Northeastern
College of Engineering

DAMG 6210 Data Management and Database Design
FALL 2024

Course Information

Course Title: Data Management and Database Design
Number: DAMG 7275
Term and Year: Fall 2024
Credit Hour: 4
CRN: 18746
Course Format: On-Ground

Instructor Information

Full Name: Syed Farhan Mazhar
Email Address: s.mazhar@northeastern.edu

Instructor Biography

Syed Farhan Mazhar has over 18 years of experience in both the service provision industry and academia, where he has held leadership positions. He has a deep passion for teaching and has served as a permanent and visiting faculty member at several reputable higher education institutions, both locally and internationally. His teaching portfolio covers a wide range of subjects, including Computer Science, Software Engineering, Database Systems, Programming Languages, and Project Management.
Syed holds a Master's degree in Software Engineering with a specialization in Intelligent Systems from the University of Alberta, an M.Sc. in Electronics from Karachi University, and is currently a PhD candidate in Computer Science at McMaster University. He has also completed numerous international certifications and training programs, including PMP (Project Management Professional) from PMI, Oracle Certified Professional from Oracle, ITIL Foundations, A+ certification, Mini MBA courses, and Advanced Teaching and Learning Certificates.
His recent research interests focus on managing IT projects, discrete-event systems (including fault diagnosis and detection), formal verification of hardware and software, business process design, data analytics, data cleaning, and database systems.

TA Information:

Full Name: Mayur Govindbhai
Email Address: saparia.m@northeastern.edu

COURSE DESCRIPTION

The Advanced Database Management Systems course is an extension of the Data Management and Database Design course. It uses a data-centric approach to cover the concepts, theories, development and management ofthe architecture, technologies, security, and solutions relevant to working with large volumes of diversified data. Both the NoSQL and relational databases will be covered. This course presents many of the valuable knowledge and skills required for dealing with the data-related challenges.

Standard Learning Outcomes

Learning outcomes common to all College of Engineering Graduate programs:

1. An ability to identify, formulate, and solve complex engineering problems.
2. An ability to explain and apply engineering design principles, as appropriate to the program's educational objectives.
3. An ability to produce solutions that meet specified end-user needs with consideration of public health, safety, and

welfare, as well as global, cultural, social, environmental, and economic factors.

The Information Systems Program accepts students of different engineering backgrounds with minimum programming skills and produces first class Information Systems engineers that operate at the intersection of real-world complexity, software development, and IT management. Graduating students will be able to construct end-to-end advanced software applications that meet business needs.

- Specific Learning Outcomes for the Information Systems program:
- Create a strong technical foundation through diverse, high-level courses
- Built crucial interpersonal skills needed to succeed in any industry
- Foster a deep level of applied learning through project based case studies

Course Outcomes and Assessment Standards

Upon successfully completing the course, students will be able to conduct the following:

- Understand and describe the Architecture of large-scale NoSQL and Relational Database Management Systems
- Design and implement Data Structure for NoSQL Databases based on the data usage pattern
- Implement and manage Data Movement, such as Transaction, Replication and Data Pipelines
- Survey major Data High Availability and Data Locality approaches
- Plan for Disaster Recovery and implement its solutions to meet the business requirements
- Architect and implement the Event-Driven Data Management
- Understand Data Governance and develop code to implement its solutions
- Explore and develop code to work with Data of Complex Relationships
- Write SQL commands to perform advanced data and table manipulation in the context of a prescribed business problem.
- Explain the basic concepts of security and the responsibilities of a database administrator.
- Write PL/SQL anonymous blocks, procedures, functions, triggers and packages to access and manipulate data.
- Create the back-end to a software application using functions, procedures, packages and triggers

PREREQUISITES

INFO 6210, INFO 5100, CSYE 6200, INFO 6205, or consent of the instructor.

BOOKS

Connolly, T. M. & Begg, C. E. (2015)
Database Systems: A Practical Approach to Design, Implementation, and Management (6th Edition) Addison-Wesley Publishing, [ISBN-10: 0-13-294326-3] The 4th or 5th Edition is also acceptable.

