Unit 41: Database Management Systems

Unit code	**H/618/7472**
Unit level	**5**
Credit value	**15**

Introduction

As globalisation increases and the 24-hour economy develops, organisations must ensure that their database management systems (DBMS) are reliable, secure, efficient and able to cope with rapid change. Database management systems will continue to service the many operations of our modern world. They are becoming increasingly complex to develop and manage owing to technological advancements and changes in the way that organisations do their business in a global market.

In this unit, students will examine the structure of data and how an efficient data design follows through into an effectively developed database management system. Students will examine the merits of different DBMS platforms and investigate system administration and management tools of the platform.

Among the topics included in this unit are: examination of different database management systems, database design tools and techniques of relational database management systems, using an open source platform to develop and test and manage a client's system.

On successful completion of this unit, students will be able to demonstrate their knowledge of the fundamentals of database management systems, make informed choices between vendor and open source platforms for database management systems, design and develop a relational DBMS for a client using an open source platform and carry out system administration tasks. As a result, they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

Learning Outcomes

By the end of this unit students will be able to:

LO1   Analyse different types of database management systems

LO2   Design a database management system using a relational model to meet client requirements

LO3   Develop a database management system using a suitable platform

LO4   Demonstrate the system administration and management tools available on the chosen platform.

Essential Content

LO1 Analyse different types of database management systems

Types of database management systems (DBMS) and their operating system support, e.g. MySQL, Oracle.

Data models, e.g. entity-relationship, relational, hierarchical, network, object-oriented, object-relational.

Examine details of DBMS based on a relational model.

Relational data structures, including relations, attributes, domain, tuple, cardinality.

Constraints, including key, domain, referential integrity.

Normalisation in developing efficient data structures.

Modelling languages, e.g. query language, data definition language (DDL), data, manipulative language (DML), relational languages.

Transaction and concurrency in DBMS.

Investigation of open source and vendor-specific systems. Multiple platform approaches to database management.

LO2 Design a database management system using a relational model to meet client requirements

Design considerations:

Determine user and system requirements.

Examine design tools and techniques for a relational database management system.

Physical system design.

Logical design, including design for relational databases, tables, data elements, data types, keys and indexes, entity relationship modelling, data-flow diagrams, flowcharts.

DBMS selection, e.g. MySQL.

Hardware, software and other resource requirements.

Mathematical relations, e.g. relational algebra, relational calculus.

Application development:

Data input, including verification, validation, calculated fields, masks, directed input.

Reports, including queries, presentation of data, layouts.

Task automation, e.g. imports, updates, deletions

Queries using multiple criteria, form values and wild cards, action queries, calculated queries, queries across multiple tables.

Error checking and quality assurance:

Test plans to check correctness of data, security, functionality, accessibility and usability.

Quality, effectiveness and appropriateness of the solution, including correctness of data, relationships between data, data integrity, normalisation.

Working with clients and others to improve the quality, effectiveness, security and appropriateness of solution design

LO3 Develop a database management system using a suitable platform

Development of DBMS:

Use of an appropriate database management system and Structured Query Language (SQL) to produce a secure solution to meet client's requirements.

Creating, setting up and maintaining data tables. Applying data validation rules.

Generating outputs, e.g. user-generated queries, automated queries, reports.

Application and user interface, e.g. navigation, data entry forms and sub-forms, automated functions.

Populating the database.

SQL statements to extract, manipulate and modify data.

Applying security measures to control access to data, e.g. user access levels.

Testing effectiveness:

Testing the database solution using different types of testing: referential integrity, functionality, security, stability.

Selection and use of appropriate test data.

Selecting suitable test users and gathering feedback from users. Making use of testing outcomes to improve and/or refine the solution.

Optimising the solution:

Reviewing the solution, including quality of the database, fitness for purpose, suitability against the original requirements, technology constraints, strengths and improvements, platforms and compatibility.

Optimisation of data types.

Optimisation of data size, e.g. size on disk.

Tables, e.g. overheads for many tables.

Query optimising.

LO4 **Demonstrate the system administration and management tools available on the chosen platform**

Demonstrations of server management:

Describe core database administration tasks and tools.

Setting up and managing data storage for servers and users.

Back-up and recovery routines for data and applications.

Managing authorisations.

Managing security and encryption.

Importing and exporting data.

Trace database activity.

Monitoring performance and optimising performance.

Audit trails.

Managing alerts and notifications.

Database maintenance, including setting up automatic routines.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Analyse different types of database management systems		
P1 Compare the different types of database models.	**M1** Assess how relational database models and the process of normalisation can provide reliable and efficient data structures.	**D1** Evaluate different database management systems available in relation to open source and vendor-specific platforms, justifying the criteria used in the evaluation.
LO2 Design a database management system using a relational model to meet client requirements		
P2 Produce a design for a relational database management system to meet client requirements.	**M2** Analyse how the design will optimise system performance.	**D2** Evaluate the effectiveness of the system design and development against client and system requirements.
LO3 Develop a database management system using a suitable platform		
P3 Develop a fully functional system that meets client and system requirements, using an open source language with an application software. **P4** Test the system for functionality and performance.	**M3** Implement effective features in the solution to handle concurrency, security, user authorisations and data recovery.	

Pass	Merit	Distinction
LO4 Demonstrate the system administration and management tools available on the chosen platform		
P5 Demonstrate the tools available in the system to monitor and optimise system performance and examine the audit logs. **P6** Demonstrate the tools available in the system to manage security and authorisations.	**M4** Assess the effectiveness of the system administration and management tools available on the platform, identifying any shortcomings of the tools.	**D3** Analyse any future improvements that may be required to ensure the continued effectiveness of the database system.

Recommended Resources

Textbooks

Connolly, T. and Begg, C. (2014) *Database systems: A Practical Guide to Design, Implementation and Management*. 6th Ed. Addison-Wesley.

Elmasri, R. and Navathe, S. (2015) *Fundamentals of Database Systems*. 7th Ed. Addison-Wesley.

Hoffer, J. (2008) *Modern Database Management*. Pearson Education.

Jeffrey A., Ramesh, V. and Topi Heikki, T. (2016) *Modern Database Management*. 12th Ed. Pearson Education.

Silberschatz, A., Korth, H. F. and Sudarshan, S. (2011) *Database System Concepts*. 6th Ed. McGraw-Hill Edition.

Plus other textbooks linked to the version of the software used for a given platform.

Journals

The Computer Journal - Oxford Academic

International Journal of Database Management Systems - AIRCC

Journal of Database Management - IGI Global

Journal of Emerging Trends in Computing and Information Sciences - CIS Publishers

Links

This unit links to the following related units:

Unit 4: Database Design & Development

Unit 11: Strategic Information Systems.