DAMG/DMDD 6210 Fall 2022

Course Goals

This course covers topics related to Database management, design, Entity relationship modeling, Normalization, Understand, Relational and Non-Relational Databases and Transaction management

- Basic concepts of DBMS
- Relational Algebra
- Client/Server architecture
- Database Design principles
- Hands-on with SQL, DML, TCL, DDL
- Convert an ER model to Database structure
- Transaction management, Concurrency control
- Different types of locking mechanisms
- Overview of –
    - Performance Tuning
    - Scaling
    - Load balancing and Fail over
    - Database clustering concepts and advantages
    - Cloud, On-Prem and Hybrid database implementations methods.
    - Database security
    - Database Auditing
    - Data masking

Course Information

DAMG6210 - Data Management and Database Design
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, enterprise wide, and Internet databases; and distributed data applications.

Course weekly schedule details are here (Below)

Lecture_Date	**Topics**
9/10/2022	Course Overview Introduction to DBMS Client - Server Architecture overview Why SQL and NoSQL Databases
9/17/2022	Codd's Rules Why Data modeling Data models Entity & Attribute Relationships What type of documents expected for Project Delivery
9/24/2022	Normalization SQL Introduction
10/01/2022	Relational Algebra, Design Implementation using SQL High level architecture, SDLC, DML, Constraints, Data dictionary, DML, Views, MAT Views, User Grants and Permissions
10/08/2022	Aggregation, Grouping data sets, Architecture high level, Exercise questions, Date functions, Analytical functions, demo, Why Data warehouse
10/15/2022	Review ER diagram with teams
10/22/2022	**Mid Term Exam** **Review ER diagram with teams**
10/29/2022	ETL vs ELT, Pl/SQL,Triggers Bulk Loads importance
11/02/2022	Indexes and Performance tuning, Types of locks.

11/12/2022	CAP Theorem, OLTP, Datawarehouse concepts, Business Intelligence, Centralized vs Decentralized
11/19/2022	Performance tuning, Intro to Advance topics, Security, SQL Injection
11/26/2022	**No Class**
12/03/2022	Project Demo
12/10/2022	Project Demo
12/17/2022	**Final Exam**

Grading

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

- **Absolute** grading system is used and Late submission **5%** reduction each day.
- Course grades will be based on participation, assignments, exams, and presentation of your group project.
- Midterm and Final exam must be taken at the time and location determined by the schedule and announced in class.
- Make up exams permitted only for exceptional circumstances in accordance with NEU policy .
- There is **NO** rounding of **marks** or **percentage**.

4 Assignments (2 of 4 will be in class)	30%
Exam (Multiple choice, True / False) Syllabus: From Week#1 till exam Day.	30%
Project work	40%

Grading scheme

Grades scored %	**Grade**
94% and 100%	**A**
90% and < 94%	**A-**
87% and < 90%	**B+**
84% and < 87%	**B**
80% and < 84%	**B-**
77% and < 80%	**C+**
74% and < 77%	**C**
70% and < 74%	**C-**
0% and < 70%	**F**

Academic Integrity

- Midterm and Final exams are individual effort and collaboration of any kind would be considered violation.
- For group activities, you are strongly encouraged to work with your group and submissions must be done by each individual.
- Don't share your code to other teams.

Academic Integrity Policy | Office of Student Conduct and Conflict Resolution (northeastern.edu)

Project

Students will work in team to present the project in class at the end of the semester. Project items should be submitted as per the scheduled dates.

Below is the list of Deliverables expected as a part of project submission by each student. Each team member must know all the deliverables and should be in a position to explain and present.

Team should submit final soft copy during DEMO exam.

What is expected during project submissions?

1. PowerPoint slide explaining each team member contribution
2. Project should contain all the below topics covered and scripted. The script should be successfully executed in the demo to deploy the code to database on your laptop and

you have to execute the transactions to prove data is inserted, updated and deleted successfully

   a. Tables
   b. Views
   c. Indexes
   d. Triggers
   e. Stored procedures, functions, packages with well-defined exception handling
   f. Execution of stored process, functions and packages

3. Reports – Minimum 5 different types of Reports showing the value of the project. The reports should justify the problem statement which proves the purpose of automation
4. Entire code should be available on GitHub, and you have to prove the check in and checkouts over a period of time. I don't want to see last minute code check-ins for entire code
5. Proper names to be used for all the objects/entities/attributes/constraints
6. None of the code should be executed as Admin / System / DBA account. Additionally, only required permissions should be provided to application owner schema.
7. Security is very critical and hence appropriate users to be created and environment should contain only required permissions. If there is no proper security implementation, then you get straight ZERO marks for all subsequent project items.
8. Well defined flow charts, test cases to be presented and should prove the business logic flow.
   a. Every phase of the project is critical. Business flow diagrams should be created
   b. Logic flow must be clearly explained using data flow diagrams
   c. Implementation must match the data flow diagrams
   d. ER diagram will be the blueprint of the project and must contain all the objects that you plan to implement and appropriate versions should be maintained for review
9. Every program module must contain proper exception handling and must clearly report the error based on the flow diagram.
   a. User defined exceptions must return a proper error message
   b. System errors must be trapped and clearly return back with appropriate / relevant error message back to the user
10. Every script that you submit should contain appropriate inline comments to explain the purpose of the functionality. Clearly document the steps for the script(s) execution steps. If any of the script(s) fails to execute multiple times, then you get ZERO marks.

All items carry equal weightage.

Project Delivery Item#	List of deliverables	weightage in Percentage
1	Team formation Project Topic Problem statement	10%

	Objective Database Design document (Business problem and how its addressed with this solution) Entity Relationship Diagram with clear relations defined [Draft] Document Entity and Attributes with Datatypes defined. Each team will present the ERD in the class.	
2	Revised ERD [Final version] Business rules to be clearly documented and defined Define Security (User level access, permissions) Incorporate all the changes suggested in the review session.	10%
3	Create & Execute SQL scripts - DDL (environment creation, users/security roles, grants, tables, indexes, views, triggers, sequences, etc) Transaction management (Stored procs/packages/functions) Reports - VIEWS Instructions as how to run the scripts (DDL, DML, Views, Stored procs, etc) to be clearly specified.	10%
4	Demo / Presentation Must present the business flow such as registration/enrollment/on-boarding flow, Transaction management (Inventory), shipments/deliveries, etc.,	5%

Resources

- **Database Systems Design, Implementations and Management** By Carlos Coronel, Steven Morris, Peter Rob.
- **Database Management Systems** By Raghu Ramakrishnan, Johannes Gehrke

Tools and Software

Students are responsible for the cost to acquire tools and software. Instructor or University will not be responsible for any of the charges incurred.

Source code to be maintained on **Github** (Links to an external site.)

Basic Software Downloads **Knowledge Base - Northeastern Service Portal** (Links to an external site.)

Data Modeling with **Oracle SQL Data Modeler (Links to an external site.)**

Database IDE with **Oracle SQL Developer** (Links to an external site.)

Oracle Database server via **Oracle Software Delivery (Links to an external site.)**

Oracle Cloud for Database server configuration and setup