Cleveland State University
Department of Electrical Engineering and Computer Science

CIS 430/530 Database System and Processing (3-0-3)

Prerequisites: CIS 265
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Office Hours: Will be announced on the class webpage each semester

Catalog Description: The course introduces fundamental concepts for design and use of modern database systems. It explores a number of areas such as database design process, conceptual modeling of data, converting conceptual data representations to a relational database scheme, use of the relational database language SQL to create database and to write SQL statements for insert, delete, update and retrieve data. The course also introduces some of the fundamental file system that is used as physical data storage and index structures in relational database systems. The course introduces database programming with stored procedure, functions, cursor, and triggers. The course extends to modern database processing in distributed database systems - client server database programming - Embedded SQL, Dynamic SQL with JDBC/ODBC and building database and web service applications with PHP. The course also introduces View and Transaction concept. Finally the course advances with introduction of Semi-structured Database concept with XML and Data Warehouse concept if time permitted.


List of Required Materials:

1. Visual Studio 2014 or higher
2. SQL Server 2014 or higher

MS Software are also available at the Microsoft Academic Alliance programs:
https://azureforeducation.microsoft.com/devtools

Text:
Available at http://iips.icci.edu.iq/images/exam/databases-ramaz.pdf

2. Selective Lecture Notes from Relational Database Systems and Database Industry Online Manuals

Supplement Text:

Class Web page:
http://eecs.csuohio.edu/~sschung/cis430/CIS430.html  or
Go to my web page at http://eecs.csuohio.edu/~sschung then choose CIS 430/530 Link

Official Academic Calendar

Please consult the university academic calendar for the semester and the final exam schedules at: https://www.csuohio.edu/registrar/academic-calendar

Grading: The course grade is based on a student's overall performance through the entire Semester. The final grade is distributed among the following components:
Required:
Exams 50%: Midterm 20% and Final (Comprehensive) 30%
Computer Labs 50% (6-7 lab assignments)

Optional: Extra Project and/or Extra Assignments may be given for the students who are in CIS530, who want to outperform, or honor students in a contract course.

A  94% +  A: Outstanding (student's performance is genuinely excellent)
A-  90% - 93%
B'  88% - 89%
B  82% - 87%  B: Very Good (student's performance is clearly commendable but not necessarily outstanding)
B-  80% - 82%
C  75% - 80%  C: Good (student's performance meets every course requirement and is acceptable; not distinguished)
D  65%-75%  D: Below Average (student's performance fails to meet course objectives and standards)
F  <65%  F: Failure (student's performance is unacceptable)

Examination Policy: Students are allowed to bring to the final exam a summary page (standard letter size) with their own notes. The note page is not allowed to midterm. During the exams: (1) the use of books, cell phones, calculators, or any electronic devices is prohibited, and (2) students must not share any materials.

Make-Up Exam Policy: No makeup exams will be given unless notified and agreed to in advance. Requests will be considered only in case of exceptional demonstrated need.

Homework Policy: The students are expected to attend all classes. The students are responsible for collecting the notes, handouts and any other course material distributed during the class period. All assignments must be individually and independently completed and must represent the effort of the student turning in the assignment. Should two or more students turn in substantially the same solution or output, in the judgment of the instructor, the solution will be considered group effort. All involved in group effort homework will receive a zero grade for that assignment. A student turning in a group effort assignment more than once will automatically receive an “F” grade for the course.

Late Assignment: All lab assignments are due at the beginning of class on the date specified. Laboratory Assignments handed in after the class has begun will be accepted with a 25% grade penalty for up to a week and then not accepted at all. All laboratory assignments must be completed. Failure to do so will lower your course grade one additional letter grade.

Student Conduct: Students are expected to do their own work. Academic misconduct, student misconduct, cheating and plagiarism will not be tolerated. Violations will be subject to disciplinary action as specified in the CSU Student Conduct Code. A copy can be obtained on the web page at: http://www.csuohio.edu/studentlife/StudentCodeOfConduct.pdf or by contacting Valerie Hinton Hannah, Judicial Affairs Officer in the Department of Student Life (MC 106 email v.hintonhannah@csuohio.edu). For more information consult the following web page CSU Judicial Affairs available at http://www.csuohio.edu/studentlife/affairs/faq.html
**Contract Course Requirement for Honor Students:** Honor Students in a Contract Course should complete at least 2 out of 3 of the followings:

1. Extra Project
2. One of Extra Lab Assignments
3. One of Extra Exercises

**Course Schedule:** The schedule of topics to be covered is given below. The schedule and topics covered may vary depending upon the progress made. Please see the class website for the detailed schedule of the subjects to be covered.

