IS 331-452 Spring 2024

Database Design, Management and Applications

Class Time: Asynchronous Online

Location: Online

Instructor Information:

Name: Dr. Chris Markson

Email: crm23@njit.edu

Office Hours:

Via WebEx by Appointment

Textbook

REQUIRED: Kroenke and D. Auer, S. Vandenbrg, R.Yoder, DATABASE CONCEPTS, 10th Edition, Pearson, 2022.
ISBN: 978-013-791678-8

REQUIRED: Syverson, Bryan and Joel Murach, SQL Server 2022 for Developers, Mike Murach and Associates, 2023. ISBN: 978-1-943873-06-7

Hardware Required

Windows-based computer. If you do not have one, then you must use the computers available on campus.

Software (Required for installation on your personal machine or used in NJIT Computer Labs)

- Microsoft Access
- Microsoft Excel
- Microsoft Visio
- Microsoft SQL Server 2022. Mac users may have to use the version in a virtual machine.
- Microsoft SQL Server Management Studio

- Virtual machine software if you are using a Mac
- Repondus Lockdown browser and webcam

Course Description

Businesses use databases extensively for analysis and decision-making because they provide efficient, large-scale information storage and rapid retrieval. Databases support the "back end functionality" of most large web systems. This course gives students extensive, pragmatic experience in designing, building, querying, updating, maintaining and managing relational databases, using the Structured Query Language (SQL). Proper database design principles are emphasized throughout the course, beginning with high level descriptions of relational databases using data modeling tools(such as entity-relationship or ER diagrams)and progressing to relational database design principles based on higher order normalizations. We will examine some poorly designed databases and show how these can be transformed into well designed databases. SQL will be extensively covered, and students will design implement sophisticated SQL queries invoking self-joins, outer joins, correlated sub-queries and related concepts. Students will explore and utilize design methodologies for input data validation and maintaining database integrity, and study issues of database privacy and security. Advanced topics to be discussed include the role of the Database Administrator (DBA), database life cycle activities, database de-normalization, read-only database and data warehouses. Hands-on experience will be gained by with actual database using industry-standard database management systems such as Oracle.

Prerequisite

Completion IS218, Building Web Applications or IT202, Internet and Applications. It is also assumed that students have some basic familiarity with Microsoft Office, particularly Microsoft Access.

Class Communication Space/Learning Management System

We will be using Canvas, an open source Learning Management System at NJIT, for the posting of projects and class resources and other class announcements are postings. Students having questions on projects, etc., may contact Dr. Hendela directly at ahh2@njit.edu or, if the answer would benefit the class, post the question in the appropriate forum within Canvas. Students are obligated to log into Canvas on a near-daily basis, and to keep current. DO NOT use the Canvas Message feature. It does not give your name or class section. I cannot respond to these messages. Email me instead.

Course Goals

To understand the design and development issues regarding databases. Students will obtain a strong conceptual foundation of the underpinnings of database design, as well as gain experience

with some commercial database management products, such as SQL Server. IS331 seeks to provide the student with the conceptual and practical aspects and issues related to designing, implementing, managing, deploying, and utilizing database applications. The main emphasis is on the student's comprehension of key concepts in database design as opposed to programming or algorithms. The student will utilizes various DBMS products and software tools, including SQL Server and SQL Server Management Studio, to put into practice the database concepts presented.

Lecture Notes

Presentation slides will be downloadable each week from Canvas.

Course Grade Components

- Midterm Exam - 29%
- Final Exam - 29%
- Database conceptual assignments and DBMS projects (30%) – 8 throughout semester
- Work participation / attendance 12%. The proportion of the assignments handed in will mostly determine your work participation grade.

Grade Cutoffs

- A: 90 - 100
- B+ 86 - 89
- B: 80 - 85
- C+: 76-79
- C: 70 - 75
- D: 60 - 69
- F: Below 60

Work Participation and Attendance

Attendance will be taken for each class meeting and is important for you to gain the most from this course. This course is offered face to face in order for you to gain the most understanding of the material and to be able to ask questions in real-time. For cases where you miss less than 4 classes, attendance will be used to determine the higher or lower of two grades when you are between grade cutoffs such as above 85 but not fully 86. The more classes you attend, the better chance you have of gaining the higher grade.

