

ALG #119 Final Report Supporting Material

Prepared by

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Summary

This document contains detailed information about the four courses we developed and implemented. For each course, we included catalog description, learning objectives, developed learning modules, analysis of effectiveness of the developed material, and summary of the survey results.

1. IT 4153 Advanced Database – Supporting Material.

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Catalog Description

Prerequisite: CSE 3153 This course will study how databases are used with programming applications. Topics include advanced PL/SQL (or similar database programming language), database transaction, database security, database maintenance, and distributed and web databases.

Course Outcomes

Students who complete this course successfully will be able to

1. Understand and describe current and emerging database models and technologies;
2. Develop functions and procedures for data manipulation and database access auditing;
3. Describe database monitoring and performance tuning;
4. Describe database security and administration issues, including backup and recovery;
5. Explain the concepts of data warehousing and data mining

Textbook

There is no textbook assigned. All readings are assigned in weekly modules. I require that you read the relevant papers and tutorials each week as a way to prepare you for assigned lab/quiz. Knowledge of the readings will reduce the time it takes you to finish lab assignments.

Course Modules

Topic	Assigned Reading
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<p>Module 1 SQL Review</p>	<p>1. SQL http://docs.oracle.com/database/121/CNCPT/sqlangu.htm#CNCPT015 <i>Overview of the Structured Query Language (SQL) and how Oracle Database processes SQL statements.</i> <i>This chapter includes the following topics:</i></p> <ul style="list-style-type: none"> • <i>Introduction to SQL</i> • <i>Overview of SQL Statements</i> • <i>Overview of the Optimizer</i> • <i>Overview of SQL Processing</i> <p>2. http://www.tomjewett.com/dbdesign/dbdesign.php?page=tables.php <i>Information of basic structures of rows and tables , such as representation of data in rows. It also gives definition of tables , constraint and different keys such as Primary, super key.</i></p> <p>3. Associations http://www.tomjewett.com/dbdesign/dbdesign.php?page=association.php <i>Information about the various UML associations, relational schema, foreign keys, the concept of parent and child table and referential integrity.</i></p> <p>4. Keys http://www.tomjewett.com/dbdesign/dbdesign.php?page=keys.php <i>Information about keys such as Candidate keys, size of Primary keys.</i></p> <p>5. http://technet.microsoft.com/en-us/library/cc505842.aspx <i>How to design a normalized database , First Normal Form, Second Normal Form, third normal form and then practice of normalizing the database with examples.</i></p> <p>6. http://technet.microsoft.com/en-us/library/cc505841.aspx</p>
<p>Module 2 Introduction to SQL Procedures & Functions</p>	<p>1. PL/SQL Language Fundamentals http://docs.oracle.com/database/121/LNPLS/fundamentals.htm#LNPLS99920PL/ <i>Explains these following aspects of the PL/SQL language:</i></p> <ul style="list-style-type: none"> • <i>Character Sets</i> • <i>Lexical Units</i> • <i>Declarations</i> • <i>References to Identifiers</i> • <i>Scope and Visibility of Identifiers</i> • <i>Assigning Values to Variables</i> • <i>Expressions</i> • <i>Error-Reporting Functions</i> • <i>SQL Functions in PL/SQL Expressions</i> • <i>Pragmas</i> • <i>Conditional Compilation</i> <p>2. SQL Subprograms http://docs.oracle.com/database/121/LNPLS/subprograms.htm#LNPLS008 <i>Reasons to Use Subprograms, Nested, Package, and Standalone Subprograms, Subprogram Invocations, Subprogram Parts, Forward Declaration, Subprogram Parameters, Subprogram Invocation Resolution, Overloaded Subprograms, Recursive Subprograms, Subprogram Side Effects, PL/SQL Function Result Cache, PL/SQL Functions that SQL Statements Can</i></p>

