

## National Unit Specification: general information

**UNIT** Relational Database Systems (Higher)

**NUMBER** DM4K 12

**COURSE** Information Systems (Higher)

### SUMMARY

This Unit is designed to develop knowledge and understanding of the principles of relational database systems and provides an opportunity to apply this knowledge to solve problems through the use of contemporary hardware and software. It is designed for candidates, undertaking the Higher Information Systems Course, but it is also suitable for anyone wishing to extend and deepen their experience of database systems beyond Intermediate 2 Level.

### OUTCOMES

1. Demonstrate knowledge and understanding of the principles, features and techniques of relational database systems.
2. Demonstrate practical skills using contemporary hardware and software in the context of relational database systems.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following or equivalent:

- ◆ Intermediate 2 Database Systems Unit
- ◆ Intermediate 2 Information Systems Course
- ◆ Standard Grade in Computing Studies at Credit level

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### Administrative Information

**Superclass:** CD

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## National Unit Specification: general information (cont)

### CREDIT VALUE

1 credit at Higher (6 SCQF points at SCQF level 6\*).

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### CORE SKILLS

This Unit gives automatic certification of the following:

<b>Core Skill components for the Unit</b>	Critical Thinking	H
	Planning and Organising	H

## **National Unit Specification: statement of standards**

### **UNIT        Relational Database Systems (Higher)**

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

#### **OUTCOME 1**

Demonstrate knowledge and understanding of the principles, features and techniques of relational database systems.

##### **Performance Criteria**

- a) A range of database terminology is used appropriately.
- b) Descriptions and explanations are related to practical and familiar contexts.
- c) Conclusions, predictions and generalisations are made from knowledge and understanding.

##### **Evidence Requirements**

Written or oral evidence that the candidate can describe, explain and apply the principles, features and techniques of relational database systems accurately and concisely.

Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample the content (see Information Systems (Higher) Course Content) in each of the following areas:

- ◆ database fundamentals
- ◆ entities and data relationships
- ◆ data modelling concepts
- ◆ normalisation
- ◆ implementation

(The content statements are also reproduced for convenience as a table in the support notes for this Unit)

The standard to be applied is illustrated in the National Assessment Bank items available for this Unit. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

#### **OUTCOME 2**

Demonstrate practical skills using contemporary hardware and software in the context of relational database systems.

##### **Performance Criteria**

- a) A range of appropriate hardware is used effectively and efficiently.
- b) A range of appropriate features of software is used effectively and efficiently.
- c) Practical tasks are planned and organised with minimal guidance.
- d) Practical tasks are undertaken in an appropriate range of familiar contexts.

## **National Unit Specification: statement of standards (cont)**

### **UNIT**      Relational Database Systems (Higher)

#### **Evidence Requirements**

Observation checklist showing that the candidate has demonstrated practical skills in each of the following contexts:

- ◆ design of data tables from source documents
- ◆ normalisation of data to 3NF
- ◆ creation of database (including interface) from design
- ◆ implementation of complex queries
- ◆ implementation of macros/scripting

Candidates will be presented with two source documents and one requirements specification which must be represented as one entity in UNF. At most complex this decomposes to two entities in 1NF, three entities in 2NF and four entities in 3NF.

Hard copy evidence should be provided of the database implementation.

These practical skills may all be demonstrated in a single extended task, or in a number of smaller tasks.

The practical skills should be demonstrated in the context and at a level defined by the content statements (see Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and on-line help while completing the tasks.

(The content statements are also reproduced for convenience as a table in the support notes for this Unit)

The standard to be applied is illustrated in the National Assessment Bank items available for this Unit. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

## National Unit Specification: support notes

### UNIT Relational Database Systems (Higher)

This part of the Unit Specification is offered as guidance.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

#### GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The content for this Unit is detailed below (and also in the National Course Specifications: Course details.)

Content statements in the left-hand column describe the content covered in the corresponding Unit at Intermediate 2 level, and are included here to clarify the context for the new learning for this Unit. They indicate the prior learning required by the candidate before undertaking new learning within this Unit. Content in the right-hand column is the new content for this Unit.

