

Database Systems: Concepts, Design, and Implementation

ISE 382 (4 Units)

Spring 2016



Course Description

Data model for industry applications. Modeling and designing robust databases. Implementing and querying databases with SQL. Innovations in database applications.

Objectives

To prepare students to model and build databases. Upon completion of the course, students will be able to:

- Create relational data models
- Perform normalization to eliminate anomalies
- Convert models to functioning databases
- Use Structured Query Language (SQL) to build and query databases
- Demonstrate effective use of database management systems such as
 - Microsoft Access
 - Oracle DBMS
 - MySQL DBMS
 - Teradata DBMS
- Test and validate database implementation with transactions
- Explain how database transactions are controlled in multiuser environments
- Describe database security and maintenance
- Describe the innovations and uses of databases in diverse applications

Instructor

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Office hours

2-4 Wednesday in OHE 412

3-5 Thursday, online <https://bluejeans.com/351861442>

Prerequisite

None

Lecture

12 – 1:50 TTh, ZHS 163

Discussion (choose one)

11 – 11:50 F, KAP 107

9:30 – 10:20 F, KAP 107

Course Builder (leads discussion)

Saurabh Agrawal, ssagrawa@usc.edu

Grader

Ines Guinard, guinard@usc.edu

Website

Blackboard.usc.edu

All lecture notes, assignments, news, announcements and grades will be posted on Blackboard. Students are expected to check Blackboard regularly. Students can customize their personal notification settings in Blackboard to be notified of class updates.

Software

Several software tools will be used in this class. All software will be available remotely (via Viterbi Virtual lab)

- Microsoft Excel
- Microsoft Word
- Microsoft Access
- Microsoft SQL Server
- Oracle Database
- MySQL Database
- Erwin Data Modeler
- Teradata SQL Assistant

Required Textbook

Database Systems, 11th Edition, *Coronel/Morris*, Cengage Learning, ISBN 978-1-285-19614-5

Grading

The weight of graded material during the semester is listed below.

Homework	15%
Projects	25%
Exam 1	30%
Exam 2	30%
Total	100%

Grading Scale

The following shows the grading scale to be used to determine the final letter grade.

A 100-95

A-	95-92
B+	92-89
B	89-86
B-	86-83
C+	83-80
C	80-77
C-	77-74
D+	74-71
D	71-68
D-	68-65
F	65 or below

Projects

There are three projects in all: *1, 2 and Final*. All projects are group projects. Teams of 2-3 students each will be formed mid semester. The three projects are separate projects although they use similar skills that students learn during the semester. The project scenarios are different.

Grading of projects: Each project score will be divided into three parts.

Implementation	40%
Completion and correctness	40%
Anonymous team member evaluation	20%

Policies

No make-up exams (except for documented medical or family emergencies) will be offered nor will there be any changes made to the Final Exam schedule, except as permitted by university rules.

It is the responsibility of the student to make sure projects and assignment are turned in on time. Make sure you follow the procedures outlined in each assignment or project. Late assignment submissions will be subject to a late penalty. No assignments will be accepted later than five days from the due date.

Incomplete and Missing Grades

Excerpts for this section have been taken from the University Grading Handbook, located at <http://www.usc.edu/dept/ARR/grades/gradinghandbook/index.html>. Please see the link for more details on this and any other grading concerns.

A grade of Missing Grade (MG) “should only be assigned in unique or unusual situations... for those cases in which a student does not complete work for the course before the semester ends. All missing grades must be resolved by the instructor through the Correction of Grade Process. One calendar year is allowed to resolve a MG. If an MG is not resolved [within] one year the grade is changed to [Unofficial Withdrawal] UW and will be calculated into the grade point average a zero grade points.

A grade of Incomplete (IN) “is assigned when work is no completed because of documented illness or other ‘emergency’ **occurring after the twelfth week** of the semester (or 12th week equivalency for any course scheduled for less than 15 weeks).”

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards*<https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

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Jan 12: Lecture 1 - Introduction

- Brief history of databases and their role in information systems
- Different types of databases and their organizational context
- Survey of DBMS

Reading Assignment: *Chapter 1*

Jan 14: Lecture 2 - Data Modeling

- Overview of Data Models
- Business Rules
- Relational data model

Reading Assignment: *Chapter 2*

Homework 1: *Create a data model for a college using ERWin Data Modeler. Due Date: End of week 2*

Jan 19: Lecture 3 – Data Modeling contd.

- Entities
- Attributes
- Relationships

Reading Assignment: *Chapters 2 and 3*

Jan 21: Lecture 4 – Data Modeling contd.