	<i>Invoke, Invoker's Rights and Definer's Rights (AUTHID Property), External Subprograms.</i>
Module 3 Advanced SQL Procedures & Functions	<p>1. Using PL/SQL Control Structures http://docs.oracle.com/cd/B28359_01/appdev.111/b28370/controlstructures.htm#BABDAEGB <i>How to use testing conditions such as: IF-THEN statement, IF-THEN-ELSE statement, IF-THEN-ELSIF statement, Simple case statement, Searched case statement, Guidelines for IF and CASE statements with examples.</i></p>
Module 4 Overview of Database Administration	<p>1. Oracle Triggers http://docs.oracle.com/database/121/CNCPT/srvrside.htm#CNCPT218 <i>Creation of triggers with syntax and explanations of basic components in PL/SQL triggers, examples of creating triggers, Invoking Row-level triggers.</i></p> <p>2. Enforcing business rules with triggers https://technet.microsoft.com/en-us/library/aa214450(v=sql.80).aspx <i>This is about enforcing business rules with triggers, comparison of triggers with constraints in enforcing business rules.</i></p>
Module 5 Database Environment	Modules 1 - 4
Module 6 Database and Application Design	<p>1. Guidelines for the Database Specifications http://gametlibrary.worldbank.org/FILES/966_Database Specification Checklist.doc <i>Database Specification checklist, this checklist is provided as part of the evaluation process for the Database Specifications. The checklist assists designated reviewers in determining whether specifications meet criteria established in HUD's System Development Methodology (SDM). The objective of the evaluation is to determine whether the document complies with HUD development methodology requirements.</i></p> <p>2. ACID Properties http://docs.oracle.com/cd/E35855_01/tuxedo/docs12c/ads/adtrn.html <i>Explanations about transactions covers: definition of transaction, Benefits of using transaction, example of global transaction, what is Oracle tuxedo Transaction manager, how system tracks distributes transaction processing, how system uses a two-phase commit to commit transaction.</i></p> <p>3. Naming Convention http://ss64.com/ora/syntax-naming.html <i>Oracle naming conventions about tables names, field names, primary key fields, view names, index names, naming constraints, naming about other fields, SQL keywords, PL/SQL naming, instances, naming data files, tablespaces, REDO logs and at last summary of Naming conventions.</i></p> <p>4. Data Dictionary http://docs.oracle.com/database/121/CNCPT/datadict.htm#CNCPT1210 <i>This explains storage of the data dictionary, how oracle databases use the Data Dictionary, public synonyms for data dictionary views, data dictionary cache.</i></p>

<p>Module 7 Data Availability and Change Managem ent</p>	<ol style="list-style-type: none"> 1. Creating Indexes in Oracle http://docs.oracle.com/database/121/ADMIN/indexes.htm#ADMIN016 <i>Oracle documentation of managing indexes. Chapter covers: Indexes, guidelines for managing indexes, creating indexes, altering indexes, monitoring space use of indexes, dropping indexes, indexes data dictionary views.</i> 2. Oracle Data structure denormalization http://www.dba-oracle.com/art_9j_denormal.htm <i>Detailed description of Oracle Data Structure denormalization. Also explains when to add redundancy and violate third normal form, planned data denormalization, Snapshots, Varrays, Oracle Materialized view with examples and at last the conclusion.</i> 3. Isolation http://en.wikipedia.org/wiki/Isolation_%28database_systems%29 <i>Wikipedia article of Isolation of Database systems covers: concurrency control, different Isolation levels, and default isolation level.</i>
<p>Module 8 Performanc e Managem ent</p>	<ol style="list-style-type: none"> 1. Oracle Database High Availability http://www.oracle.com/technetwork/database/availability/maximum-availability-wp-12c-1896116.pdf (pp 3-23) <i>Oracle documentation of Maximize Availability with Oracle Database 12c. It contains Oracle database high availability, addressing unplanned downtime, addressing planned downtime and managing Oracle Database High availability Solutions.</i> 2. Database Performance Analyzer http://www.solarwinds.com/database-performance-analyzer-oracle.aspx (watch now link) <i>Talk about Database Performance Analyzer.</i>
<p>Module 9 Database Security</p>	<ol style="list-style-type: none"> 1. Managing Security for Oracle Database Users https://docs.oracle.com/database/121/DBSEG/users.htm#DBSEG99778 <i>Oracle documentation of Creating a New User Account and Granting the User the Minimum Database Privileges, contains: example of create user statement and grant statement.</i> 2. Guidelines for choosing account names http://www.indiana.edu/~dss/Services/Naming/nvgbns.html <i>Oracle documentation of creating a new user account and granting the user the minimum database privileges, with examples of creating users and also contains guidelines or restrictions on creating user name for a account.</i> 3. Oracle security check lists http://web.nvd.nist.gov/view/ncp/repository?keyword=oracle&startIndex=0 <i>National vulnerability database which contains security checklist that provides detailed low level guidance on setting the security configuration of operating systems and application, it has security checklist for Oracle 10g, 11g and 12c also.</i> 4. Multitenant Architecture https://docs.oracle.com/database/121/CNCPT/cdbovrvw.htm#CNCPT89234 <i>Oracle documentation of Introduction to the Multitenant Architecture, it contains: about the multitenant architecture, benefits of multitenant</i>

