Class meeting time and place:
This is an asynchronous online class.

Catalog Description:

Extended Description:
This course focuses on approaches to and methods for designing relational databases. After almost half a century of development, and challenges from various competing paradigms, relational databases remain to be the industry standard for data persistence. A high-quality relational database can help leverage an organization’s data and information assets for better fulfillment of its mission. On the other hand, a poor, problem-ridden database can complicate even the simplest data-driven functions within the organization. There are various factors that determine the quality of a relational database. An indispensible prerequisite for establishing a high-quality database is a robust database design. This course covers principles and methods for logical and physical database design, as well as SQL, a language for maintaining relational databases, and managing and querying data held in relational databases.

Goals:
After completing this course the student will be able to:

1 This syllabus is subject to change. Please check the course ELMS space frequently for updates.
- understand and define fundamental concepts in relational databases,
- develop a logical database design,
- develop entity-relationship diagrams,
- normalize relational database tables,
- develop a physical database based on a logical design,
- perform CRUD (create, read, update, delete) operations on relational databases

**Elements of the Course:**

**Modules:** The course will be delivered as a sequence of modules on Canvas (ELMS), each of which will cover one or a few key concepts regarding relational databases or skills in database design. Each module will combine one or more learning components, such as videos, slideshows, examples, exercises and assignments. (Not all modules will involve all of these components.) Each module will have a due date by which it should be completed with all of its components, including assignments, if any. Students may choose to complete the modules at a faster pace, but have to complete each module by its due date in order to stay on track and be on time with assignment submissions. See the Course Plan further below for a list of modules and completion due dates.

**Examples and Exercises:** Some modules will include examples and exercises. Students are expected to observe and analyze the examples, and then try applying what they have learned on a number of ungraded exercises. You are encouraged to seek the instructor’s help if and when you encounter problems working on the exercises. Students’ work on and solutions for the exercises will not be submitted and will not be graded.

**Online Help Sessions:** Students will have the opportunity to work with the instructor online if they need and want to. Online sessions will be scheduled based on the need and the availability of the student and the instructor. We will use Adobe Connect and Team Viewer (available free of charge at [http://www.teamviewer.com](http://www.teamviewer.com)) for online help sessions, as needed.

**Assignments:** Students will work on a number of graded assignments throughout the semester. Students are expected to **work on these assignments individually, and not receive any help from classmates or other individuals.** If any of the assignment due dates is a holiday for you,
please inform the instructor in advance, so an alternate due date can be set for you. Students’ solutions for the assignments will be submitted via Canvas (ELMS) and will be graded.

Instructor’s feedback and grades will be posted on Canvas, as well.

**Peer-Coached Individual Project:** Students will work on a semester-long project to develop a logical design for a small-scale, non-trivial relational database, and subsequently implement the design in a physical database. Each student will be in a two-person peer-coaching team. The two students in a given team will work on the same topic, but each student will develop their own database and make their individual submission for the project. Each student will be responsible for their own work on the project and its submission, and will only be graded on their individual work. Partners in a team will coach each other as they work on their projects by sharing ideas and perspectives, and by critically evaluating each other's work in a constructive manner. Working on the same topic will allow them to understand and evaluate each other's work more easily, and will have the additional benefit of learning from each other's work. **Students are free to form their project coaching pairs, and responsible for coordinating all logistics of peer-coaching teamwork. If you are not able to find a project coaching partner, the instructor may suggest someone with whom you can form a pair.**

Students will apply what they learned in the course modules to the design of their database, starting with logical design and then moving on to physical design. Each student will work on the logical and physical design of their separate database while maintaining the peer-coaching relationship with their project partners. Once the logical and physical design stages are completed, students will populate their databases with sample data and run CRUD operations on their databases. Each student will populate their database separately. (I.e., students in a pair will not share work in populating their databases.)

Coaching pairs will choose their topic in consultation with the instructor. Project work will begin only after the topic, the scope and other particulars of the project are fully and explicitly approved by the instructor. There are at least two ways in which you can approach starting this project: 1) You may start by identifying a project partner and working with that person on possible topics for your database, or 2) you may start by identifying a possible topic, and then go on to looking for a partner who would want to work on that topic as your project partner. In either case, you should start working on this as soon as possible, and identify your possible topic and project partner within the first two weeks of the course.
Students are not allowed to receive any help from classmates (other than their project coaching partner,) or other individuals. Each student will submit their own project deliverables via Canvas (ELMS) for review and grading. Instructor’s feedback and grades will be posted on Canvas, as well.

