

CSCI-C 442 Fall 2021

Database Systems

Indiana University Northwest



1 GENERAL INFORMATION

Instructor : Jie Wang Class duration: 08/23/2021-12/18/2021
Office: Online Meetings: Online
E-mail : Canvas Inbox Office Hours: MW by appointment
Phone: 219-9806623

2 COURSE DESCRIPTION

This course covers fundamentals of data modeling, database query, design, creation and management. Students will learn entity-relationship and relational models, database design with normalization, data retrieval structured query language as well as managing multi-user databases. Students will design and implement a relational database using an industrial-strength management system, and write a client program to access the database.

Prerequisite(s): CSCI-C
A106 and CSCI-C 106

3 TEXTBOOK

- Option 1: *Database Processing Fundamentals, Design, and Implementation. 14th edition.* David M. Kroenke and David J. Auer. Prentice Hall. ISBN-13: 9780133878998
- Option 2: (Global Edition) *Database Processing: Fundamentals, Design, and Implementation 14th.* David M. Kroenke and David Auer. ISBN: 9781292107639.

See [Online-Chapters-Appendices-StudentData folder in Files function at Canvas.](#)

4 COURSE RESOURCES

The resource files are available for download via Canvas Files.

The two options have the same chapter text except for after-chapter exercises and questions.

5 LEARNING GOALS

Students who complete this course should acquire the core skills of identifying organization data management requirements, modeling them using conceptual data modeling techniques, converting the conceptual data models into relational database models and verifying its structural characteristics with normalization techniques, and implementing a relational database using an industrial-strength database management system. An ability to design, implement and evaluate a database system to meet desired needs.

ACM/IEEE Computer Science Core Topic [Database and Information Management]
Information Systems Curriculum Core Course [IS 2010.2]

6 BRIEF LIST OF TOPICS TO BE COVERED

An Overview and Database Query

- An overview of databases and database systems
- SQL (Structured Query Language)
- Access database in a client program

Database Design

- The relational model and normalization
- Database redesign using normalization
- Data modeling with the Entity-Relationship model
- Transforming a conceptual data model into a database schema

Database Implementation

- SQL DDL for Database creation
- SQL view and trigger

Database Administration

- Managing Multiuser Databases
- Managing Databases with a popular DBMS

7 CLASS SCHEDULE

A class schedule table in the resource file.

dbsguide : <https://cisjw.sitehost.iu.edu/dbsguide/>

8 LEARNING OUTCOMES

Students should become familiar with various concepts, principles, and applications of databases and database management systems. Students who complete this course should be able to:

Chapter 1 Introduction

- 1) To understand the nature and characteristics of databases
- 2) To survey some important and interesting database applications
- 3) To gain a general understanding of tables and relationships
- 4) To describe the components of an enterprise-class database system and explain the functions they perform
- 5) To define the term database management system (DBMS) and describe the functions of a DBMS
- 6) To define the term database and describe what is contained within the database
- 7) To define the term metadata and provide examples of metadata
- 8) To define and understand database design from existing data
- 9) To define and understand database design as new systems development
- 10) To define and understand database design in database redesign
- 11) To understand the history and development of database processing

Chapter 2 Introduction to Structured Query Language

- 12) To understand the use of extracted data sets
- 13) To understand ad-hoc queries and business intelligent (BI) systems
- 14) to describe the components of a data warehouse
- 15) To understand the history and significance of Structured Query Language (SQL)
- 16) To understand the basic SQL SELECT/FROM/WHERE framework as the basis for database queries
- 17) To be able to write queries in SQL to retrieve data from a single table

