**CS 360: Database Systems**

Department of Computer Science

University of Idaho

***Course Syllabus***

**Instructor**: Hasan Jamil **Semester**: Spring 2022

**Office**: JEB 224 **Prerequisites**: CS 240 and CS 270

**Office hours**: 10:30-12:30 WF Via Zoom **Class Rooms**: MH 209, HC 128, Via Zoom

**E-mail**: [jamil@uidaho.edu](mailto:jamil@uidaho.edu) **Class Time**: 14:00-15:15 TR

This course will emphasize on database models, basic concepts in database management systems, database design and popular file systems design. Students will learn how to design, manage and query a relational database using a relational DBMS such as MySQL. A substantial database project implementation using a modern database management system is required.

1. Database Management Systems – goals and advantages, and database system architecture.
   1. Chapter 1: Introduction
2. The Entity-Relationship Model of Data.
   1. Chapter 7: Entity-Relationship Model
3. Relational Model
   1. Relational Algebra, SQL, and Views.
      1. Chapter 2: Introduction to the Relational Model
      2. Chapter 3: Introduction to SQL
      3. Chapter 4: Intermediate SQL
      4. Chapter 5: Advanced SQL
      5. Chapter 6: Other Relational Languages. Section 6.1 (Relational Algebra)
   2. Conceptual Database Design – Data Dependencies and Normalization.
      1. Chapter 8: Relational Database Design

**Text:**

* Avi Silberschatz, Henry Korth and S. Sudarshan, Database System Concepts (Sixth Edition or later), McGraw-Hill.

**Additional References:**

1. Michael Kifer, Arthur Bernstein and Philip Lewis, *Database Systems – An Application Oriented Approach*, 2nd Edition. Addison Wesley, 2005.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 2nd Edition. McGraw Hill; 2000 (or later).

**Grading Scheme**:

1. Assignments (7 total – 2 RA, 3 SQL, 1 FD and 1 NF) – **25%**
2. Traditional Option:
   1. Implementation Project (Conceptual/ER Design 5%, Implementation 30% and Final Report 10%) – **45%**
   2. Two Midterm Exams – **30%**
3. Advanced Learning Option:
   1. A research-based implementation project (Conceptual Design 10%, Rapid Prototyping 10%, Production System Hosted on a Server 40%, Final report 15%) – **75%**.

**Tentative Lecture Schedule**

1. January 13: Introduction. Course Project discussion, all assignments and notes are handed out this week. Please submit your team composition on August 31, identify team leader and contact person along with contact info. You will be assessed as a team for the project. This semester we have two project options. The first is a traditional option in which you complete a set of assignments, a database project and take two midterm tests. The second is the advanced learning option in which you complete a set of assignments, and implement a research-based database application, and take no tests. The complexity levels of the two projects in both options are similar, only difference is that in the research project you will read a couple of papers to understand what the design should be like. Finally, each research project will be different while the traditional option will have a single application for all students.
2. January 18, 20:The basics – Database Management Systems: goals and advantages, architecture of a database management system. Data modeling using Entity Relationship Model.Relational Data Model.
3. January 25, 27: Discussion on tables, introduction to SQL and simple SQL SPJ queries. Database creation using SQL – Schema definitions and constraints.
4. February 1, 3: Complex SQL – Set and Sub-queries, Division, Nested and advanced queries. Advanced SQL (DDL, triggers, views, and updates). *Assignment #1 on SQL due on February 1.*
5. February 8, 10: **Tutorial I on SQL Queries on February 8 (by Tutor Kallol Naha). Tutorial II on Interfacing with MySQL and Java/Python/C++ on February 10 (by Tutor Kallol Naha).**
6. February 15, 17: SQL queries and wrap-up. *Phase I project report and Assignment #2 on SQL due on February 15.*
7. February 22, 24: **Discussion on course project on February 22 (by Instructor)**. Introduction to Relational Algebra. *Assignment #3 on SQL due on February 22.*
8. March 1, 3: Advanced Relational Algebra. *Assignment #4 on relational algebra due on March 1.*
9. March 8, 10: **Tutorial III on database querying on March 8 (by Tutor Kallol Naha). Midterm Exam I on March 10 (10%, Covers entire SQL and Algebra).** *Assignment #5 on relational algebra due on March 8*.
10. March 15, 17: Spring Break. No classes.
11. March 22, 23: Functional dependencies. Axiomatization, keys, closures and covers.
12. March 29, 31: Functional dependencies. Axiomatization, keys, closures and covers continued.
13. April 5, 7: Introduction to conceptual database design. *Assignment #6 on FDs due on March 29*.
14. April 12, 14: Design theory and normalization – First, Third and Boyce-Codd Normal Forms.
15. April 19, 21: **Tutorial IV on normalization on April 19. Interim Demo and Phase II project report in the form of a presentation on April 21**. *Assignment #7 on Covers and NFs due on April 19*.
16. April 26, 28: **Midterm Exam II on April 26**. Advanced topics – Object-Oriented databases and Deductive databases.
17. May 3, 5: *Project Demo. Project final report (Phase III) due before your demo begins. No late submission will be accepted. Request a project report template.*
18. May 10, 12: Final Exam (**NO FINAL EXAM**)

