

Fall 2020

## **CS 632-001: Advaced Database Systems Design**

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# Advanced Database Systems Design

Fall Semester 2020

<b>Course No</b>	CS 632
<b>Section</b>	001
<b>Title</b>	Advanced Database Systems Design
<b>Date and Time</b>	Friday: 12:30 – 3:20 PM (online)
<b>Prerequisites</b>	CS 631 and good knowledge of programming in any modern high-level procedural programming language such as Python, Java or C++.
<b>Instructor</b>	<b>Joann (Canan) Eren</b> Office: GITC 4212  Email: <a href="mailto:canan.eren@njit.edu">canan.eren@njit.edu</a> Web page: <a href="https://people.njit.edu/faculty/ce85">https://people.njit.edu/faculty/ce85</a>
<b>Instructor Office Hours</b>	Tuesday: 2:00 – 3:30 PM Thursday: 2:00 – 3:30 PM. (office hours not valid on the Reading day, during exam periods, holidays, and breaks) If you cannot meet my office hours, send me an email to schedule an appointment.
<b>Description</b>	The purpose of the course is to get better in programming in an Oracle environment, especially in PL/SQL and to learn about different models of data, such as objects, XML, and JSON.  This course has six parts. <ol style="list-style-type: none"><li>1) Review your SQL and learn more of it.</li><li>2) Learn PL/SQL.</li><li>3) Practical ETL (Extract-Transform-Load) of data.</li><li>4) Study of a few advanced topics on databases, such as XML, OODBs, DB security, Indexing, and Buffer tuning, and some basics of UNIX/AFS use.</li><li>5) Study JSON and No-SQL databases, especially MongoDB.</li><li>6) Regular expressions in Oracle SQL</li></ol>

<b>Course (learning) outcomes</b>	<p>At the end of the course, students will have a working knowledge of the following subjects and techniques:</p> <ul style="list-style-type: none"> <li>• PL/SQL as "normal" language</li> </ul>
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	<ul style="list-style-type: none"> <li>• PL/SQL accessing tables</li> <li>• Using Oracle SQL Developer for Oracle programming</li> <li>• Extract-Transform-Load</li> <li>• Object-Oriented Modeling</li> <li>• Inserting etc. in PL/SQL</li> <li>• Object-Oriented DBs</li> <li>• Triggers in PL/SQL</li> <li>• Object-Relational DBs</li> <li>• Regular expressions in Oracle SQL</li> <li>• Objects in Oracle SQL</li> <li>• HTML (brief)</li> <li>• Intro to XML</li> <li>• Intro to JSON</li> <li>• Database Security</li> <li>• XML data insertion in Oracle SQL</li> <li>• Querying XML in Oracle SQL</li> <li>• JSON in Oracle SQL</li> <li>• Introduction to UNIX/LINUX/AFS (shell use) (brief)</li> <li>• Introduction vi (brief)</li> <li>• No-SQL databases, esp. MongoDB</li> <li>• Intro to MongoDB use</li> <li>• Indexing in Oracle and MongoDB</li> <li>• Buffer Tuning, Exceptions, Transactions (brief)</li> </ul> <p>Topics are subject to change or omission, depending on time.</p>
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<b>Textbooks</b>	<p><b>1) REQUIRED:</b> Oracle 10g Programming: A Primer (Paperback) by Rajshekhar Sunderraman Paperback: 438 pages Publisher: Addison Wesley; Copyright: 2008 ISBN: 0-321-46304-8</p> <p>If there are not enough copies in the NJIT bookstore, then please get it at <a href="http://www.amazon.com">www.amazon.com</a> or <a href="http://www.barnesandnoble.com">www.barnesandnoble.com</a>.</p> <p><b>2) WEB MATERIAL AND HANDOUTS:</b> There will be handouts and reading materials that can be found on the Web.</p>
<b>Grading Policy</b>	<p><b>Exams:</b> There will be two midterm exams and one final exam.</p> <p><b>Homework (= Project):</b> There will be four programming homework assignments covering all the material that we are studying in the class.</p>

Late policies will be announced together with the assignments. *In general, there will be late penalties.*

### **Canvas Credit**

There will be Canvas Quizzes EVERY WEEK which you have to do at home. I will check EVERY WEEK whether you are keeping up with the quizzes.

**By the end of the semester, if you did not do all the quizzes you will get an F in the class, even if you have passing grades on all exams and all homework.**

If you do fall behind on the Canvas quizzes by three weeks I will send you a “Warning you will fail the course” message.

If you do Canvas quizzes late, you will not get points for them. Even though you still have to do the old quizzes, because otherwise the system does not let you access the new quizzes.

### **Extra Credit**

There will be **NO** way to get extra credit. **Please don't ask.**

### **Grading:**

The assignments will be graded with points from the following maxima:

Midterm 1\*: 100

Midterm 2\*: 100

Final Exam\*: 200

Programming Homework 1: 40

Programming Homework 2: 40

Programming Homework 3: 40

Programming Homework 4: 40

Canvas Quiz Credit: 40

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**Total 600**

\* Exams will require appropriate software tools for exams.

### **Penalty Points:**

**I reserve the right to take penalty points off from students whose phones are ringing during an exam.**

**Letter Grade:**

At the end of the semester, I will add up your total points and curve the results for the whole class. The department has voted on a stringent curve for all courses. Only the top 25% of the class should expect an A.

Furthermore, up to 20% of the class may face a C+, C, or F. In my experience, students getting 550 out of 600 points tend to be in the top 25%, but this is **no guarantee** for the future.

