

# George Mason University

## DEPARTMENT OF COMPUTER SCIENCE

### CS 475 Concurrent & Distributed Systems

Spring 2024

TR 1:30 - 2:45 pm, Krug Hall 242

[Professor Sanjeev Setia](#)

703-993-4098

[setia at gmu.edu](mailto:setia@gmu.edu)

#### ***OFFICE HOURS***

Wed 2-3:30 pm, Room 5305, Nguyen (Engineering) Building

#### ***PREREQUISITES***

CS 367 (Computer Systems & Programming)

This is a programming intensive course. You need to be comfortable with programming in C and Java to be able to do the programming assignments. (You will also need to learn to program in Go). It is not a good idea to take this class if your course/work schedule is already quite full.

#### ***DESCRIPTION***

The class focusses on issues that arise in the design and implementation of concurrent and distributed applications. Course work will involve several programming assignments.

#### ***TOPICS***

The following topics will be covered:

- Processes & Threads
- Concurrent Programming (Mutual Exclusion, Synchronization Mechanisms, Locking Strategies)
- Exploiting thread-level parallelism
- Network Fundamentals
- RPC/RMI
- Distributed Application Architectures
- Coordination in Distributed Systems
- Consistency and Replication in Distributed Systems
- Fault Tolerance in Distributed Systems

#### ***READINGS***

Unfortunately there is no single textbook that covers all the material that will be discussed in this class. The following books are strongly recommended (but not required):

- Randal Bryant & David O'Halloran. Computer Systems: A Programmer's Perspective,

- Prentice Hall, 3rd edition (2015)
- Remzi Arpaci-Dusseau & Andrea Arpaci-Dusseau [Operating Systems: Three Easy Pieces](#)
- Martin Steen & Andrew Tannenbaum [Distributed Systems 4th edition \(2023\)](#)

### **GRADING**

There will be five programming assignments. The software required for these projects is available on the computers in the [CEC Labs](#) but you can also do the projects on your own computer. (The programming assignments involve programming in C, Go, and Java on a UNIX/Linux platform). The assignments will be graded on zeus (CEC Labs) so please make sure to test them on zeus before submission.

The first four programming assignments need to be done individually by each student while you can work in groups of two for the fifth and final assignment.

- 50% of the course grade will be based on the programming assignments.
- 10% of the grade will be based on quizzes and in-class activities.
- 15% Midterm Exam (tentative date: March 19)
- 25% Final Exam (Tuesday, May 7, 1:30-4:15 PM)

The final exam will be comprehensive in nature, i.e., it will cover all the topics discussed during the semester.

Overall course grades will be generally based on the following scheme (but we may change the thresholds for various grades taking into account the performance of the class as a whole):

- A+ ( $\geq 95\%$ ) A ( $\geq 90\%$ ) A- ( $\geq 85\%$ )
- B+ ( $\geq 80\%$ ) B ( $\geq 75\%$ ) B- ( $\geq 70\%$ )
- C+ ( $\geq 66\%$ ) C ( $\geq 63\%$ ) C- ( $\geq 60\%$ )
- D ( $\geq 50\%$ )
- F ( $< 50\%$ )

### **LATENESS**

The late submission policy is as follows: you have five **slip days** that you can use during the course of the semester, but at most two slip days per assignment. An assignment is considered late by one day irrespective of whether you miss the deadline by 1 minute or up to 24 hours.

### **GTA**

Rosy Sultana (rsultan6@gmu.edu)

### **CLASS NOTES**

Class notes, slides, handouts, etc. will be available on the class Blackboard page. Students should use Piazza for online discussions.

### **ABET COURSE OUTCOMES**

- Demonstrate an ability to design and implement concurrent programs
- Demonstrate an understanding of the fundamental concepts in synchronizing concurrent processes and threads by using locks, monitors and channels
- Demonstrate an ability to design and implement distributed programs using current

- middleware technologies
- Demonstrate an understanding of the fundamental concepts underlying distributed programming including message passing and remote procedure calls
- Demonstrate an understanding of the fundamental concepts in coordination in distributed systems
- Demonstrate an understanding of the fundamental concepts in consistency and replication in distributed system
- Demonstrate an understanding of the fundamental concepts in fault tolerance in distributed systems

### ***HONOR CODE***

GMU is an Honor Code university; please see the [Office for Academic Integrity](#) for a full description of the code and the honor committee process, and the [Computer Science Department's Honor Code Policies](#) regarding programming assignments. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. When in doubt (of any kind) please ask for guidance and clarification.

### ***ACCOMMODATIONS FOR DISABILITIES***

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with [Disability Services](#) (<https://ds.gmu.edu>; [ods@gmu.edu](mailto:ods@gmu.edu); +1-703-993-2474; SUB I Suite 2500) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

### ***PRIVACY***

Students must use their GMU email account to receive important University information, including messages related to this class. See <https://mail.gmu.edu> for more information.

### ***DIVERSITY***

This class seeks to create a learning environment that fosters respect for people across identities. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own.

This class abides by the GMU anti-racism statement.

### ***NOUNS AND PRONOUNS***

If you wish, please share your name and gender pronouns with me and how best to address you in class and via email. I use he/him/his for myself. You may address me as Prof. Setia in email and verbally.

***OTHER USEFUL CAMPUS RESOURCES***

- Writing Center: <https://writingcenter.gmu.edu>; +1-703-993-1200; Robinson Hall A114
- University Libraries: [Ask a Librarian](#)
- Student Support and Advocacy Center (SSAC): <https://ssac.gmu.edu>; +1-703-380-1434; Student Union Building (SUB) I, Suite 3200
- Counseling and Psychological Services (CAPS): <https://caps.gmu.edu>; +1-703-993-2380
- University Policies: The [University Catalog](#), is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at <https://universitypolicy.gmu.edu>. All members of the university community are responsible for knowing and following established policies.
- [GMU Academic Calendar](#)