

# Advanced Relational Database Management

## MISM Course S21-95736 A3

### Spring 2021

Carnegie Mellon University

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Building / Room: Hamburg Hall (HBH) 1002

Time: 6:30 – 9:20 EST, Thursday

Remote offering: ZOOM (see meeting logistics on the Canvas site)

Web site: <http://www.cmu.edu/canvas/>

## Textbooks

- Thomas Connolly, Carolyn Begg. *Database Systems: A Practical Approach to Design, Implementation and Management*. 6<sup>th</sup> Edition. Addison-Wesley, Harlow, England. 2015. ISBN: 978-0-294326-0 (CB) (REQUIRED)
- Joan Casteel. *Oracle 11g: PL/SQL Programming*. Course Technology, Boston, MA. 2013. ISBN: 978-1-133-94736-3 (JC) (OPTIONAL)

<https://www.oreilly.com/library/view/oracle-database-11g/9780071494458/?ar>

When prompted to “Select your institution”, select “Not Listed? Click here.”. Enter your CMU Andrew email address and password, when prompted for your “Academic email”.

## Prerequisite and Requirements:

Prerequisite: Database Management, 95-703, 90-746; <or> Intermediate Database Management, 95-813

Requirement: Students *MUST* have a laptop with Oracle Database Express 11G, Oracle Client 11G, and Oracle Data Modeler installed on it.

## Course Description

This course will have a technology component and an advanced topics component. Within the technology component, the student will learn and use several products: *Oracle Data Modeler* for database modeling, *PL/SQL* for creating program units that use SQL, and *Oracle Enterprise Manager and/or Tool for Oracle Application Developers (TOAD)* for managing and Oracle RDBMS and program units.

Within the advanced topics component, we will use some of our class sessions to review and discuss readings in topics like RDBMS –vs- NoSQL databases, database security, distributed databases, object-oriented databases, data mining and warehousing, grid computing, introduction to New SQL databases, OLTP, and database uses for the web.

## Learning Objectives

Learning Objective	How Assessed
Demonstrate competency using Structured Query Language (SQL) to design, develop, deploy, secure, and administer a relational database management system that meets the business needs of a user community.	Final Exam, In-Class Labs, Homework, Group Project
Demonstrate competency using Procedure Language (PL) / SQL to enforce complete business rule at the database and application level.	Final Exam, In-Class Labs, Homework, Group Project
Demonstrate competency designing a relational database management system using Unified Modeling Language (UML).	Final Exam, In-Class Labs, Homework, Group Project
Demonstrate competency administering a relational database, including DBA tasks such as authentication, authorization, performance tuning, normalization & de-normalization, encryption, concurrency control, transaction support, backup and recovery strategies, XML, and criteria for database selection.	Final Exam, In-Class Labs, Homework, Group Project
Demonstrate competency in designing relational database management systems for eventual integration with data warehousing (DW) solution(s) and designing extraction / transformation / and migration procedures of tuples and attributes.	Final Exam, In-Class Labs, Homework, Group Project
Articulate in oral and written form all aspects of the relational database management system, including how it securely stores data, enforces complex business requirements, and how it makes the organization operations more efficient.	Final Exam, In-Class Labs, Homework, Group Project

## Modules

The class will be organized into four modules. The first three will focus on skills. In these modules, the student will learn to use a database design (Oracle Data Modeler) tool to design and generate a database schema, a procedural programming language that incorporates SQL statements, and a Graphical User Environment (SQL Developer, Oracle Enterprise Manager, and/or TOAD) for managing the RDBMS and program units. For these modules, we will spend some of our time working on our laptops in class with the tools. In the fourth module, we will learn about and discuss a series of advanced topics that will include distributed databases, grid technology, object-oriented database issues, data warehousing, data mining, No-SQL databases, and database web connectivity.

### Module 1 – Database Design and Development

In this module, we will learn how to use a database design tool, *Oracle Data Modeler*, to develop a database model and generate the SQL code to build tables. We will review the principles of good database design and the building blocks of SQL and we'll learn about the use of design tools for database development.

## Module 2 – Program Development with *SQL* and *PL/SQL*

*PL/SQL* is Oracle's SQL-based procedural programming language. In this module, we will write program blocks and learn how to create and use procedures, functions, and packages. The emphasis will be on good program design and the introduction of new concepts like triggers and cursors. A discussion and demonstration of SQL and PL/SQL development environments will be compared against the command-line interface of the SQL\*plus application (TOAD, SQL Developer, etc...).