Also note that most students typically get all the points on the Homework assignments. Thus your position in the curve and your class grade depend almost entirely on the exams. On the other hand, missing a single homework is highly likely to lower your grade at least by one letter grade.

**Make-up Policy:**

Exam makeup *after* missing the exam will be only allowed in extreme cases with written proof, e.g., hospital stay, car accident with police report, and similar.

Exam makeup due to travel may or may not be approved ahead of time and **never** after the trip. As above, trips related to an extreme emergency, e.g., death in the family, will be allowed with written proof (death announcement in a newspaper or government death certificate with *official* English translation, if from a foreign country).

<b>Computer Use</b>	<p><b>The Department has a Bring Your Own Device Policy. If you do not own a laptop talk to the Department Chair (or take a different class.)</b></p> <p>You have to get an AFS account (ID), if you don't have one.</p> <p>You will need a printer, Web access, AFS access and a text editor (notepad will do). You will need fast internet access if you work from home.</p> <p>Media Services can be reached at (973) 596-3005.</p> <p><b>Canvas:</b> We will use CANVAS. You will need to watch videos posted there and take quizzes there.</p> <p><b>Oracle and SQL Developer:</b> You will use the Oracle database system and PL/SQL. PL/SQL is part of the normal Oracle distribution. Instructions about SQL Developer are in the class materials web page and I will talk about them in the lecture.</p>
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**MongoDB:**

We will use MongoDB. It is available at NJIT.

**Studio3T:**

We will use the Studio3T development environment as a frontend to MongoDB. The company is making it available for free to NJIT students. Find the information here:

<https://studio3t.com/discount/education>

**NJIT Passwords:**

If there is an NJIT password problem, try this:

<http://myucid.njit.edu>

This is the UCID password reset.

You need a DIFFERENT password for Oracle.

How do you get that different password?

Go to:

<https://ist.njit.edu/database-password-assistant/>

In order to work from home on Oracle you need to install VPN. See here: <http://telecom.njit.edu/vpn/>

The computer we are using is called **prophet.njit.edu**

The connection identifier that you will be asked for is **course**.

Furthermore, you can get extensive explanations of the ORACLE setup by going to:

<http://ist.njit.edu/support/db/oracle.php>

**RESPONDUS:** We will use the Respondus Lockdown Browser as needed.



<b>Cheating</b>	<p><i>“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:</i></p> <p><i><a href="http://www5.njit.edu/policies/sites/policies/files/academic-integritycode.pdf">http://www5.njit.edu/policies/sites/policies/files/academic-integritycode.pdf</a></i></p> <p><i>Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. <b>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.</b> If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at <a href="mailto:dos@njit.edu">dos@njit.edu</a>”</i></p>
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	<p>You may "talk" about Homework assignments with each other. Where does talking end and cheating start? You may NOT copy lines of code from anybody. You may NOT use code in your program where you don't understand WHY it works, even if it works, and even if you wrote it yourself.</p>
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**COURSE OUTLINE – Topics to be covered in the course (Schedule of topics is subject to change.)**

<b>DATE</b>	<b>CLASS</b>	<b>ASSESSMENT</b>	<b>Topics (Approximate!!!!)</b>
9-04	1		Introduction
9-11	2	PL/SQL PART 1	Introduction basics, if/then/else, variables, WHILE loops, procedures, functions, parameters, booleans

9-18	3	SQL Developer PL/SQL Part 2 System Tables	Set up SQL DEVELOPER/ plain insert into my table recursion, FOR loops
9-25	4	(Hwk 1 assigned: SQL review, basic PL/SQL, cursors)	
	4	PL/SQL Part 3, Part 4, Part 5 b. t. c.	Cursors, relational algebra operations in programs, non-Select SQL statements in programs, cursors for update
10-02	5	<b>Midterm 1</b>	-----
10-09	6	<b>HWK 1 Due</b> (Hwk 2 assigned: Object data, more cursors, triggers)	
10-16	6	Introduction to Object Oriented DB, PL/SQL Part 6 btc	UML, class diagrams, triggers
10-23	7	Objects in Oracle btc	

			Create classes, insert objects, select objects and object data fields
10-30	8	<b>HWK 2 Due</b> (Hwk 3 assigned: XML data)	
	8	UNIX and VI and PL/SQL Part 7 btc	Editing a file with vi Regular expressions in Oracle

11-06	9	<b>Midterm 2</b>	-----
11-13	10	XML and PL/SQL Part 8 btc	<b>XML insert</b> XML, tree and box diagrams, XML in Oracle
11-20	11	<b>HWK 3 Due</b> (Hwk 4 assigned: JSON, MongoDB)	
	11	Intro to JSON and NO SQL DB btc	<b>JSON insert</b> JSON, JSON diagrams, 4 types of NO-SQL databases
11-25	12	JSON in Oracle, MongoDB Environment and MongoDB Part 1 btc	<b>Mongo Login</b> Oracle cursors for JSON data Studio3T Basic Database operations in MongoDB Arrays in MongoDB
12-04 <b>LAST CLASS</b>	13	Mongo MapReduce, Mongo Aggregates, Mongo Part 2, Oracle Indexing, MongoDB Indexing btc	MongoDB sort, count revisited, measuring time in Oracle, measuring time in MongoDB Declaring, using and dropping indexes in Oracle and MongoDB
12-04	13	<b>HWK 4 Due</b>	
12-15, 12-21	14	<b>FINAL EXAMS</b>	