# Knight Foundation School of Computing and Information Sciences

**Course Title:** Database Management **Date:** 03/22/2019

**Course Number:** COP 4710

**Number of Credits:** 3

| | |
|---|---|
| **Subject Area:** Computer Systems | **Subject Area Coordinator: Gr**egory Reis<br>**email:** gmuradre@fiu.edu |
| **Catalog Description:**<br>Covers logical aspects of databases including Relational, Entity-Relationship, and Object-Oriented data models, database design, SQL, relational algebra, tuple calculus, domain calculus, and physical database organization. | |
| **Textbook:** Fundamentals of Database Systems, 7th Edition<br>Elmasri and Navathe<br>Addison Wesley (ISBN: 0-13-397077-9) | |
| **References:** Database Management Systems, 3rd Edition<br>Ramakrishnan and Gehr<br>McGraw Hill (ISBN: 0072465638) | |
| **Prerequisites Courses:** COP 3337 | |
| **Corequisites Courses:** COP 3530 | |

Type: Elective for CS (Systems group)

Prerequisites Topics:

- Function call/return, recursion
- Sequential, random access, index files
- Linked list, indexing, hashing techniques

Course Outcomes:

1. Be exposed to information systems
2. Be familiar with database system and database architecture
3. Master the design conceptual schemas
4. Master normalization theory and the mapping of a conceptual schema to a relational schema
5. Master the expression of queries in SQL, relational algebra, and relational calculus
6. Be familiar with physical database design
7. Be familiar with writing application programs that use SQL

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## Relationship between Course Outcomes and Program Outcomes

| BS in CS: Program Outcomes | Course Outcomes |
|---|---|
| a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms | 1 |
| b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems. | 2,3,4,5,6 |
| c) Demonstrate proficiency in problem solving and application of software engineering techniques | 7 |
| d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other. | |
| e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist. | |
| f) Demonstrate the ability to work cooperatively in teams. | |
| g) Demonstrate effective communication skills. | |

## Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: https://abet.cs.fiu.edu/csassessment/

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## Outline

| Topic | Number of Lecture Hours | Outcome |
|---|---|---|
| • Information systems<br>o Information storage and retrieval<br>o Information capture and representation<br>o Information privacy, integrity, security, and preservation<br>o Scalability, and efficiency | 3 | 1 |
| • Database systems<br>o History and motivation for database systems<br>o Components of database systems<br>o DBMS functions<br>o Database architecture and data independence<br>o Use of a database query language | 4 | 2 |
| • Data model<br>o Conceptual models (E-R, semantic, UML)<br>o Relational data model<br>o Object-oriented model<br>o Object-relational model | 4 | 3 |
| • Relational databases<br>o Mapping conceptual schema to a relational schema<br>o Entity and referential integrity<br>o Relational algebra and relational calculus | 8 | 3,4 |
| • Database query languages<br>o Overview of database languages<br>o SQL (data definition, query formulation, update sublanguage, constraints, integrity)<br>o Embedding SQL queries in a procedural language<br>o Introduction to Object Query Language<br>o Stored Procedures | 8 | 5,7 |
| • Relational database design<br>o Functional dependency<br>o Normal forms (1NF, 2NF, 3NF, BCNF)<br>o Multivalued dependency (4NF)<br>o Join dependency (PJNF, 5NF) | 6 | 4 |
| • Physical database design<br>o File structures: index, hash, B-tree<br>o Files with variable length records<br>o Database efficiency and tuning | 4 | 6 |

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## Course Outcomes Emphasized in Laboratory Projects / Assignments

| | Outcome | Number of Weeks |
|---|---|---|
| 1 | Conceptual schema design<br>Outcome: 3 | 2 |
| 2 | Database query design (relational algebra)<br>Outcomes: 5 | 2 |
| 3 | Database query design (relational calculus and SQL)<br>Outcomes: 5 | 2 |
| 4 | Mapping of a conceptual schema to a relational schema<br>Outcomes: 4 | 2 |
| 5 | Embedding SQL queries in an application program<br>Outcomes: 7 | 2 |

## Oral and Written Communication:

No significant coverage

## Social and Ethical Implications of Computing Topics

No significant coverage

## Approximate number of credit hours devoted to fundamental CS topics

| Topic | Core Hours | Advanced Hours |
|---|---|---|
| **Algorithms:** | | **1.0** |
| **Software Design:** | | |
| **Computer Organization and Architecture:** | | |
| **Data Structures:** | | **1.0** |
| **Concepts of Programming Languages:** | | **1.0** |

## Theoretical Contents

| Topic | Class time |
|---|---|
| Set theory | 0.5 |
| Predicate calculus | 0.5 |

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## Problem Analysis Experiences

1. Conceptual schema design

## Solution Design Experiences

1. Mapping a conceptual schema to a relational schema
2. Design of database queries

## The Coverage of Knowledge Units within Computer Science Body of Knowledge[1]

| Knowledge Unit | Topic | Lecture Hours |
|---|---|---|
| IM1 | Information storage & retrieval; capture & representation; privacy, integrity, security, and preservation; Scalability and efficiency | 3 |
| IM2 | Database system, database architecture, data independence, DBMS functions | 4 |
| IM3 | Conceptual models: E-R, semantic, UML, relational, object-oriented, object-relational | 4 |
| IM4 | Conceptual schema to relational schema, integrity constraints, relational algebra and calculus | 8 |
| IM5 | SQL: definition, retrieval, update, and integrity queries; embedding queries in a procedural language | 8 |
| IM6 | Relational database design: functional dependencies, normal forms, multivalued and join dependencies | 6 |
| IM9 | Indexed files, hashed files, B-trees, files with variable length records, database efficiency and tuning | 4 |

[1]See https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf for a description of Computer Science Knowledge units