- 18) To be able to write queries in SQL to use the SQL SELECT, FROM, WHERE, ORDER BY, GROUP BY, and HAVING clauses
 - 19) To be able to write queries in SQL to use SQL DISTINCT, AND, OR, NOT, BETWEEN, LIKE, and IN keywords
 - 20) To be able to use the SQL built-in functions of SUM, COUNT, MIN, MAX, and AVG with and without the use of a GROUP BY clause
 - 21) To be able to write queries in SQL to retrieve data from a single table but restricting the data based upon data in another table (sub-query)
 - 22) To be able to write queries in SQL to retrieve data from multiple tables using an SQL JOIN
- Chapter 3 The Relational Model and Normalization*
- 23) To understand basic relational terminology
 - 24) To understand the characteristics of relations
 - 25) To understand alternative terminology used in describing the relational model
 - 26) To be able to identify functional dependencies and identify determinants and dependent attributes
 - 27) To identify primary, candidate and composite keys
 - 28) To be able to identify possible insertion, deletion, and update anomalies in a relation
 - 29) To be able to place a relation in BCNF normal form
 - 30) To be able to identify multivalued dependencies
- Chapter 4 Database Design Using Normalization*
- 31) To design updateable databases to store data received from another source
 - 32) To use SQL to access table structure
 - 33) To understand the advantages and disadvantages of normalization
 - 34) To understand de-normalization
 - 35) To design read-only databases to store data from updateable databases
 - 36) To recognize and be able to correct common design problems
- Chapter 5 Data Modeling with the Entity-Relationship Model*
- 37) To understand the two-phase data modeling/database design process
 - 38) To understand the purpose of the data modeling process
 - 39) To understand entity-relationship (E-R) diagrams
 - 40) To be able to determine entities, attributes and relationships
 - 41) To be able to create entity identifiers
 - 42) To be able to determine minimum and maximum cardinalities
 - 43) To understand variations of the E-R model
 - 44) To understand and be able to use ID-dependent and other weak entities
 - 45) To understand and be able to use supertype/subtype entities
 - 46) To understand and be able to use strong entity patterns
 - 47) To understand and be able to use the ID-dependent association pattern
 - 48) To understand and be able to use the ID-dependent multivalued attribute pattern
 - 49) To understand and be able to use the ID-dependent archetype/instance pattern
 - 50) To understand and be able to use the Line-Item pattern
 - 51) To understand and be able to use the for-use-by pattern
 - 52) To understand and be able to use the recursive patterns
 - 53) To understand the iterative nature of the data modeling process
 - 54) To be able to use the data modeling process
- Chapter 6 Transforming Data Models into Database Designs*
- 55) To understand how to transform data models into database designs
 - 56) To be able to identify primary keys and understand when to use a surrogate key
 - 57) To understand the use of referential integrity constraints
 - 58) To understand the use of referential integrity actions
 - 59) To be able to represent ID-dependent, 1:1, 1:N, and N:M relationships in tables
 - 60) To be able to represent weak entities in tables
 - 61) To be able to represent supertype/subtypes as tables
 - 62) To be able to represent recursive relationships as tables
 - 63) To be able to represent ternary relationships in tables
 - 64) To be able to implement referential integrity actions required by minimum cardinalities
- Chapter 7 SQL for Database Construction and Application Processing*
- 65) To be able to create and manage table structures using SQL statements

- 66) To understand how referential integrity actions are implemented in SQL statements
- 67) To be able to create and use SQL constraints
- 68) To understand several uses for SQL views
- 69) To be able to use SQL statements to create and use views
- 70) To gain an understanding of how SQL is used in an application program
- 71) To understand how to create and use triggers
- 72) To understand how to create and use stored procedures
- Chapter 9 Managing Multiuser Databases*
- 73) To understand the need for and importance of database administration
- 74) To understand the need for concurrency control, security, and backup and recovery
- 75) To learn about typical problems that can occur when multiple users process a database concurrently
- 76) To understand the use of locking and the problem of deadlock
- 77) To learn the difference between optimistic and pessimistic locking
- 78) To learn the meaning of ACID transaction
- 79) To learn the four 1992 ANSI standard isolation levels
- 80) To understand the need for security and specific tasks for improving database security
- 81) To know the difference between recovery via reprocessing and recovery via rollback/rollforward
- 82) To understand the nature of the task required for recovery using rollback/rollforward
- 83) To know basic administrative and managerial DBA functions

9 COURSE GRADE

In general, students expect a grading distribution where:

15 – 20% of students will receive A or A- for excellent work

35 – 50% of students will receive B+ or B or B- for good or very good work

15 – 30% of students will receive C+ or below for adequate or below work

Note that while the School uses these ranges as a guide, the actual distribution for this course and your own grade may depend upon how well the students actually perform in this course.

Weights of Categories:	Assignments, Cats, Practices	15%
	Projects, Quizzes, Tests	25%
	Exams	30%
	Final Exam	30%

10 COPYRIGHT OF CONTENT

Audio/Video Recording/Copyright Policies: To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.

Copyrighted Material: All material provided through the class web site is subject to copyright. This applies to class notes, slides, assignments, solutions, project descriptions, etc. You are allowed (and expected) to use all the provided material for personal use. However, you are strictly prohibited from sharing the material with others in general and from posting the material on the Web or other file sharing venues in particular.