## Module 3 – Database Management

In this module, we will use *SQL Developer*, *Oracle Enterprise Manager* and/or *TOAD*, to manage and Oracle RDBMS. In addition to creating an Oracle Instance, we will explore the following topics: Oracle Physical Architecture, Storage Concepts and Settings, Data Management, Table Management, Constraints, Indexes, Security Management, Performance Monitoring, Database Maintenance, and Backup and Recovery.

## Module 4 – Advanced Database Management Topics

In this module, we will look at current and emerging issues involving database management systems. There will be assigned readings for each topic in this module that will serve as a starting point for our lecture and discussion of that topic.

### Schedule *(tentative...subject to change during semester)*

Date	Module	Lecture/Lab	Readings/References
February 4	1	Compare SQL / NoSQL Database Design Advanced Database Design Oracle DataModeler <i>Oracle DataModeler Lab 1</i>	CB: Ch. 12 CB: Ch. 13 CB: Ch. 14 & 15
February 11	2	Advanced SQL <i>SQL Lab 2</i>	CB: Ch. 6 CB: Ch. 7
February 18	2	Introduction to PL/SQL Cursors and Subprograms <i>PL/SQL Lab 3 &amp; PL/SQL Lab 4</i>	CB: Ch. 8 pgs. 224 – 240 JC: Ch. 1, 2, & 3
February 25	2	Advanced PL/SQL Stored Procedures, Functions, Packages, and Exceptions Database Triggers Database Jobs <i>Triggers Lab 5</i>	CB: Ch. 8 pgs. 224 – 240 JC: Ch. 1, 2, & 3
March 4	3	Database Administration <i>DBA Lab 6</i>	CB: Ch. 8 pgs. 224 – 240 JC: Ch. 4 – 7 JC: Ch. 9 Handouts CB: Ch. 20
March 11	4	Data Warehousing, OLAP, Data	CB: Ch. 24 – 25 CB: Ch. 31

		Mining Distributed Databases Grid Computing	CB: Ch. 33 CB: Ch. 34
March 18		<b>Final Exam</b>	

\* Remember to bring your laptop to class on lab days.

## Assignments

There will be four assignments based on your work with the tools in the lab sessions. In general, these will be due every week or every other week. There will also be a project assignment for which you'll work in groups to design a database, implement it, create database objects to enforce complex business rule, analyze and performance tune the database, and build reports that can be used to interact with the database.

Following is a list of due dates for each assignment.

Assignment	Module	Due Date (EST)
1	1 – Oracle DataModeler	February 11 @ 6:30 pm
2	1 – Advanced SQL	February 18 @ 6:30 pm
3	1 – PL/SQL	March 4 @ 6:30 pm
4	2 – Database Administration	March 11 @ 6:30 pm
Project Assignment	Synthesis of modules 1, 2 & 3	March 18 @ 6:30 pm

## Lab Assignments

There will be 6 labs based on the technologies implemented in the class and covered in lectures. These labs will provide exposure to the tools that will be used in the homework, group project, and on the final exam. In general, these will be due every week or every other week, with each submission due before 11:59 pm on the **Monday** after it is assigned. It is expected that students work on the lab(s) individually and submissions to demonstrate the completion of the lab will be done through the canvas course. Students may be given time in class to work on a lab but if the lab cannot be completed during the class, it is the responsibility of the student to complete it outside of class before the posted deadline.

Following is a list of due dates for each lab assignment.

Lab	Module	Due Date
1	1 – Oracle DataModeler	February 8 @ 11:59 pm
2	2 – Advanced SQL	February 15 @ 11:59 pm
3	3 – PL/SQL	February 22 @ 11:59 pm
4	4 – PL/SQL	February 22 @ 11:59 pm
5	5 – Triggers	March 1 @ 11:59 pm
6	6 – Database Administration	March 8 @ 11:59 pm

## Evaluation Method

## Grading Scale

Assignments	25%	100 – 98	A+	81 – 80	B-
Lab Assignments	5%	97 – 92	A	79 – 78	C+
Project Assignment	30%	91 – 90	A-	77 – 72	C
Final Exam	<u>40%</u>	89 – 88	B+	71 – 70	C-
Total	100%	87 – 82	B		

Please note that class attendance is important. Although I don't include attendance as part of the total percentage making up your grade, failure to attend class on a regular basis will have an adverse effect on your grade.

***Students will only have 2 weeks after an assignment or exam is returned to question or challenge a grade.*** After the two week challenge period, the grade will not be changed. Please contact the instructor if you wish to question a grade.

