

Fall 2019

# IS 331-005: Database Design, Management and Applications

Art Hendela

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# IS 331-005 Fall 2019

## Database Design, Management and Applications

**Class Time:** Monday 8:30 AM – 11:20 AM

**Location:** PC MALL 39

### **Instructor Information:**

Name: Dr. Art Hendela  
Office: 5108 GITC  
Phone Number: 973-596-5841  
Email (preferred): ahh2@njit.edu

### **Office Hours:**

Monday: 4PM-5PM (By Appoint Only)  
Tuesday: 9:00 AM – 9:45 AM  
Wednesday: 11:30 AM – 12:30 PM

### **Textbooks**

D. 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. Hendela directly at [ahh2@njit.edu](mailto: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 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. 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 5 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>.

*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/>

## **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	9/08	Welcome & Intro		Assignment 1
2	9/15	File processing systems Database Intro	Chapter 1	Assignment 2
3	9/22	Conceptual Design 1 Conceptual Design 2	Chapter 1	Assignment 3
4	9/29	Conceptual Design 3 Conceptual Design 4	Chapter 2	Assignment 4
5	10/06	Logical Design 1 Logical Design 2	Chapter 5	
6	10/13	Logical Design 3	Chapter 4	Assignment 5
7	10/20	Logical Design 4 Physical Design	Chapter 4	
8	10/27	Midterm Exam		Online or In person at Professor's discretion. Online exam will require Respondus lockdown browser and webcam.
9	11/03	Data Definition Language Data Definition Language Lab	Chapter 7	
10	11/10	Relational Algebra 1 Relational Algebra 2	Chapter App E	
11	11/17	Relational Algebra 3 Relational Algebra 4	Chapter 6	
12	11/24	SQL Practice SQL Developer	Chapter App I	Assignment 6
13	12/01	PL SQL, TSQL Creating Views and other objects	Chapter App A	
14	12/08	Transaction Processing Data Warehousing	Chapter 8	Assignment 7
15	During Finals Week 12/13-12/20	Final Examination	During Finals Week	In person or online at Professor's discretion. Online exam will require

				<b>Respondus lockdown browser and webcam.</b>
<b>16</b>	<b>12/22</b>	<b>Grades due at Registrar</b>		



## **Student Outcomes for IS331**

1. The student can demonstrate the use of SQL to properly and optimally design and implement a database from a set of user requirements, insuring data integrity, and providing a high level description of the database, using Entity Relationship Data Modeling. (A04).
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. (A05).
3. The student will be able to construct sophisticated SQL queries, using advanced SQL topics such as self-joins, inner and outer joins, and correlated sub-queries. (A07).

## ABET Measured Outcomes

Student Outcomes	Addressed by
a) An ability to apply knowledge from computing, mathematics, statistics, and management to effective Information Systems practice.	(1, 2, 3)
b) Have demonstrated the capability to analyze problems and systems, and identify/define/design apropos computing/IS/IT solutions, tools and methodologies.	(1, 2, 3)
c) Have achieved and demonstrated a working knowledge of the SDLC (Software Development Life Cycle) which includes requirements analysis, systems design, implementation, testing, deployment, maintenance, and evaluation, and applied it to Information Systems projects that solve problems where computing solutions are appropriate.	
d) An ability to function effectively on teams in order to accomplish a desired goal.	
e) An understanding of the ethical, societal and professional responsibilities of the Information Systems professional.	
f) An ability to communicate effectively in both oral and written modes.	
g) An ability to identify and analyze the bi-directional impact of socio-technical problems and computing on individuals, organizations and society, including ethical, legal, security and policy issues.	
h) An ability to invoke current techniques, skills, tools and methodologies necessary to becoming an effective Information Systems professional.	(1, 2, 3)
i) An understanding of the need to engage in continuing professional development, and to understand the purpose of research in the Information Systems and Computing fields, and how this benefits current practice.	
j) (BSBIS) An understanding of processes that support the delivery and management of information systems within a business/managerial/organizational environment. <b>OR</b> (BAIS) An understanding of processes that support the delivery and management of information systems to either a business/managerial/organizational environment, or a publishing/media/communications environment.	(1,2)
k) None of the above	

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

## Topics to be Covered

- a) Properties of databases
- b) Flatfile databases vs. relational databases
- c) High-level descriptions of databases using Entity-Relationship Diagrams with Chen and Crow's Foot Nomenclature
- d) Translation of ER Models to Relational Designs
- e) Methodologies for querying a database, including Relational Algebra operators and graphical query interfaces such as GQBE
- f) Fundamental syntax of SQL, creating a database with SQL
- g) Examination of some poorly designed databases and rectifying their design
- h) Responsibilities of the database professional, including issues of database integrity and ethical obligations involving privacy/security of data
- i) Functional dependencies and multivalued dependencies
- j) Optimal database design using Normalization (1NF, 2NF, 3NF, BCNF, 4NF, DKNF)
- k) Denormalization and when it should be used.
- l) Use of updateable vs. read-only databases
- m) Referential integrity, foreign key constraints, and casual relationships
- n) Data warehouses and their high level design
- o) Advanced SQL query design using, for example, self, inner, outer, left and right joins
- p) Input validation and database integrity
- q) Methods for database redesign
- r) Use of correlated and non-correlated subqueries
- s)