**Course Tutor/Teaching Assistant:**

Kallol Naha

Email: naha7197@vandals.uidaho.edu

**Notes**:

1. Assignments should be handed in by the due date in **class**. No late submissions, please.
2. To pass the course, *usually* a minimum of 50% is required in **each** of the exams, assignments and projects.
3. **There is no direct relationship between the numerical percentages and the final letter grades awarded in this course**. Performance will be assessed by ``normalizing" the marks obtained in each exam, assignment, and project separately. Typically, 90%+ is assigned an A, 80%+ is B, 70%+ is C, 60%+ is D and less than 60% is assigned F.
4. You are advised to retain a copy of all your course works till a final grade has been assigned.
5. Please back up all your computing work, computers do break down and at the worst possible time, such as a day before a project is due! It is your responsibility to be prepared for such accidents and still meet the deadlines.
6. University and departmental policies on cheating, plagiarism and academic misconduct apply to this course. Please consult departmental/university home pages regarding professional and academic conduct.
7. You may copy class materials, including lecture notes (such as project description, assignments, lecture notes, etc.) from my web page (tentative, not decided yet). This page will contain, when ready, pointers to important information from time to time. Please visit the site frequently.
8. Most exams are multiple-choice type and are designed to expedite marking and evaluation efficiency. Please consult past exams to gather some ideas about the nature of the exams. In particular, notice the uneven distribution of the coverage of topics. There is no guarantee, however, that this year's tests will be similar.
9. Please note that there may be a couple of extra classes to make up for any missing regular classes that I will announce from time to time due to travel commitments.
10. Students with any disability are advised to talk to me outside the class and contact disability services for help. All required accommodations for students with disability will be made in accordance with the university policies.
11. Office our Zoom link: <https://uidaho.zoom.us/j/87208492697>, Passcode: 369421. Has a waiting room.

**Course Project: Best Buy**

**Points**: Preparation and presentation of the ER diagram and first phase presentation – 5%, Normalization and second phase presentation – P/F, Project implementation and demo – 30%, third phase presentation and final report – 10%. Total 45%.

**Description**: Design a service matching database in which users or customers will put out their background, and product and services need anonymously. Vendors will list their products and services under a binding contract if accepted by the customers. Customers’ product wish list will be in three forms – a specific product they want (an exact match, e.g., LG 50” 4K Smart TV), a closest match of product or service description based on a priority criterion on multiple axes (LG 50” Smart TV [5th], price < $500 [1st], Free delivery [4th], OLED display [2nd], Delivery within a week [3rd], etc.), and requirement based best match (product must be matched with the need, not features, e.g., no contract high speed internet for 1 TV, 4 cell phones, DSL or satellite, best price). The last category will require you to first determine how providers sell internet services – different tiers, speed, packages, cost, etc. You will need to first discover the essential elements or properties that will satisfy the customer need. For example, 1 TV and 4 cell phones can be served with a 20MB download capable internet service with a modem router. If the customer already has a router, that must be matched with the service options. Basically, your goal is to protect the customers from overpaying for a service of product they do not need. Same goes for car or home insurances.

A class discussion on ***February 22*** will further clarify the project requirements.

**Requirements/Deliverables:**

* + - 1. You will have to host this database on the UI server. – 5%
      2. You will design a web-based interface for user and vendor interaction. – 10%.
      3. All the features must function. – 10%
      4. Must use Faker or Mockaroo to populate the database with test data. – 5%

**Report: Sample will be provided**

1. ACM Conference format/style – 10-point Roman, two column format. – 2.5%.
2. At least 8 pages long – at most one-page references. No large pics. – 2.5%.
3. Must include figures showing various system features and functions. – 2.5%.
4. Acceptable style, presentation, and clarity. – 2.5%.
5. Use of Latex text editor. *Bonus Points* – 2.5%.

**Research Project: VOiC Document Processing Database**

**Points**: Preparation and presentation of the initial research plan and first phase presentation – 5%, PoC Demo and second phase presentation – 10%, Project implementation and demo – 50%, third phase presentation and final report – 10%. Total 75%.

**Description**: While almost all of the documents we write, read, share, act on, process or archive are digital, their management remains archaic. This is particularly true in the case of most office and government systems. In business and government, documents chronicle and immortalize the evolution of thoughts, deliberations, laws and decisions for the for the past as historical records, the present and the future. While the traditional paper-based hard copies serve as reliable preservation medium, they are vulnerable to theft, destruction and loss. On the other hand, digital documents are prone to cybercrimes of various kinds, but less prone to destruction due to aging, fading or loss. With proper safeguards in place, they are largely indestructible. Yet, a robust office document management system is mostly absent. In this project, you will develop a new web-based document processing and management system called *V*irtual *O*ffice *i*n the *C*loud}, or *VOiC* (pronounced voice), to create, share, query and update office documents. In VOiC, you will make provisions to support decision workflows, virtual office and provenance and privacy based on role-based authorization. The system will be based upon a recently proposed model for document management in virtual offices.

A class discussion on ***February 22*** will further clarify the project requirements.

**Requirements/Deliverables:**

1. You will design a web-based interface for user interaction. – 10%.
2. Documents authoring, storage and management – 20%.
3. Document processing workflow design and management – 20%.

**Report: Sample will be provided**

1. ACM Conference format/style – 10-point Roman, two column format. – 2.5%.
2. At least 8 pages long – at most one-page references. No large pics. – 2.5%.
3. Must include figures showing various system features and functions. – 2.5%.
4. Acceptable style, presentation, and clarity. – 2.5%.
5. Use of Latex text editor. *Bonus Points* – 2.5%.