The following stages of the project will be graded as separate elements:
- Proposal
- Logical design (including an E-R diagram, and normalization as necessary),
- Physical design (including data type choices and queries for building the physical database),
- Sample data and CRUD operations.
- Final report and project log/diary. (A final report will summarize the overall project. Students will keep a log/diary of their activities on the database throughout the semester, including the challenges faced at different stages of the project and how they were solved. The log/diary will be included in the report as a section of an appendix.

The database and the report will be of professional quality, in the sense that they could be used as the basis for development of an actual relational database in an actual organization. Further details about the expectations for the project and submission deadlines will be given on the course website on Canvas.

Active Interaction with Instructor (including Progress Updates): The students are expected to maintain active interaction with the instructor during the semester. At a minimum, you are expected to
- Reply in a timely manner to the instructor’s emails that are addressed specifically to you, and
- Email the instructor weekly updates about your progress. See the course plan further below for exact dates by which to email the updates.
You are not required to reply if an email is sent to the whole class, a reply from each student is not explicitly requested, and the issue(s) covered in the email do(es) not apply to you.

Grading:
Assignments 30%
Project - Proposal 5%
Project - Logical Design 15%
Project - Physical Design 15%
Project - Sample Data and CRUD 15%
Project - Project Diary and Report 15%
Active Interaction with Instructor 5%

Texts:
Peachpit Press. ISBN: 0321553578 / 978-0321553577
(An electronic version might be available for purchase/download.)
A few chapters from this book will be made available on electronic reserves.
Other: Several other readings from different sources will be made available on electronic reserves. See the course plan below regarding those readings.

Required Software:

We will use the freely-available MySQL Database Server and the MySQL Workbench application to work on exercises and to build our project databases in this course. Please install the software on your computer at your earliest convenience. You should complete installing the required software by the end of the first week of the course. The instructor will help you with installation as needed, but you are responsible for starting the process and getting in touch with the instructor with any issues that may emerge during the installation process.

As an alternative to installing the MySQL Database Server, you may want to download an install XAMPP. XAMPP is a “distro” that includes various software components along with MySQL Database Server. Some of the software components that come along with MySQL Database Server, such as Apache Web Server, may be useful in other courses (such as INFM 747 - Webenabled Databases) in the future. However, since we will not use any of the other software components that come in the XAMPP distribution in this course, you may want to stay with just the MySQL Database Server component, if you are not planning to take any courses (such as INFM 747) that might require some of the other software components that come in the XAMPP distribution. If you decide to install XAMPP, install Workbench only after installing XAMPP.

(Important: Newer versions of XAMPP come with MariaDB, instead of MySQL. While MariaDB is quite similar to MySQL, it is different enough for the purposes of what we will do in this course; so, you are advised to download and install XAMPP version 5.5.28, one of the last XAMPP releases that include MySQL, rather than MariaDB. If you are in doubt
about what version of XAMPP you have downloaded, contact the instructor before attempting an installation.)

MySQL Workbench is a GUI (graphical user interface) tool that allows connecting to and working on the MySQL Database Server. Although there are other GUI tools available for working with the MySQL Database Server, I require that you use MySQL Workbench, since it provides all the functionality that we need for this course as far as a GUI tool is involved, such as entity-relationship diagramming, forward engineering of ERDs into physical database, reverse engineering of physical databases into ERDs, and SQL query development and execution.

You can download the software components through the links provided on the Canvas site for the course on the Software page; you will need both the MySQL Server (or XAMPP 5.5.28, which includes MySQL Server), and MySQL Workbench. If you need help with installation and configuration, contact the instructor as soon as possible.
Policy on Academic Misconduct
Cases of academic misconduct will be referred to the Office of Student Conduct irrespective of scope and circumstances, as required by university rules and regulations. It is crucial to understand that the instructors do not have the choice of following other courses of actions in handling these cases. **There are severe consequences of academic misconduct, some of which are permanent and reflected on the student’s transcript.**

Different instructor may define academic misconduct differently. For this section of this course, academic misconduct includes, but is not necessarily limited to,

- copying or presenting another person’s work as a whole or in part, such as diagrams, figures, charts, graphs, text, equations;
- making one’s work available to another person as a whole or in part including elements mentioned above;
- doing another person’s course-related work that includes developing elements mentioned above.

If you are not sure whether a particular action constitutes academic misconduct, consult with the instructor before committing that action.

For details about procedures governing such referrals and possible consequences for the student please visit [http://osc.umd.edu/OSC/Default.aspx](http://osc.umd.edu/OSC/Default.aspx)

University of Maryland Code of Academic Integrity:
"The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit [http://shc.umd.edu/SHC/Default.aspx](http://shc.umd.edu/SHC/Default.aspx)."

