CS425 – Database Organization **Last Updated -** 02/22/02
Course Manager – Dr. Nazli Goharian, Clinical Assistant Professor
3 credit hours; elective for CS & CPE; 150 min. lecture each week

Current Catalog Description - Overview of database architectures, including the Relational, Hierarchical, Network, and Object Models. Database interfaces, including the SQL query language. Database design using the Entity-Relationship Model. Issues such as security, integrity, and query optimization. Prerequisite: CS 331 or CS 401 or CS 403. (3-0-3) (T)

Textbook

- R. Ramakrishnan and J. Gehrke, *Database Management Systems*, McGraw-Hill, ISBN 0072322063

References - other textbooks or materials

- Silberschatz, H.F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw-Hill, ISBN 0072283637

Course Goals - Students should be able to:

- Design and model a design scenario using relational data modeling, which includes:
  - Analyze the design anomalies
  - Construct Entity Relationship Diagram.
  - Analyze and Construct Functional Dependencies for the business rules.
  - Analyze Functional Dependencies to identify Primary keys.
  - Analyze and Perform Normalization and Normal Forms.
  - Define referential integrities.
  - Create relational database design schemas in 3-NF for a design scenario of the size of ca. 8-10 tables.
- Solve abstract relational language, such as relational algebra problems.
- Solve database transactions by using Structured Query Language (SQL), used by commercial RDBMSs.
- Explain File Organizations, Indexing, and Query Processing.
- Explain Query Optimizations such as Rule-Based and Cost-Based.
- Explain Concurrency Control.
- Explain Recovery.
- Implement a relational database application, using a commercial RDBMS.

Prerequisites by Topic

- Data Structures, Algorithm and Programming.

Major Topics Covered in Course

1. Introduction, basic terminology, data models: hierarchical, network, relational, object oriented database management systems.	3 hours
2. Abstract relational language: relational algebra and relational calculus.	2 hours
3. Structured Query Language (SQL)	4 hours
4. Relational Data Modeling, keys, referential integrity, constraints, anomalies	3 hours
5. Entity Relationship Diagram	3 hours
6. Functional Dependencies, Armstrong axioms, Closure of FD and attribute	3 hours
7. Normalization, Normal Forms, Loss-less decomposition proof, dependency preservation proof	6 hours
8. Object Oriented database design	3 hours
9. File Organization, Indexing, Query Processing.	3 hours
10. Query Optimization	1 hours
11. Concurrency Control	1 hours

12. Recovery	1 hours
13. Paper Presentation	6 hours
Exam 1	3 hours
Exam 2	3 hours
	45 hours

Laboratory projects (specify number of weeks on each)

- 3 optional lab sessions in semester, each 150 min.

Estimate CSAB Category Content in Credit Hours

	CORE	ADVANCED		CORE	ADVANCED
Data Structures		1	Computer Organization and Architecture		
Algorithms		1	Concepts of Programming Languages		
Software Design		1			

Oral and Written Communications - Every student is required to submit at least __2___ written reports (not including exams, tests, quizzes, or commented programs) of typically ___3__ pages and to make __0___ oral presentations of typically __0___ minutes duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.

- Structured Query Language (SQL) assignment.
- Database design assignment.
- Design document for project.

Social and Ethical Issues - Please list the topics that address the social and ethical implications of computing covered in all course sections. Estimate the class time spent on each topic. In what ways are the students in this course graded on their understanding of these topics (e.g., test questions, essays, oral presentations, and so forth)?

- none

Theoretical Foundations - Please list the types of theoretical material covered, and estimate the time devoted to such coverage in contact (lecture and lab) hours.

- Relational algebra and calculus, 2 hrs.
- Data modeling and constraints, 3 hrs.
- Functional dependencies (FD), Armstrong axioms, closure of FD and attribute, 3 hrs.
- Normalization, normal forms, loss-less decomposition proof, dependency preservation proof, 6 hrs.
- File organization and indexing, 2 hrs.
- Query optimization, concurrency and recovery, 3 hrs.

Problem Analysis - Please describe the problem analysis experiences common to all course sections.

- All sections include database model analysis (this includes analysis of DB anomalies, functional dependency derivation, key identification)

Solution Design - Please describe the design experiences common to all course sections.

- Database design problem to be solved by person or in a team.

SQL assignment (individual 2 week).
Design Assignment (group of 2; 2 weeks)
Project: Database Application Design and Development (group of 2-3; 4 weeks)

Other Course Information

- Planned Course Enhancements:
  - Changing the name of CS425 from "Database Organization" to "Database Design and Applications". New Course Description: This course provides an overview to database management systems such as hierarchical, network, object oriented and relational. The course covers fundamental database concepts with the focus on the relational DBMS. Students in detail learn relational data modeling and design, abstract relational languages, and structured query language (SQL). The DBMS implementation topics including file organization, indexing, and query processing are discussed. An overview of query optimization, recovery, and concurrency control is given in the course. Students build a database application for their course project. Prerequisite: CS 331 or CS 401 or CS403. (Fall 2002)
  - Creating a new 500 level course (CS520) with the name of "Database Design and Engineering". Course prerequisite: (CS 351 or CS 402 or CS403) and (CS 430 or CS406). (3-0-3) (T). Description: Course covers design and implementation and engineering of the database management system. Students build the RDBMS engine for their class project. The students can take either CS425 or the new CS500 level course, but not both courses. (Approved by CS Graduate Committee, staring in Fall 2002)
  - Including 1 optional oral presentation of 15 minutes for each student. (Fall 2002)