## Grade Distribution

I plan on using the Heinz School guidelines in deciding on the overall grade distribution. Accordingly, the average grade will be an A-. However, I grade on an absolute scale. If every student does well in the class, each will get an A+ regardless of the recommended grading scale. The same holds true on the other end of the scale.

## Final Exam

The final exam will cover material from the entire course. The Final exam is scheduled for March 18. Please do not schedule anything that might conflict with the final exam. *No one will be excused from it and there will be no make-up exam dates.*

## Late assignment policy

Homework is due at 6:30 pm and Labs are due at 11:59 pm on the assigned due date. I WILL NOT accept late homework unless the student has made arrangements with me prior to the assignment's due date. ***PRIOR ARRANGEMENTS MUST BE MADE NO LATER THAN 12 PM ON THE DUE DATE.***

## Policy on cheating and plagiarism

For Homework Assignments 1 through 4 and Lab Assignments 1 through 6, each student is responsible for handing in his/her own work. For the project assignment, each project team will work on and turn in work that has been created and developed by only those members of the team. For any assignment found to be the partial or complete result of cheating or plagiarism, your grade for that assignment will be zero. Cheating is defined as inappropriate collaboration among students on an assignment. This can include copying someone else's work with or without alteration. When students are found to be collaborating in this way, ***BOTH*** will pay the penalty regardless of who originated the work.

## **Classroom Etiquette**

This is a Master's level course taught as part of a professional degree program. Accordingly, you are expected to conduct yourself in a professional manner during the course and not engage in behavior in the class that would be considered unacceptable in the workplace.

I expect the following guidelines to be followed:

- Do not sleep in class
  - I realize you may occasionally have had a rough day, are unwell, or otherwise are too tired to stay awake. In those cases, it is acceptable to excuse yourself from that class.
  - If you are always too tired to stay awake during lectures, you should consider finding an alternative course offering.
  - If you find the material boring, please let me know. I will attempt to modify the content to better suit your interests and needs.
- Turn off your cell phones. You are not to answer calls while in class. If you have a need to be available during class, please let me know before the lecture begins.
- Please don't browse the web, instant message, or check email during lectures. If you use your laptop for taking notes, please inform me prior to class.
- If you have a question about the content of the lecture, please direct it to me. If you are confused about an issue, chances are your classmates are confused as well. Please do not ask for clarification from your classmate during lecture.

## **Take Care of Yourself**

Do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress.

All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner than later is often helpful.

If you or anyone you know experience any academic stress, difficult life events, or feel anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is available to help: call 412.268.2922 and visit the website: <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

## Spring 2021 Semester

If the class needs to go fully remote, you will receive an email from me (the instructor) and an announcement will be published on our course website on Canvas ([www.cmu.edu/canvas/](http://www.cmu.edu/canvas/)). During the semester, we will use the same zoom link available on Canvas in the first module of the landing page.

At any point during the semester, you may choose to participate in the class remotely. If you decide to switch to remote for one or more classes, please try to let me know by email [randallt@andrew.cmu.edu](mailto:randallt@andrew.cmu.edu) at least 24 hours in advance so I can prepare the breakout rooms and in-class sessions appropriately. In addition, if you are able, let me know the expected length of your remote engagement (e.g., number of classes or for an extended period of time).

## ZOOM Lectures

In our class, we will be using Zoom for synchronous (same time) sessions. The link is available on Canvas site.

If you are participating remotely, please make sure that your Internet connection and equipment are set up to use Zoom and able to share audio and video during class meetings. Let me know if there is a gap in your technology set-up [randallt@andrew.cmu.edu](mailto:randallt@andrew.cmu.edu) as soon as possible, and we can see about finding solutions.

Sharing video: In this course, being able to see one another helps to facilitate a better learning environment and promote more engaging discussions. Therefore, our default will be to expect students to have their cameras on during lectures and discussions. However, I also completely understand there may be reasons students would not want to have their cameras on. If you have any concerns about sharing your video, please email me as soon as possible [randallt@andrew.cmu.edu](mailto:randallt@andrew.cmu.edu) and we can discuss possible adjustments. Note: You may use a background image in your video if you wish; just check in advance that this works with your device(s) and internet bandwidth.

## Recording Lectures

All synchronous classes will be recorded via Zoom so that students in this course (and only students in this course) can watch or re-watch past class sessions. Please note that breakout rooms (if established) will not be recorded. I will make the recordings available on Canvas as soon as possible after each class session (usually within 12 hours of the class meeting). Recordings will live in our Canvas website [www.cmu.edu/canvas/](http://www.cmu.edu/canvas/). ***Please note that you are not allowed to share these recordings.*** This is to protect your FERPA rights and those of your fellow students.