<b>Content Statements: Database fundamentals</b>	
<i>Intermediate 2</i>	<i>Higher</i>
<i>Description of the benefits of an electronic database system in comparison with manual data storage, including.</i> <ul style="list-style-type: none"><li>◆ <i>searching and sorting</i></li><li>◆ <i>data retrieval</i></li><li>◆ <i>data storage and updating</i></li><li>◆ <i>data analysis and reporting</i></li></ul>	Description of need for and methods of achieving good database design, including consideration of the following: <ul style="list-style-type: none"><li>◆ data duplication</li><li>◆ data insertion</li><li>◆ data deletion</li><li>◆ data modification</li><li>◆ problems associated with meaningful identifiers</li></ul>

## National Unit Specification: support notes (cont)

### UNIT Relational Database Systems (Higher)

<b>Content Statements: Entities and Data Relationships</b>	
<i>Intermediate 2</i>	Higher
<p><i>Description and exemplification of simple data entities, in terms of the following attributes:</i></p> <ul style="list-style-type: none"> <li>◆ <i>name</i></li> <li>◆ <i>multi-valued or single valued</i></li> <li>◆ <i>data type (text, integer, real, object, date, time)</i></li> </ul>	<p>Description and exemplification of data entities, in terms of the following attributes:</p> <ul style="list-style-type: none"> <li>◆ name</li> <li>◆ multi-valued attributes</li> <li>◆ single valued attributes</li> <li>◆ data type (text, integer, real, object, link, boolean, date, time)</li> </ul> <p>Definition of data domain including domain constraints.</p> <p>Description of methods of achieving good database design, including appropriate choice of entities and entity relationships.</p> <p>Description, exemplification and identification of entity relationships, including:</p> <ul style="list-style-type: none"> <li>◆ cardinality (one-to-one, one-to-many, many-to-many)</li> <li>◆ use of entity occurrence modelling</li> <li>◆ use of entity relationship diagrams</li> </ul>

## National Unit Specification: support notes (cont)

### UNIT Relational Database Systems (Higher)

<b>Content Statements: Data Modelling Concepts</b>	
<i>Intermediate 2</i>	Higher
	Definition and exemplification of data relationships using: <ul style="list-style-type: none"> <li>◆ consistent notation</li> <li>◆ appropriate nomenclature (defining relation names, primary keys, foreign keys and non-key column names)</li> </ul>
<p><i>Design and creation of data tables, including consideration of:</i></p> <ul style="list-style-type: none"> <li>◆ <i>table names</i></li> <li>◆ <i>fields (name and type)</i></li> <li>◆ <i>keys (primary and foreign)</i></li> <li>◆ <i>validation (presence, restricted choice)</i></li> </ul> <p><i>Description and exemplification of the following field types: text, number, object, link, date, time, Boolean.</i></p> <p><i>Identification of the limitations of flat file databases, and the advantages of linked tables (relational databases).</i></p>	Design and creation of linked data tables, including consideration of: <ul style="list-style-type: none"> <li>◆ table names</li> <li>◆ uniquely named columns</li> <li>◆ choice of primary key with one or two attributes including non-meaningful identifiers, compound key, surrogate keys</li> <li>◆ foreign keys (domain constraints and null values)</li> </ul>
	Definition of referential integrity.  Definition of entity integrity: <ul style="list-style-type: none"> <li>◆ non-null primary key</li> <li>◆ no multi-valued attributes</li> </ul>
	Exemplification of data retrieval, including consideration of: <ul style="list-style-type: none"> <li>◆ user views and queries</li> <li>◆ answer tables</li> </ul>
	Description of need for, and exemplification of data dictionaries including name, type, size, validation, index/key.

## National Unit Specification: support notes (cont)

### UNIT Relational Database Systems (Higher)

<b>Content Statements: Normalisation</b>	
<i>Intermediate 2</i>	Higher
<p><i>Explanation of normalisation.</i></p> <p><i>Identification of entities with a single one-to-many relationship between them in a single source document.</i></p> <p><i>Identification and removal of multi-valued fields in records.</i></p>	<p>Definitions of normal forms:</p> <ul style="list-style-type: none"> <li>◆ UNF</li> <li>◆ first normal form (1NF)</li> <li>◆ second normal form (2NF)</li> <li>◆ third normal form (3NF)</li> </ul> <p>Creation of UNF from source documents.</p> <p>Normalisation to 1NF, by identifying and eliminating repeating groups. Description of problems of 1NF.</p> <p>Normalisation to 2NF by identifying partial key dependency. Description of problems of 2NF.</p> <p>Normalisation to 3NF by identifying non-key dependency.</p>

<b>Content Statements: Implementation</b>	
<i>Intermediate 2</i>	Higher
<p><i>Implementation of database system based on data table.</i></p> <p><i>Description and implementation of simple queries including:</i></p> <ul style="list-style-type: none"> <li>◆ <i>sorting (two fields, ascending/descending)</i></li> <li>◆ <i>searching (two fields)</i></li> </ul> <p><i>Description and implementation of data input forms and simple reports.</i></p>	<p>Implementation of database system based on a data model, including entity/relationship diagram and data dictionary.</p> <p>Description and implementation of complex queries including:</p> <ul style="list-style-type: none"> <li>◆ sorting (multiple fields, ascending/descending)</li> <li>◆ searching (multiple fields, across linked/related tables)</li> <li>◆ calculating and summarizing (including count, sum and average)</li> </ul> <p>Use of related tables as sources for data entry (including lookups).</p> <p>Enforcement of data integrity through validation.</p>
<p><i>Implementation of consistent, user-friendly user interface and screen design.</i></p>	<p>Implementation of simple macros and scripting for navigation.</p>



## National Unit Specification: support notes (cont)

### UNIT Relational Database Systems (Higher)

#### GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit.

The two Outcomes should be delivered in an integrated way. Appropriate practical activities, both computer based and non-computer based, should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1.

