

CS465, Fall 2024

Computer Systems Architecture

1 Course Basics

1.1 Class Time and Location:

- Tue, Thu 10:30-11:45pm, HORIZN 2009
- [Here's a campus map, for reference](#)

1.2 Instructor: Prof. Radu Negulescu, PhD

- **Email:** rnegules (at) gmu (dot) edu
- **Office hours:** Tuesdays 12:30-1:30 pm in RSCH 364
(Research Hall – the building with a little tower next to ENGR)
- **My other course office hours:** Thu 6-7pm, Fri 4:30-5:30pm

1.3 GTA: Trent Zakielarz

- **Email:** tzakiela (at) gmu (dot) edu
- **Office hours:** Thursdays 12:30-1:30 pm in ENGR 4456

1.4 Course Outcomes:

- Be able to analyze and compare performance characteristics of a computer.
- Be able to demonstrate knowledge of instruction set architectures; be able to show how instructions are represented at both the machine level and in the context of a symbolic assembler; be able to read and write small assembly programs.
- Be able to manipulate low-level data representations and understand the implementation of computer arithmetic operations.
- Be able to explain how an instruction is executed; be able to explain the role of datapath and control; be able to explain pipelining and the relevant improvement technologies.

- Be able to understand the effect and implementation of memory hierarchy, in particular, the role of cache and virtual memory.
- Be able to explain the reasons for the performance impact of choosing RISC vs CISC and assess tradeoffs and developments in computer architecture.

1.5 Prerequisite:

C or better in CS 367.

1.6 Textbook:

- **Required** - Computer Organization and Design: the Hardware/Software Interface, 5th edition (MIPS edition), John L. Hennessy and David A. Patterson, Morgan Kaufmann, 2014. [Free Online with Library Access](#) [Physical Copies in the Libraries](#) [Companion Material](#)
- **Optional** - Computer Organization and Design: the Hardware/Software Interface, 6th edition (MIPS edition), John L. Hennessy and David A. Patterson, Morgan Kaufmann, 2020.

1.7 Other Useful Resources:

- **Canvas:** Course schedule, lecture slides, assignments, and quizzes.
- **Piazza:** Will be used for most announcements instead of Canvas, as well as discussion forum. Follow the link on Canvas to sign up.
- **Gradescope:** Homework submission. Link will be available from Canvas.

1.8 Hardware and Software Needs:

For in-class coursework including class exercises and exams, you will need a laptop computer with at least 2 GB of RAM and a fast, reliable wifi card. The recommended computer monitor and laptop screen size is 13-inches or larger. You will need computer speakers or headphones to listen to recorded

content. A webcam and headset microphone are required for live audio sessions using course tools like Honorlock.

For the computer hard disk space required, consider and allow for the space needed to:

- Install the required and recommended software (a JVM and the MARS MIPS simulator)
- Save your course assignments

You are strongly encouraged to back up all contents of your computer on a regular basis. Loss of data will not excuse late or unsubmitted assignments.

During our exams, you can use a 4-way calculator. Although more sophisticated calculators can be used, we require that they do not have programming capabilities or base conversion, eg. hexadecimal. If your calculator does not obviously lack these features, an adequate calculator will be supplied by the teaching staff.

2 Grading

Category	Percent
Homework Assignments	30%
Quizzes	10%
Class exercises	10%
Midterm	20%
Final exam	30%

2.1 Assessment

Letter grades shall be assigned based on the weighted average of coursework, as follows:

GRADE	CUTOFF
A+	98%
A	92%
A-	90%
B+	88%
B	82%
B-	80%
C+	78%
C	72%
C-	70%
D	60%
F	Less than 60%

Cutoff levels will be applied ***without*** rounding.

2.2 Homework

- Homework assignments might require some programming.
- Homework assignments must be done on an individual basis unless stated otherwise.
- All assignment grades are normalized and each contributes to your final grade evenly.
- Incorrect/broken submissions:
 - Turning in the wrong files or corrupted files will result in a zero.
 - Code that doesn't compile/assemble/run will get a low score.
- **Late Policy:**
 - Homework can be turned in **at most 24 hours** late.
 - Submitting an assignment late incurs a **25%** ceiling penalty so that $\text{RecordedGrade} = \min(75\%, \text{RawGrade})$.
 - Catastrophic computer failure will not be cause for an extension. Even if it is out of your control, we lack the logistic capabilities to track it. Use a backup service such as OneDrive (or any cloud service), emailing yourself, making multiple rounds of submissions to Canvas/Gradescope, whatever it takes. Be sure to turn in your submissions early.
 - Each student gets two Emergency-Days (2 late tokens) for use only on homework assignments, which are automatically used by turning in an assignment 24 hours

late (no need to email your professor). Emergency days avoid the 25% ceiling penalty. You can only use one token per assignment.

- Tokens cannot be combined by working in a group. Late policy will apply per student even for assignments submitted jointly.
- There are no late-late tokens: missing the late deadline results in a score of zero for that assignment.

