

# CS-550 – Database Systems

Master of Science in Computer Science

## Course Information

**Course Section:** CS 550 / Section 2 + CS 450 / Section 1

**Course Term:** Spring 2022

## PROGRAM OBJECTIVES

**CS-550 is a core course;** it is offered in multiple programs. Here are examples of program objectives that tie in with the course objectives of CS-550:

- 1) **Foundations of Computer Science:** apply mathematical foundations and algorithmic principles in the modeling and design of computing systems.
- 2) **Computer Systems Fundamentals:** apply fundamental concepts in computer systems to model, design, and implement a computer-based system, process, or program that meets desired needs.
- 3) **Information Processing Fundamentals:** apply fundamental concepts in information processing to model, design, and implement a computer-based system, process, or program that meets desired needs.
- 4) **Advanced Computer Systems:** use advanced concepts in computer systems to design, implement, and evaluate a computer-based system, process, component, or program.
- 5) **Advanced Information Processing:** use advanced information processing concepts to design, implement, and evaluate a computer-based system, process, component, or program.

## COURSE DESCRIPTION

This is a graduate Database Systems course designed to provide students with both the theoretical knowledge and practical hands-on project experience on how to design and develop database applications and information systems using Relational Database Management Systems. Students will **gain command and proficiency** in

- (1) Relational database design, including Entity-Relationship model and its translation to SQL tables and integrity constraint definitions; theoretical and SQL relational model; and refining relational designs to satisfy properties of Boice-Code Normal Form, Third Normal Form, lossless join decomposition and dependency preservation;
- (2) Implementing database queries with significant level of complexity in relational algebra, relational calculus and SQL

Students will also **gain overview knowledge** in transaction management properties of atomicity, consistency, isolation and durability; SQL isolation levels; two-phase commit protocol for distributed transaction management; SQL access control; noSQL JSON data model and JSONiq query language; and, Big Data technologies.

**Prerequisites:** (CS 310 and 330) or (INFS 501, 515, 519, SWE 510) or equivalent

Each student enrolled in this class certifies that she/he has the prerequisites listed above.

## COURSE METHODOLOGY

Each week, learners will:

- Study content in Blackboard, including video lectures, tutorials, and interactive media.
- Practice writing code, checking results, and updating code as needed
- Work on assignments (when due)

## COURSE OBJECTIVES

After completing the course, learners will be able to design and develop database applications and information systems using Relational Database Management Systems, including to

- Design databases using an entity relationship diagram (ERD) and translate it to SQL tables and integrity constraints definitions.
- Refine database designs using Relational Normalization Theory.
- Formally understand database queries formulated in English using Predicate Logic
- Implement database queries with significant level of complexity in Relational Algebra, Calculus and SQL.

## Instructor Information

Professor Alex Brodsky. Refer to the Blackboard course shell for section-specific instructor contact, biography, and office hours information.

## Course Resources

### TEXTBOOKS AND READINGS

#### REQUIRED

- **Textbook—The course schedule lists readings from Ramarishnan & Gehrke. You may opt for the Kifer et al. title if you wish. You must select either of these titles:**
  - Ramakrishnan, R., and Gehrke, J. (2003). Database Management Systems (3rd ed.). McGraw-Hill: New York. ISBN-13: 978-0071231510
  - Kifer, M., Bernstein, A., and Lewis, P. (2006). Database Systems: An Application Oriented Approach, Complete Version (2<sup>nd</sup> ed. or later). Pearson: Boston. ISBN-13: 978-0321268457

### COMPUTER REQUIREMENTS

#### HARDWARE

You will need access to a Windows or Macintosh computer with at least 2 GB of RAM and to a fast, reliable broadband Internet connection (e.g., cable, DSL). The recommended computer monitor and laptop screen size is at least 13 inches. Computer speakers or headphones are recommended for recorded content. A headset microphone is recommended for live audio sessions using course tools like Blackboard Collaborate. Computer hard disk space must allow for:

- Installing the required and recommended software.
- Saving your course assignments.

