LIS 2680: Database Design and Applications [Current as of: 1/5/16]

Spring 2016

Class time: **Thursdays 9:00pm – 11:50pm**
Location: **411 IS Building**

Instructor:

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CourseWeb URL: http://courseweb.pitt.edu

I. Course Description:

This course offers an examination of characteristics and concepts of database design, which includes database development process, entity-relationship mode, relational database models, normalization, structured query language (SQL), basics of transaction management and physical database design; current database technologies; and database applications in libraries and archives.

The course aims at helping students to develop a broad understanding of modern database design. The teaching method is a mixture of theoretical lectures and practical exercises. Besides weekly lectures, an essential part of the course is the final term project through which students design and develop a practical database system for library access, electronic commerce, information retrieval, or a similar application. The final project involves the use of a database management system (DBMS), the database language SQL and MS frontpage 2003 or (optionally) a language used in Web applications such as PHP, Javascript, Java, or Perl.

II. Course Goals

Upon finishing this course, the students should be able
- to understand the basic concepts, models and components of modern database systems.
- to gain experience with both theoretical and practical aspects of database design

- to be able to design and develop a simple database project using existing database management systems.
- to understand the current state and likely future directions of database applications in library science and information science in general.

III.   CourseWeb Information:

CourseWeb is a Web-based system using BlackBoard software that facilitates course-related communication as well as distribution of course materials and grades. You can access CourseWeb at http://courseweb.pitt.edu . You must log in with your University Computer Account – this is the one that goes with your 'pitt.edu' e-mail address. If you do not have a Pitt account, please contact Computing Services (CSSD) at 412-624-HELP [4357] to find out how to get one. Course-related e-mail will be sent to your Pitt e-mail account. If you do not read e-mail on your Pitt account, you are responsible for forwarding any e-mail received on your Pitt account to the e-mail address that you use. See http://accounts.pitt.edu/ for information on managing your Pitt account and forwarding e-mail. If you have trouble logging in to CourseWeb, you may need to log in to the accounts website above to activate your Pitt e-mail account. Call 412-624-HELP with any problems relating to your account.

IV.   Required textbooks and Readings

- Peter Rob, Carlos Coronel. Database Systems: Design, Implementation, & Management. Any edition between 2004 and 2014, Thomson Course Technology, 2010.[1]
- Hernandez, Michael J. Database design for mere mortals: a hands-on guide to relational database design. Pearson Education, 2013.

Complementary materials will be distributed during the class when appropriate.

V.   Course Schedule Summary

Week	Date	Theme	Topics
1	January 7	Introduction	Introduction to database and DBMS Introduction to the course Lab 1: Software preparation
2	January 14	Data Models, Relational DB	Data Models Relational Database Lab 2: Access, MySQL, DBTools, PostgreSQL
3	January 21	ER Model	Quiz 1 Entities and Relations ER Diagram

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[1] There are plenty of used versions of this book available online or at the university book store. You can get much cheaper one (usually about $10 to $20) to buy online rather than buying a new one.

			Lab 3: Visio Tutorial Assignment 1
4	January 28	Normalization	Normalization and Normal forms Normalization and DB Design Lab 4: Normalization Assignment 2
5	February 4	DB Design	Quiz 2 Design Procedure Conceptual Design Lab 5: DB Design
6	February 11	SQL	SQL Lab 6: SQL Project Deadline
7	February 18	SQL 2	SQL 2 Lab 7: SQL 2
8	February 25	SQL 3	Quiz 3 SQL 3 Lab 8: SQL 3 Assignment 3
9	March 3	Midterm Exam Team Talks	Exam in the first 90 minutes Project Proposal Talks
	March 10		Spring Break University closed
	March 17		No class
10	March 24	XML	XML Query Lab 9:
11	March 31	Internet Database Environment	Quiz 4 Object-Oriented Modeling, Distributed DB and NoSQL Lab 10: CouchDB Assignment 4
12	April 7	Database Management	Database Transaction Management, Lab 11:
13	April 14	Database Applications in	

		Libraries	Lab 12:
14	April 21	Data Mining and Data Warehouse	Quiz 5 Data Mining Data Warehouse Lab 13:
15	April 28	Student Team presentations	

VI.   Assessment

Participation 10%

Class attendance is required for success in this course, as material covered in class may not be included in the readings. Participation is based on the following two activities:

1. off-class contribution to each week's "my comments" after the class (5 participation points). Your comments should be posted in the discussion board of the courseweb. Total 10 responses will be needed for earning the 5 participation points, each of which counts .5 participation point.
2. in class 10-minute quiz. Throughout the semester, we will have total five quizs. Each will last for about 10 minutes at the beginning of the class. Each quiz lasts for about 10 minutes, and a full mark in each quiz will contribute to the 1 participation point in the final grade.