2.3 Exercises

- There will be in-class exercises and grading will be based on **participation**.
- The two lowest exercise grade will be dropped.
- **Late Policy: late submissions** will NOT be accepted for exercises. **Exercises can only be submitted during class, to benefit from group collaboration and active learning. In case of extenuating circumstances on top of the two exemptions granted by default, the average of other exercises will be applied to the exempted exercises.**

2.4 Quizzes

- Practice questions will be released weekly, in the form of Canvas quizzes.
- The two lowest quiz grades will be dropped.
- Quiz marks will be included in the course grade calculation.
- **Late Policy: late submissions** will NOT be accepted for quizzes.
- **Quizzes will use Honorlock or similar systems to be sure they are completed without aids. If this causes too much stress, we will waive the Honorlock requirement on prior request from the student. However, solving the quizzes without aids will prepare students well for the exams.**

2.5 Exams

- **Exams are closed book unless specified otherwise by the instructor. They will be entirely paper and pencil. No computing or communicating devices are allowed.**
- A double sided study sheet is allowed. The study sheet cannot be shared among students. Any font size is fine as long as the student can read it without eyewear or with their usual eyewear. Either printed or handwritten sheets are fine, or combinations thereof.
- All students must have their GMU identification available on testing days.
- Missing an exam due for any non-university-accepted reason (such as not paying attention to when the exam is), will result in a zero.
- If you miss an exam due to a university-accepted excused absence (such as an illness or car accident the day and time of the exam), you must notify your professor within 24 hours of your absence to make arrangements for a makeup, and hand-in approved documentation. Failure to follow either of these policies will result in a zero.
- We may elect to replace a missed midterm with some (or all) of the final exam grade rather than offering a makeup exam.
- The final will not be given early, as we are obligated to follow the Registrar schedule. See [GMU's Final Exam Calendar](#) for the latest schedule, updated as weather events require. Look for the entry that matches our lecture time, TR 10:30-11:45am.

2.6 Discussion Board

- Students are encouraged to use the discussion board, **Piazza**, to ask and answer questions. *Link/access code to Piazza will be available on Canvas.*
- No sharing answers to homework assignments on the discussion board.
- Under no circumstances should your code of assignments be posted publicly to the discussion board. Students can post questions and code privately, although the instructor reserves

the right to make any post public, so that other students can see the responses.

2.7 Other Grading Policies

- **Contested Grades:** Contesting of grades on any/all submissions must be requested within one week of receiving the grade. No grade change requests will be considered past that deadline.
- There will be no make-up or extra-credit assignments at the end of the semester; your grade should be a measure of your semester-long progress.
- IN (Incomplete) policy as indicated in the catalogue will be strictly adhered to. Students who wish to use it must provide the necessary back-up documentation (e.g. medical certificate) for their application to be considered favourably. A written request for an IN grade, with complete back-up documentation, must be received before the final exam week.

3 University and Departmental Policies

3.1 Academic Standards

Academic standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our

standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is outlined in the university's procedures (<https://academicstandards.gmu.edu/>). Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or

exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

3.2 Accommodations for Students with Disabilities

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <https://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu. Phone: (703) 993-2474.

Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor in advance of any relevant class meeting, assignment, or exam.

3.3 FERPA and Use of GMU Email Addresses for Course Communication

The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. Students must use their GMU email account to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility: Students are responsible for checking their GMU email regularly for course-related information,

and/or ensuring that GMU email messages are forwarded to an account they do check.

3.4 Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity: If you prefer to speak to someone confidentially, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.

3.5 Honor Code

- All students are expected to abide by the GMU Honor Code (<https://oai.gmu.edu/full-honor-code-document/>). This policy is rigorously enforced. The computer science department has [CS Honor Code Policies](#) that you are subject to particularly for our course. Cheating on any assignment will have to result in a notification of the Academic Integrity Committee. Unauthorized sharing, collaboration, or copying of any piece of code or assignment solution that is not your own (or outside the group for group assignments), including resources from the Internet, using large language models to generate homework, is considered cheating.
- **Confirmed cases of cheating almost always translate into course failure (grade of F). This is not in the professor's hands.**

3.6 Land Acknowledgment Statement

<https://legacies.gmu.edu/about/land-acknowledgement-statement>

Land acknowledgment engages all present in an ongoing indigenous protocol to enact meaningful, reciprocal relationships with ancestors and contemporary tribal nations. As a state university, we have a responsibility to include and support indigenous communities and sovereign tribes in our work.

At the place George Mason University occupies, we give greetings and thanksgivings

to these Potomac River life sources,

to the Doeg ancestors, who Virginia annihilated in violent campaigns while ripping their lands apart with the brutal system of African American enslavement,

to the recognized Virginia tribes who have lovingly stewarded these lands for millennia including the Rappahannock,

Pamunkey, Upper Mattaponi, Chickahominy, Eastern Chickahominy, Nansemond, Monacan, Mattaponi, Patawomeck, and Nottaway, past, present, and future, and

to the Piscataway tribes, who have lived on both sides of the river from time immemorial.

4 Other Resources

- [Student Support Resources on Campus](#)

5 Acknowledgment

The present document and most of our course materials are based on previous offerings of this course, taught by Professor Yutao Zhong and Professor Daniel A. Menascé.