Candidates who have completed the *Database Systems* Unit at Intermediate 2 level should already have covered the content listed in the left-hand column of the content grids, but may well need to revise this material before progressing to the right-hand column.

Candidates will be required to demonstrate knowledge and understanding of the principles and concepts of relational database systems as specified in the content grids at Intermediate 2 and Higher levels. Candidates are required to explain features of the content grids and use appropriate terminology. The context within which Intermediate 2 content is examined will be appropriate to Higher level.

The Unit is designed to provide candidates with the skills to produce a data model, correct to third normal form, and then to implement this using relational database software. Current relational database management software which would be appropriate for this task includes MySQL/PHP, Microsoft Access and Corel Paradox.

Candidates should be presented with **two** source documents and a requirements definition detailing the restrictions which apply to the system and, from this, should analyse, design and implement a database system. In the **most** complex problem presented to the candidate the source documents should breakdown into two tables in 1NF (one of which will have a compound key of not more than **three** attributes), three tables in 2NF (based on the compound key given in 1NF) and four tables in 3NF (based on a single non-key dependency). It is appropriate that some problems given to candidates will not require all of the stages of normalisation to be applied. Candidates should be aware that entities in 3NF are already in 1NF and 2NF by definition and that entities in 2NF are already in 1NF.

The problems presented to candidates should be familiar, and appropriate contexts include video clubs, lending library and sales systems. However, all the information presented in the requirements definition should be sufficient to allow the candidate to produce the correct data model irrespective of how familiar the candidate is with context.

The implementation of the database system involves the application of knowledge, understanding and skills from Intermediate 2 level. These knowledge, understanding and skills are now applied to a problem at Higher level and this should be reflected in the complexity of the problem. In addition, Higher level introduces referential integrity and the use of linked/related tables. Candidates should be aware of the importance of referential integrity in a database system. Candidates should be aware of the appropriate use of referential integrity and when it is and is not appropriate to enforce it. Limited use of scripting or macros should also be covered where this adds to the navigation of the implemented system.

## National Unit Specification: support notes (cont)

### UNIT Relational Database Systems (Higher)

The amount of time spent on each area of content will vary depending on the teaching methodology used and the ability and prior experience of the candidates. However, the following times are suggested as a rough guide:

database fundamentals	3 hours
entities and data relationships	4 hours
data modelling concepts	9 hours
normalisation	8 hours
implementation	12 hours

1½ hours should be set aside to:

- a) administer the Outcome 1 test
- b) gather evidence for Outcome 2

A further 2½ hours is allowed for remediation and re-assessment if required.

If the Unit is delivered as part of a Course, the Course documentation will provide further information on teaching and learning in a Course context, including the identification of a number of ‘themes’ to facilitate holistic learning across the Course.

### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

National Assessment Bank tests have been created specifically to assess Outcome 1 of the Unit. This assessment consists of a closed book test, and must be conducted under examination conditions. In order to gain success in this Outcome, the candidate must achieve at least the cut-off score for the test. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

Outcome 2 requires the candidate to demonstrate practical skills while using contemporary hardware and software. These practical skills will normally be demonstrated in a number of relatively short tasks. Skills will normally be demonstrated by the candidate during the teaching and learning activities of the Unit, rather than as separate formal assessment activities. The candidate will be allowed access to books, notes and online help while completing the tasks.

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in four of the following contexts, as defined in the content statements (see Information Systems (Higher) Course Content):

- ◆ design of data tables from source documents
- ◆ normalisation of data to 3NF
- ◆ creation of database (including interface) from design
- ◆ implementation of complex queries
- ◆ implementation of macros/scripting

Hard copy evidence should be provided of the database implementation.

These practical skills may all be demonstrated in a single extended task, or in a number of smaller tasks.

## **National Unit Specification: support notes (cont)**

### **UNIT            Relational Database Systems (Higher)**

The practical skills should be demonstrated in the context and at a level defined by the content statements (see Information Systems (Higher) Course Content).

The candidate will be allowed access to books, notes and online help while completing the tasks.

(The content statements are also reproduced for convenience as a table in the support notes for this Unit)

All evidence must be retained by the centre. The assessment of this Unit is subject to moderation by SQA.

### **SPECIAL NEEDS**

This Unit Specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, September, 2003).