If you must miss a class, please notify the teaching assistant, and make arrangements to obtain course notes and handouts. Makeup exams and quiz will not be offered except under extreme circumstances.

Assignment 32%

There are total four assignments, each of which will count 8% in the final course score. The deadline of submitting each assignment is before 9am of the due date. Each 24 hours delay will have 40% deduction of the maximal score. No submission later than 2 days will be accepted except in the case of emergencies and personal disasters.

Exams 28%

The exam will last 90 minutes, and covers all the topics taught in the weeks before it. Common exam questions include multiple choices, short definitions, and discussion questions.

Previous year's exam questions and answers can be located at the past exam section in the Courseweb.

Term Project 30%

Please see section VIII for detail description of term project.

Course Grading Scale:

The final grade depends on the percentage of points you have earned, and the definition of letter grades is:
- 90 <= A- < 93, 93 < A <= 97, 97 < A+ <= 100
- 80 <= B- < 83, 83 < B <= 87, 87 < B+ < 90
- 70 <= C- < 73, 73 < C <= 77, 77 < C+ < 80
- 60 <= D < 70,
- F < 60

VII. Detailed Course Schedule

Week 1 Introduction

Objectives: After this class, you should be able to
  – tell the difference between data and information
  – understand what is database, database management
  – articulate the reasons for having database systems
  – tell the history of modern databases
  – understand what you will learn from this course
  – tell what you expected to achieve in this course

Required Readings
- Rob&Coronel, Chapter 1

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Week 2 Data Models and Relational Databases

Objectives: After this class, you should be able to
  – tell and understand the different degrees of data abstraction
  – tell the idea behind hierarchical and network models
  – understand the logical view of data in relational model
  – understand the characteristics of relational operators
  – able to calculate the outcomes of relational operators

Required Readings:
- Rob&Coronel, Chapters 2 and 3

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Week 3 Entity-Relation Modeling

Objectives: After this class, you should be able to

– tell how to define and refine relationships in database design
– understand how to develop a ER diagram for database design

Required Readings:
• Rob&Coronel, Chapter 4.

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Week 4 Normalization

Objectives: After this class, you should be able to
– understanding what normalization is and its role in database design
– tell 1NF, 2NF, 3NF, BCNF, and 4NF
– able to transform tables from lower normal forms to higher normal forms
– understand that normalization and ER modeling are used concurrently to produce a good database design

Required Readings:
• Rob&Coronel, Chapter 5

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Week 5 DB Design

Objectives: After this class, you should be able to
– understand that a successful database design must reflect the information system of which the database is a part
– understand Systems Development Life Cycle (SDLC) and Database Life Cycle (DBLC)
– know how to conduct evaluation and revision within the SDLC and DBLC frameworks
– tell the pros and cons of database design strategies: top-down vs. bottom-up design, and centralized vs. decentralized design

Required Readings:
• Rob&Coronel, Chapter 8

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Week 6 SQL 1

Objectives: After this class, you should be able to
– understanding the basic commands and functions of SQL
– able to use SQL for data administration (e.g. create tables, indexes)

   –   able to use SQL for data manipulation (e.g., add, modify, delete data)

Required Readings:
- Rob&Coronel, Chapter 6

Week 7 SQL-II

Objectives: After this class, you should be able to
- understanding the basic commands and functions of SQL
- able to use SQL for data administration (e.g. create tables, indexes)
- able to use SQL for data manipulation (e.g., add, modify, delete data)

Required Readings:
- Rob&Coronel, Chapter 7

Week 8 SQL III

Objectives: After this class, you should be able to
– _understand the advanced commands and functions of SQL
– _able to use SQL join operator and relational set operators
– _able to use SQL subqueries and correlated queries
– _able to use SQL for data administration (e.g. create tables, indexes)

Required Readings:
  _Coronel, Chapter 7&8

Week 11 XML for Database

Objectives: After this class, you should be able to
– _Describe basic concepts of XML
– _explain why XML is important to Web database development

Required Readings:
  _Coronel, Chapters 14

Week 12 Internet Database Environment

Objectives: After this class, you should be able to
– _explain client/server architectures
– _understand the internet and database connection
– _list common internet architecture components

Required Readings:
  _Coronel, Chapters 14

Week 13 DB and Library

Objectives: After this class, you should be able to
   – define e-commerce and identify e-commerce companies
   – describe the styles and architecture of e-commerce
   – explain the issues related to e-commerce
   – explain why and how the client server architecture is extended
   – identify and explain simple ColdFusion code

