Unit 33: Data Analysis and Design

Unit code: H/601/1991

QCF Level 5:   BTEC Higher National

Credit value: 15

Aim

To provide learners with the knowledge and skills needed to understand, design, query and implement database systems.

Unit abstract

An understanding of database tools and technologies is key to many of today's industries. Database systems are predominant in the world of IT, and continue to demand more complex data structures and interface, as applications get increasingly sophisticated.

Databases provide the infrastructure to many organisations, and they offer support to key business applications and information systems. The most common database model used commercially is the relational one.

The aim of this unit is to provide a knowledge and understanding of database systems including design principles, practical implementation and development skills for both the system designer and software engineer. The importance of structured query languages should be stressed, in terms of how they can be used to manipulate data and how they are used for a variety of tasks including querying and report writing.

On completion of this unit the learner should be able to understand, design, query and implement a database(s). Learners will also have a theoretical insight into the requirement for designing a database that meets a given user or system requirement and that is functional, user friendly and robust.

Learning outcomes

On successful completion of this unit a learner will:

1   Understand data models and database technologies

2   Be able to design and implement relational database systems

3   Be able to use manipulation and querying tools

4   Be able to test and document relational database systems.

Unit content

1 Understand data models and database technologies

Data models: Hierarchical; Network; Relational; data manipulation languages; data definition languages; data independence; data redundancy issues; data integrity; schema; eg tables fields relationships, views, indexes; conceptual scheme; physical scheme, data dictionary.

Approaches: top down and bottom up; tools and techniques eg entity analysis, Entity Relation Diagrams (ERDs), determinancy diagrams, data flow diagrams; entities; attributes and key identifiers; relationship types and enterprise rules; degrees of relationships; functional dependency; first, second and third normal forms

New developments: dynamic storage; data mining and data warehousing; web enabled database applications; other developments eg multimedia databases, document management systems, digital libraries

2 Be able to design and implement relational database systems

Designs: data types; entity and referential constraints; conversion of logical database design to a physical implementation; tools and techniques; issues around the degree of normalisation chosen; verification and validity checks; data definition; control mechanisms

Requirements: requirements specification; relational requirements; other requirements eg need to integrate with legacy systems, future requirements, timescales, costs.

User interface: requirements eg functionality, reliability, consistency, performance, menu driven, HCI interface

3 Be able to use manipulation and querying tools

Data manipulation: query languages; visual tools; typical tasks eg for database maintenance, inserts, updates and amendments

Queries and reporting: query languages and query by example (QBE); formatting; functions/formulae; report writing tools

4 Be able to test and document relational database systems

Control mechanisms. example systems eg TQM(Total Quality Management); connection to requirements specification; sign off procedures.

Testing procedures: test plans; test models eg white box, black box; test documentation; other eg organisational requirements; user documentation eg help menu, pop-ups, hot-spots

Learning outcomes and assessment criteria

Learning outcomes **On successful completion of this unit a learner will:**	Assessment criteria for pass **The learner can:**
LO1 Understand data models and database technologies	1.1 critically compare different data models and schemas 1.2 critically discuss the benefits and limitations of different database technologies 1.3 analyse different approaches to database design
LO2 Be able to design and implement relational database systems	2.1 design a relational database system to meet a given requirement 2.2 build a relational database system based on a prepared design 2.3 apply a range of database tools and techniques to enhance the user interface
LO3 Be able to use manipulation and querying tools	3.1 explain the benefits of using manipulation and query tools in a relational database system 3.2 implement a query language into the relational database system 3.3 critically evaluate how meaningful data has been extracted through the use of query tools
LO4 Be able to test and document relational database systems	4.1 critically review and test a relational database system 4.2 create documentation to support the implementation and testing of a relational database system 4.3 create user documentation for a developed relational database system 4.4 explain how verification and validation has been addressed 4.5 explain how control mechanisms have been used.

Guidance

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes associated with this unit are closely linked with:

Level 3	Level 4	Level 5
Unit 21: Data Analysis and Design	Unit 17: Database Design Concepts	

This unit has links to the Level 4 and Level 5 National Occupational Standards for IT and Telecoms Professionals, particularly the areas of competence of:

- Data Analysis
- Data Design.

Essential requirements

Learners must have access to database software.

Resources

Books

Avison D and Fitzgerald G – *Information Systems Development*: *Methodologies*, *Techniques and Tools* (McGraw Hill Higher Publishing Company, 2006) ISBN 0077114175

Chao L – *Database Development and Management* (CRC Press, 2006) ISBN 0849392381

Connolly T and Begg C – *Database Systems*: *A Practical Approach to Design*, *Implementation and Management* (Addison Wesley, 2004) ISBN 0321210255

Howe D – *Data Analysis for Database Design* (Butterworth-Heinemann Ltd, 2001) ISBN 0750650869

Kroenke D – *Database Concepts*, *2nd Edition* (Prentice Hall, 2004) ISBN 0131451413

Ponniah P – *Database Design and Development: An Essential Guide for IT Professionals: Visible Analyst Set* (John Wiley & Sons Inc, 2006) ISBN 0471760943

Ritchie C – *Relational Database Principles* (Thomson Learning, 2002) ISBN 0826457134

Websites

www.deeptraining.com/litwin/dbdesign/FundamentalsOfRelationalDatabaseDesign.aspx

www.geekgirls.com/menu_databases.htm

www.smart-it-consulting.com/database/progress-database-design-guide/

Employer engagement and vocational contexts

To further enrich the content of this unit and to provide more of a vocational context it would be beneficial to bring in guest speakers, such as database designers, end users and administrators to discuss their role within an organisation(s) and the importance of good database design.