Database Systems for Analytics

ITP 250 (2 Units)

USC Viterbi School of Engineering

Course Description

Concepts in modeling data for analytic applications. Designing and implementing robust databases. Querying databases to extract business intelligence.

Objectives

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

- Model data using Entity-Relationship model
- Perform Normalization to Boyce-Codd Normal Form
- Design real world databases
- Use Structured Query Language (SQL) to build and query databases
- Describe the importance of Business Intelligence: Reporting and data mining
- Enumerate the differences between SQL and NoSQL databases, and between row and column stored databases.

DRAFT

Prerequisites

None.

Lecture

1.5 hours/week

Lab

1.5 hours/week

Course Structure

Students are expected to:

- Participate in lecture discussions and critiques
- Complete weekly lab assignments and projects
- Manage and complete individual class projects

Students are responsible for completing all assignments by stated deadlines.

Required Textbook

Database Systems: Design, Implementation, and Management, 11th Edition, *Carlos Coronel*, ISBN: 978-1285196145

Grading

The weight of graded material during the semester is listed below.
No extra credit assignments will be offered.

Homework	25%
Final Project	15%
Midterm	30%
Final Exam	30%
Total	100%

Grading Scale

The following shows the grading scale to be used to determine the 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*

DRAFT

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 projects will be reduced a letter grade per day after the assignment was due. No projects 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)."

Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to your course instructor (or TA) as early in the semester as possible. If you need accommodations for an exam, the form needs to be given to the instructor at least two weeks before the exam.

DSP is located in STU 301 and is open from 8:30am to 5:00pm, Monday through Friday. Contact info: 213-740-0776 (Phone), 213-740-6948 (TDD only), 213-740-8216 (FAX), ability@usc.edu, http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html.

DRAFT

Emergency Preparedness/Course Continuity in a Crisis

In case of emergency, when travel to campus is difficult, if not impossible, USC executive leadership will announce a digital way for instructors to teach students in their residence halls or homes using a combination of the Blackboard LMS (Learning Management System), teleconferencing, and other technologies. Instructors should be prepared to assign students a "Plan B" assignment that can be completed 'at a distance.' For additional information about maintaining your classes in an emergency, please access: http://cst.usc.edu/services/emergencyprep.html

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.htmlprovides 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.

DRAFT

Database Systems for Analytics

ITP250 (2 units)

Course Outline

Week 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*
Homework*: None*

Week 2 — Data Modeling
- Data Models
- Business Rules
- Relational and Entity-Relationship Modeling

Reading Assignment: *Chapters 2 and 3*
Homework: *Create a data model for sales order processing*

Week 3 — Data Modeling (con't)
- Entities, attributes, relationships
- Keys
- Minimum and maximum cardinality
- E-R model for modeling business situations

Reading Assignment: *Chapters 2 and 3*
Homework: *Create a data model for health records*

Week 4 — Entity-Relationship Models
- Degrees of relationships
- Weak Entities

Reading Assignment: *Chapter 4*
Homework: *Create an ER diagram for a college*

Week 5 — Entity-Relationship Models (cont.)
- Subtypes and supertypes

Reading Assignment: *Chapters 4 and 5*
Homework: *Create an ER diagram for a hospital*

Week 6 — Normalization
- Anomalies and the need for normalization

DRAFT

- Normal forms
- First, second, third, Boyce-Codd, Fourth normal form
- Denormalization
- Constraints
- Indexes

Reading Assignment: *Chapter 6*
Homework: *Normalize several databases to 4NF*

Week 7 — Structured Query Language

- Creating a database using MySQL
- DDL
- DML

Reading Assignment: *Chapter 7*
Homework*: Convert college ER model to MYSQL database*

Week 8 — SQL (cont.)

- SELECT queries
- Querying multiple tables
- Difference between Sub query and join for querying multiple tables

Reading Assignment: *Chapter 7*
Homework: *Populate the college database*

Week 9 — ***Midterm Exam***

Week 10 — SQL (cont.)

- SQL Functions
- Aggregation
- Grouping

Reading Assignment: *Chapter 8*
Homework: Run queries against the college database

Week 11 — SQL (cont.)

- Advanced JOINs

Reading Assignment: *Chapter 8*
Homework: Do joins (inner, outer, correlated) on multiple tables in college database

DRAFT

Week 12	Business Intelligence Systems - Big data - Data warehouses and data marts - Business reporting and intelligence - Data mining **Reading Assignment**: *Chapter 13* **Homework***: Draw a star schema for health record database*
Week 13	Query Performance and Optimization **Reading Assignment**: *Chapter 11* **Homework***: Performance metrics for queries against large database*
Week 14	Other Database Systems - NoSQL **Final Project***: Model, build and implement a database for flight reservations*
Week 15	Other Database Systems - Columnar and in-memory databases
Week 16	**Final Exam**

DRAFT