Department of Electrical and Computer Engineering
University of Puerto Rico
Mayagüez Campus

Syllabus for ICOM 5016
Introduction to Database Systems
Fall 2015

1. Faculty

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2. Course Description

Introduction to Database Management Systems, with emphasis on relational database design and application development. Study of Entity-Relationship Model, Relational Model, Object-Oriented Model and Object-Relational Model. Techniques for database design: E-R modeling , UML modeling, E-R to relational mappings, functional dependencies, and normalization. Discussion of Structured Query Language (SQL), Applications servers and DBMS, XML and Web applications. Introduction to Transaction Processing and Database Recovery. Overview of DBMS implementation techniques: Storage Management, Indexing and Access Methods, Query evaluation and optimization.

3. Pre-requisites

ICOM 4035 or equivalent. Proficiency with C++ or Java, and UNIX.

4. Time and Place

Lecture: MJ 2:00 PM – 3:15 PM @ S-113

Laboratory: There will be no laboratory in this course

5. Credits

3 credits

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[1] Syllabus originally prepared by Dr. Manuel Rodríguez

6. Class Web Page

http://ece.uprm.edu/~bvelez/site/?page_id=1635

You are responsible to read this Web page periodically to obtain class materials, and other important announcements about this class.

7. Textbooks

Required:

Database System Concepts, 6th Ed.
Abraham Silberschatz, Henry F. Korth, and S. Sudarshan
McGraw-Hill, 2010
ISBN: **0073523321**

8. Grading

Your grade will be based <u>**exclusively**</u> on the scores that you obtain in the class projects, and exams. The curve to be used to assign a grade to your score will be as follows:

<u>Score</u>	<u>Grade</u>
100 – 90	A
89 – 80	B
79 – 70	C
69 – 65	D
64 – 0	F

Your total score will be calculated from your individual scores in the projects, exams and laboratory assignments. The weights assigned to each of these categories are as follows:

Term Project	35%
Midterm Exams (3)	45%
Final Exam (Comprehensive)	20%

Hence your final score will be determined as follows:

Final Score = (0.35 * Term Project Score) + (0.45 * Sum of Scores in Midterms) + (0.20 * Final Exam Score)

There will be no special project, no special homework, no special exam, nor any other kind of "*special work*" to improve grades. However, each project or exam might have an extra credit problem that you can use to help improve your score in that corresponding category. **The term project will have three phases, and you must submit a working version of each project phase in order to pass this class.**

9. Exams

In this course, there will be three midterm exams and a comprehensive final exam. Unless otherwise indicated, all exams will be taken with closed books and closed notes. The midterm exams will be administered outside the regular class time. The date and time for each midterm exam will be as follows:

Exam Number	Date	Time	Place
I	September 22, 2015	8:00 PM – 10:00 PM	S-113
II	October 20, 2015	8:00 PM – 10:00 PM	S-113
III	November 17, 2015	8:00 PM – 10:00 PM	S-113

The final exam will be administered in accordance with the schedule specified by the Registrar of the University of Puerto Rico, Mayagüez Campus. ***NOTE: THE FINAL EXAM CANNOT AND WILL NOT BE A TAKE HOME FINAL***.

Each question included in each exam (midterm or final) will be either a **multiple-choice question, or a written answer question**. The questions will ask you to provide an answer that serves as:

- Explanation of a technical concept.
- Proof of a mathematical proposition.
- Correct relational algebra expression.
- Correct SQL query for a given expression.
- Solution to a problem using the concepts discussed in class.
- Programming question.

10.1 Exam Reposition Policy

In this course, there will be **NO** repositions for missed midterm exams. If a student misses one midterm exam due to a valid justification underlined previously approved by the professor then that score will be replaced with the average score obtained on the other two midterm exams. **Any other missed midterm exam will carry a score of 0.**

10. Incomplete Grade Policy

A student will receive an incomplete grade if and only if the student misses the **final exam** and has a valid excuse. Such excuse must be one of the following:

- Medical certificate indicating illness.
- Legal certificate indicating an appointment to attend a Court of Law.
- Certificate from a hospital or a physician indicating the death of either: parent, child, husband, wife or sibling.

11. Vacation/Coop

The UPRM Academic calendar is published well in advanced to the start of the academic years. Do not schedule vacations, internships, or COOP programs within the academic period for classes or exams. **You will not be excused and no arrangements for alternate dates for exams will be made.**

12. Term Project

In this course you will be **required** to complete a term project, consisting of the design and implementation of an original full-fledged mobile database application. Specifically, you will build a mobile app that is coupled to a database server as a storage backend. This application will manage all business tasks associated with a trading site for goods and services (such as ebay but with services such as pool cleaning or car detailing included). This app will allow the user to complete the following (but are

not limited to) tasks: browsing for items, ordering items, checking the status of an order, and generating reports about sales based on some time-related parameter. At the end of the semester, you will deliver a complete solution similar to the mobile portals used by stores such as Ebay, OverStock, or uBid. More details will be given during the second week of the course.

