



Faculty of Computer Studies

Supplementary Material
Information Technologies and Computing : Level 2
Special Topics in Computer Science: Database Management Systems

CS490

Course Guide

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1. Welcome

Welcome to CS490, a flexible and exciting course that is dedicated to covering variable special topics in Computer Science. In future offerings of this course, various topics of current interest such as Artificial Intelligence, Neural Networks, Pattern Recognition, Image Processing, and Computer Security will be presented. The selected special topic for this guide is Data Base Management Systems (DBMS). You can find specific information about the current CS490 offer, such as the course calendar, the software used, the weekly study guides, and the TMA in the accompanying Offer Notes.

It is hard to find today an area of computer science that is more pervasive in society than the area of database management. Most businesses, whether small or large, require the use of database technology to manage their day-to-day operations and many of them are opting to computerize their data management operation. Banks, hospitals, retail stores, travel agencies, airlines, insurance companies, schools, universities, the telephone directory service and mobile phone users, all rely on database technologies. For many, not a day passes by without some sort of interaction with a computerized database system. As a result, the employment market is creating an increasing demand for excellent and well trained database professionals. We very much hope that you will enjoy and benefit from this course.

2. What to do before the Course Starts

Learning in an Open University requires that you keep up-to-date on your readings and your activities. This begins before the 1st week, as it will be assumed that you have already covered the material of the 1st session. You are also expected to have all required materials and equipment ready and to make sure also that you have all necessary background. So, upon receiving this guide, you should focus your energies to make sure that you start the course on the right footing, in particular you should:

- ⊕ Make sure that you are properly registered and know your group number and meeting times
- ⊕ Have received all the learning materials detailed later in this guide
- ⊕ Have a working computer with Internet access
- ⊕ Read this course guide and the accompanying offer notes carefully, especially the sections on assessment.
- ⊕ Read Chapter 1 in the textbook and attempt at least the exercises in the enclosed calendar.

3. Pre-requisites

CS490 is a 10 point / 3 credit hour, third year level course. It is a specialty requirement for all students in the B.Sc. program in Information Technology and Computing (ITC). Students taking this course should have completed the following pre-requisites:

- TU170 – Learning Online: Computing with Confidence
- T171: You, your Computer and the Net, and
- M206: Computing: an Object-Oriented Approach.

4. Language Requirements

CS490 is taught entirely in English. It is therefore imperative that all students enrolled in this course should have successfully completed, or were exempted from, EL112: Communication Skills in English II.

5. Aims and Outcomes

Aims:

To give the student an understanding of the principles of modern database management technology and the ability to assess a business situation and develop a suitable database application for it.

Outcomes:

After completion of the course, students are expected to have achieved a certain level of knowledge and understanding of key issues and to have acquired some key practical skills:

Knowledge and Understanding of:

- ⊕ The benefits and characteristics of the database technology and modern Database Management Systems (DBMS).
- ⊕ The importance of modeling in database design.
- ⊕ The principles of good database design and the concepts of normalization.
- ⊕ The underlying principles of relational databases.
- ⊕ The essentials of database access and manipulation using a data manipulation language with special emphasis on Structured Query Language (SQL).
- ⊕ The need for procedural programming in database systems.
- ⊕ The notion of transactions and the principle of locking as an approach to allow concurrent access.
- ⊕ Relevant advanced topics in database management, including:
 - On Line Analytical Processing (OLAP), data warehousing and data mining.
 - The essential tasks of database administration and what can be done to protect the database against system failures and security threats.
 - The need for distributed and client-server databases.

Key Practical Skills – to be able to:

- ⊕ Assess the feasibility of applying the database technology to address a given business problem.
- ⊕ Develop a model of the problem requirements using the class diagrams of the Unified Modeling Language (UML), based on sound modeling principles.
- ⊕ Convert a class diagram into a set of normalized tables.
- ⊕ Perform simple database size estimation.
- ⊕ Install and run a modern DBMS.
- ⊕ Create and manipulate relational databases using SQL.
- ⊕ Obtain answers to business questions from a database using SQL.
- ⊕ Develop a complete database application using queries, forms and reports.
- ⊕ Use data triggers to ensure the integrity of the database.

