

CS 692-003: Reliability in Computer Systems (Special Topics) (Fall 2024)

1 Course Basics

1.1 Instructor

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1.2 Description

This course covers the concepts and practice of computer system reliability. Reliability is the probability of performing desired tasks and generating correct outputs in the presence of faults and errors in a system. Topics include fundamental reliability concepts, resilience evaluation methodology, reliability enhancement and hardening techniques, and their use cases in real-world applications. The course also provides the students with hands-on experience in computer system reliability through a course project.

1.3 Prerequisites

Suggested prerequisites are the undergrad-level system core-courses, such as operating systems, architecture, networking, compiler, or parallel computing. You need to be comfortable with programming in one of the following languages including C, Python. Knowing a language serves as a soft prerequisite.

1.4 Course Outcomes

Upon completion of this course, the students should be able to:

- Demonstrate an understanding of the fundamental concepts in system reliability
- Describe the motivation and importance of reliability in computer systems
- Get an overview of the recent reliability evaluation and hardening methodology
- Have the ability to quantitatively evaluate the resilience of a computer system.
- Demonstrate an ability to design, prototype, and implement an idea to improve computer system reliability.

1.5 Textbooks

There are no required textbooks. The course will be mainly based on lecture slides and papers.

1.6 Course Project

You will get hands-on experience in resilience estimation and hardening through a project. Students will work individually or in group (depends on class size) on a project and will make a presentation (a final exhibition) to the whole class. Each student (or group) has to turn in a written report describing the motivation of the project, the designed methodology, the implementation, the evaluation, the related work, and conclusions obtained. Each student (or group) should also turn in the related programming code. In order for projects to complete successfully, it is very important to plan all activities and to follow a schedule. Starting to work on a project a few days before it is due will very likely cause problems to its successful completion. Details concerning the course project will be presented in class.

1.7 Course Structure

The first month is lecture-based to introduce necessary background knowledge to students. Then, the majority of the semester will be in the format of paper readings, presented by students and discussed in groups. Students will be given chances to present their course projects twice in class (one at the beginning to introduce the project topic, and the other one at the end of the semester to show results).

1.8 Discussion Board: Piazza

- Announcements, discussion and instructor contacts will be on Piazza.
- All correspondence will go through Piazza. You can send private messages to the instructors (visible to all professors and GTAs) as well as post public questions visible to all students, collaborate on responses, and tag everything by topic.
- All instructors and TAs can view all material on Piazza.
- No sharing answers or code solutions to assignments on the discussion board. You can include code in private posts to the instructors. See Academic Integrity section below for more details.
- Email course staff only for logistical issues such as meeting outside of office hours, missing lab/lecture, grading disputes, medical situations, etc. Do not e-mail course staff about programming problems; use the discussion board. Project help questions sent via email are of extremely low priority, as they were sent to the wrong place and will most likely be responded to with “please post on Piazza”.
- The discussion board on Piazza is required reading for all projects. You MUST read the discussion board for clarifications and project updates.

1.9 Blackboard

- Course schedule, course syllabus, description of assignments, course project instructions and lecture slides will be posted on Blackboard.
- All assignments will be submitted (per published deadlines) via Blackboard.
- Midterm and final exam will be held in class.
- All grades will be posted to Blackboard.

1.10 Office Hours

- Office hours can be used for asking questions, discussing homeworks, and also discussing and presenting course projects for feedback.
- Office hours are often crowded - do not rely on them for last minute help, as we cannot guarantee that we will be able to spend significant time with every student. You can also use the discussion board for posting questions.

2 Grading

Your grade will be calculated as follows:

- 35% course project
- 5% quizzes and in-class activities
- 10% homeworks
- 20% midterm exam
- 30% final exam

The final grade is computed according to the following rules:

- A+: $\geq 97\%$; A: $[93\%, 97\%)$; A-: $[88\%, 93\%)$
- B+: $[85\%, 88\%)$; B: $[81\%, 85\%)$; B-: $[77\%, 81\%)$
- C: $[60\%, 77\%)$
- F: $< 60\%$

There is **no curving**. 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. The instructor may decide to give an extra-credit assignment during the semester. Everyone will be given the opportunity to do the extra-credit assignment.

2.1 Collaboration Policy

No collaboration is allowed among students in any of the individual exams. We encourage you to have high-level discussions with other students in the class about the homework and course project. Please list the students you discussed with when turning in the homework. However, we require that when you turn in an assignment, it is only your work. That is, copying any part of another student's assignment is strictly prohibited. Anything that you hand in, whether it is a written problem or a computer program, must be written in your own words. If you base your solution on any other written solution, you are cheating.

Never look at the code from other students or share your code with any other student. You must not make your code and homework solutions public (on GitHub/GitLab/Piazza/Pastebin or by any other means). It is your responsibility to lock your computers with a password, to not post your code to websites that are publicly accessible, to guard your USB drives and computers, to not upload your files to someone else's computer, etc. You are liable for any access gained to your code.

For students in the same course project group, sharing and working on the same code of the course project is allowed. However, for individual assignments and exams, code sharing is not allowed.

2.1.1 AI-assisted tool usage policy

ChatGPT or other Generative-AI models may be used (but **not encouraged**) in this course as an assistant in projects and homework assignments. Any use must follow the fundamental principles of the Honor Code and include the following statement with assignment submission:

The ideas in this submission are original and were generated by (my name). ChatGPT (or name other Generative-AI model) was used as an editorial/coding assistant, however, I take full responsibility for the originality and accuracy of the content.

