Northeastern University
College of Engineering

DAMG 6210 Data Management and Database Design

Course Information
Course Title: Data Management and Database Design
Course Number: DAMG 6210
Term and Year: Spring 2022
Credit Hour: 4 Credits
https://canvas.northeastern.edu/

Instructor Information
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Technical/Course Materials Requirements

BOOKS

Jeffrey A. Hoffer, V.Ramesh, Heikki Topi

Modern Database Management Hoffer Database Management, Tenth Edition

Prentice Hall, [ISBN-13: 978-0-13-608839-4]

Dusan Petkovic (2016)

Microsoft SQL Server 2016: A Beginner's Guide, Sixth Edition

McGraw Hill, [ISBN: 978-1259641794]

Additional resources:

W3schools SQL Tutorial will be leveraged to develop basic SQL skills. This learning will be used to support more extensive SQL development enhancing the course objectives.

T-SQL Querying (Developer Reference) 1st Edition https://www.amazon.com/T-SQL-Querying-Developer-Reference-Ben-Gan/dp/0735685045

SOFTWARE

Students will need to download and install SQL Server database engine and SQL Server Management Studio to their local computers or in a cloud environment (Azure, Google, AWS etc). The Developer Edition of SQL Server 2016/17/19 is recommended. **SQL Server 2019** is preferred. In addition to SQL Server, Microsoft Visio or Toad Data Modeler is required.

Course Description/Prerequisite

Studies design of information systems from a data perspective for engineering and business applications; data modeling, including entity-relationship (E-R) and object approaches; user-centric information requirements and data sharing; fundamental concepts of database management systems (DBMS) and their applications; alternative data models, with emphasis on relational design; SQL; data normalization; data-driven application design for personal computer, server-based, enterprisewide, and Internet databases; and distributed data applications

Student Learning/Course Outcomes (SLOs)

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

- Describe the rationale for designing and deploying database management systems

- Translate business requirements to conceptual, logical, and physical model

- Communicate the various forms of data integrity (domain, entity and referential)

- Define the process of developing a fully normalized database design

- Explain the structural components of databases (entities, attributes, data types & indexes)

- Perform queries and analysis of data using SQL programming language

- Articulate concepts of ACID properties and principles of transaction management

Attendance Policy

Students are expected to complete course readings, participate in class discussions or other learning activities during the unit, and complete written assignments for each unit during the time of that unit. It is understood that there might be one week when active participation in ongoing class conversations and learning activities might be delayed.
Beyond one week time, if there is an absence or lateness in participation (1) faculty must be notified in advance; (2) grades will be adjusted accordingly.

Late Work Policy

Students must submit assignments by the deadline in Eastern timezone 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.

Grading/Evaluation Standards

Work in this course will be graded to criteria. In other words, you won't be graded on a curve. Each assignment is designed to test your achievement against one or more of the learning objectives. Different assignments emphasize different learning objectives. The meanings of grades are described below. Assignments balance between theory and practice and between individual and group work.

Grade Scale

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

EVALUATION:

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

Assessment	% Grade
Mid-Term	25%
Final	30%
Participation	5%
Homework	5%
Quizzes	5%
Database project	30%

DATABASE PROJECT

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

Deliverable	% of grade
P1. Topic and Objectives	3
P2. Database Design, Initial ERD	7
P3. Final ERD	5
P4. Database Implementation	8
P5. Presentation	7

Total Project   **30%**

The rubrics for the project grading is Completeness 40%, Correctness 40%, and Creativity 20%.

P1. Topic and Objectives

Form a team of a four members. Each team will collaborate to decide a database topic. The database topics may be like Book Store, University Registration, etc. Each team will also establish the mission statement and identify the mission objectives that the database will accomplish. The mission objectives may be like Book Sale, Inventory Control, etc.

* One submission per team

Database Design and Initial ERD

Based on reading and class lectures, each team will create an initial Entity-Relationship diagram (ERD) that depicts a database for a real or fictitious business. This database will allow for data collection, processing, and reporting for an organization. It is strongly suggested that each team model a database for a type of organization that they have relatively deep understanding---such as the current or previous work experience or perhaps a personal hobby. In the past, students have created databases to capture data about video rental stores, bike repair shops, beer tasting/review professionals, athletic leagues, and airlines. Students are encouraged to use their imagination!

Each team will submit an ERD for the database of their choosing. The target for the initial ERD is 10 entities or more. In addition to the ERD, students should submit a database design document containing the description of the business problems being addressed by their database, list all entities and how they are related to each other, and key design decisions.

For the part of the business problems being addressed, this section could be like the mission objective document completed earlier. Additionally, and more importantly, this document should contain your team's key database design decisions, such as why an entity is included and how that entity is related to other entities.