	<i>architecture, path to database consolidation and multitenant environment documentation roadmap.</i>
Module 10 Database Backup and Recovery	<p>1. Oracle Backup and Recovery http://docs.oracle.com/database/121/BRADV/toc.htm (48 pages) <i>Oracle documentation of Database Backup and Recovery User's Guide, it contains links for: Overview of Backup and Recovery, Starting and Configuring RMAN and Flashback Database, Backing Up and Archiving Data, Managing RMAN Backups, Diagnosing and Responding to Failures, Tuning and Troubleshooting, Transferring Data with RMAN and Performing User-Managed Backup and Recovery.</i></p>
Module 11 Data Warehouse	<p>1. Oracle Database/ Data Warehousing Guide/ 12c https://docs.oracle.com/database/121/DWHSG/toc.htm (chapters 1, 2 and 3 will be included in the test 2) <i>Oracle documentation of Database Data Warehousing Guide. It contains links for: Data Warehouse - Fundamentals, Optimizing Data Warehouses, Data Movement/ETL and Relational Analytics.</i></p> <p>2. The Top 10 Trends In Data Warehousing http://www.forbes.com/sites/oracle/2014/03/10/the-top-10-trends-in-data-warehousing/#698f7f811123 <i>A new white paper from Oracle explores the top 10 trends and opportunities in data warehousing. Here's a recap of that Top 10 list along with my own take on each trend.</i></p> <p>Additional reading</p> <p>1. Text mining examples http://lesswrong.com/lw/8ep/the_promise_of_connected_science/ <i>A blog on the promise on connected science.</i></p> <p>2. http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/datamining.htm <i>An article on Data mining, contains definitions of: Data, Information, and Knowledge and Data Warehouses. Also it explains: What can data mining do?, How does data mining work?, and What technological infrastructure is required.</i></p> <p>3. http://www.thearling.com/text/dmwhite/dmwhite.htm <i>An article on An Introduction to Data Mining, topics include: Overview, The Foundations of Data Mining, The Scope of Data Mining, How Data Mining Works, An Architecture for Data Mining, Profitable Applications and conclusion.</i></p> <p>4. http://insights.wired.com/profiles/blogs/top-10-big-data-use-cases-to-watch#axzz3R6BmW2gK <i>An article of Top 10 Big Data Use Cases to Watch, the top 10 key enterprise use cases for big data, what these use cases are, why companies are investing in them, and their common reference architectures.</i></p>
Module 12 NoSQL Databases	<p>1. NoSQL http://www.w3resource.com/mongodb/nosql.php <i>An article about NoSQL. Topics includes: Introduction, Classical relation database follow the ACID Rules, Distributed Systems, Advantages of Distributed Computing, Disadvantages of Distributed Computing, Scalability,</i></p>

	<p><i>What is NoSQL , Why NoSQL with examples, RDBMS vs NoSQL, RDBMS vs NoSQL, CAP Theorem (Brewer's Theorem), NoSQL pros/cons, The BASE, NoSQL Categories, Key-value stores, Column-oriented databases, Graph databases, Document Oriented databases, Production deployment and aat last summary in a video.</i></p> <p>2. MongoDB https://docs.mongodb.org/manual/introduction/ <i>MongoDB documentation of Introduction to MongoDB. This document contains topics: Document database and Key features of MongoDB.</i></p> <p>3. MongoDB Installation http://docs.mongodb.org/manual/tutorial/install-mongodb-on-windows/?_ga=1.227014557.1276862453.1418932796 <i>MongoDB documentation of Install MongoDB Community Edition on Windows. Topics includes: Overview, Requirements, Get MongoDB Community Edition, Install MongoDB Community Edition, Run MongoDB Community Edition, Configure a Windows Service for MongoDB Community Edition, Manually Create a Windows Service for MongoDB Community Edition and some Additional Resources.</i></p>
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2. IT 5433 – Database Design and Applications Supporting Material

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Catalog Description:

This course will provide a practical foundation of database systems with emphasis on relational database design, implementation, and management. Topics include normalization, ERD, logical and physical design, SQL query, database applications, usage of XML in database, and data warehouse.

Learning Objectives:

Students who complete this course successfully will be able to:

1. Compare and contrast the basic database models;
2. Analyze, design, develop and implement a relational database system based on business requirements;
3. Create, modify and query databases using the SQL language;
4. Analyze the major aspects of database administration and compare and contrast issues of database security;
5. Describe XML and its use in database systems;
6. Conduct independent research on a subject related to the course material.

Learning Modules

<p>LM1. Database Environment</p> <p>Learning objectives:</p> <ol style="list-style-type: none"> 1. Understand key terms in database 2. Explain file processing systems 3. List parts of a database environment 4. Explain types of database develop approaches
