CIS 8040 – Fundamentals of Database Management Systems
Course Syllabus
Buckhead Center, Room 627
Wednesdays 5:30-9:45 PM

Instructor:
Dr. Wael Jabr
Email: wjabr@gsu.edu
Phone: 404.413.7363
Office hours: By appointment

Prerequisites:
CIS 3210 or CIS 3260.

Textbook & Supplementary material:

A good supplementary resource: http://ovid.cs.depaul.edu/Classes/CSC355-S14/CSC355-links.htm

Suggestions for (optional) reading material from students are also appreciated (please email them to me).

Course Catalog Description:
Developing and managing efficient and effective database applications requires understanding the fundamentals of database management systems, techniques for the design of databases, and principles of database administration. This course emphasized database concepts, developments, use and management in three main sections: database concepts, practice, and emerging trends. Relational database systems are the main focus, but other types, including object-oriented databases, are studied. Practical design of databases and developing database applications using modern software tools will be emphasized.

Detailed Course Description:
Upon successfully completing this course, the student will:
1) Understand the fundamentals of relational, object-oriented, and distributed database systems including: data models, database architectures, and database manipulations
2) Understand the theories and techniques in developing database applications and be able to demonstrate the ability to build databases using enterprise DBMS products such as Oracle or SQL Server.
3) Be familiar with managing database systems
4) Understand new developments and trends in databases.
**Course Project:**
The project consists of a research report and presentation on a topic of your choice that is relevant to the course. It is group-based. Check the course site for details.

**Course Software:**
Oracle SQL Developer will be used for hands-on activities. It is an integrated environment for the development and management of Oracle Database and is available to you for free. Check the course site for download instructions.

**Typical class session:**
Class sessions will comprise (1) lecture/discussion of certain database software concepts and features, (2) instructor demonstrations of these same database software concepts and features, and (3) student lab sessions working with these same database software concepts and features.
The purpose of this pedagogical approach is to introduce and reinforce ideas and skill sets so that students can master these on their own after class hours. To bring this knowledge to a highly proficient, professional level, students will have to spend time and effort outside of class using the system.
To ensure that you have the basic knowledge that will allow you to function on your own after class, be sure to ask the instructor questions during class, either during the lecture/discussion, demo, or lab.

**Classroom guidelines:**
Attendance is not mandatory but highly recommended.
Coming to class fully prepared helps push the conversation much further.
Make-up exams are not available (except for excused absences).
Individual deliverables are to be submitted individually and group work is collaborative.

**Grading:**
Deliverables

<table>
<thead>
<tr>
<th>Deliverables</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Lab Assignments</td>
<td>25%</td>
</tr>
<tr>
<td>Project</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm</td>
<td>25%</td>
</tr>
<tr>
<td>Final exam</td>
<td>25%</td>
</tr>
<tr>
<td>Participation</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
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*Late submission policy: deliverables submitted after their due date will be penalized 10% per day. No submission is accepted after the fifth day.*

**Letter Grade Scale**

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<th>98</th>
<th>94</th>
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<th>79</th>
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<th>68</th>
<th>65</th>
<th>62</th>
<th>Less than 61</th>
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<tbody>
<tr>
<td>A+</td>
<td>A</td>
<td>A-</td>
<td>B+</td>
<td>B</td>
<td>B-</td>
<td>C+</td>
<td>C</td>
<td>C-</td>
<td>D+</td>
<td>D</td>
<td>F</td>
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Additional information: Refer to [http://www2.gsu.edu/~wwwfhhb/sec400.html](http://www2.gsu.edu/~wwwfhhb/sec400.html) for additional guidance on instructional information.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Deliverables</th>
<th>References</th>
<th>Downloads</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to database management systems - Basic concepts&lt;br&gt;Databases Modeling</td>
<td>Project assignment</td>
<td>S&amp;E: Ch. 1 – pp. 1-20&lt;br&gt;S&amp;E: Ch. 2 – pp. 31-42; 51-53; 60</td>
<td>Hierarchical Data Model&lt;br&gt;Network Data Model&lt;br&gt;Intro. Slides&lt;br&gt;DBMS Concepts Slides&lt;br&gt;Semantic Modeling Slide</td>
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<td>2</td>
<td>The Relational Data Model&lt;br&gt;Conceptual Design: Mapping Relational Model</td>
<td>Lab 1 assigned</td>
<td>S&amp;E: Ch. 3 – pp. 65-71&lt;br&gt;S&amp;E: Ch. 3 – pp. 72-89</td>
<td>ER for class example&lt;br&gt;Relational Data Model Slides&lt;br&gt;Mapping the ER Model Slides&lt;br&gt;Perfect Pets Practice Specs&lt;br&gt;Perfect Pets ER Solution</td>
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<tr>
<td>3</td>
<td>SQL an introduction&lt;br&gt;SQL (DDL)&lt;br&gt;SQL (DML)</td>
<td>Lab 1 due</td>
<td>S&amp;E: Ch. 4 - pp. 169-191; 201</td>
<td>Oracle SQL Developer - Installation&lt;br&gt;SQL Slides</td>
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<tr>
<td>4</td>
<td>SQL (Oracle specific)</td>
<td></td>
<td>S&amp;E: Ch. 5 – 213-267&lt;br&gt;S&amp;E: Ch. 6 – pp. 288-311</td>
<td>Oracle SQL / Oracle DDL&lt;br&gt;Oracle Char. Func.&lt;br&gt;Oracle Numeric &amp; Date Functions&lt;br&gt;Oracle Parameters, Variables, &amp; Views&lt;br&gt;Oracle PL/SQL Intro.&lt;br&gt;R.A. Example Answers from In-class exercise</td>
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<td>5</td>
<td>Midterm&lt;br&gt;Relational Commands, Embedded SQL, Stored Procedures, Triggers&lt;br&gt;&lt;br&gt;Guest Speaker</td>
<td>Lab 2 assigned</td>
<td></td>
<td>Relational Views and the System Catalog Slides&lt;br&gt;Flavio Villanustre; VP - Infrastructure &amp; Security at HPCC Systems &amp; LexisNexis</td>
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<td>6</td>
<td>Exam Review Functional Dependencies, Normalization&lt;br&gt;&lt;br&gt;Guest Speaker</td>
<td></td>
<td>S&amp;E: Ch. 7 - pp. 319-334</td>
<td>Normalization Slides&lt;br&gt;Kent's Five Normal Forms Article&lt;br&gt;Matt McGivern; Managing Director, Business Intelligence &amp; Data Governance Lead at Protiviti</td>
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<td>7</td>
<td>Database administration – Transaction Management – Concurrency ControlObject</td>
<td>Lab 2 due&lt;br&gt;Lab 3&amp;4 assigned</td>
<td>S&amp;E: Ch. 8; pp. 353-370</td>
<td>Database Administration&lt;br&gt;Oracle User Creation</td>
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*While we will follow this syllabus throughout the term, some changes might be necessary.*