Database Systems Design, Implementations and Management- 13th Edition

- By Carlos Coronel, Steven Morris, Peter Rob.

Text Book(s):

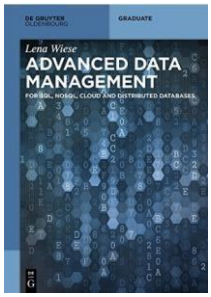
Casteel, Joan. 2013. Oracle 11g: PL/SQL Programming, 2nd Edition. Cengage Learning.
ISBN-13: 9781133947363

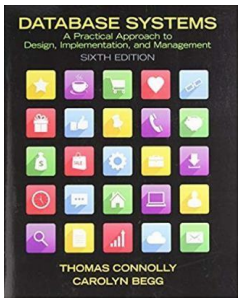
Reference Books:

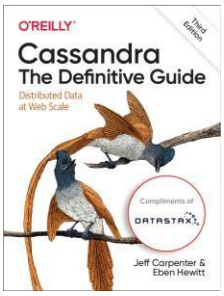
Jeff Carpenter and Eben Hewitt (2020)
Cassandra: The Definitive Guide, 3rd Edition
Published by O'Reilly Media, Inc.

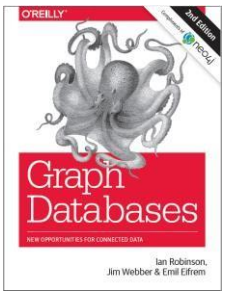
Lena Weise (2015)
Advanced Data Management: For SQL, NoSQL, Cloud and Distributed Databases
De Gruyter, [ASIN: B019LFN2MM]

Ian Robinson, Jim Webber, and Emil Eifrem (2015)
Graph Databases, 2nd Edition
Published by O'Reilly Media, Inc.









These textbooks have been selected because of their breadth and depth of coverage of databases. They are well written and contain many examples. Students should find these books to be useful for several years to come.

Software: Students will need to download and install SQL Oracle database engine or SQL Server Management Studio to their local computers or in a cloud environment (Azure, Google, AWS etc.).
Entity-Relationship Diagram (ERD) tool of your choice is mandatory. Recommended ERD tools include draw.io, ERWin, and Microsoft VisiO

Course Schedule/Topics Covered.

Important Note: Changes may occur to the syllabus at the instructor's discretion. When changes are made,students will be notified via Canvas and/or in-class announcement.

Week	Date	In Class Topic
1		**Introduction** **Review of Data Hierarchy and Aggregation** **Reading** • chapter 1: "Background" (Advanced Data Management)
2		**Overview of Multiple Database** **Reading** • chapter 2: "Relational Database Management Systems" (Advanced Data Management) • chapter 3: "New Requirements, Not only SQL and the cloud" (Advanced Data Management)
3		Multi-Model Database • Management Systems NoSQL • Database Design • Introduction to PL/SQL
4		**Selected Database Issues:** • Security and Administration • Professional, Legal, and Ethical Issues in Data • Management
5		**Selected Database Issues:** • Transaction Management • Query Processing
6		MongoDB (Graph/Document/Key-Value Models) Data Modeling for MongoDB Database
7		Property Graphs vs Knowledge Graphs ADBMS- LAB including PL/SQL Procedure and Function
8		**Distributed DBMSs and Replication:** Distributed DBMSs—Concepts and Design
9		Cosmos DB SQL API Database (Document Data Model) SQL and JSON ADBMS-Transaction Management and concurrency Control II
10		Cassandra Database (Columnar Data Model) Data Modelling for Cassandra Database
11		**The Web and DBMSs:** • Web Technology and DBMSs • Semistructured Data and XML • Database Performance
12		**Business Intelligence:** • Data Warehousing Concepts • Data Warehousing Design • New Database Technologies • Data High Availability, Data Locality and Disaster Recovery

13		**Business Intelligence:** • OLAP • Data Mining • XML Database and XML
14		
15		

EVALUATION:

Assignments balance between theory and practice and between individual and group work.