* Entity-Relationship Diagramming tool, Microsoft Visio or Toad Data Modeler can be downloaded for free.

* One submission per team

Final ERD

Based on the instructor's feedback of the initial ERD, each team will make improvements to the initial ERD. Most likely, these changes will be regarding further 'normalization' of the database entities, reducing redundant data, and recognizing additional entities.

In addition to submitting a fine-tuned ERD, each team will also submit a brief description identifying the changes made to the initial ERD. It is also important to update the design document to reflect the new design changes. Resubmission of the updated design document is not required at this time.

* One submission per team

Database Implementation

Each team will submit the 'SQL code' to implement the database design as well as enter a minimal amount of data (at least 10 rows for each table) using the SQL INSERT scripts, Data Import Wizard, and/or stored procedures. Specific objects to be reflected in the code include the database, tables, data types, primary and foreign keys, and views.

Each team is expected to create the following database objects:

•   at least 3 stored procedures containing input and output parameters

•   at least 2 views (often used for reporting purposes).

•   At least 1 trigger

•   The implementation must include at three of the following three items:

•   Table-level CHECK Constraints

•   Computed Columns based on a function

•   Column Data Encryption

•   Non-clustered indexes

•   A simple Power BI report/ or a GUI (a plus, not required)

* Submission instruction:

•   1 .sql file containing all DDLs for all database objects created.

•   1 .sql containing insert statements for data population

•   A zipped file containing files used for GUI, dashboard or reports.

Project Presentation

Each team will present the database design project to the class. The presentation should include the following items.

1)   A Power Point slide deck, containing highlights, to showcase the project

2)   The design documents

3)   The final ERD

4)   The SQL DDL statements for implementing the database

5)   At least two views for reporting purposes and the SQL DDL statements used to create them

6)   At least one reports (Using PowerBI/SSRS (not required). Other data mining tools could also be used.)

7)   Only one member of team needs to submit the presentation materials

Course Schedule

Week	Topic	Reading
Week 1	General Database Purpose and Development History	chapter 1: "Database Environment and Development Process" (Hoffer, Ramesh, & Topi)
Week 2	Entity–Relationship Modeling	chapter 2: "Modeling Data in the Organization" (Hoffer, Ramesh, & Topi)
Week 3	Enhaced Entity–Relationship Modeling (EER)	chapter 3: "The enhanced E-R Model" (Hoffer, Ramesh, & Topi)
Week 4	Conceptual and Logical Database Design	chapter 4: "Logical Database Design and the Relational Model" (Hoffer, Ramesh, & Topi) chapter 3: "SQL Server Management Studio" (Petkovic)
Week 5	Physical Database Design	chapter 5: "Physical Database Design and Performance" (Hoffer, Ramesh, & Topi) chapter 4: "SQL Components" (Petkovic)
Week 6	Introduction to SQL: Data Definition Language & Data Manipulation Language	chapter 6: "Introduction to SQL" (Hoffer, Ramesh, & Topi) chapter 5: "Data Definition Language" (Petkovic) chapter 7: "Modification of a Table's Contents" (Petkovic)
Week 7	Multiple Table Processing: JOINS and Subqueries	chapter 6: "Queries" (Petkovic) chapter 7: "Advanced SQL" (Hoffer, Ramesh, & Topi) page 289- 310
Week 8	Persistent Stored Module	chapter 7: "Advanced SQL" (Hoffer, Ramesh, & Topi) from page 320 - end of chapter chapter 8: "Stored Procedures and User-Defined Functions" (Petkovic)
Week 9	Transaction Management / ACID Properties	ACID Property: https://en.wikipedia.org/wiki/ACID_(computer_science) https://en.wikipedia.org/wiki/Concurrency_control chapter 13: "Concurrency Control" (Petkovic)
Week 10	Introduction to Data Warehouse and Multi-Dimensional Modeling	chapter 22: "Business Intelligence: An Introduction" (Petkovic) chapter 9: "Data Warehousing" (Hoffer, Ramesh, & Topi)
Week 11		https://en.wikipedia.org/wiki/NoSQL

	Introduction to NoSQL and Big Data	https://www.thoughtworks.com/insights/blog/nosql-databases-overview https://en.wikipedia.org/wiki/Big_data https://docs.microsoft.com/en-us/sql/advanced-analytics/what-is-sql-server-machine-learning?view=sql-server-2017
Week 12	Final Presentation	None

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.

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 http://www.northeastern.edu/drc/getting-started-with-the-drc/.

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 http://subjectguides.lib.neu.edu/edresearch.

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, member 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 www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.