Work Participation is worth 12% of your final grade. Many people, including the course coordinator worked for a long time as a consultant that was home-based. Customers only knew me from the work I handed to them on time. My customers did not accept excuses for late work. In order to better prepare you for the many work places which work on a results basis with flexible hours and attendance policies, I put the weight of this grade into your results, not just sitting in a seat. That said, if you have a life situation that needs to be taken into account for your performance, please see me. Medical excuses must go through the Dean of Students office.

Any missing homework assignments, A01-A08, go against your work participation grade. Missed homework assignments not only get a zero for the assignment but also a lowering of your work participation grade. This is also true for assignments that score a zero for any other reason. This is how I calculate your participation grade:

*(Number of assignments attempted with grade above 0) / Number of total assignments * 12)*

With this formula, the proportion of the work you factually attempt is considered your participation. Do not miss assignments. They must be on time or no credit is given.

Late Project Policy

All projects and assignments must be turned in on time, or no credit is given unless an exception granted by extraordinary circumstances verified by the Dean of Students..

Extra Credit Policy

There is no extra credit assignments given. You do the assigned work at the time it is given and submit it on time for a grade.

Make Up Policy

There are no make ups for missed assignments or exams. The grade is entered as Zero unless an exception granted by extraordinary circumstances verified by the Dean of Students.

Absence Policy

You are expected to attend every class if you will not attend a class you should notify me that you will not be attending. **MISSING 4 OR MORE CLASSES WILL LOWER YOUR FINAL GRADE BY ONE LETTER GRADE FOR EACH 4 CLASSES YOU MISS. YOU MUST SIGN YOURSELF IN ON THE ATTENDANCE SHEET TO BE COUNTED. IT IS YOUR RESPONSIBILITY TO MAKE SURE YOU ARE SIGNED IN. SIGNING SOMEONE ELSE IN IS COUNTED AS CHEATING. SEE ACADEMIC INTEGRITY POLICY FOR PENALTY.**

Medical Excuses need to be reported to the Dean of Students and they will decide if it is to be excused or not.

Academic Integrity Policy

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

My expectation is that each person will complete original work for this course and will not copy from fellow students or tutorials online. It is OK to refer to tutorials online; however, you will be considered in violation of the NJIT honor code by submitting work found online. Any violations of the honor code will be referred to the Dean of Students for investigation and possible disciplinary action.

Every assignment/project is a 'home-mini-exam.' The NJIT Honor Code will be strictly upheld. Students found cheating/collaborating/plagiarizing will be immediately referred to the Dean of Students and the NJIT Committee on Professional Conduct and subject to possible Disciplinary Probation, a permanent marking on the record, possible dismissal and a grade of 'F' in the course. All submitted assignments are carefully checked for similarities, and plagiarism and guilty students will be identified and referred to the Dean of Students for disciplinary action.

Use of file sharing sites such are CourseHero.com is strictly forbidden. Students either posting or using these sites will be referred to the Dean of Students for disciplinary action and/or copyright infringement prosecution. Additionally, DO NOT share files among yourselves. If you need help, ask me for it.

DO NOT share your laptops or any of your files from this semester or from anyone that has taken this course before. If your machine breaks, use the ones on campus in the PC Mall.

This is your only warning. Cheating is not worth it - you may not only fail this course, but also be suspended or expelled from NJIT. THE INSTRUCTOR RESERVES THE RIGHT TO REQUIRE REMOTE EXAM PROCTORING SOFTWARE SUCH AS RESPONDUS.

For more information about the NJIT honor code, you should refer to this document:

http://www.njit.edu/doss/code-student-conduct-article-11-university-policy-academic-integrity/

General Policy

Assignments and exams are to be completed **with assignments uploaded to Canvas** by the due dates. You must have a very good reason for requesting an extension—email your request to the instructor well before the due date. Exceptions are granted under extraordinary circumstances verified by the Dean of Students.

Topics

Below are the topics covered in the course and the related textbook readings. The key to success in IS331 is your own self-discipline. Keep up with the work and readings and do not fall behind. Catching up is nearly impossible. I want you to develop the self-discipline to succeed not only in this class, but also in your future careers.

