

The University of Sheffield
Department of Information Studies
Module Outline 2009-2010

Module Title:	Database Design
Module Code:	INF205
Online Teaching Resources:	Notes and coursework details on MOLE
Pre-Requisites:	None
Status:	Core module: INFU01 Approved module: MGTU17, MGTU18, TRPU02
Credits:	20 credits
Semester:	SPRING
Timetabling:	Weeks 1-12: Lectures Tuesdays 13.10-15.00 Weeks 1-11 (HI-LT06) Practicals Self-directed learning (MOLE) Laboratory sessions Thursdays 9:00-10:50 Weeks 7 & 10 (RC-205)
Module Coordinator:	Paul Clough
Other Lecturers:	Peter Stordy and John Holliday
Version Date:	20 th January 2010

Effective data management is key to any organisation, particularly with the increasing availability of large and heterogeneous datasets (e.g. transactional, multimedia and geo-spatial data). A database is an organised collection of data, typically describing the activities of one or more organisations and a core component of modern information systems. A Database Management System (DBMS) is software designed to assist in maintaining and utilising large collections of data and becoming a necessity for all organisations. This module provides an introduction to the area of databases and database management, relational database design and a flavour of some advanced topics in current database research that deal with different kinds of data and organisational context. Lectures are structured into three main areas: (1) an introduction to databases, (2) the process of designing relational databases, and (3) advanced topics (e.g. OO and XML databases). The course includes a series of practical sessions aimed at providing you with the skills required to implement a database in Oracle and extract information using the Structured Query Language (SQL).

Module Aims:

The main aims of this module are to: (1) consider the role of databases within the organisation, (2) provide an appreciation of the rigorous methods that are needed to design, develop and maintain database systems, and (3) highlight current and emerging technologies in the topic of databases.

Learning Objectives:

On successful completion of the module, you will be able to:

- Develop an understanding of databases and their role within organisations
- Apply database design concepts (for example, conceptual, logical and physical modelling) to a given scenario
- Demonstrate the ability to implement a given logical model using an industry standard relational database (e.g. Oracle) and query it using SQL
- Analyse an organisation's data and suggest how database technologies could add value
- Develop an awareness of database developments and areas of research

Learning Methods:

You will be taught both theoretical and practical aspects of database design through a mixture of formal lectures and self-directed activities and optional drop-in sessions that help you to implement your designs in Oracle. The knowledge acquired will be assessed through individual coursework that will require you to design and implement a database in Oracle, and write an executive report for management that makes recommendations on the use of database technologies for a given case study. Through weeks 3-9 you will be offered support through optional drop-in (laboratory) sessions.

Assessment:

The assessment consists of two pieces of **individual** coursework and **a pass mark in both components is required in order to pass the module as a whole**. More details will be provided during the course. The assessment consists of:

- 1) Design, implement and query an Oracle database for a given problem scenario (**60% weighting**). This coursework will be handed out in the Week 4 lecture.

- 2) Write a 1,600 word executive report recommending database technologies for a given case study (**40% weighting**). This coursework will be handed out in the Week 7 lecture.

Submissions differing from the specified **word length** by more than 5% will be penalised, as detailed at <http://www.shef.ac.uk/is/current/length.html>. There are also penalties for **late submission**, as outlined at <http://www.shef.ac.uk/is/current/latesub.html>. You must include a note of the word count at the end of your assignment. Word count should exclude title, abstract, tables, diagrams, bibliography and appendices but include all quotations and citations within the text. Referencing should be in Harvard style as detailed in the Student Handbook.

Design Coursework submission date:	2pm Monday Week 10 (3 rd May) Electronic submission via MOLE (not Turnitin)
Report submission date:	2pm Monday Week 13 (24 th May) Electronic submission via Turnitin
Coursework will be returned to students by:	Friday week 15 (11 th June)

Introduction to Databases

Week 1: Introduction to Databases and the Course

Lecture: An outline of the aims and organisation of the course, the role of data within organisations and an overview of the fundamentals of database systems (PC/PS).

Laboratory: None

Week 2: Database Planning, Design and Administration

Lecture: An overview of the database approach and issues related to managing data in the organisation, data integrity, confidentiality, selecting database tools and database administration (PC).

Laboratory: None

Week 3: Relational Databases and SQL

Lecture: An overview of the relational data model including an introduction to data manipulation using SQL (PS).

Laboratory: Optional drop-in Oracle support session (PS/PC).

