ITD 256

Advanced Database Management

Course Syllabus

Instructor	Jeffrey Elkner
Session	Spring 2023
Meeting Days	B Day
Time	8:00 - 9:24 am
Location	Arlington Career Center Room 512
Contact	jde232@email.vccs.edu

Course Description:

Focuses in-depth instruction in the handling of critical tasks of planning and implementing large databases. Includes an introduction to concepts of advanced data warehousing and database configuration.

General Course Purpose:

The purpose of this course is to provide a comprehensive introduction to database management. The course will define essential database terms and concepts. The emphasis of the course is on the design, development, and use of a relational database. The student will learn the basics of drawing an Entity-Relationship diagram (ERD) to represent user requirements, transform the ERD to a normalized relational design, and then use Structured Query Language (SQL) to implement and work with the database.

Course Objectives:

Upon completion of this course, the student will be able to:

- Define essential database vocabulary
- Effectively apply data relationships and normalization techniques
- Describe the transformation of database design from a conceptual user model (e.g., an ERD) to a normalized relational model
- Explain and apply Structured Query Language (SQL) in a database environment
- Characterize the roles and responsibilities of the Database Administrator (DBA)
- Apply fundamental database concepts to an information systems problem

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Major Topics to be Included

- Basic Database Concepts
- Relational Database Terms and Concepts
- Normalization
- Structured Query Language
- Data Modeling
- Database Design
- Database Management and Administration
- Business Intelligence / Basic Data Warehousing Concepts

Student Learning Outcomes

Basic Database Concepts

- Define basic database terms and principles.
- Discuss why databases are used
- Contrast (traditional) file processing with database processing.
- Describe the components of a database/database management system
- Describe the purpose and functions of a database management system

Relational Database Terms and Concepts

- Describe the conceptual foundation of the relational model
- Distinguish between relations and non-relational tables
- Explain basic relational terminology to include, but not limited to, relation/table, tuple/row, attribute/column, cardinality/multiplicity
- Explain the meaning and importance of keys, foreign keys, and related terminology
- Explain how foreign keys and intersection relations represent relationships
- Explain the purpose and use of surrogate keys
- Explain the meaning of referential integrity

Normalization

- Define normalization
- Explain the impetus behind use of Normalization in database design
- Explain the nature and background of normalization theory
- Apply the normalization process to produce a relation in 3NF
- Explain the meaning of functional dependencies

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Structured Query Language

- Write basic SQL statements for creating database structures
- Write basic SQL statements to add data to a database
- Write basic SQL SELECT statements and options for processing a single table
- Write basic SQL SELECT statements for processing multiple tables
- Write basic SQL statements to modify and delete data from a database
- Write basic SQL statements to modify and delete database tables and constraints
- Write basic SQL statements for creating and using views
- Explain the reasons for using views
- Meet several times during the semester in a computer lab to practice as a class

Data Modeling

- Describe the basic stages of database development
- Explain the purpose and role of a data model
- Describe the principal components of the E-R data model
- Interpret traditional E-R diagrams
- Interpret Information Engineering (IE) Crow's Foot E-R diagrams
- Construct E-R diagrams
- Represent binary relationships to include 1:1, 1:N, N:M with the E-R model
- Explain weak entities and how to use them
- Explain non-identifying and identifying relationships and know how to use them
- Create an E-R diagram from source documents

Database Design (logical and physical)

- Transform E-R data models into relational designs
- Recognize and describe motivations and processes for de-normalization
- Represent weak entities with the relational model
- Represent 1:1, 1:N, and N:M binary relationships

Database Management and Administration

- Describe the need for, and importance of, database administration
- Describe different ways of processing a database
- Describe the need for concurrency control, security, and backup and recovery
- Describe typical problems that can occur when multiple users process a database concurrently
- Explain the use of locking and the problem of deadlock
- Distinguish between optimistic and pessimistic locking
- Describe specific design and implementation strategies for improving database security
- Distinguish between recovery via reprocessing and recovery via rollback/rollforward
- Explain the nature of the tasks required for recovery using rollback/rollforward
- Describe basic administrative and managerial DBA functions
- Explain distributed database processing
- Explain the concept of object-relational databases

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Business Intelligence / Basic Data Warehousing Concepts

- Explain the basic concepts of data warehouses and data marts
- Explain the basic concepts of dimensional databases
- Explain the basic concepts of business intelligence (BI) systems
- Explain the basic concepts of Online Analytical Processing (OLAP) and data mining

Database Project

Given a business case (project scenario), the student will:

