Unit 7: Using Database Software

Externally assessed

Introduction

In Unit 2, you used database software to organise and to interrogate structured information. You saw how large organisations rely on databases to manage their information and provide them with fast and flexible access to it. You looked at examples of transactional websites which use databases to store product, customer and sales information and learned at first hand how database queries can be used to analyse information and identify trends.

In this unit you will develop your knowledge of, and skills in using, databases further. You will learn the principles of data modelling and sound database design, and will use relational database software to build working database systems capable of storing large quantities of data and of handling both routine and one-off requests for information.

In all likelihood, people other than yourself will want to use some — if not all — of the databases you create. With this in mind, you will design and implement user interfaces that make it easier for people to enter data and extract information, whilst ensuring the overall security and integrity of the database.

You will make full use of the facilities of the software to generate reports that are well presented, easy to read and fit for purpose. Your work for this unit will culminate in the design, development, testing and evaluation of a database for a specific purpose within a given scenario.

This is an externally assessed unit.

This is a user-focused unit. The knowledge and skills developed in this unit are particularly relevant to those who use advanced ICT skills on a daily basis at work or at school/college for personal, social and work-related purposes.

Recommended prior learning

This unit builds on the database knowledge and skills you acquired in *Unit 2: The Digital Economy*.

What you need to learn

7.1 Database applications

In Unit 2, you looked at the role that databases play in the day-to-day operation of transactional websites. You will find it useful to begin your work for this unit by exploring other database applications in areas such as commerce, education and manufacturing.

You should pay particular attention to design issues such as:

- the database structure

- the user interface

- measures used to protect the quality of the data

- types and forms of output

- the methods used to extract information.

You will be able to put much of what you learn to good use when you start to design and implement relational databases of your own.

7.2 Functional specification

As you will have realised by now, databases are too complex and usually too important to the business for their creation to be left to chance. They need to be systematically designed, built and tested.

As with all software development, the first step in the process is to produce a functional specification identifying the requirements of the database — what exactly it needs to do — including:

- the task(s) the database must perform

- the information it must supply, in what format, to whom

- the data to be input into the database, how and from where

- the processing that is required

- the levels of security and validation needed.

Having a clearly defined functional specification will help to keep you on track once you start building the database. By checking what you have achieved against the functional specification from time to time you can measure progress and make sure you do not lose sight of your goal.

7.3 Database development

Once you are clear about the functional requirements, you can begin work on the design of the database.

The first thing to do is to analyse the data requirements of the system and produce a data model.

The next step is to translate the data model into a physical database structure using your chosen database software.

You must be able to convert data models into physical database structures and test that they work correctly, before beginning work on other aspects of the system, including:

- data entry and validation functions

- queries

- reports

- menus.

| 7.4 | Data modelling | You are already familiar with the concept of a model. In Unit 3, you used spreadsheet models to represent real-life processes and situations. In this unit you will learn a technique known as entity-relationship modelling to represent the data in a given scenario. |

Entity-relationship models (ER models) have three components:

- entities
- attributes
- relationships.

You will learn what each of these terms means and will practise constructing ER models showing the entities, their attributes and the relationships between them for a given scenario.

You will need to be able to construct Entity Relationship Diagrams and Data Flow Diagrams to show you understand the task of the database.

You will learn how to determine the degree of a relationship and to take steps to resolve many-to-many relationships.

Normalisation is a process for removing unnecessary duplicated data and maximising the efficiency of a database. You will learn how to normalise an initial data model to third normal form and the reasons for doing this.

7.5 Creating a relational database structure

You will learn how to use database software to build physical representations of data models, in which entities are represented as tables and attributes as fields.

You must be able to choose suitable data types and formats for fields, including:

- text, eg limited length, unlimited length, memo
- number, eg integer, auto record number, floating point
- Boolean, eg true and false, Y and N
- date, eg dd/mm/yy, dd month
- time, eg 24-hr clock, hh/mm/ss
- currency, eg pound (£), dollar ($).

You should also know how to store pictures and other forms of non-textual data.

You must understand how these data types are actually stored and how the database software converts them to the format required.

It is important that you are aware of the limitations of particular number formats and choose the most appropriate.

You will learn how to index a field or group of fields in order to speed up data retrieval and when it is appropriate to do so.