11 CLASS POLICIES REGARDING GRADED WORK

****The following policies are in effect for all submissions throughout the semester, unless noted otherwise. ****

Original Work

Unless group collaboration is required, i.e., for group discussion assignments or projects, your submission should be an individual work. Plagiarism can result in course failure and university dismissal. In cases of suspected plagiarism, university policy will be followed. Any student discovered cheating (copying files, committing plagiarism, sharing answers with others, etc.) will receive a zero for that assignment, and will be reported to the Dean of his/her division. If more than one student is involved in the incident, s/he will receive the same punishment. To avoid this, a student must give credit to the originality and acknowledge sources whenever directly quoting or paraphrasing words, ideas or opinions from others, whether oral or written.

Late Submission (3-3-3)

It is highly recommended that you start working on an assignment soon after it is given. All assignments and projects have a deadline. Due dates will be strictly enforced, unless an extension is granted to all students. A late submission will NOT be accepted and will receive a grade of zero (0). If you become sick or a family emergency arises and you are unable to turn in your work on time, Documented proof is needed for such excuses. *A reduction of 20% a day in the score* will be applied to all late work, not accepted if more than three (3) days late.

Tests and Exams

All tests and exams are closed books if not specified. Use of any electronic devices is not permitted during a test or exam session. If you would like to observe any holidays other than the public holidays, please inform the instructor during the first week of the class.

Tests and exams can't be made up. A make-up may only be given under exceptional circumstances. A request submitted after the deadline is invalid. *A reduction of 30% a day* will be applied to a make-up, not accepted if more than three (3) days late. Documented proof is needed before a make-up is granted.

Grading

If you have a question on a grade you have received, please see the instructor within three (3) days from the grade is posted. Re-graded score may go up or down. The instructor will keep students apprised of assignment grades via the online grade book. Students are responsible for contacting the instructor if they do not receive any grade by 10 days after the assignment submission date.

Poor presentation in a submission may cause lose of points. If you turn in your work in a hard copy, be sure that your work is stapled together and your name is printed on every page. Please also make sure your work is written legibly or typed.

Incompletes

Campus policy for Incompletes will be used. Incompletes will be granted only in extreme circumstances, not for work-related deadlines, prior personal commitments, or falling behind in readings or assignments.

Incomplete Grades (see IU's policy on Incomplete Grades below) The grade of I (Incomplete) indicates that the student has satisfactorily completed the major portion of a course but is prevented by extraordinary circumstances from completing the balance of the course. The grade of I will be given only if the instructor has sufficient reason to believe that the failure to complete the requirements of the course was beyond the student's control and that it would be unjust to hold the student to the time limits normally fixed for completion of the required assignments. The grade of I will not be awarded simply to exempt a student from paying tuition for a repeated course. <http://www.iu.edu/~bulletin/ius/2011-2013/policies/grading-system/incompletes.shtml>

12 ADDITIONAL INFORMATION

Right to Accommodation for Individuals with Disabilities

Indiana University is committed to creating a learning environment and academic community that promotes educational opportunities for all individuals, including those with disabilities. Course directors are asked to make reasonable accommodations, upon request by the student or the university, for such disabilities. It is the responsibility of students with documented physical or learning disabilities seeking accommodation to notify their course directors and the relevant campus office that deals with such cases in a timely manner concerning the need for such accommodation. Indiana University will make reasonable accommodations for access to programs, services, and facilities as outlined by applicable state and federal laws.

Student Support Services: Hawthorn 239, (219)980-6798. <http://www.iun.edu/~supportn>

Policies Regarding Sexual Misconduct

What you should know about sexual misconduct: IU does not tolerate acts of sexual misconduct, including sexual harassment and all forms of sexual violence. If you have experienced sexual misconduct, or know someone who has, the University can help. It is important to know that federal regulations and University policy require faculty to promptly report complaints of potential sexual misconduct known to them to their campus Deputy Title IX Coordinator(s) to ensure that appropriate measures are taken and resources are made available. The University will work with you to protect your privacy by sharing information with only those that need to know to ensure the University can respond and assist. If you are seeking help and would like to speak to someone confidentially, you can make an appointment with a Mental Health Counselor on campus (contact information available at <http://stopsexualviolence.iu.edu/employee/confidential.html>). Find more information about sexual violence, including campus and community resources at <http://stopsexualviolence.iu.edu/>

Expectations of classroom behavior

A classroom is analogous to a professional environment. Students are expected to behave professionally so that everyone can engage fully in the educational process, which means that disruptive behavior during class is prohibited. This includes, but is not limited to, arguing with the instructor about grades or assignments, arguing with other students, bringing up individual concerns with the instructor in the middle of class, or using language or exhibiting other behavior that distracts others from engaging fully in the academic enterprise. A student who disrupts the learning environment will be asked to stop the behavior immediately; if the disruptive behavior continues, the student will be asked to leave the class session.