For hardware and software purchases, visit Patriot Computers.

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.

#### SOFTWARE

Software applications include the following:

- Web browser (See Blackboard Support for supported web browsers)
- Adobe Acrobat Reader (free download)
- Flash Player (free download)
- Microsoft Office (purchase)
- Blackboard Collaborate (select from the course menu)
- Python 3

- [MySQL DBMS](#)
- [Atom](#) studio

### **UPDATING YOUR COMPUTER**

Please be sure to update your computer and prepare yourself to begin using the online format BEFORE the first day of class.

### **COMPUTING RESOURCES REQUIRED FOR THIS COURSE**

- Access to Oracle DBMS via GMU: [GMU Labs Oracle](#)
- VPN setup: [GMU Labs VPN](#)
- Oracle reference material: [Oracle Database](#)

## Grading Information

### GRADING SCALE

The following table describes the grading system. Additional letter grade will correspond to intermediate percentage scores.

GRADE	PERCENTAGE
A	90 or higher
B	75 or higher
C	60 or higher

A score of 90% or higher guarantees an A grade, 75% or higher a B grade, and 60% or higher a C grade. Late homework and project submission are NOT allowed. A submission is considered on time if submitted electronically on Blackboard on or before required submission date/time.

### LETTER GRADING DESCRIPTIONS:

Listed below are grades and academic standards for each grade awarded.

- A:** Consistently performs above and beyond the course/assignment requirements
- B:** Meets and occasionally exceeds the course/assignment requirements
- C:** Minimally meets the course/assignment requirements
- F:** Fails to meet the course/assignment requirements

### CATEGORIES AND WEIGHTS

The following table lists the types of graded activities in this course and each category's weight in the final course grade.

ASSIGNMENT CATEGORY	% OF OVERALL COURSE GRADE
Attendance and Class participation	2%
Homework Assignments	12%
Midterm Exam	38%
Final Exam	40%
Project	8%
<b>TOTAL:</b>	<b>100%</b>

### LATE ASSIGNMENTS

Late homework and project submission are NOT allowed. A submission is considered on time if submitted electronically on Blackboard on or before required submission date/time.

### UNGRADED ITEM DESCRIPTIONS

#### UNGRADED DISCUSSIONS 00%

Two non-graded discussion forums are included in this course: each with a specific purpose. *While participating in these discussions doesn't directly affect your course grade, those who regularly participate in the discussions historically*

*perform better in the course and final exam.* Building connections with others and learning from others are keys to deeper understanding. Review each of the three discussion types below.

### **Course Q and A Discussion**

Participate in this discussion to ask, view, and respond to questions of the instructor about the course material. Doing so creates a resource of information and insights. Often, even students who may not initially have a question will find a question and answer they didn't know to ask. Instructors and TAs can provide help and insights in this forum for those who may not have been able to attend the most recent office hours.

### **Cyber Café Discussion**

Participate in this discussion to discuss things that are not directly related to the course. Use this space to socialize, network, and to discuss topics of mutual interest beyond the instructional content of the course. Building personal connections, even when not directly related to course content, improves the learning experience.

## **GRADED ITEM DESCRIPTIONS**

A submission is considered on time if submitted electronically on Blackboard on or before required submission date/time. The following are descriptions of the five assignment categories:

### **ATTENDANCE AND CLASS PARTICIPATION 2%**

#### **Introductions Discussion – Required for Class Attendance Grade**

Participate in this discussion to get to know your classmates, instructor, and TAs so that when you ask questions and attend office hours, you will be able to learn from others and response to others well.

### **HOMEWORK ASSIGNMENTS 12%**

You will be required to submit homework assignments in some weeks, as specified in the course schedule. Submit all homework assignments via Blackboard. The homework assignments reinforce your development of skill in applying key concepts and techniques. You will work on your assignments and receive immediate feedback in a development environment; Atom studio is recommended for this. While the weight of home assignments is 12%, its de facto weight is much higher. If you get proficiency in solving problems of the kind appearing in your home assignments, you should be able to perform very well on the exams. The opposite is also true: without proficiency in home assignments, you are unlikely to perform well in the exams.