You will use the primary/foreign/composite key mechanisms to create relationships between tables and learn how to make relationships compulsory by enforcing referential integrity wherever possible or needed.

| **7.6** | **Validation techniques** | The 'garbage in, garbage out' rule is particularly relevant to databases. You must make every effort to stop incorrect data from getting into a database. |

You will learn a number of techniques for validating data, including building in checks, such as:

- presence check
- range check
- file lookup check
- list check
- format (picture) check
- length of data check.

| **7.7** | **The user interface** | You will learn how to design and implement user-friendly interfaces to help people enter data into your databases and extract information from them. |

You must be able to produce screen input forms with facilities, such as:

- input masks
- drop-down lists
- option buttons
- command buttons.

You must incorporate help for users by means of:

- instructions
- help screens
- easy to understand error messages.

You will learn how to minimise the potential for invalid data input by incorporating validation checks into all elements of the database.

You also need to think about how information from your databases will be selected and displayed. You should know how to create menus and searches to make it easier for people to use a database and to control how much or how little users are allowed to see and do.

You will use the presentation and formatting features of the software to produce reports onscreen and on paper that turn database output into meaningful information, using titles, layout etc. Where appropriate, you will incorporate calculations such as totals and running sums into reports.

7.8   Testing and evaluation

You will learn to test any databases you create to make sure that they work correctly and are fit for purpose. You should design and carry out tests to ensure that:

- the solution meets all the requirements of the functional specification

- all menus work properly

- validation checks prevent unacceptable data from being entered

- the database can cope with normal, extreme and abnormal data

- output from the database is complete, accurate and in the required format

- other people could use it without help.

Testing will help you to verify that any database that you have created works as it was designed to do.

Evaluation should include whether the database is 'fit for purpose' and that you did not lose sight of the functional specification you identified in 7.2. It also includes how well this has been achieved and how easy it is to use.

You will need to consider both quantitative and qualitative criteria for judging success. You will also need to identify any shortcomings in the database system and ways in which it could be improved.

- As an evaluation should be an informative document the quality of the written communication needs to be carefully addressed.

| 7.9 | ICT skills | In order to produce relational databases you must be able to use database software to carry out tasks, including: |

- constructing tables to represent entities

- defining the fields in each table to represent attributes

- defining appropriate data types and formats

- defining primary keys

- creating relationships between tables

- defining searches and sorts (single and multiple fields and tables)

- using relational logic in searches

- importing data from and exporting data to other databases and applications

- using macros to automate common tasks

- using wizards effectively

- creating screen data-entry forms that

    - enable the entry of data into single and multiple tables

    - have appropriate entry-form field lengths

    - provide clear labelling of entry-form fields

    - provide instruction fields where necessary

    - include validation checks on field entries as appropriate

    - enable the selection and entry of data from built-in lists (constructed from other tables)

    - include calculation (formula) fields

    - make use of automated number fields (counter fields)

    - use date and time fields

- creating database reports that

    - have suitable headers and footers

    - have an appropriate format and layout

    - have sorted data grouping

    - include calculations and total fields

    - include specified queries.

7.10 Standard ways of working

Whilst working on this unit, you will be expected to use ICT efficiently, legally and safely. You must adhere to standard ways of working, including:

- file management
  - saving work regularly
  - using sensible filenames
  - setting up directory/folder structures to organise files
  - making backups
  - choosing appropriate file formats
  - limiting access to confidential or sensitive files
  - using effective virus protection
  - using 'readme' files where appropriate to provide technical information, eg system requirements

- personal effectiveness
  - selecting appropriate ICT tools and techniques
  - customising settings
  - creating and using shortcuts
  - using available sources of help
  - using a plan to help you organise your work and meet deadlines

- quality assurance
  - using spell check, grammar check and print preview
  - proofreading
  - seeking views of others
  - authenticating work

- legislation and codes of practice
  - acknowledging sources
  - respecting copyright
  - avoiding plagiarism
  - protecting confidentiality

- safe working
  - ensuring that hardware, cables, seating etc are positioned correctly
  - ensuring that lighting is appropriate
  - taking regular breaks
  - handling and storing media correctly

Assessment guidance

This unit is externally assessed.

