Unit title:	Data analysis and design
Unit number:	23
Level:	5
Credit value:	15
Guided learning hours:	60
Unit reference number:	H/601/1991

UNIT AIM AND PURPOSE

The aim of this unit is to equip learners with the knowledge to allow them to develop robust database systems which they can then both manipulate and query. The unit will provide the learner with the knowledge to be able to explain the database design life cycle and discuss the various aspects of database planning.

LEARNING OUTCOMES AND ASSESSMENT CRITERIA

A pass grade is achieved by meeting **all** the requirements in the assessment criteria.

Learning Outcome (LO) The Learner will:	**Pass** The assessment criteria are the pass requirements for this unit. 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

GRADING CRITERIA

A merit grade is achieved by meeting **all** the requirements in the pass criteria **and** the merit descriptors.

A distinction grade is achieved by meeting **all** the requirements in the pass criteria **and** the merit descriptors **and** the distinction descriptors.

Merit Criteria (M1, M2, M3) (M1, M2, and M3 are mandatory to achieve a merit grade. Each must be achieved at least once per unit to achieve a merit grade.)	**Distinction Criteria (D1, D2, D3)** (D1, D2, and D3 are mandatory to achieve a distinction grade. Each must be achieved at least once per unit to achieve a distinction grade.) (In order to achieve a distinction grade, all merit criteria must also have been achieved.)
MANDATORY TO ACHIEVE A MERIT GRADE	MANDATORY TO ACHIEVE A DISTINCTION GRADE
M1 Analyse concepts, theories or principles to formulate own responses to situations.	D1 Evaluate approaches to develop strategies in response to actual or anticipated situations.
M2 Analyse own knowledge, understanding and skills to define areas for development.	D2 Evaluate and apply strategies to develop own knowledge, understanding and skills.
M3 Exercise autonomy and judgement when implementing established courses of action.	D3 Determine, direct and communicate new courses of action.

TEACHING CONTENT

The Teaching Content describes what has to be taught to cover **all** Learning Outcomes.

Learners must be able to apply relevant examples to their work although these do not have to be the same as the examples specified.

LO1 Understand data models and database technologies	
Data models	Hierarchical, Network, Relational. Network schema (e.g. CODASYL), relational schema (e.g. tables). Primary keys, foreign keys, composite keys. Database terminology: entity, attribute, domain, tuple. Strong and weak entities. Entity integrity, referential integrity. Data Dictionary. Data definition language. Fat and thin client models.
Design methodology	Identifying entities and their relationships. Degrees of relationships. Identifying candidate keys and selecting appropriate primary key. Entity relationship diagrams (e.g. ER model, Information Engineering (IE)). Normal Forms: First, Second and Third Normal Forms. First and Second Normal Form anomalies. Boyce-Codd Normal Form. Identify and resolve any complex, recursive, many-to-many relationships. Insertion, deletion and update anomalies.
LO2 Be able to design and implement relational database systems	
Design	Common data types; Data Definition Language (DDL); data definition, determining referential constraints, creation of user views, database access rules, appropriate level of normal form selected, validity checks; Data Control Language; user requirements
Implementation	Create physical database (e.g. schema, tables using SQL based DDL based on logical design, user views), develop user interface (e.g. functionality, menu driven, GUI), efficiency considerations (e.g. secondary keys, denormalisation).
LO3 Be able to use manipulation and querying tools	
Data manipulation	DML (insert values into relations, delete records, update records).
Querying data	SELECT statement (Aliases, use of DISTINCT, WHERE clause, Boolean operators, IN BETWEEN LIKE operators, ORDER BY clause). Database interface (e.g. report writer, programming language). Data Control Languages (GRANT and REVOKE privileges).

LO4 Be able to test and document relational database systems	
Transaction Controls	Commit, rollback, transaction properties (atomicity, consistency, isolation, durability); concurrency (locking, timestamps)
Documentation	User requirements, logical data model, physical data model, normalisation record, user views, user privileges, test plans, test document, sign off procedures.

GUIDANCE

Delivery guidance

It will be beneficial to deliver this unit in a way that uses actual events, industry forecasts or sector specific contexts which offer the learner the opportunity to explore, develop and apply the fundamental principles of the sector or subject area. Typical delivery contexts could include use of a relational database system which uses a structured query language (SQL) which adheres to the standards administered by ISO and ANSI. Public domain software MySQL conforms to this standard as well as the major commercial systems of ORACLE and Microsoft Sequel.

Learners will benefit from being encouraged to exercise autonomy and judgement to analyse the database requirements of a local organisation which they are familiar with. Learners will need to adapt their thinking and reach considered conclusions, when proposing the appropriate entities and attributes required to develop a system which would be independent of existing and potential applications.

Learners would benefit from being presented with subject/sector-relevant problems from a variety of perspectives and from being given the opportunity to explore them using a variety of approaches and schools of thought (e.g. consider the differing views required (academic staff, finance staff, funding staff, student) of a database to handle student enrolment).

Assessment evidence guidance

Evidence must be produced to show how a learner has met each of the Learning Outcomes. This evidence could take the form of assignments, project portfolios, presentations or, where appropriate, reflective accounts.

Where group work/activities contribute to assessment evidence, the individual contribution of each learner must be clearly identified.

All evidence must be available for the visiting moderator to review. Where learners are able to use real situations or observations from work placement, care should be taken to ensure that the record of observation accurately reflects the learner's performance. This should be signed, dated, and included in the evidence. It is best practice to record another individual's perspective of how a practical activity was carried out. Centres may wish to use a witness statement as a record of observation. This should be signed and dated and included in the evidence.

RESOURCES

Books

Elmasri, R., Navathe, S. B., *Fundamentals of Database Systems,* Benjamin/Cummings, 1989. ISBN 0-8053-0145-3 {Required as later text do not cover hierarchical and network systems}

Melon, J. C., *Teach Yourself MySQL,* SAMS, 2002. ISBN 0-672-32349-4

Rob, P., Coronel, C., Crockett, K., *Database Systems: Design, Implementation & Management,* Cengage Learning, 2008. ISBN 978-1-84480-732-1

Connolly, T. M., Begg, C. E., *Database Systems: A Practical Approach to Design, Impementation and Management,* Addison Wesley, 2009. ISBN 0-321-52306-7

Journals

Journal of Database Management (JDM)
ISNN 1063-8016 (print)
ISNN 1533-8010 (on line)

International Journal of Database Management Systems (IJDMS)
ISNN 0975-5705 (on line)
ISNN 0975-5985(print)

Websites

www.searchdatabase.com
www.jcc.com/sql.htm
www.sqlcourse.com/intro.html