



# Unit: Database Design and Development

## Assignment

### Spring – Winter 2023

#### Important notes

- Please refer to the Assignment Presentation Requirements for advice on how to set out your assignment. These can be found on the NCC Education *Campus*. Click on Policies and Advice in the left-hand menu and look under the Advice section.
- You must read the NCC Education documents 'What is Academic Misconduct? Guidance for Candidates' and 'Avoiding Plagiarism and Collusion: Guidance for Candidates' and ensure that you acknowledge all the sources that you use in your work. These documents are available on *Campus*. Click on Policies and Advice in the left-hand menu and look under the Policies section.
- You **must** complete the '**Statement and Confirmation of Own Work**'. The form is available on *Campus*. Click on Policies and Advice in the left-hand menu and look under the Policies section.
- Please make a note of the recommended word count. You could lose marks if you write 10% more or less than this.
- You must submit a paper copy and digital copy (on disk or similarly acceptable medium). Media containing viruses, or media that cannot be run directly, will result in a fail grade being awarded for this assessment.
- All electronic media will be checked for plagiarism.

## Introduction

This assignment requires you to demonstrate knowledge and skills you have acquired throughout this module by producing a database and a report that addresses the tasks given below. In order to complete the assignment, you will need to choose an appropriate organisation to research and base your database project on it.

### Choosing an appropriate organisation

Step 1: select an industry in which you are interested. For example, commercial airlines, commercial banking, retail, beauty, IT, publishing, hospitality, leisure and tourism, automotive, construction etc.

Step 2: select one or more organisations in that industry to research. You should investigate the sort of data they hold and the types of transactions they carry out. For example the education college shown in the appendix holds data about the courses, staff, modules, laboratories and equipment. Their transactions might include allocating modules to courses, staff to modules, equipment to laboratories and assigning laboratories to courses.

Step 3: You should investigate the requirements that your organisation has in the development of a new database system. This could be particular problems they are trying to solve, processes they want to be more efficient or new approaches they want to implement to improve their business. For example an education college might want to make enrolment of students onto courses easier than it is currently done.

**Do not** choose a college for your organisation as this has been used as an example.

You should reference the businesses or organisations that you investigate.

### Step 4. Gathering materials

For your chosen type of organisation gather materials relating to their data and transactions. You could do this by looking online, through personal contacts with someone who works in the industry or simply by using a particular business's services. Materials that you gather might include:

- Invoices
- Receipts
- Order Forms
- Customer Records
- Delivery Notes
- Complaints Forms
- Booking Forms
- Descriptions of daily tasks
- Interviews with staff members
- Company reports

## Task 1 – Business Overview and Requirements (10 marks)

Give a brief written overview of your organisation.

You should include an outline of the context in which the organisation operates. For example a college would operate in an environment in competition with other colleges.

You should outline their day-to-day operations, their data requirements and the types of transactions they carry out. You might include scans and/or diagrams of any documents you have gathered, which should be suitably anonymised so as not to show any personal data that might be included. You should explain the purpose of these documents in the context of the organisation.

You should outline the scope of the database project that you will undertake. This should be suitably ambitious enough to include at least TEN (10) entities in the data model. You should make clear what will be included within the scope of the project and what will not be included. This discussion of scope should include both data and operational issues.

You should clearly outline or list the requirements of the organisation with regard to the database that is being developed.

(This section should be 200 - 300 words excluding any diagrams)

## Task 2 – ER and Data Dictionary (15 marks)

Produce an *entity relationship diagram (ERD)* for your organisation and an accompanying *data dictionary*. Your entity relationship diagram should include at least TEN (10) entities. You should use the UML format.

Define the integrity constraints on the tables in your design. You should clearly include domain constraints, business rules (Table constraints) and propagation constraints in your data dictionary.

## Task 3 Normalisation (15 marks)

Show how you have used normalisation in developing your data model. You should:

- Explain the purpose of normalisation, and clearly justify why each of your entities is in 3NF.
- Explain how you have used normalisation to check tables are well-structured.

Using examples from your design, explain how normalisation solves the problem of update, insertion and deletion anomalies

(This section should be 200 - 300 words excluding any diagrams)

## **Task 4 – Scripts to create table structures (10 marks)**

Show the SQL scripts that you have used to create your database in a suitable database environment. You should include scripts for tables, columns, primary and foreign keys and any other database objects that you use. You should include screen shots of the scripts running within the database environment. For high marks, your scripts should implement integrity constraints you identified in Task 2.

You should provide an explanation of how you developed the scripts, order of running, and any issues encountered with them.

You should comment on how the use of SQL has enhanced your database including decisions about table structure, fields and data types.