You will work in teams of three students, and you can use your own laptop computer, or the facilities of the INCADEL Computer Center or the AMADEUS Computer Center. The project will constitute 35% of your grade. The project will be completed in three phases, and each phase will have the following weight on the final term project grade (which is 35% of your grade):

Phase	Weight
Phase I: E-R Modeling and App Design	25%
Phase II: Relational Design and Implementation	25%
Phase III: Operational System and Final Report	50%

Hence, your final project grade can be computed as follows:

Project Score = (0.25 * Score Phase I) + (0.25 * Score Phase II) + (0.50 * Score Phase III)

Unless otherwise indicated, all projects are due by 11:59 PM of the given due date. The projects must be implemented using any combination of the following technologies:

- **Client Side**
  - iOS
  - Android
  - jQuery Mobile
  - Kendoui
  - Titanium

- **Server Side**
  - **Web Framework**
    - Node.js + Express.js
    - Java Play Framework
    - Django (with raw SQL) and REST API
    - Apache 2 Web server

  - **Database Engine**
    - MySQL
    - PostgreSQL
    - MS SQL Server
    - Oracle

You must use a SQL database engine (excluding SQLite). You must use raw SQL to connect to the database on all server side code. Projects that use an Object Relational Mapper (ORM) (e.g., Hibernate, Django ORM) will be considered as not running, and will get a score of 0.

Each phase of the project will be graded by the teaching staff during an interview at the professor's office. At this interview, your code will be evaluated, compiled, tested, and run. In addition, you will be asked

questions about the structure and functionality of your code. **All groups must maintain a repository with all Java code, HTML code, SQL scripts, Javascript code, documentation, etc., for each phase of the term project.** These repositories must be maintained **at Github.com** (https://github.com/edu), where you can have free private repositories with your @upr.edu account. Students in groups that do not submit the materials for one of the phases will automatically receive a grade of F in the class. **All groups MUST submit a working Phase III to receive grade in the class.** Students in groups that do not submit a working Phase III will automatically receive a grade of F in the class. A working Phase III is a project that completes and generates the output for the set of tasks for phase III to be specified in the project description document. This project description document will be handed out to you in class.

Each project phase will be graded following a scheme that counts the group effort as well as your individual effort. At each interview, the project will be tested for functionality, and a score between 0 and 85 will be given to it. Then, you will be asked certain questions about the overall project functionality, and also about the specific parts that you worked on. You will get between 0 and 15 points for these questions. Thus, the total points for each phase will be 100. Since this is a group project, it is important for each group member to contribute fairly to the effort needed to complete the project. Hence, your score for each phase of the project will be multiplied by a **weight factor** to obtain your final score for each phase. This weight factor will capture your effort in helping complete the project phase. The weight factor will be computed from the average **effort score** that each one of your peer group members will give you. Each student will provide an effort score to the other members of the group. **This process will be confidential, and none will know the specific effort scores that a student gives to other students.** The value of the effort score runs between 0 and 10, with 0 indicating no effort, and 10 indicating full participation. For each student, the average of the effort scores will be computed, and then divided by 10 to obtain the weight factor to be used in computing the final score for a given project phase. The following example should help clarify this whole process. Suppose that the group of student Ann Diaz obtained an initial score of 90 for phase I of the project. The two peers did all the work, and Ann Diaz simply wrote the report the night before the due date. The two peers of Ann Diaz gave her the following effort scores: 4 and 3. Then, Ann Diaz final score in the phase I of the project is computed as follows. First the average of the effort scores, 4 and 3, is obtained, yielding a value of 3.5. This value is divided by 10, to obtain the weight factor which is 0.35. Then, the final score for Ann Diaz for phase I will be 0.35 x 90, which equals 32. Notice that the lack of effort dropped Ann from 90 to 32! As you can see, students that do not work on the project will receive a poor score. Hence, each group member must take an active role in making the project a success.

13. Class attendance

Attendance to the class is mandatory. You will be required to sign an assistance sheet that will be used to keep track of your attendance.

14. Use of laptops/tablets/smartphones during class time

The use of laptops, tablets, smartphones and other portable devices in class is only allowed for class-related work.

15. Academic Integrity

Each student and/or student team is expected to work individually on all exams and project assignments. You may not share your answers to the programming assignments. You may not use code from another student, or code that you find on the Internet or any similar resources. You may not share your code with another student. Failure to comply with these requirements will result in a grade of F in the course for the

student(s) breaking these rules. Unauthorized group efforts, particularly during exams, will be considered academic dishonesty and the students involved will receive an F in the course. You should read Article 10 of the "Reglamento General de Estudiantes de la Universidad de Puerto Rico" to learn more about the possible sanctions that you might experience if caught in an act of academic dishonesty.

16. List of Topics

The following is a list of the course topics in the order in which they will be presented. This list is subject to change and it will vary depending on the pace of the lectures.

TOPICS:

1. Discussion of the Course Syllabus

2. Entity-Relationship Model

3. OO and UML Modeling

4. Relational Model of Data

5. Relational Algebra

    a. Selection Operator

    b. Projection Operator

    c. Join Operator

    d. Set-oriented Operators

    e. Aggregate Operators

    f. Data Cube Operator

6. E-R to Relational Mappings

7. Structured Query Language (SQL)

    a. Data Definition Language

    b. Data Manipulation Language

8. Web-based Application Development

    a. Middle-tie Architectures

    b. Web Servers

    c. Servlets

    d. Model-View-Controller Design Pattern

    e. Web Services

9. Integrity and Security in Databases

    a. Triggers

10. Normalization Rules and Functional Dependencies

    a. First Normal form

    b. Second Normal Form