Assessment	% Grade
Ind Lab Exercises	30%
Discussion	10%
Database project	30%
Final Exam	30%

DATABASE PROJECT

Students will form teams of 4 and develop a relational database based on reading and class lectures. The project will have the following deliverables:

Grading Scale

	87-89.9% B+	77-79.9% C+	
95-100% A	84-86.9% B	74-76.9% C	
90-94.9% A-	80-83.9%B-	70-73.9% C-	69.9% or below F

Attendance/Late Work Policy

Attendance Policy

Students registered in MGEN courses (INFO, CSYE, and DAMG) are allowed **a maximum of 2 absences per course, with 3 or more absences resulting in an automatic 'F' for that course.** Students are expected to inform their instructors of any absences in advance of the class; if a student is sick long-term or experiences a medical issue that prevents class attendance, it is strongly encouraged that they speak with their Academic Advisor (coe-mgen-gradadvising@northeastern.edu) to learn more about the Medical Leave of Absence. Should a student anticipate being unable to attend 3 or more classes, they should discuss their situation with their Academic Advisor to explore other types of leave in accordance with the University's academic and global entry expectations. International students should review the Office of Global Services webpage to understand their visa compliance requirements. Teaching Assistants (TAs) or Instructional Assistants (IAs) will be present at each class to collect student attendance.

Late Work Policy

Students must submit assignments by the deadline in the time zone noted in the syllabus. Students must communicate with the faculty prior to the deadline if they anticipate work will be submitted late. Work submitted late without prior communication with faculty will not be graded.

End-of-Course Evaluation Surveys

Your feedback regarding your educational experience in this class is particularly important to the College of Engineering. Your comments will make a difference in the future planning and presentation of our curriculum. At the end of this course, please take the time to complete the evaluation survey at **https://neu.evaluationkit.com**. Your survey responses are **completely anonymous and confidential**. For courses 6 weeks in length or shorter, surveys will be open one week prior to the end of the courses; for courses greater than 6 weeks in length, surveys will be open for two weeks. An email will be sent to your Northeastern University Mail account notifying you when surveys are available.

Academic Integrity

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to http://www.northeastern.edu/osccr/academic-integrity-policy/ to access the full academic integrity policy.

MGEN Student Feedback

Students who would like to provide the MGEN unit with anonymous feedback on this particular course, Teaching Assistants, Instructional Assistants, professors, or to provide general feedback regarding their program, may do so using this survey: https://neu.co1.qualtrics.com/jfe/form/SV_cTIAbH7ZRaaw0Ki

University Health and Counseling Services

As a student enrolled in this course, you are fully responsible for assignments, work, and course materials as

outlined in this syllabus and in the classroom. Over the course of the semester if you experience any health issues, please contact UHCS.

For more information, visit https://www.northeastern.edu/uhcs.

Student Accommodations
Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.

For more information, visit https://drc.sites.northeastern.edu.

Library Services
The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for education specific resources, visit https://library.northeastern.edu
Network Campus Library Services: Northeastern University Library Global Campus Portals

24/7 Canvas Technical Help
For immediate technical support for Canvas, call 617-373-4357 or email help@northeastern.edu
Canvas Student Resources: https://canvas.northeastern.edu/student-resources/
For assistance with my Northeastern e-mail, and basic technical support:
Visit ITS at https://its.northeastern.edu
Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

Diversity and Inclusion
Northeastern University is committed to equal opportunity, affirmative action, diversity, and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration, and an awareness of global perspectives on social justice.
Please visit http://www.northeastern.edu/oidi/ for complete information on Diversity and Inclusion
Title IX
Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.

Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty, and staff.

In case of an emergency, please call 911.

*Please visit **https://www.northeastern.edu/ouec** for a complete list of reporting options and resources both on- and off-campus.*