## Schedule of Readings & Questions

<table>
<thead>
<tr>
<th>Session</th>
<th>Topic</th>
<th>Readings</th>
<th>Questions</th>
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</thead>
</table>
| 1       | Introduction to database management systems - Basic concepts Database Modeling | Codd, E. F. “A Relational Model of Data for Large Shared Data Banks.” *Communications of the ACM* 13, no. 6 (1970): 377-387. (Focus on sections 1.3 and all of section 2.) *(available through library* – requires username & password) | 1. What is the notion of data independence? Why is it important?  
2. Codd spends a fair amount of time talking about "Normal forms". Why is it important that a database be stored in a normal form?  
3. What are the key ideas behind the relational model? Why are they an improvement over what came before? In what ways is the relational model restrictive?  
4. What, according to Codd, are the most important differences between the "hierarchical" model (as exemplified by systems like IMS) and the relational model that Codd proposes? Make sure you understand what Codd means by "Data Dependencies". |
2. What is the distinction between BCNF and 3NF? Is there a reason to prefer one over the other?  
3. Think about a data set you have worked with recently, and try to derive a set of functional dependencies that correspond to it. What assumptions did you have to make in modeling your data in this way?  
4. How is it that ER modeling generally leads to BCNF/3NF schemas? |
| 7       | Database administration | Chang, F. et al. "Bigtable: A Distributed Storage System for Structured Data." ODIS, 2006. *(PDF)*. Ovide, S. Once Again, Oracle Must Reinvent Itself; As Larry Ellison Leaves CEO Post, Company Faces Major Shifts Reshaping Its Market. Wall Street Journal Sept. 19, 2014 *(available through library).* | 1. What is the tradeoff between coarse granularity (e.g., table-level) and fine granularity (e.g., tuple-level) locks in a database system?  
2. What are the performance tradeoffs between the different degrees of locking? |
| 8       | Big Data & NoSQL |  | 1. In what ways does Bigtable replicate the behavior of a relational database? How is it different?  
2. Could Google have built Bigtable using a relational system? Would that have been a good idea? Why so?  
3. What consistency guarantees does Bigtable provide in the face of failures?  
4. What is a distributed lock service? |
Appendix
MSA Program Goals and Objectives

Goals:
Students completing the MS in Analytics will:

G1 Understand organizational problems in general and associated analytical problems in particular.
G2 Proficient in the management of data needed for decision-making.
G3 Proficient with the methodological skills needed for data-driven decision-making.
G4 Understand the implementation issues that accompany analytical problem solving.
G5 Be able to demonstrate the positive impact on analytics on organizations.

Objectives/Learning Outcomes (LO):
After finishing the program students are expected to have mastered the knowledge and skills to carry out the following analytical tasks:

LO1 Frame Business Problems (G1) MSA students will properly frame a business problem.
LO2 Frame Analytical Problems (G1) MSA students will demonstrate the ability to properly solve analytical problems.
LO3 Data Management (G2) MSA students will effectively acquire, clean, and manage both structured and unstructured data.
LO4 Methodology (G3) MSA students will identify and apply the appropriate methodology for the business and analytical problem(s) identified.
LO5 Modeling (G3, G4) MSA students will build and deploy analytical models across organizations that fit the underlying organizational needs and the analytical problem(s) identified.
LO6 Programming (G4) MSA students will solve analytical problems by utilizing computer programming, both by employing available tools where possible and by developing customized solutions where necessary.
LO7 Life Cycle Management. (G3, G4) MSA student(s) will develop adaptable models that allow for continued organizational improvement of productivity and quality.
LO8 Organizational Impact (G5) MSA student(s) will effectively communicate the positive, strategic impact of a model on the firm to which it is being applied.