6. Course contents

The topics in this course focus on the use of relational database technology for building business applications as students will encounter in businesses today. Before students begin building relational databases, students need to master three specific areas of knowledge: 1. database design and normalization, 2. Structured Query Language (SQL), and 3. programming. Since a background in programming is assumed by all students taking this course, we focus on the two remaining topics crucial to building successful databases: database design and normalization and SQL. These two topics must be covered carefully and thoroughly, particularly because they can be difficult for some students.

Database design is the foundation for building applications. A well-designed database can simplify building, maintaining, and expanding an application. An important strength of relational database design is its flexibility. A properly designed database can be expanded to meet changing business conditions. On the other hand, if the design is weak, building an application will be substantially harder, error-prone, and more time-consuming. It is often better to throw away a poorly designed database and start over, than to try fixing or expanding it.

SQL is a powerful, standard query language that is used for virtually every step of application development. One of its greatest strengths is its availability in many different products supporting it. Once students learn the foundations of SQL, they will be able to retrieve data from almost any major database system. Many queries in SQL are relatively simple, so the foundations can be learned rapidly. Yet SQL can also be used to answer complex questions, requiring a higher level of skill.

Another area of knowledge, that students need to build solid business applications, is programming skills. Some applications and some database systems require detailed programming skills. However, in many cases, programming is used sparingly. It can be used as a glue to combine various components or add new features that make the application easier to use.

Most applications experience trade-offs among database design, SQL, and programming. The weaker the design, the less you rely on SQL and the more programming you will need to build the application. Because programming code is more likely to create errors and is harder to change, application developers should rely on proper database design and the power of SQL.

Students will be provided with a detailed knowledge of database design using UML. More details of the UML approach are shown in Chapters 2 and 3. Only a small fraction of the UML diagrams, notation, and terminology will be used in this course. You can find full specifications at <http://www.rational.com/uml/>

After ensuring that students have obtained a solid foundation of UML and SQL, the course goes on to examine application issues, such as forms and reports, transactions and triggers to develop applications with assured integrity. Further advanced topics include data warehousing, database administration and distributed databases.

7. Course Organization

The course is organized into 4 modules that follow the basic steps of application development: design, queries, applications, administration, and other advanced topics. The division of time among the various course topics is listed below:

Modules	Chapter	Topic	Weeks
Module 1	1	Introduction	1
	2	Database Design	1
	3	Data Normalization	2
Module 2	4	Queries	2
	5	Advanced Queries	2
Module 3	6	Forms, Reports and Applications	2
	7	Transactions	2
Module 4	8-10	Data Warehouses and OLAP	1
		Database Administration	
		Distributed Databases	
		Review / Study Week	1
		Total	14

Module 1 consists of an introduction and two chapters on database systems design. The introduction explains the importance of databases and relates database applications to topics the students have likely seen in other classes.

The section on database design has two chapters: Chapter 2 on general design techniques (systems techniques, diagramming, and control) and Chapter 3, which details data normalization. The objective is to cover design early in the term so that students can get started on the CS490 project.

Module 2 covers queries in two chapters. Chapter 4 introduces queries and focuses on the fundamentals of converting business questions to SQL queries. Chapter 5 discusses more complex queries including sub-queries and outer joins.

Module 3 describes the development of database applications, beginning with the essentials of form and report development in Chapter 6. Chapter 7 provides a foundation in transactions and in writing programs in a database environment.

Module 4 examines various advanced topics in database management. Chapter 8 discusses data warehouses and On Line Analytical Processing (OLAP). Chapter 9 investigates aspects of database administration. Finally, chapter 10 examines several issues involving distributed databases and discusses developing databases for use over the Internet. This module is only covered lightly and is not assessed. Its assigned exercises are optional.

8. Special Features of the Course

1. Focus on modern business application development.
 - Database design explained in terms of business modeling.
 - Application hands-on emphasis with many examples and exercises.
 - Emphasis on modern graphical user interface applications.
 - Material on database programming and application development.
 - Additional materials on programming and development details.
2. Hot topics.
 - Description and use of the unified modeling language (UML) for modeling and system diagrams. This new standard will soon be required for all designers.
 - A discussion of security topics in a database environment.
 - Development of databases for the Internet and intranets.
 - Emphasis on SQL, with an introduction to SQL-99.
 - Integrated applications and objects in databases.
3. Development examples in Access and Oracle.
4. Applied business exercises and cases.
 - Many database design problems.
 - Exercises covering all aspects of application development.
 - Database case for a mid-term design project
 - Complete case for an end-of-term project.
5. A complete sample database application (Rolling Thunder Bicycles).
 - Fully functional business database.
 - Sample data and data generator routines.
 - Program code to illustrate common database operations.
6. A second database (Sally's Pet Store) for comparison and additional assignments.