1. Explain how database principles may be applied as a part of the IT solution
2. Draw an ERD to represent the pertinent user data
3. Transform the ERD into a 3NF relational model
4. Write the necessary SQL to create the database structures (CREATE and INSERT)
5. Write the necessary SQL to manipulate data into meaningful query (report) results

Time Allocation per Topic

The following table has the breakdown of the time in this course that will be spent on each course topic:

Topic	Hours	Percentage
Basic Database Concepts	3	7%
Relational Database Terms and Concepts	4	9%
Normalization	6	13%
Structured Query Language	11	24%
Data Modeling	6	13%
Database Design	5	11%
Database Management and Administration	7	16%
Business Intelligence / Basic Data Warehousing Concepts	3	7%
Other Optional Content	3	7%

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Total:	**45**	**100%**

Required Instructional Materials:

Database Systems: Design, Implementation, & Management, 12th edition *by Carlos Coronel and Steven Morris*
A Curious Moon: A data science mystery featuring PostgreSQL, Cassini and Enceladus *by Rob Conery*
Learning PostgreSQL 10, 2nd edition *by Salahaldin Juba and Andrey Volkov* (Available on NVCC Safari Books)

Course Credit: 3 Credits

Policies:

I. Expectations

a. Advanced Database Management is a rigorous, college level course that will require sustained and consistent engagement from students.
b. An average of 90 minutes of homework will be assigned for each 90 minutes in class. We will be utilizing a flipped classroom learning environment, where the lecture portion of the course material will be viewed individually at home *before* class meets, and class time will be used for collaborative engagement and discussion.
c. Daily "mini quizzes" at the beginning of class will be used to be sure homework readings and practice have been completed. To be successful in this class, students will be expected to be prepared for these quizzes when they arrive in class.

II. Grading Policies

a. Grading Scale
A= 100 - 90 B= 89 - 80 C= 79 - 70 D=69 - 60 F= 59 and below
b. Students will receive a weekly cumulative letter grade that will incorporate daily quizzes, tests, projects, and presentations. These weekly evaluations can be challenged by the student, *but only during the week immediately following when the evaluation is given*.
c. The average of the weekly evaluations will make up 70% of the final grade, with the course final exam making up 30%.
d. In cases where district grading policies conflict with college grading policies, the high school and college grades may differ; this may include assignment/test retakes, extended assignment due dates, capped minimum grade allowed, among other such district policies.
e. It is important that students check their final NOVA grades in Blackboard as soon as the course(s) completed.

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III. Course Policies

a. Academic Integrity

i. The College does not tolerate academic dishonesty. Students who are not honest in their academic work will face disciplinary action along with any grade penalty the instructor imposes. Procedures for disciplinary measures and appeals are outlined in the Student Handbook (http://www.nvcc.edu/students/handbook/). In extreme cases, academic dishonesty may result in dismissal from the College.

ii. Plagiarism: is the act of appropriating passages from the work of another individual, either word for word or in substance, and representing them as one's own work. This includes any submission of written work other than one's own. In short, plagiarism means using the exact words, opinions, or factual information from another person without giving that person credit. Students who are not honest in their academic work will face disciplinary action along with any grade penalty the instructor imposes. For more information about student academic integrity: https://www.nvcc.edu/curcatalog/policies/integrity.html

b. Disabilities

i. Students with disabilities are required to contact NOVA's Office of Disability Support Services (DSS) to discuss possible accommodations. All information is kept confidential and may increase your chances of success in the academic setting. If accommodations are agreed upon, student will receive a Memorandum of Accommodation (MOA) by DSS. For more information about NOVA's DSS office: https://www.nvcc.edu/disability-services.

c. Self-Advocacy

i. Students are expected to reach out to their instructor if they do not understand content or expectations.

ii. College instructors and other college personnel will not talk with a parent without the permission of and presence of the student. The conversation is between the administrator / faculty member and the student. The parent's role is to listen, give moral support, and summarize information and agreements if needed.

iii. Dual enrolled students have access to full NOVA campus services to include tutoring, library, and counseling services; student resources are found here: http://www.nvcc.edu/students/index.html

IV. Course Schedule

a. Critical Course Dates

Course Start Date	Tuesday, January 31, 2023
Course Drop Date	Monday, February 20, 2023
Course Withdrawal Date	Friday, April 21, 2023
Final Exam Date	Week of June 12 to 16, 2023
Course End Date	Friday, June 16, 2023

b. Final Exam Date: *The final exam will be given during the last week of class, between Monday, June 12 and Friday, June 16.*