- Keys: Primary, Foreign, candidate, surrogate, super
- Minimum and maximum cardinality
- Relationship strength: Identifying and non-identifying

Reading Assignment: *Chapter 3*

Jan 26: Lecture 5 – Entity-Relationship diagrams

- E-R diagrams for modeling business requirements
- Degrees of relationships
- Associative entities

Reading Assignment: *Chapter 4*

Homework 2: *Create an ER model for a small business. Add cardinality, relationship strength, degrees of relationship. Due Date: End of week 4*

Jan 28: Lecture 6 – Entity-Relationship Models contd.

- Subtypes and supertypes

Reading Assignment: *Chapter 5*

Feb 2: Lecture 7 – Update, insert and delete (CRUD)

- Handling update, insert and delete records for various types of relationships

Reading Assignment: *Instructor notes*

Feb 4: Lecture 8 – Normalization

- Anomalies and the need for normalization
- Normal forms

Reading Assignment: *Chapter 6*

Homework 3: *Normalize database tables to fourth normal form. Due Date: End of week 5*

Feb 9: Lecture 9 – Normalization contd.

- First normal form
- Second normal form
- Third normal form

Reading Assignment: *Chapter 6*

Feb 11: Lecture 10 – Normalization contd.

- Boyce-Codd, Fourth normal form
- De-normalization

Reading Assignment: *Chapter 6*

Feb 16: Lecture 11 – Exam 1

Feb 18: Lecture 12 – No Class

Feb 23: Lecture 13 – Structured Query Language

- Data Definition Language (DDL)
- Data Manipulation Language (DML)

Reading Assignment: *Chapter 7*

Homework 4: *Use SQL to convert college data model into a database. Due Date: End of week 7*

Feb 25: Lecture 14 – SQL (contd)

- SELECT queries

Reading Assignment: *Chapter 7*

Homework 5: *Use SELECT queries to query the college database. Due Date: End of week 8*

Mar 1: Lecture 15 – SQL (contd)

- Sub queries

Reading Assignment: *Chapter 8*

Mar 3: Lecture 16 – SQL (contd)

- Querying multiple tables using JOIN
- Working with Sub queries and JOINS

Reading Assignment: *Chapter 8*

Project 1: *Create a database for a medical office using Microsoft Access. Due Date: End of week 10*

Mar 8: Lecture 17 – SQL (contd)

- Constraints
- Indexes
- SQL Functions
- Aggregation
- Grouping

Reading Assignment: *Chapter 8*

Mar 10: Lecture 18 – SQL (contd)

- Advanced JOINS
- Cross join, inner join, outer join, full join
- Correlated subqueries
- Relational set operators: Union, intersect
- Views

Reading Assignment: *Chapter 8*

Mar 22: Lecture 19 – CRUD with SQL

- Insert
- Update
- Delete

Reading Assignment: *Chapter 8*

Mar 24: Lecture 20 – CRUD with SQL contd.

- Triggers
- Stored procedures

Reading Assignment: *Chapter 10*

Mar 29: Lecture 21 – Multiuser databases

- Concurrency in multiuser databases
- Database transactions and their properties
- Transaction management
- Locking methods

Reading Assignment: *Chapter 10*

Project 2: *Create a database for a college using MYSQL. Load data, write SQL to query the database. Due Date: End of week 12*

Mar 31: Lecture 22 – Database security

- Disaster preparedness
- Backup and Recovery strategies
- Securing databases
- SQL Injection

Reading Assignment: *Instructor notes*

Apr 5: Lecture 23 – Database applications

- Client/Server architecture
- Database applications and their environments
- Database connectivity – ODBC/JDBC etc.
- Apps, web and mobility

Reading Assignment: *Chapter 14*

Apr 7: Lecture 24 – Exam II

Apr 12: Lecture 25 – Database applications contd.

- ERP systems
- E-commerce
- Social networks
- Cloud computing

Reading Assignment: *Instructor notes*

Apr 14: Lecture 26 –Business Intelligence Systems

- Big data
- Data warehouses and data marts
- Business reporting and intelligence
- Data mining

Reading Assignment: *Chapter 13*

Homework 6: *Use OLAP tools to query the data warehouse. Due Date: End of week 13*

Apr 19: Lecture 27 –Final Project

Project description: Model, design, and implement a database for electronic health records (EHR)

Project technology: ERWin data modeler etc

- Part I
 - Identify requirements
 - Identify business rules
 - Model the data
 - Design ER diagram
 - Convert ER diagram to physical database model
 - Normalize the tables
 - Implement database tables
- Part II
 - Populate tables
 - Test database with sample transactions
 - Validate design
 - Query database for patient records etc.
- Part III
 - Discuss security, privacy, backup and restore capability

Apr 21: Lecture 28 – Final Project contd.

Apr 26: Lecture 29 – Final Project contd.

Apr 28: Lecture 30 –Innovations in database systems

- Distributed databases
- NoSQL databases
- Columnar storage
- In-memory databases for real time analytics

Reading Assignment: *Instructor notes*

Final Project due on Viterbi IT database server and on Blackboard (no late projects will be accepted)

May 11: Peer evals due