(This section should be no more than 100 words for the explanation and comment excluding scripts)

## **Task 5 – Data population (5 marks)**

You should create suitable data for your database. Show the SQL insert scripts that you have used to populate your database with this data. You should include screen shots of the scripts running within the database environment.

You should provide an explanation of how you developed the scripts, order of data population and any issues encountered with them.

(This section should be no more than 100 words for the explanation and comment excluding scripts)

## **Task 6 – SQL reports (10 marks)**

Use SQL to produce TEN (10) queries that will be useful for your organisation. For each query you should supply the following:

- Rationale for query – what is its purpose and what is it trying to retrieve?
- SQL script running in database environment.
- Result set of query, shown in database environment.

Query scripts and results should be shown as running in the database environment with the use of screen shots. They should be well-formatted and easy to read.

To achieve higher marks, queries should include the joining of TWO (2) or more tables, the use of renaming columns to ensure a user friendly result set, using sub-queries and the inclusion of descriptive columns from the tables.

(This section should be no more than 100 words for the rationale excluding scripts)

## **Task 7 Assessment of Design and Implementation (15 marks)**

Give an evaluation of how the work you have done has met the requirements of the organisation as outlined in Task 1. You should show how you have implemented the logical and physical design processes in the work you have completed. You should discuss how you have:

- Mapped logical database design to physical database design.
- Designed tables for your target DBMS.
- Identified any derived data and how you have represented it.
- Produced a set of queries that have utility for the business.
- Met specific requirements outlined in Task 1.

(This section should be 400 - 500 words excluding any diagrams)

## **Task 8 – Future development of a data warehouse (10 marks)**

Discuss the factors that might lead your organisation to build a data warehouse. You should demonstrate with the use of examples your understanding of the common uses of a data warehouse and how it would operate in the context of your chosen organisation.

(For guidance this section should be 300 - 400 words)

## **Task 9 – Distributed Database Option (10 marks)**

In the future your organisation could expand by merging with other similar companies. They suggested the possibility of developing a distributed database system and they would like you to assess the advantages and disadvantages of this. Outline how a distributed database could help them in the future. For guidance some of the points that could be covered are listed below. TWO (2) of these points should be covered.:

- The components of a distributed database management system.
- Factors that might make your chosen organisation consider implementing a distributed database.
- How a distributed database would be implemented given the organisation's current organisational and geographic structure including the use of replication, fragmentation and varying distributed database types.
- How a distributed database might allow the organisation's business to adapt to potential future expansion.

(For guidance this section should be 300 – 400 words)

## Appendix – Example of information collated on scenario

**DO NOT use this example or a variation of it for your own assignment.**

The example below shows a written scenario that could be derived from investigating an organisation. Also shown are some documents. You should be able to collect similar examples of from your own chosen firm or organisation. From this material it is possible to identify the entities that would constitute the database. Note that there is some overlap of entities between the documents.

Attributes names would be those shown in the documents. It is acceptable to introduce new attributes to take account of the data needs of the organisation. It is also worth noting that data in its current form is not necessarily normalised and it would be up to the developer to ensure that it is when the new database model is being developed.

### Scenario

Lowry College is Further Education College based in Kent, United Kingdom. They specialise in science education.

They want a database to help them manage teaching and resources for their various courses. This database will not be concerned, at least initially, with the allocation of students to courses.

Each course will have a number of staff allocated to it. A member of staff might be allocated to more than one course. Staff are defined by type: Teacher, Technical Support, Administration, Other.

Courses are made up of modules. A module might be part of more than one course. Modules are defined by type: 'Core', 'Elective' or 'Optional'. Some modules such as 'Biochemistry of Life' are taught on different courses.

A course might have one or more laboratories associated with it. A laboratory is administered by one particular course.

A module will be taught in a particular laboratory. A laboratory might host many different modules. Laboratories have equipment in them. A piece of equipment might be allocated to more than one laboratory. Equipment is defined by type.

Examples of data are shown in the tables below.

## Document 1. Staff Allocated to Courses

Course ID	Course Name	Staff ID	Staff Name	Staff Type
CHEM	BTEC Level 3 Chemistry	S2399	Barry Harvey	Teacher
BIO	BTEC Level 3 Biology	S2399	Barry Harvey	Teacher
CHEM	BTEC Level 3 Chemistry	S2400	Dorinda Harvey	Teacher
BIO	BTEC Level 3 Biology	S2300	Arabella Johnson	Teacher
CHEM	BTEC Level 3 Chemistry	S2301	Mavis Kingdom	Other
BIO	BTEC Level 3 Biology	S2301	Mavis Kingdom	Other
ENG	Certificate in Engineering	S2301	Mavis Kingdom	Other
CHEM	BTEC Level 3 Chemistry	S1101	Alison Walters	Technical Support
BIO	BTEC Level 3 Biology	S1101	Alison Walters	Technical Support
ENG	Certificate in Engineering	S1101	Alison Walters	Technical Support
ENG	Certificate in Engineering	S1102	Dennis Brown	Teacher
CHEM	BTEC Level 3 Chemistry	S2111	Abidh Khan	Teacher
BIO	BTEC Level 3 Biology	S2111	Abidh Khan	Teacher
BIO	BTEC Level 3 Biology	S8321	Kristian Cobaj	Administration
ENG	Certificate in Engineering	S8321	Kristian Cobaj	Administration
CHEM	BTEC Level 3 Chemistry	S9088	Julius Env	Administration

