

Spring 2020

## **IS 331-454: Database Design, Management and Applications**

Christopher Markson

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IS 331-454 Spring 2020

(available: <https://njit.instructure.com/courses/9449/assignments/syllabus>)

Database Design, Management and Applications

Class Time: Distance Learning

Location: Online

**Instructor Information:**

Name: Dr. Chris Markson

**Office Hours:**

Office: ---

(By Appoint Only)

Phone Number: ---

Email (preferred): [crm23@njit.edu](mailto:crm23@njit.edu)

**Textbook**

Kroenke and D. Auer, S. Vandenberg, R. Yoder, DATABASE CONCEPTS, 8th Edition, Pearson, 2018.

ISBN: 978-013-460-1533

Syverson, Bryan and Joel Murach, SQL Server 2016 for Developers, Mike Murach and Associates, 2016. ISBN: 978-1-890-0774-96-7

**Software**

- Microsoft Access
- Microsoft Excel
- Microsoft Visio
- Microsoft SQL Server 2017. Mac users may have to use version 2014 in the virtual box.
- Microsoft SQL Server Management Studio
- Virtual Box 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 subqueries 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 denormalization, 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 (2010 or 2013), 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. Markson directly at [crm23@njit.edu](mailto:crm23@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 utilize 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 - 30%
- Final Exam - 30%
- Database conceptual assignments and DBMS projects (30%) – 7 throughout semester
- Work participation / attendance 10%. 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 5 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 10% 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-A07, 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 how I calculate your participation grade:

*(Number of assignments attempted / Number of total assignments \* 10)*

With this formula, the proportion of the work you 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.

### **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.

### **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. 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> (Links to an external site.).*

*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](mailto: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 as 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.

***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/> (Links to an external site.)

## 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.

## 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	WEEK STARTING	TOPICS	BOOK READINGS	HOMEWORK
1	1/19	Welcome & Intro		Assignment 1

2	1/26	File processing systems Database Intro	Chapter 1	Assignment 2
3	2/02	Conceptual Design 1 Conceptual Design 2	Chapter 1	Assignment 3
4	2/09	Conceptual Design 3 Conceptual Design 4	Chapter 2	Assignment 4
5	2/16	Logical Design 1 Logical Design 2	Chapter 5	
6	2/23	Logical Design 3	Chapter 4	Assignment 5
7	3/01	Logical Design 4 Physical Design	Chapter 4	
8	3/08	Midterm Exam		Online or In person at Professor's discretion. Online exam will require Respondus lockdown browser and webcam.
9	3/22	Data Definition Language Data Definition Language Lab	Chapter 7	
10	3/29	Relational Algebra 1 Relational Algebra 2	Chapter App E	
11	4/05	Relational Algebra 3	Chapter 6	

<b>Relational Algebra 4</b>				
12	4/12	SQL Practice SQL Developer	Chapter App I	Assignment 6
13	4/19	PL SQL, TSQL Creating Views and other objects	Chapter App A	
14	4/26	Transaction Processing Data Warehousing	Chapter 8	Assignment 7
15	During Finals Week 5/20-5/14	Final Examination	During Finals Week	In person or online at Professor's discretion. Online exam will require Respondus lockdown browser and webcam.
16	5/16	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 A05)
- *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 A07)

## Student Outcomes

Student outcomes versus course outcomes.

<b>Student Outcomes</b>	<b>Addressed by</b>
SO 1 Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions	(CO1-A04), (CO2-A05), (CO3-A07)
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-A05)
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-A07)

**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. Flatfile 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 multivalued dependencies
10. Optimal database design using Normalization (1NF, 2NF, 3NF, BCNF, 4NF, DKNF)
11. Denormalization and when it should be used.
12. Use of updateable 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 subqueries

## Course Summary:

Date	Details
Wed Feb 5, 2020	Assignment <a href="#">A01. Assignment 1 Introduce yourself / Pick Stock Symbol - DUE Wed, 02/05 @ 4:30 PM</a>
Wed Feb 19, 2020	Assignment <a href="#">A02. Assignment 2 submission - DUE Wednesday, Feb 19 @ 4:30 PM</a>
Wed Feb 26, 2020	Assignment <a href="#">A03. Assignment 3 submission - DUE Wednesday, Feb 26 @ 4:30 PM</a>
Wed Mar 11, 2020	Assignment <a href="#">A04. Assignment 4 submission - DUE, Wednesday, Mar 11 @ 4:30 PM</a>

Date	Details
Sat Mar 28, 2020	Assignment <a href="#">Midterm exam- Online-Requires Respondus LockDown Browser March 25 - Requires Respondus LockDown Browser + Webcam</a>
Sun Mar 29, 2020	Assignment <a href="#">Midterm exam- Online-Requires Respondus LockDown Browser March 25 - Requires Respondus LockDown Browser + Webcam (1 student)</a>
Wed Apr 8, 2020	Assignment <a href="#">A05. Assignment 5 submission - DUE Wednesday, Apr 8 @ 4:30 PM</a>
Wed Apr 22, 2020	Assignment <a href="#">A06. Assignment 6 submissions - DUE Wednesday, Apr 22 @ 4:30 PM</a>
Wed Apr 29, 2020	Assignment <a href="#">A07. Assignment 7 submissions - DUE Wednesday Apr 29 @ 4:30 PM</a>
Tue May 12, 2020	Assignment <a href="#">Final Exam - Online, May 12, 2:30 PM - May 14 5:00 PM) - Requires Respondus LockDown Browser + Webcam</a>
	Assignment <a href="#">Respondus Test Quiz - Requires Respondus LockDown Browser</a>
	Assignment <a href="#">Work Participation</a>

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Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29Previous monthClick to view event details	30Previous month	31Previous month	1	2	3	4
5	6	7	8Click to view event details	9	10	11
12	13	14	15	16	17	18
19	20Today	21	22Click to view event details	23	24	25

Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27	28	29Click to view event details	30	1Next month	2Next month
3Next month	4Next month	5Next month	6Next month	7Next month	8Next month	9Next month

**Assignments are weighted by group:**

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