**Tentative Course Schedule is as follow:**
(Please See the Class Webpage for More Updated Contents and Recent Schedules)

1-2 **Chapter 1 - Databases and Database Users**  
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- 1.1 Introduction
- 1.2 An Example
- 1.3 Characteristics of the Database Approach
- 1.4 Actors on the Scene
- 1.5 Workers behind the Scene
- 1.6 Advantages of Using the DBMS Approach
- 1.7 A Brief History of Database Applications
- 1.8 When Not to Use a DBMS
- 1.9 Summary

**Chapter 2 - Database System Concepts and Architecture**

- 2.1 Data Models, Schemas, and Instances
- 2.2 Three-Schema Architecture and Data Independence
- 2.3 Database Languages and Interfaces
- 2.4 The Database System Environment
- 2.5 Centralized and Client/Server Architectures for DBMSs
- 2.6 Classification of Database Management Systems

**PrepLab for Lab Assignments:**

1. Installing SQL Database Server
2. How to Use SQL Server and Client – SQL Management Studio
Chapter 3 - Data Modeling Using the Entity-Relationship (ER) Model

- 3.1 Using High-Level Conceptual Data Models for Database Design
- 3.2 An Example Database Application
- 3.3 Entity Types, Entity Sets, Attributes, and Keys
- 3.4 Relationship Types, Relationship Sets, Roles, and Structural Constraints
- 3.5 Weak Entity Types
- 3.6 Refining the ER Design for the COMPANY Database
- 3.7 ER Diagrams, Naming Conventions, and Design Issues
- 3.8 Example of Other Notation: UML Class Diagrams
- 3.9 Relationship Types of Degree Higher Than Two
- 3.10 Summary

Chapter 7 - The Enhanced Entity-Relationship (EER) Model

- 7.1 Subclasses, Superclasses, and Inheritance
- 7.2 Specialization and Generalization
- 7.3 Constraints and Characteristics of Specialization and Generalization Hierarchies
- 7.4 Modeling of UNION Types Using Categories
- 7.5 An Example UNIVERSITY EER Schema, Design Choices, and Formal Definitions
- 7.6 Example of Other Notation: Representing Specialization and Generalization in UML Class Diagrams
- 7.7 Data Abstraction, Knowledge Representation, and Ontology Concepts

(a) Data Modeling Using the Entity-Relationship Model

Lab Assignment 1: ER Modeling, Database Design
Chapter 4 - SQL-99: Schema Definition, Constraints, Queries, and Views

- 4.1 SQL Data Definition and Data Types
- 4.2 Specifying Constraints in SQL
- 4.3 Schema Change Statements in SQL
- 4.4 Basic Queries in SQL
- 4.5 More Complex SQL Queries
- 4.6 INSERT, DELETE, and UPDATE Statements in SQL

Lab Assignment 2: Build Company Database Creation of Schema and Population of the Database and Run SQLs over Company Database

Lab Assignment 3: Run SQLs over Company Database

Chapter 5 – Complex SQL

- 5.1 Correlated Subquery
- 5.2 IN/NOT IN, EXISTS/NOT EXISTS
- 5.3 Aggregate Functions
- 5.4 GROUP BY, HAVING
- 5.5 Subquery in FROM Clause
- 5.6 GRANT/REVOKE
- 5.7 Additional Features of SQL
- 5.8 Summary

Lab Assignment 4: Retrieve Complex SQLs over Company Database

Lab Assignment 5: Create Views and Make Use of it for Database Applications

Chapter 6 - The Relational Algebra and Relational Calculus

- 6.1 Unary Relational Operations: SELECT and PROJECT
- 6.2 Relational Algebra Operations from Set Theory
- 6.3 Binary Relational Operations: JOIN and DIVISION
- 6.4 Additional Relational Operations
- 6.5 Examples of Queries in Relational Algebra

Extra Exercise on Relational Algebra on DIVISION

Introduction to Database Programming:

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Data Types;
Conditional and Flow Control Statements;
Cursor
Stored Procedure

Chap 14, 15
Lecture Notes
User Defined Function (UDF)
Table Function
Embedded SQL
Dynamic SQL
JDBC/ODBC

**Lab Assignment 6**: Create System Triggers and Stored Procedure to implement application related business rules

**Extra Lab Assignment 6**: Implementing Table Function Using Stored Procedure and Cursor

- **12-13**
  - Implementing Constraints as Triggers
  - Implementing Views (Virtual Tables) in SQL
  - Transactions, COMMIT, ROLL BACK, and Dealing with Constraint Violations

- **14**
  - Web Programming with PHP

**Extra Project**: Building a Web Service Application on WAMP Server using PHP and Mysql

**Disk Storage, Basic File Structures, and Hashing**

- **13.1** Introduction
- **13.2** Secondary Storage Devices
- **13.3** Buffering of Blocks
- **13.4** Placing File Records on Disk
- **13.5** Operations on Files
- **13.6** Files of Unordered Records (Heap Files)
- **13.7** Files of Ordered Records (Sorted Files)
- **13.8** Hashing Techniques
- **13.9** Other Primary File Organizations
- **13.10** Parallelizing Disk Access Using RAID Technology
- **13.11** New Storage Systems
- **13.12** Summary

**Indexing Structures for Files**

- **14.1** Types of Single-Level Ordered Indexes
- **14.2** Multilevel Indexes
- **14.3** Dynamic Multilevel Indexes Using B-Trees and B+ Trees
- **14.4** Indexes on Multiple Keys
- **14.5** Other Types of Indexes
- **14.6** Summary
Extra

Introduction of Semi-Structured Database

Introduction of Data Warehouse Concept

NOTE: The instructor reserves the right to retain, for pedagogical reasons, either the original or a copy of your work submitted either individually or as a group project for this class. Students’ names will be deleted from any retained items.