

## Unit 2: Creating Systems to Manage Information

Level: **3**

Unit type: **External**

Guided learning hours: **90**

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### Unit in brief

Learners study the design, creation, testing and evaluation of a relational database system to manage information.

### Unit introduction

In order to produce information to support many business processes as well as our social lives, relational databases are widely used to manage and process data. From the smallest in-house systems to stock control systems for large online retailers, databases are repositories of information that are a significant part of organisational operating requirements.

You will examine the structure of data and its origins, and how an efficient data design follows through to an effective and useful database. You will examine a given scenario and develop an effective design solution to produce a database system. You will then test your solution to ensure that it works correctly. Finally, you will evaluate each stage of the development process and the effectiveness of your database solution. In this unit you will draw on your learning from across your programme to complete assessment tasks.

The skills you gain in this unit support progression to IT-related higher education courses and to employment in a role that requires computing-related expertise.

### Summary of assessment

This unit is externally assessed through a task set and marked by Pearson.

The set task will be completed under supervised conditions for 10 hours in a one-week period set by Pearson, which can be arranged over a number of sessions.

The set task will assess learners' ability to design, create, test and evaluate a relational database system to manage information.

The number of marks for the unit is 66.

The assessment availability is December/January and May/June each year. The first assessment availability is May/June 2017.

Sample assessment materials will be available to help centres prepare learners for assessment.

## Assessment outcomes

**AO1** Demonstrate knowledge of database development terminology, standards, concepts and processes

**AO2** Apply knowledge and understanding of database development terminology, standards, concepts and processes to create a software product to meet a client brief

**AO3** Analyse information about database problems and data from test results to optimise the performance of a database solution

**AO4** Evaluate evidence to make informed judgements about the success of a database's design and performance

**AO5** Be able to develop a database solution to meet a client brief with appropriate justification

## Essential content

The essential content is set out under content areas. Learners must cover all specified content before the assessment.

### A The purpose and structure of relational database management systems

#### A1 Relational database management systems

- Types of relational database management systems (RDBMS) and their characteristics.
- RDBMS based on relational models:
  - relational data structures – relation, attribute, domain, tuple, cardinality and relational database
  - relational algebra sets – symbols, union, intersect, join, select
  - database relations – entity relationship, generic, semantic
  - relational keys – super key, candidate key, primary key, foreign key
  - integrity constraints – entity integrity, referential integrity
  - entity relationships – one-to-one, one-to-many, many-to-many.

#### A2 Manipulating data structures and data in relational databases

Use of RDBMS software tools and structured query language (SQL) for defining, modifying and removing data structures and data:

- updating, inserting, deletion
- retrieval of data for queries, reports
- administration of users
- security, integrity, recovery.

#### A3 Normalisation

The role of normalisation to develop efficient data structures:

- anomalies – update, insertion, deletion
- primary keys, foreign keys, composite keys
- indexing
- referential integrity
- data dictionary – tables, fields, data types, validation
- cascading update
- deletion techniques
- joins, unions, intersects
- stages of normalisation:
  - un-normalised form (UNF)
  - first normal form (1NF)
  - second normal form (2NF)
  - third normal form (3NF).

### B Standard methods and techniques to design relational database solutions

#### B1 Relational database design

Selection of RDBMS and SQL software, tools, techniques and processes.

- Database design: conceptual, logical and physical modelling and entity relationship modelling.
- Relational algebra: one to many, one to one, many to many, AND, OR, NOT, >, <, ≥, ≤
- RDMS and SQL software selection.
- Application design: user interface, software applications.
- Database implementation techniques: prototyping, data conversion, testing.
- Quality, effectiveness and appropriateness of the solution: correctness of data, relationships between data, data integrity, normalisation.

**B2 Design documentation**

The features and characteristics of relational database design techniques and their application to solve problems:

- requirements of the brief (audience, purpose and client's requirements)
- security and legal considerations:
  - Data Protection Act 1998
  - The European Union (EU) Directive on Data Protection (legislation must be current and applicable to England, Wales, Northern Ireland)
- data structure designs:
  - data dictionaries and their use: tables, field attributes, validation
  - use of naming conventions
  - entity relationship diagrams
  - normalisation
- user interface design:
  - data entry/input – verification, validation, calculated fields, masks, directed input
  - reports – fields, queries, presentation of data, calculations
  - task automation – imports, updates, deletions
- extracting and presenting data:
  - queries using multiple criteria, form values and wild cards
  - action queries
  - calculated queries
  - reports
- design and use of test plans: to check correctness of data, functionality, accessibility, usability.

