S511: Database Design

Indiana University-Purdue University Indianapolis
School of Informatics and Computing Department of
Library and Information Science

Fall Semester, 2017

Meeting Time: 6:00-8:40pm
Meeting Location: IT 271
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Zoom Personal Meeting Room: https://IU.zoom.us/j/8945580761

Note: This is an edited version for public access. For a full version, please contact me via email at the address listed above.
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Course Overview

Catalog Description

Concerned with a comprehensive view of the processes involved in developing formal access to information from a user-centered point of view. Considers various database models such as flat file, hierarchical, relational, and hypertext in terms of text, sound, numeric, image, and geographic data. Students will design and implement databases using several commercial database management systems.

Instructor’s Description

Database Design is concerned with a comprehensive view of the processes involved in developing formal access to information from a user-centered point of view. The course will introduce you to technical skills, theoretical concepts, and critical data issues on database design, management, and related sociotechnical and ethical concerns. As an introduction to the area, we will cover basic database models and review different systems, which will support your work in various information roles.

Prerequisites

Database Design requires successful completion of S401 - Computer-Based Information Tools. Additionally, I expect you to have the ability to manage your own computer with respect to installing new applications. While not required, a curiosity about and interest in learning new technologies will serve you well in this course. Other than that, no specific database skills are necessary to be successful in this course.

Instructional Style and Philosophy

My goal is to create positive and productive learning environments where we work together as a community to achieve the course objectives, educational goals, and to gain knowledge. To achieve this, I develop social and collaborative learning environments including collaborative projects, in-class activities, and online discussions to engage all types of learners. Additionally, I encourage students to share past experiences and knowledge, and consider how their personal interests could align with course objectives. I require that students are respectful of themselves, their peers, and their instructor in order to ensure a positive and productive learning community so that everyone may reap the benefits of intellectual inquiry.

Student Learning Outcomes

Departmental Master of Library Science Learning Outcomes

The Master of Library Science (M.L.S.) program prepares students to become reflective practitioners who connect people and communities with information. Upon completion of the M.L.S. program, graduates are prepared to:
1. Approach professional issues with understanding
   1.1. Understand the social, political, ethical, and legal aspects of information creation, access, ownership, service, and communication
   1.2. Anticipate emerging trends and respond proactively

2. Assist and educate users
   2.1. Analyze and identify the information needs of diverse communities of users
   2.2. Educate users and potential users to locate, use, and evaluate information resources and tools
   2.3. Analyze and evaluate information systems and services in a variety of settings

3. Develop and manage collections of information resources
   3.1. Design and apply policies and procedures that support the selection and acquisition of information resources for particular communities of users
   3.2. Manage, evaluate, and preserve physical and virtual collections of information resources
   3.3. Uphold ethical and legal standards in acquiring, leasing, preserving, and providing access to information resources

4. Manage and lead libraries and other information organizations
   4.1. Perform basic managerial functions, including planning, budgeting, and performance evaluation
   4.2. Communicate effectively to a variety of audiences
   4.3. Apply theories of organizational behavior and structure

5. Represent and organize information resources
   5.1. Understand and apply principles of representation and organization

6. Use research effectively
   6.1. Design, conduct, interpret, and take action based upon research and evaluation

7. Deploy information technologies in effective and innovative ways
   7.1. Implement and evaluate information and communication technologies for efficiency, usability, and value to users

Course Learning Outcomes
Upon completion of this course, students should be able to:

1. Conceptualize databases for particular users and operational needs
   1.1. Understand conceptual design of relational databases including basic concepts such as: tables, keys, relationships, create commands and query commands
   1.2. Understand advanced concepts such as enforcing referential integrity and mandatory and optional relationships
   1.3. Build entity-relationship diagrams (ERDs) for relational databases using crows’ foot notation
   1.4. Document a database for current and future maintainers
2. Develop databases following conceptual strategies
   2.1. Implement relational databases using GUI interfaces
   2.2. Implement relational databases in open source environments using Structured Query Language (SQL) commands

3. Retrieve data from databases
   3.1. Analyze data dictionaries and ERDs for available data
   3.2. Use SQL to retrieve according to users’ and operational needs

4. Understand relevant social issues of databases and emerging database design
   4.1. Recognize the potential benefits and harms that could accrue from Big Data practices
   4.2. Acknowledge the role of databases in creating potentially unfair classificatory systems
   4.3. Critique data practices for perpetuating social injustices

**Student Learning Outcome Map**

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>MLS Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.1.</td>
</tr>
<tr>
<td>1.1.</td>
<td>2.3.</td>
</tr>
<tr>
<td>1.2.</td>
<td>3.1.</td>
</tr>
<tr>
<td>1.3.</td>
<td>5.1.</td>
</tr>
<tr>
<td>1.4.</td>
<td>7.1.</td>
</tr>
<tr>
<td>2</td>
<td>7.1.</td>
</tr>
<tr>
<td>2.1.</td>
<td></td>
</tr>
<tr>
<td>2.2.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.1.</td>
</tr>
<tr>
<td>3.1.</td>
<td></td>
</tr>
<tr>
<td>3.2.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1.1.</td>
</tr>
<tr>
<td>4.1.</td>
<td>1.2.</td>
</tr>
<tr>
<td>4.2.</td>
<td>3.3.</td>
</tr>
<tr>
<td>4.3.</td>
<td></td>
</tr>
</tbody>
</table>
Materials and Resources

Required Textbooks

The following texts are required, and you need to purchase them in order to work through this course. They are both available at the bookstore and online via retailers such as Amazon.