Database Design (Focusing on Relational Databases)

Week 4: Conceptual Database Design

Lecture: An overview of the stages, tasks and methods of database design, focusing on requirements analysis/specification, conceptual data modelling using E-R diagrams and view integration (PC/PS).

Laboratory: Optional drop-in Oracle support session (PS/PC).

Week 5: Logical Database Design

Lecture: A study of the logical design stage of the database design process: how conceptual models are transformed into relational data structures (i.e. SQL statements) and how to deal with constraints (PC/PS).

Laboratory: Optional drop-in Oracle and coursework support session (PS/PC).

Week 6: Normalisation

Lecture: A study of normalisation (up to 3rd normal form) in relational database design, including how to deal with anomalies that can arise in the logical design (JH/PS).

Laboratory: Optional drop-in Oracle and coursework support session (PS/PC).

Week 7: Physical Database Design

Lecture: A study of the physical design stage of the database design process, data storage, distributed architectures and examples of database selection criteria (PS).

Laboratory: Optional drop-in Oracle and coursework support session (PS/PC).

Advanced Topics (Beyond Relational Databases)

Week 8: Data Management and Organisational Intelligence

Lecture: Organisational intelligence including OLAP, data mining and data warehousing (PC).

Laboratory: Optional drop-in Oracle and coursework support session (PS/PC).

Week 9: Spatial, Temporal and Multimedia Data Management

Lecture: How databases deal with spatial, temporal and multimedia data (JH/PC).

Laboratory: Optional drop-in Oracle and coursework support session (PS/PC).

Week 10: Semi-Structured Data Management and XML Databases

Lecture: How to model semi-structured data using XML and how databases handle semi-structured data (PC).

Week 11: Object-Oriented Databases

Lecture: How databases support Object-Oriented and the design of Object-Relational databases (PC).

Week 12: Support and Feedback Week

Lecture: Essay coursework support and student feedback from course. (PC)

References:

In addition to the recommended resources below, relevant papers and case studies will be made available online. Sources considered as key references are highlighted in bold. Resources on specific topics will be provided during lectures.

Core Readings

Teorey, T., Lightstone, S. & Nadeau, T. (2006). *Database Modelling and Design* (4th Edition), Elsevier Inc.

(Online resources: <http://www.eecs.umich.edu/~teorey/lec.notes.pdf>)

Watson, R.T. (2006). *Data Management: Databases and Organisations* (5th Edition), John Wiley & Sons, Inc .

(Online resources: <http://richardtwatson.com/dm5e/index.html>)

Further Readings

Benynon-Davies, P. (2002). *Information Systems: An Introduction to Informatics in the Organisation*. (2nd edition), Palgrave Macmillan.

Chaffey, D. and Wood, S. (2004) *Business Information Management: Improving Performance Using Information Systems*. Financial Times/ Prentice Hall.

Connolly, T. & Begg, C. (2005). *Database Systems: A Practical Approach in Design, Implementation and Management* (4th Edition), London: Addison-Wesley.

Eaglestone, B. & Ridley, M. (1998). *Object Databases: An Introduction*, London: McGraw-Hill.

Maciaszek, L.A. (2005) *Requirements Analysis and Systems Design* (2nd Edition), Harlow: Pearson Education Limited.

Mannino, M.V. (2004). *Database Design, Application Development and Administration* (2nd Edition), New York: McGraw-Hill/Irwin.

Ramakrishnan, R. and Gehrke, J. (2003). *Database Management Systems* (3rd Edition), New York: McGraw-Hill.

Witt, G.C. and Simsion, G.C. (2005). *Data Modelling Essentials* (2nd edition), San Francisco: Morgan Kaufmann.

Useful Online Resources

Database design with UML and SQL, 3rd edition (Tom Jewett):

<http://www.tomjewett.com/dbdesign/dbdesign.php?page=intro.html> [last visited: 20/01/10]

10 useful articles about database design (Antonio Lupetti):

<http://woork.blogspot.com/2008/09/10-useful-articles-about-database.html> [last visited: 20/01/10]

Practical database design Parts 1 & 2 (Philipp Janert):

<http://www.ibm.com/developerworks/web/library/wa-dbdsn1.html> [last visited: 20/01/10]

<http://www.ibm.com/developerworks/web/library/wa-dbdsn2.html> [last visited: 20/01/10]

List of database conferences (Daniel Lemire):

<http://www.daniel-lemire.com/blog/conferences/> [last visited: 20/01/10]

Fundamentals of Relational Database Design

<http://www.deepraining.com/litwin/dbdesign/FundamentalsOfRelationalDatabaseDesign.aspx> [last visited: 20/01/10]