**C Creating a relation database structure****C1 Producing a database solution**

Select and configure appropriate RDBMS and SQL tools to produce a database solution to meet client's requirements:

- creating, setting up and maintaining data tables
- creating links, relationships between data tables
- applying data validation rules
- generating outputs – user-generated queries, automated queries, reports
- user interface – navigation, data-entry forms, sub-forms
- automated functions
- populating the database:
  - importing
  - adding data
  - manipulating data
- devising and using SQL statements to extract, manipulate and modify data
- applying security measures to control access to data: passwords, user access levels.

**C2 Testing and refining the database solution**

- Different types of testing: referential integrity, functionality, security.
- Selection and use of appropriate test data: erroneous data, extreme data.
- Recording appropriate test documentation.
- Using testing outcomes to improve and refine a database solution.

## **D Evaluating a database development project**

The characteristics, concepts, impact and implications of testing methodologies to monitor and evaluate database design, the database created, testing processes and success of the solution.

### **D1 Database design evaluation**

Evaluating a design against the given requirements:

- use and application of an entity-relationship diagram, data dictionary, normalisation
- coverage of functionality requirements and identification of any omissions
- identification of design strengths and potential further improvements to meet given requirements.

### **D2 Evaluation of database testing**

Evaluating the application of test data to ensure that the database solution meets requirements.

- Different types of testing:
  - normal test data
  - erroneous test data
  - extreme test data.
- Recording of actual results and analysis.
- Commenting on results.
- Test records:
  - completion of test records
  - taking of and storing screenshots of tests.
- Making use of testing outcomes.
- Using iterative processes to improve accuracy, readability and robustness.
- Identifying and recording which tests were successfully met and which test data issues were not resolved.

### **D3 Evaluation of the database**

Evaluating the software outcome against the given requirements.

- Strengths and weaknesses of the database:
  - solution fitness for purpose
  - intuitiveness and ease of use
  - constraints of the database software used
  - maintainability of the database
  - extent to which database meets the given requirements.

## Grade descriptors

To achieve a grade a learner is expected to demonstrate these attributes across the essential content of the unit. The principle of best fit will apply in awarding grades.

### Level 3 Pass

Learners are able to use their knowledge and understanding of database design and development terminology, standards, concepts and processes and apply problem-solving skills to design and develop a solution in context. Learners demonstrate their understanding of how to use standard database constructs to develop a functioning solution that evidences testing and evaluation.

### Level 3 Distinction

Learners are able to evaluate a given problem and develop a detailed and complex solution to meet all requirements of the brief. They apply an in-depth understanding of database constructs, using test results to produce an optimised solution. Learners are able to evaluate the quality, performance and usability of their database with supporting justification.

## Key terms typically used in assessment

The following table shows the key terms that will be used consistently by Pearson in our assessments to ensure students are rewarded for demonstrating the necessary skills.

Please note: the list below will not necessarily be used in every paper/session and is provided for guidance only.

Command or term	Definition
Annotated screen shot	Image copy of a computer screen (obtained by pressing the print screen key then pasting in a document) with added annotations explaining what the image shows.
Database structure	The structure is composed of fields (a single piece of data, e.g. name, date of birth, etc.), records (a complete set of fields, e.g. an employee's personnel record) and tables (a collection of records, e.g. all employees' personnel records).
Data dictionary	A centralised repository of information on data, such as meaning, relationships to other data, origin, usage, tables, fields and format.
Entity-relationship diagram	A diagrammatical representation of database tables and the relationships (and types of relationship) among them.
Evaluate	A review and synthesis of each stage of database design and development processes and outcomes to provide a supported judgement about the quality. Typically, a conclusion will be required.

Command or term	Definition
Normalisation	The process of organising raw data into separate related tables to minimise data redundancy.
Query	An SQL select statement that extracts data from a table or tables which match(es) defined criteria.
Test log	Used to plan and record program testing, record the outcomes of testing and the changes made to solve problems.
Report	A database report presents information from a database. Information should be displayed simply and efficiently. Printed reports from the database should allow the viewing of information quickly and easily.
User interface	The visual part of the database through which a user interacts with a computer or software. A good interface is intuitive and allows a user to easily enter the required data accurately. A user interface is implemented using screen forms with titles, labelled boxes for data-entry, buttons to perform actions and other features to make interaction as easy as possible.

## Links to other units

This unit links to *Unit 1: Information Technology Systems*.

## Employer involvement

This unit would benefit from employer involvement in learning delivery in the form of:

- guest speakers
- technical workshops hosted by staff from local organisations/businesses
- opportunities for observation of organisational/business application during work experience.