This text is expensive. I apologize for the cost, but it is of superior quality, particularly in terms of quality, clarity, and instructional support (e.g., sample databases, sample SQL statements).

A note on older editions: I have reviewed the detailed tables of contents for the 10th and 11th editions. It seems that these editions align very closely with our 12th edition text, and they may be a fine substitute at a much lower cost.

I will refer to examples and sample files from the 12th edition, and some of our homework will come from the 12th edition. With respect to sample files and homework questions, I will make them accessible to you so that you do not need the 12th edition text.

The following links take you to the respective editions for you to review the tables of contents:
10th: https://goo.gl/TXuFsA
11th: https://goo.gl/TZxtLU
12th: https://goo.gl/RTjPTJ (this is the version I will be using)


This text is widely available used at a low cost, usually for less than $11. An eBook copy is available via IUCAT using your IU account. It is accessible at http://iucat.iu.edu/catalog/15953775

However, the electronic copy is a single-user edition, which means that if one student selects “check out” on the ebook, it will be unavailable to all. If students do not select “check out,” multiple users will be able to read it online and/or print chapters. For everyone’s benefit please do not “check out” the ebook.

Other Required and Supplementary Materials

Other book chapters, journal articles, miscellaneous readings, and media listed in the weekly modules are either openly accessible or available through eReserves associated with our online course site. I will make these available via Canvas.
Suggested Texts and Resources

The following texts are recommended, and they may help you to be successful in this course:


Technical courses such as this one benefit from the accessibility to a wide variety of free, online resources. I highly encourage you to peruse and reference the following resources throughout the course as needed:

IU resources:
- IU IT Training workshop materials (look for Access and SQL items): https://ittraining.iu.edu/downloads/
- Books 24x7 IT Pro: https://ittraining.iu.edu/learningoptions/books24.aspx

Self-paced tutorials/"courses":
- W3schools SQL Tutorial: http://www.w3schools.com/sql/
- Code School: https://www.codeschool.com/courses/try-sql
- Khan Academy: https://www.khanacademy.org/computing/computer-programming/sql
- Code Academy: https://www.codecademy.com/learn/learn-sql
- Lynda.com Access tutorials: https://www.lynda.com/Access-training-tutorials/140-0.html
- Lynda.com SQL tutorials: https://www.lynda.com/SQL-training-tutorials/446-0.html

Some self-paced tutorial sites require you to create an account. Lynda.com videos are available at no-charge by signing into the organizational portal at https://www.lynda.com/signin/organization by putting in iupui.edu as the organization name.

Technology

*Basics*
Internet and computer access is required. Your Internet speed should sufficiently support uploading and downloading of large file sizes. Your computer should be up-to-date with the latest operating system in order to support the required applications listed below; it should also have anti-virus software. The latter is especially important given the fact that we will be sharing files between ourselves.

*Course Site*
We have access to a Canvas course site (https://canvas.iu.edu/). I will use this site as a way to post updates, store documents, receive assignments, and for online learning activities, among other things. It is your responsibility to review the course site multiple times a week.

*Required Applications*
The following applications are required for you to participate successfully in this course. I will not make accommodations for alternative applications, because these are directly related to exercises, assignments, and learning objectives.
1. Microsoft Access 2013
We will use Access for all of our database exercises.

For PC: Access is available to download for free within the Microsoft Office 2013 package via the IUware software system at https://iuware.iu.edu/Windows/Title/1786.

For Mac users: Access is available for free using the IUanyware desktop virtualization platform available at https://iuanyware.iu.edu/. See the following knowledge base document for help: https://kb.iu.edu/d/bclt. Note that you must have an Internet connection in order to use IUanyware.

2. Microsoft Visio 2013
We will use Visio to create entity relationship diagrams using Crow’s Foot notation.

For PC AND Mac users: Access is available for free using the IUanyware desktop virtualization platform available at https://iuanyware.iu.edu/. See the following knowledge base document for help: https://kb.iu.edu/d/bclt. Note that you must have an Internet connection in order to use IUanyware.

3. Jing
We will use Jing to create and share screencasts. Screencasts can capture our desktop and applications as we interact with them, which allows us to demonstrate our processes and technical questions in an easy way.