Required Readings:
   • Rob&Coronel, Chapters 13 and 14

Week 14 Data Warehouse and Data Mining

Objectives: After this class, you should be able to
   – explain the difference between operational data and decision support data
   – explain the concepts of data warehouse, online analytical processing, and why they are needed
   – explain star schemas as the extension to RDBMS for ROLAP
   – define data mining and identify patterns and issues in it

Required Readings:
   • Rob&Coronel, Chapter 12

VIII. Term Projects

Introduction:

The term project is designed for students to integrate and extend knowledge acquired throughout the course and to apply that knowledge to solve a problem of substantial scope. The task is to propose, plan and develop a prototype database system to handle a real problem that matters to real people, although there could be some degree of simplification to down scale the effort to solve the problem.

Requirements to the Report

The final outcome of your term project should include two major components:
1. Database design. A report (about 2000 words) which includes:
    a. Problem statement
    b. Database overview and scope
    c. Conceptual schema
    d. Data dictionary
    e. Sample SQL queries
2. Database Implementation. You are free to use whatever techniques and database management systems to implement the database. The minimal requirements are that the database implementation should have functions such as data entry, update, querying, and simple report.

Milestones for the project:
Introduction of term project:	week 2
Project topic deadline:	week 5
Project proposal presentation:	week 9
Final project report and demo:	week 15

When writing either your assignment essays or project reports, please follow one of the established styles for reference and citation (visit "Research, Writing, and Style Guides" (http://www.aresearchguide.com/styleguides.html) for various existing styles). However, you are highly recommended to adopt the American Psychological Association APA style (the fifth edition of the *Publication Manual of the American Psychological Assocation* published by the American Psychological Association (2001)). "A Guide for Writing Research Papers" (http://webster.commnet.edu/apa/) is a wonderful online place to obtain the guidance for this style.

IX. Course Policies

Ground rules for class discussion

On-class interaction and discussion will be an important means of learning in this course, therefore, it is important that we work together to create a constructive environment by observing these rules:
- You should participate in the discussion of ideas.
- You should respect diverse points of view.
- You should aware the diverse backgrounds of peers.
- You may not belittle or personally criticize another individual for holding a point of view different than your own
- Your use of language should be respectful of other individuals or groups

Plagiarism

It is expected that the work you submit in this course will be your own. While collaboration is allowed for the course project, it should be approved in advance and the nature of each contribution should be specified in the project proposal and the final submission.

The following statement is taken from *The Teaching Assistant Experience: A Handbook for Teaching Assistants and Teaching Fellows at the University of Pittsburgh* (A.P. Haley and J.M. Nicoll, eds.)]

> Plagiarism means submitting work as your own that is someone else's. For example, copying material from a book or other source without acknowledging that the works or ideas are someone else's and not your own is plagiarism. If you copy an author's words exactly, treat the passage as a direct quotation and supply the appropriate citation. If you use someone else's ideas, even if you paraphrase the wording, appropriate credit should be given. You have committed plagiarism if you purchase a term paper or submit a paper as your own that you did not write[2].

> Plagiarism is a violation of the University of Pittsburgh's standards on academic honesty, and violations of this policy are taken seriously. **From the *Guidelines on Academic Integrity: Student and Faculty Obligations and Hearing Procedures* (effective September, 1995):**

A student has an obligation to exhibit honesty, and to respect the ethical standards of the historical profession in carrying out his or her academic assignments. Without limiting the application of this principle, a student may be found to have violated this obligation if he or she:
- Presents as one's own, for academic evaluation, the ideas, representations, or words of another person or persons without customary and proper acknowledgment of sources.
- Submits the work of another person in a manner which represents the work to be one's own. [Quotation ellipsed.] [3]

Special Needs

Students with disabilities who require special accommodations or other classroom modifications should notify the instructor and the University's Office of Disability Resources & Services (DRS) no later than the 2nd week of the term. Students may be asked to provide documentation of their disability to determine the appropriateness of the request. DRS is located in 216 William Pitt Union and can be contacted at 648-7890 (Voice), 624-3346(Fax), and 383-7355(TTY). Students who must miss an exam or class due to religious observances must notify the instructor ahead of time and make alternative arrangements.

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[2] B. G. Davis, *Tools for Teaching* (San Francisco: Jossey-Bass, 1993), 300.

[3] University of Pittsburgh, *Guidelines on Academic Integrity: Student and Faculty Obligations and Hearing Procedures* (Pittsburgh: University of Pittsburgh, 1995), 7-8.