WEEK	TOPICS	BOOK READINGS	HOMEWORK
1	**Welcome & Intro**		**Assignment 1**
	File processing systems	**Chapter 1**	
2			**Assignment 2**
	Database Intro	**M:Chapter 1**	
	Conceptual Design 1	**Chapter 1**	
3			**Assignment 3**
	Conceptual Design 2	**M:Chapter 10**	
	Conceptual Design 3		
4		**Chapter 2**	**Assignment 4**
	Conceptual Design 4		
	Logical Design 1	**Chapter 5**	
5			
	Logical Design 2	**M: Chapter 10**	
	Logical Design 3		**Assignment 5**
6		**Chapter 4**	
			Assignment 6
	Logical Design 4	**Chapter 4**	
7			
	Physical Design	**M: Chapter 8**	
			Online or In person at Professor's discretion. Online exam will require Respondus
8	**Midterm Exam**		

			lockdown browser and webcam.
9	**Data Definition Language**	**Chapter 3**	
	Data Definition Language Lab	**M:Chapter 9 & 11**	
10	**Relational Algebra 1**	**Chapter 6**	
	Relational Algebra 2	**M: Chapter 3, 4**	
11	**Relational Algebra 3**	**Chapter 6**	
	Relational Algebra 4	**M: Chapter 5, 6**	
12	**SQL Practice**	**M:Chapter 2, 7, & 12**	**Assignment 7**
	SQL Management Studio		
13	**PL SQL, TSQL**	**M: Chapter 13, 14, 15, 17**	
	Creating Views and other objects		
14	**Transaction Processing**	**Chapter 7**	**Assignment 8**
	Data Warehousing	**M: Chapter 16**	
15	**Final Examination**		**In person or online at Professor's discretion. Online exam will require Respondus lockdown browser and webcam.**
16	**Grades due at Registrar**		

Course Outcomes for IS331

- *Course outcome 1*: The student can demonstrate the use of SQL to properly and optimally design and implement a database from a set of user requirements, ensuring data integrity, and providing a high level description of the database, using Entity Relationship Data Modeling. (Assignment A04)
- *Course outcome 2*: The student will transform a conceptual database design, into a logical set of relations that can be used as a basis for a physical implementation. The student will apply the principles of relational database design such as referential integrity, normalization, and relationships. (Assignment A06)

- *Course outcome 3*: The student is able to construct sophisticated SQL queries, using advanced SQL topics such including self-join, inner and outer joins, and other types of queries. (Assignment A08)

Student Outcomes

Student outcomes versus course outcomes.

Student Outcomes	**Addressed by**
SO 1 Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions	(CO1-A04), (CO2-A06), (CO3-A08)
SO 2 Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline	(CO1-A04), (CO2-A06)
SO 3 Communicate effectively in a variety of professional contexts	
SO 4 Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles	
SO 5 Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline	
SO 6 Support the delivery, use, and management of information systems within an information systems environment	(CO1-A04), (CO3-A08)

NOTE: Numbers in the "Addressed by" column refer to the numbers in the "Student Outcomes After Completing IS331" section above.

Topics to be Covered

1. Properties of databases
2. Flat-file databases vs. relational databases
3. High-level descriptions of databases using Entity-Relationship Diagrams with Chen and Crow's Foot Nomenclature
4. Translation of ER Models to Relational Designs
5. Methodologies for querying a database, including Relational Algebra operators and graphical query interfaces such as GQBE
6. Fundamental syntax of SQL, creating a database with SQL
7. Examination of some poorly designed databases and rectifying their design
8. Responsibilities of the database professional, including issues of database integrity and ethical obligations involving privacy/security of data
9. Functional dependencies and multi-valued dependencies
10. Optimal database design using Normalization (1NF, 2NF, 3NF, BCNF, 4NF, DKNF)
11. De-normalization and when it should be used.
12. Use of update-able vs. read-only databases
13. Referential integrity, foreign key constraints, and casual relationships
14. Data warehouses and their high level design
15. Advanced SQL query design using, for example, self, inner, outer, left and right joins
16. Input validation and database integrity
17. Methods for database redesign
18. Use of correlated and non-correlated sub-queries