Jing is available to download for free for both PC and Mac users at https://www.techsmith.com/jing-tool.html. Helpful tutorials for learning and using Jing are available at https://www.techsmith.com/jing-tool.html
## Grading and Assessment

### Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Outstanding achievement. Student performance demonstrates full command of the course materials and evinces a high level of originality and/or creativity that far surpasses course expectations.</td>
<td>96-100</td>
</tr>
<tr>
<td>A-</td>
<td>Excellent achievement. Student performance demonstrates thorough knowledge of the course materials and exceeds course expectations by completing all requirements in a superior manner.</td>
<td>91-95</td>
</tr>
<tr>
<td>B+</td>
<td>Very good work. Student performance demonstrates above-average comprehension of the course materials and exceeds course expectations on all tasks as defined in the course syllabus.</td>
<td>87-90</td>
</tr>
<tr>
<td>B</td>
<td>Good work. Student performance meets designated course expectations, demonstrates understanding of the course materials, and performs at an acceptable level.</td>
<td>83-86</td>
</tr>
<tr>
<td>B-</td>
<td>Marginal work. Student performance demonstrates incomplete understanding of course materials.</td>
<td>79-82</td>
</tr>
<tr>
<td>C+</td>
<td>Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course materials.</td>
<td>76-78</td>
</tr>
<tr>
<td>C</td>
<td>Unacceptable work</td>
<td>73-75</td>
</tr>
<tr>
<td>C-</td>
<td>Unacceptable work</td>
<td>69-72</td>
</tr>
<tr>
<td>D/F</td>
<td>Student has failed the course. An incomplete is not an available option.</td>
<td>68 and below</td>
</tr>
</tbody>
</table>
Notes:

1. I will calculate final grades to the first decimal point. If your final grade is at .5 or above, I will round up. For instance, if you receive a 93.5 on your final grade, I will round this up to a 94.

2. Students must receive a B- or above for a course to satisfy core requirements (e.g. S501, S502). Students must receive a C or above for an elective course applied to the MLS. Students must maintain a 3.0 GPA overall and must finish coursework with a 3.0 GPA. If in any semester a student receives less than a 3.0 for that semester, they will be placed on probation and will need to achieve a 3.0 overall GPA during the next semester.

3. A “B” grade is the norm for graduate students. A+ grades are not given in the department.

4. Incompletes are only available when unexpected events prevent completion of the course requirements in the usual time frame. No student with multiple incompletes may register for additional courses. Left unchanged, an Incomplete automatically becomes an F after one year. See registrar.iupui.edu/incomp.html for more information.

Overview of Assessments

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Points</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Homework</td>
<td>35</td>
<td>Multiple (2.5 points per module)</td>
</tr>
<tr>
<td>Discussion Leadership</td>
<td>10</td>
<td>Once per semester, choose your preferred theme</td>
</tr>
<tr>
<td>Discussion Participation</td>
<td>10</td>
<td>Weekly over 10 weeks</td>
</tr>
<tr>
<td>Data Book</td>
<td>40</td>
<td>Checkpoint 1 – 10 points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Checkpoint 2 – 10 Points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Final Submission – 20 points</td>
</tr>
<tr>
<td>Virtual Symposium</td>
<td>5</td>
<td>Once (end of semester)</td>
</tr>
<tr>
<td>Total Points:</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
### Semester Structure

#### Overview

This course covers 17 weeks. 14 of those weeks included substantive content; three weeks account for the intro to the course, fall break, and finals week.

The semester has been broken down into four thematic units with their own interconnected modules. There is a new module each week.

#### Semester Grid

<table>
<thead>
<tr>
<th>Week</th>
<th>Unit</th>
<th>Module</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intro</td>
<td>Intro</td>
<td>8/22</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>8/29</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
<td>9/5</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>3</td>
<td>9/12</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>4</td>
<td>9/19</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>5</td>
<td>9/26</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>6</td>
<td>10/3</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>7</td>
<td>10/10</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>NO CLASS/Fall Break</td>
<td>10/17</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>8</td>
<td>10/24</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>9</td>
<td>10/31</td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td>10</td>
<td>11/7</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>11</td>
<td>11/14</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>12</td>
<td>11/21</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>13</td>
<td>11/28</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>14</td>
<td>12/5</td>
</tr>
<tr>
<td>17</td>
<td>Final</td>
<td>Final</td>
<td>12/12</td>
</tr>
</tbody>
</table>
Unit and Module Overview

Full descriptions of each module and related readings are available at the course site.

Unit 1 - Database Concepts
Module 1 - Database Systems
Module 2 - Data Models
Module 3 - Relational Databases, Part 1
Module 4 - Relational Databases, Part 2

Unit 2 - Database Design and Management
Module 5 - Entity Relationship Modeling, Part 1
Module 6 - Entity Relationship Modeling, Part 2
Module 7 - Advanced Data Modeling
Module 8 - Database Normalization

Unit 3 - Data Access and Reporting Using Structured Query Language (SQL)
Module 9 - SQL Syntax and Programmatic Database Creation
Module 10 - Beginning SQL Queries with the SELECT Statement
Module 11 - SQL Queries and Programmatic Joins
Module 12 - Filtering and Operators
Module 13 - Open Lab

Unit 4 - Data Ethics
Module 14 - Big Data: Privacy, Fairness, and Opacity

Acknowledgments

A special thanks to Dr. Kyle Jones for sharing his database design course materials and syllabi used here to construct this course.