9. The End-of-Term Project

Students have to complete an end-of-term project which consists of a case study. Students should be able to build a complete database application from scratch in one term. The project is assigned as a group project to allow more interaction and to give an opportunity for group learning.

10. Assessment

The assessment of this course consists of one quiz, one TMA and a final examination. The breakdown of marks is as follows:

Assessment Item	Date	Coverage	Weight
Quiz	During Week 8	Ch.2 Database Design Ch 3 Data Normalization Ch.4 SQL Queries Ch.5 Advanced Queries	15%
TMA01	End of Week 8	Ch.1 Introduction Ch.2 Database Design Ch 3 Data Normalization Ch.4 SQL Queries Ch.5 Advanced Queries	15%
Project	End of Week 12	Ch.1 Introduction Ch.2 Database Design Ch 3 Data Normalization Ch.4 SQL Queries Ch.5 Advanced Queries Ch.6 Forms and Reports Ch.7 Transactions	20%
Final Exam	TBA	Chapters 1-7	50%
Total			100%

You need to keep a few things in mind about the assessment for this course.

Quiz:

There are two core skills that are essential to all database professionals:

1. Understanding Database design and normalization principles, and
2. Mastering SQL

The best way to learn database design and SQL is to practice on as many problems and exercises as you can. This is also the best way to prepare for the Quiz and the Final exam. CS490 gives one quiz covering the two core database skills. The quiz is taken during week 8, after the completion of chapters 5. To help you prepare for the Quiz, a list of suggested exercises and problems are given in the weekly activity guides and in the course calendar. This is to be taken as the minimum required, and you should attempt more problems if you have the time. Students should always review the end-of-chapter key terms and answer all the review questions.

TMA:

The TMA is intended to give you an opportunity to apply your understanding and develop your skills. There is one TMA in this course.

The TMA contains a set of exercises from the text. The TMA tests your understanding of the main database concepts introduced in chapters 1-5 of the text and helps you to develop your database design, normalization and SQL skills. It also gives you the opportunity to use DBMS software to test your answers.

The TMA requires TIME. Do not wait until the week before the deadline to start working on the TMA. There is way too much material in the TMA to digest, and this requires an early start. Another very important point is that you will need help. Database design, normalization and SQL are a bit of an art, and it is very unlikely that you can "get it right" the first time around with no help. It is recommended that you show your answers of the weekly exercises to your tutor and seek feedback.

Project:

The Project is intended to give you a opportunity to pull together and practice all the database design and implementation skills that you have learned during the course in a single coherent project. The project is given as a group project, which allows you to benefit from "group learning" and also gain some experience in team work. Students are required to clearly delineate each group member's tasks so that the work will be divided fairly among group members.

Final Examination:

The final exam is comprehensive and is intended to test your knowledge in an integrated fashion. Passing the final is required for passing the course.

Although chapters 8, 9 and 10, are **not** included in the final exam you are still encouraged to review its contents and solve the optional exercises indicated by the calendar so that you are aware of these important database topics.

The Passing Marks

To pass this course, you need:

1. A minimum of 40% (20/50) in the continuous assessment (TMA + Project + Quiz),
2. A minimum of 40% (20/50) in the final examination, and
3. A minimum of 50% (50/100) in the total score.

These requirements comply with the general university policy at the time of this writing.

Other Course Activities:

In order to do well on the assessed items, the course calendar and the weekly study guides prescribe a series of related activities that help you achieve the required course outcomes. These activities include: assigned readings, weekly written exercises and laboratory exercises. Students are reminded to review all the key terms and answer all the review questions, both of which can be found at the end of each chapter in the text.

11. Learning materials

The learning Material for this course consists of:

1. This Study Guide.
2. The accompanying offer notes, which also contain the course calendar, the weekly study guides, the TMA and the project.
3. The textbook: Gerald Post, "Database Management Systems", 3rd Edition, McGraw Hill/Irwin, 2005.
4. The Workbook accompanying the text book: Gerald Post, Designing & Building Business Applications: Oracle 9i, 3rd edition.

5. The Student CD-ROM that accompanies Database Management Systems, 3rd edition, by Gerald Post.
6. The three Oracle 9i CD-ROMs that accompany the text.