## Document 2. Modules on Courses

Course Code	Module Code	Module Name	Taught by	Module Type
BIO	BC	Biochemistry of Life	Barry Harvey	Core
CHEM	BC	Biochemistry of Life	Barry Harvey	Core
CHEM	EP	Experimental Practice	Dorinda Harvey	Elective
ENG	CAD	Computer Aided Design	Dennis Brown	Elective
BIO	PB	Plant Biology	Arabella Johnson	Optional
CHEM	ME1	Metals 1	Dorinda Harvey	Optional
CHEM	ME2	Metals 2	Abidh Khan	Optional
CHEM	NEU	Neurochemistry	Abidh Khan	Optional
BIO	NEU	Neurochemistry	Barry Harvey	Optional
CHEM	IO	Inorganic Chemistry	Abidh Khan	Core
BIO	EP	Experimental Practice	Dorinda Harvey	Elective



### Document 3. Courses, laboratories and equipment

Course Code	Laboratory ID	Laboratory Name	Equipment ID	Equipment Name	Quantity	Equipment Type
CHEM	CHEM1	Chemistry One	SG	Safety goggles	21	Safety
CHEM	CHEM1	Chemistry One	BS	Beakers	50	Chemistry Experiment
CHEM	CHEM1	Chemistry One	CS	Conical flasks.	30	Chemistry Experiment
CHEM	CHEM1	Chemistry One	BF	Boiling flasks.	30	Chemistry Experiment
CHEM	CHEM1	Chemistry One	TT	Test tubes.	50	Chemistry Experiment
CHEM	CHEM2	Chemistry Two	SG	Safety goggles	21	Safety
CHEM	CHEM2	Chemistry Two	BS	Beakers	50	Chemistry Experiment
CHEM	CHEM2	Chemistry Two	CS	Conical flasks.	30	Chemistry Experiment
CHEM	CHEM2	Chemistry Two	BF	Boiling flasks.	30	Chemistry Experiment
CHEM	CHEM2	Chemistry Two	TT	Test tubes.	50	Chemistry Experiment
BIO	BIO1	Biology One	SG	Safety goggles	21	Safety
BIO	BIO1	Biology One	MI	Microscopes	10	Biology Experiment
BIO	BIO1	Biology One	PD	Petri dishes	20	Biology Experiment
BIO	BIO1	Biology One	DY	Dyes	23	Biology Experiment
BIO	BIO1	Biology One	FO	Forceps	5	Biology Experiment
BIO	BIO1	Biology One	BF	Boiling flasks	20	Chemistry Experiment
ENG	ENG1	Engineering One	MM	Multi-meter.	5	Engineering Experiment
ENG	ENG1	Engineering One	LCR	LCR Meter	5	Engineering Experiment
ENG	ENG1	Engineering One	OSC	Oscilloscope.	5	Engineering Experiment
ENG	ENG1	Engineering One	SI	Soldering Iron	24	Engineering Experiment
ENG	ENG1	Engineering One	PMT	Precision Mechanical Tools set	24	Engineering Experiment
ENG	ENG1	Engineering One	SG	Safety goggles	24	Safety

## Submission requirements

- Your submission should be in the form of a single word-processed document that includes any necessary diagrams.
- The word count for the document is a maximum of **2200 words** (excluding text in any diagrams). A suggested range is between 1700 and 2200 words. You should explain any assumptions you have made.
- A digital version must be submitted on a CD, USB flash drive or other similarly acceptable medium, **along with a copy of the developed database**.

## Candidate checklist

Please use the following checklist to ensure that your work is ready for submission.

Have you read the NCC Education documents 'What is Academic Misconduct? Guidance for Candidates' and 'Avoiding Plagiarism and Collusion: Guidance for Candidates' and ensured that you have acknowledged all the sources that you have used in your work?

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Have you completed the 'Statement and Confirmation of Own Work' form and attached it to your assignment? **You must do this.**

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Have you ensured that your work has not gone over or under the recommended word count by more than 10%?

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Have you ensured that your work does not contain viruses and can be run directly?

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