Risk accompanies use of any powerful tool. Students are cautioned that sharing their own original ideas with Generative-AI models can lead to loss of control and ownership of those ideas and coding. Furthermore, in terms of learning in this class, students who replace their own learning and project work with materials prepared by Generative-AI models:

- Surrender control over the material's truthfulness and accuracy, and violate the university's Honor Code.

- Sacrifice the opportunity to acquire the knowledge, skills, and critical thinking taught in the course.
- Risk being unable to perform to expectations when Generative-AI models are unavailable, such as in exams.
- Ultimately endanger their employability if they are unable to produce work other than that produced by Generative-AI models.

2.2 Late Policy

The deadline of assignments and course project is 11:59pm New York time of the due date.

10% will be deducted for late assignments each day after the due date. That is, if an assignment is late, we will grade it and scale the score by 0.9 if it is up to one day late, by 0.8 if it is up to two days late, and by 0.7 if it is up to three days late.

Late assignments will only be accepted for 3 days after the due date. Assignments submitted more than 3 days late will receive a zero. If you're worried about being busy around the time of a HW submission, please plan ahead and get started early.

Each student gets two "Emergency Day" tokens, which are automatically used by late submissions to avoid the degrading penalty. Unused emergency-tokens will be worth 0.25% bonus to a student's overall grade at the semester's end.

Blackboard being unavailable is not an excuse for turning in a late assignment; in the rare situation that the website is somehow unavailable or giving the student an error, the student **MUST** email their submission to the instructor or GTA before the deadline, otherwise it will be considered late. Catastrophic computer failure will not be cause for an extension. Use a backup service such as DropBox (or any cloud service), emailing yourself, making multiple rounds of submissions to Blackboard, whatever it takes.

2.3 Contested Grades

If you feel points have been incorrectly deducted, contact the instructors. Contesting of grades on any/all submissions must be requested within one week of receiving the grade (on Blackboard). No grade changes will be considered after that deadline.

3 University & Departmental Policies

3.1 Academic integrity

All students must adhere to the GMU Honor Code (<https://oai.gmu.edu/mason-honor-code>) and the Computer Science Department's Honor Code (<http://cs.gmu.edu/resources/honor-code>) Policies. Only high-level discussion is allowed. The students are supposed to work individually on the homework, assignments and course project. Anything you hand in, should be only written in your words and show your own efforts. We reserve the right to use MOSS (<http://theory.stanford.edu/aiken/moss>) to detect plagiarism. **Violation of the Honor Code may result in an F.**

3.2 Privacy

All course materials posted to Blackboard or other course sites are private; by federal law, any materials that identify specific students (via their name, voice, or image) must not be shared with anyone not enrolled in this class. Video recordings of class meetings that include audio or visual information from other students are private and must not be shared. Live Video Conference Meetings (e.g. Collaborate or Zoom) that include audio or visual information from other students must be viewed privately and not shared with others.

3.3 Non-Discrimination and Inclusiveness

We are committed to providing an educational environment free from any discrimination on the basis of race, color, religion, national origin, sex, disability, veteran status, sexual orientation, gender identity, gender

expression, age, marital status, pregnancy status, or genetic information. If you feel there has been a violation of the University's policies on this, please contact GMU's Office of Diversity, Equity, and Inclusion (703-993-8730; dei@gmu.edu).

Gender identity and pronoun use: If you wish, please share your name and gender pronouns with us and we will attempt use them to address you in class and via email. You can update your chosen name and pronouns here: <https://registrar.gmu.edu/updating-chosen-name-pronouns>.

3.4 Sexual Harassment, Sexual Misconduct, and Interpersonal Violence

All faculty members are designated "Responsible Employees", and are required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per university policy 1412. If you wish to speak with someone confidentially, please contact the Student Support and Advocacy Center (703-380-1434) or Counseling and Psychological Services (703-993-2380). You may also seek assistance from Mason's Title IX Coordinator (703-993-8730; titleix@gmu.edu).

3.5 Auditing Policy

Auditors must be admitted Mason students. Students who wish to audit a class for no grade or credit must submit a course audit form with the instructor's signature to the Registrar's Office before the last day to drop a course. After the drop date has passed, students may not alter their status from credit to audit.

For admitted students over 60, there is a form they can complete to waive the Tuition. However, they still must apply to Mason, be accepted by Mason and then register to the course.

4 Common University Policy

4.1 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, coauthored 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 procedures¹. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

¹<https://academicstandards.gmu.edu/>

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.

4.2 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.

4.3 FERPA and Use of GMU Email Addresses for Course Communication

The Family Educational Rights and Privacy Act (FERPA)² governs the disclosure of education records for eligible students³ 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.

4.4 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 1202⁴: 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)⁵, Counseling and Psychological Services

²<https://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html>

³<https://registrar.gmu.edu/ferpa/>

⁴<https://universitypolicy.gmu.edu/policies/sexual-harassment-policy/>

⁵<https://ssac.gmu.edu/>

(CAPS)⁶, Student Health Services (SHS)⁷, and/or the Office of the University Ombudsperson⁸.

Student Support Resources on Campus:

<https://stearnscenter.gmu.edu/knowledgecenter/knowning-mason-students/student-support-resources-on-campus>

⁶<https://caps.gmu.edu/>

⁷<https://shs.gmu.edu/>

⁸<https://ombuds.gmu.edu/>