Working under supervision, you will be required to design, implement and test a relational database system to meet a given set of functional requirements. Some of the data to be stored in the database will be supplied to you as a comma separated values (csv) file.

You will have 10 hours in which to complete this work. This will be divided into a number of sessions by your centre. You will be not be able to remove your work from the examination room but you will be able to look things up between sessions. However, you must not discuss the task with other learners and the final database solution must be entirely your own work.

As well as creating the database to solve the task set, you will need to evaluate what you have done. You will review your solution, taking into account how else you could have approached the task and changes you could have made to the database. This evaluation will involve narrative text and you will need to be very precise when presenting it. Marks will be awarded for the quality of your written communication in this part of the examination.

Only fully functional relational database software capable of supporting one-to-many relationships should be used for this unit. An up-to-date list of acceptable software will be maintained on the Edexcel website.

At the end of the designated examination period, you will assemble the printed output produced in response to instructions specified on the front of the examination paper for submission to Edexcel.

Delivering this unit

General information

Assessment requirements

This is an externally assessed unit. Instructions for the conduct of the examination will be published on the Edexcel website in advance of each examination series.

Vocational context

This unit has a user focus. It is important that learners acquire some experience of live, large-scale database systems: the sheer volume of data they handle, the different views of the data they provide and the way in which data is imported from and exported to other software applications.

Pre-release time

This unit provides learners with pre-release material. It is important that learners use that time to investigate possible database structures to fit the scenario and create practice data to test these structures.

Standard ways of working

Learners must work safely and adhere to relevant legislation and codes of practice when carrying out the externally-set practical computer-based activities required for this unit. Marks will be awarded for evidence of adherence to relevant standard ways of working.

Teaching and learning strategies

Learners should be reminded of the work they did at AS level in *Unit 2: The Digital Economy* and may find it useful to revisit the database concepts introduced there before beginning to create database structures of their own.

Learners should be encouraged to follow a structured systems development process, involving investigation and analysis of the problem, design and implementation of the solution. They should be instructed in data modelling using entity relationship diagrams and normalisation and they should be given opportunities to practise the techniques they have learnt.

Learners need to develop skills in the chosen database management software and be familiar with the development tools supplied with this software. They should be able to create related tables, interactive forms, complex searches of their database (including linked tables, parameter searches, calculated fields, multi-field searches, range searches and totals), sophisticated reports and macros. *There is no expectation that learners will need to supply programmed solutions.*

Learners need to understand the importance of testing a system and choosing appropriate test data to ensure their system works. They will also need to understand the need for evaluation and the ways in which this may be done.

The quality of written communication will be assessed in a response that requires continuous prose.

Learners need to have practised developing parts of a system and simple systems prior to the exam.

Links

Other units

This unit builds on the database work undertaken in *Unit 2: The Digital Economy*. The concept of a model introduced in *Unit 3: The Knowledge Worker* is a useful foundation for the work on data modelling that learners undertake in this unit.

Learners taking the Double Award may wish to study *Unit 12: Customising Applications* in conjunction with this unit.

Learners taking *Unit 14: Web Management* will benefit from having already completed this unit, since they need to understand how and why database integration has become a key feature of most websites.

Assessors may want to use this unit as a vehicle for introducing some of the project management techniques covered in *Unit 8: Managing ICT Projects*.

Resources

Please note that while resources are checked at the time of publication, materials may be withdrawn from circulation and website locations may change.

Equipment

Learners will need access to:

- desktop/laptop computers ideally with the following minimum specification (based on the Becta workstation specification 2/10/03):
    - 256 MB memory
    - 1.7Ghz Intel processor or equivalent
    - 40 GB hard drive
    - video card with 32 MB memory
    - CD/DVD
    - some form of rewritable media
    - UK keyboard and pointing device
    - colour, high resolution monitor, capable of supporting 1024x768
- printing facilities
- sufficient individual storage space
- internet access (broadband)
- Windows XP operating system or equivalent
- software
    - relational database software, eg Microsoft Access, Lotus Approach

Books

Heathcote P M — *Successful ICT Projects in Access* (Payne-Gallway, 2002) ISBN 1903112737

Warrender R L — *Databases* (Learning Matters, 2003) ISBN 1903337089