Special Needs
The University is legally obligated to provide appropriate accommodations for students with disabilities. The campus’ Disability Support Services Office (DSS, [http://www.counseling.umd.edu/DSS/](http://www.counseling.umd.edu/DSS/)) works with students and faculty to address a variety of issues ranging from test anxiety to physical and psychological disabilities. If a student or instructor believes that the student may have a disability, they should consult with DSS (3013147682 or Dissup@umd.edu). Note that to receive accommodations, students must first have their disabilities documented by DSS. The office then prepares an Accommodation Letter for course instructors regarding needed accommodations. Students are responsible for presenting this letter to their instructors. Students encountering psychological problems that hamper their
course work are referred to the Counseling Center (301-314-7651 or http://www.counseling.umd.edu/) for expert help.
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<thead>
<tr>
<th>Week No. [Dates]</th>
<th>Module No.</th>
<th>Learning Module Title</th>
<th>Readings</th>
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<td>1 [1/25 - 1/31]</td>
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<td>Software installation</td>
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<td>Fri, Feb. 8</td>
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<tr>
<td>2 [2/1 - 2/7]</td>
<td>02</td>
<td>Fundamental concepts in relational databases</td>
<td>[DMDLD] - Ch. 1 [SQLRT] - Ch.s 1, 2, 3</td>
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<tr>
<td>3 [2/8 - 2/14]</td>
<td>05</td>
<td>Introduction to SQL</td>
<td>[BDBD] - Ch. 10 [MDBM] - Ch. 6 [SQLVQS] - Ch.s 2, 3</td>
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<td>06</td>
<td>Entity-relationship diagrams</td>
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<td>Fri, Mar 01</td>
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<td>4 [2/15 - 2/21]</td>
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<td>Defining entities, attributes, and data types</td>
<td>[RDDCE] - Ch. 4</td>
<td>Fri, Mar 01</td>
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<td>4 [2/15 - 2/21]</td>
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<td>Defining relationships</td>
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<td>09</td>
<td>Primary and foreign keys</td>
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<td>Normalization</td>
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<td>Read (<em>R</em>*) operations via SQL</td>
<td>[SQLVQS] - Ch.s 4, 5, 6, 7, 8, 9 [MDBM] - Ch. 7</td>
<td>Fri, Apr. 05</td>
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<td>10 [4/4 - 4/10]</td>
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<td>Physical design principles</td>
<td>[FDBMS] - Ch. 8 [MDBM] - Ch. 5 [PDBD] - Ch. 1</td>
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<td>Week No. [Dates]</td>
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<td>11 [4/11 - 4/17]</td>
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<td>Physical design for Project (Assignment)</td>
<td>[PDBD] - Ch. 2</td>
<td>ELMS (April 19</td>
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<td>12 [4/18 - 4/24]</td>
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<td>Create, Update, Delete (C*UD) operations via</td>
<td>[SQLVQS] - Ch. 10</td>
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<td>13 [4/25 - 5/1]</td>
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<td>Sample data for Project</td>
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<td>Fri, May 9</td>
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<td>14 [5/2 - 5/8]</td>
<td>24</td>
<td>SQL development for Project</td>
<td>[SQLCE] - Ch. 2</td>
<td>Fri, May 9</td>
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<tr>
<td>14 [5/2 - 5/8]</td>
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<td>Views for Project</td>
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<td>Fri, May 9</td>
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Chapters in *italics* will not be available on course reserves due to fair-use limitations.

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Book Codes:

**ASQL**: The Art of SQL [2006]
(S. Faroult, P. Robson) (O'Reilly Media - ISBN: 978-0-596-00894-9)

**BDBD**: Beginning Database Design - 2nd Edition [2012]


**MDBM**: Modern Database Management - 10th Edition [2011]

**PDBD**: Physical Database Design [2007]
(Sam Lightstone, Toby Teorey, Tom Nadeau) (Morgan Kaufmann - ISBN: 978-0-12-369389-1)

**RDDCE**: Relational Database Design and Implementation: Clearly Explained - 3rd Ed. [2009]
(Jan L. Harrington) (Morgan Kaufmann - ISBN: 978-0-12-374730-3)

**SQLCE**: SQL Clearly Explained - 3rd Edition [2010]
(Jan L. Harrington) (Morgan Kaufmann - ISBN: 978-0-12-375697-8)

**SQLRT**: SQL and Relational Theory - 2nd Edition [2012]
(C.J. Date) (O'Reilly Media - ISBN: 978-1-449-31640-2)

**SQLVQS**: SQL Visual QuickStart Guide - 3rd Edition [2008]