spring 2023

Meeting Times: Mondays 2:00 - 4:30
Classroom Location: Babbio 104
Instructor: Reza Peyrovian
Contact Info: rpeyrovi@stevens.edu
Office Hours: Posted on Canvas
Course Assistant: Posted on Canvas
Zoom link: <https://stevens.zoom.us/my/peyrovian> Passcode CCRP
Course Web Address: Canvas
Prerequisite(s): CS 383 (Computer Organization & Programming). Co-requisites: MA 222
Corequisite(s): N/A
Cross-listed with: N/A

COURSE DESCRIPTION

An introduction to the functional level structure of modern pipelined processors and the empirical and analytic evaluation of their performance. Topics include: empirical and analytic techniques for measuring performance (use of various means, Amdahl's Law, and benchmarks); tradeoff analysis; principles of instruction set design and evaluation (memory addressing, operations, types and sizes of operands, instruction set encoding, CISC vs. RISC, and related compilation issues); pipelining (basics, data hazards, and control hazards); and memory systems.

Course Outcome:

After successful completion of this course, students will be able to:

Each course outcome is followed in parentheses by the Program Outcome to which it relates.

1. **Amdahl's Law** - Apply Amdahl's law to predict quantitative performance of architectural designs. ([BS-CS J tradeoffs](#)) ([BS-CyS J tradeoffs](#))
2. **Pipelining** - Explain the concept of pipelining with RISC instruction set. ([BS-CS I currency](#)) ([BS-CyS I currency](#))
3. **Parallelism** - Explain instruction-level parallelism techniques such as branch prediction, speculation, and superscalar execution. ([BS-CS I currency](#)) ([BS-CyS I currency](#))
4. **Memory hierarchy** - Analyze memory hierarchy design, memory access time formula, performance improvement techniques, and trade-offs. ([BS-CS J tradeoffs](#)) ([BS-CyS J tradeoffs](#))

5. **Cache coherence** - Explain cache coherency in multiprocessors and the protocols for achieving it. ([*BS-CS I currency*](#)) ([*BS-CyS I currency*](#))

This course is comprised of lectures, discussions, homework assignments and exams.

COURSE MATERIALS

Required Textbook: Computer Architecture: A Quantitative Approach, Hennessey and Patterson, Sixth Edition, Morgan Kaufmann Publishers, 2019. ISBN 978-0-12-811905

Other Materials: Available on Canvas

COURSE REQUIREMENTS

Attendance Attendance is mandatory.

Participation Participation is strongly encouraged.

Homework There will be several homework assignments.

Exams There will be one midterm exam and one final exam.

GRADING PROCEDURES

Grades will be based on:

- Attendance (Quiz) 10%
- Homework 50%
- Midterm Exam 20%
- Final Exam 20%

Performance of 90% guarantees an "A", 80% a "B", and 70% a "C", etc. Also + and – will be used.

- All Homework and Exams must be typed. In case there is a complicated drawing, submit hand drawn in pdf.

ACADEMIC INTEGRITY

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the [Honor System Constitution](#). More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor/>

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

EXAM ROOM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the quiz or exam.

1. Students may use the following devices during quizzes and exams. Any electronic devices that are not mentioned in the list below are not permitted.

Device	Permitted?	
	Yes	No
Laptops	X	
Cell Phones	X	
Tablets	X	
Smart Watches	X	

2. Students may use the following materials during quizzes and exams. Any materials that are not mentioned in the list below are not permitted.

Material	Permitted?	
	Yes	No
Handwritten Notes	X	
Typed Notes	X	
Textbooks	X	

3. Students are NOT allowed to work with or talk to other students during quizzes and/or exams.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/office-disability-services>. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone (201) 216-3748.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments are strongly encouraged and can be made by phone (201-216-5177) or in-person (on the 7th floor of the Howe Center). CAPS is open from 9:00 am – 5:00 pm Mondays, Wednesdays, Thursdays and Fridays and from 9:00 am – 7:00 pm on Tuesdays during the Fall and Spring semesters.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. Other 24/7 resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.

COURSE SCHEDULE

The actual schedule will be available on Canvas, which is our PLAN of RECORD.