For each assignment, review the corresponding assignment page in Blackboard for detailed instructions. Assignments are due the **Monday** of the **following** Module at **10 PM, ET** unless otherwise stated. Precise due dates will appear on BB under each module.

Unlimited corrections and resubmissions of assignments are permitted until the due date/time. Do not copy solutions from external sources or each other when submitting results your home assignments, including programming exercises and working code. All assignments are checked for plagiarism, which constitutes a violation of the GMU Honor Code and triggers referral of violating students to GMU Honor Court. Most importantly, working on the assignments is absolutely critical in order to gain proficiency in the material, which is necessary to successfully pass the class exams.

### **MIDTERM EXAM 38%**

The Midterm Exam, due in Module 8, has the same structure as the Homework Assignments.

**FINAL EXAM 40%**

Like the Midterm Exam, the Final Exam has the same structure as the Homework assignments. This exam is due in Module 15.

**PROJECT 8%**

You will complete a realistic task using coding skills that you will have applied in the homework assignments and exams. Please see HA3+DB\_Project\_Description\_CS550.pdf for details. Dates are listed in the Course Schedule.

## Policies and Services

**MASON HONOR CODE**

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this honor code:

**Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.**

You are expected to familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.

For additional important information, including the Honor Code definitions of cheating, plagiarism, stealing, and lying, see the George Mason University [Academic Integrity page](#).

All work performed in this course will be subject to Mason's Honor Code.

**ACADEMIC INTEGRITY EXPECTATIONS**

1. Working online requires dedication and organization. Proper preparation is expected every week. You are expected to log in to the course each week and complete the assignments and activities on or before the due dates.
2. Students must check their GMU email messages on a daily basis for course announcements, which may include reminders, revisions, and updates.
3. It is expected that you will familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.
4. It is essential that you promptly communicate any questions or problems to the instructor.

**INDIVIDUALS WITH DISABILITIES**

**The university is committed to providing equal access to employment and educational opportunities for people with disabilities.**

Mason recognizes that individuals with disabilities may need reasonable accommodations to have equally effective opportunities to participate in or benefit from the university educational programs, services, and activities, and have equal employment opportunities. The university will adhere to all applicable federal and state laws, regulations, and guidelines with respect to providing reasonable accommodations as necessary to afford equal employment opportunity and equal access to programs for qualified people with disabilities.

Applicants for admission and students requesting reasonable accommodations for a disability should call the Office of Disability Services at 703-993-2474. Employees and applicants for employment should call the Office of Equity and Diversity Services at 703-993-8730. Questions regarding reasonable accommodations and discrimination on the basis of

disability should be directed to the Americans with Disabilities Act (ADA) coordinator in the Office of Equity and Diversity Services.

## **EMAIL POLICY**

Web: [masonlive.gmu.edu](http://masonlive.gmu.edu)

Mason uses electronic mail to provide official information to students. Examples include notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly.

Students are also expected to maintain an active and accurate mailing address in order to receive communications sent through the United States Postal Service

## **ADDITIONAL SERVICES AND POLICIES**

### **UNIVERSITY POLICIES**

Students must follow the university policies. See University Policies.

### **DIVERSITY**

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

### **RESPONSIBLE USE OF COMPUTING**

You are expected to adhere to the university policy for Responsible Use of Computing. See University Policies/Computing.

### **STUDENTS WITH DISABILITIES**

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester.

### **UNIVERSITY LIBRARIES**

University Libraries provides Library services for distance students.

### **WRITING CENTER**

The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing.

You can now sign up for an Online Writing Lab (OWL) session just as you may sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment.

### **COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS)**

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance.

### **FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)**

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights.

**Please See Course Schedule – published separately**