



# **COM4003**

## Database Design

### **Design Specification**

**Date for Submission:** Please refer to the timetable on ilearn

(The submission portal on ilearn will close at 14:00 UK time on the date of submission)



## Assignment Brief

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As part of the formal assessment for the programme you are required to submit a **Database Design** assessment. Please refer to your Student Handbook for full details of the programme assessment scheme and general information on preparing and submitting assignments.

### Learning Outcomes:

After completing the module, you should be able to:

1. Demonstrate a knowledge and understanding of databases and data management systems.
2. Understand key principles of relational database design techniques.
3. Transform a logical database design into a physical database design for a target database management system.
4. Apply knowledge and understanding of database design and development to design, implement, test, document and evaluate a relational database solution for a given scenario.
5. Use appropriate problem-solving techniques.

Your assignment should include: a title page containing your student number, the module name, the submission deadline and a word count; the appendices if relevant; and a reference list in Arden University (AU) Harvard format. You should address all the elements of the assignment task listed below. Please note that tutors will use the assessment criteria set out below in assessing your work.

**Maximum word count:** 3,000 words

*Please note that exceeding the word count by over 10% will result in a reduction in grade by the same percentage that the word count is exceeded.*

**You must not include your name** in your submission because Arden University operates anonymous marking, which means that markers should not be aware of the identity of the student. However, please do not forget to include your STU number.



You have been engaged as a database consultant for the following organization.

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**Environmental Angels** are the go-to company when you have uninvited and unwelcome visitors! Got bats nesting in the attic? Got a mad mole destroying your prized lawn? How about an annoying wasps' nest in the garden shed? Or perhaps a large family of rats, but not so cute, rats have taken a fancy to your house? Fear not, Environmental Angels are here! Pest control is just a phone call away.

But wait – Environmental Angels do more than serve the needs of stressed-out house-holders. They actually make most of their money from commercial and industrial contracts. Typical examples will be local government contracts to deal with vermin in schools, libraries and other council properties; mole removal from up-market private golf courses and tennis courts; protection of underground utility services for the electricity, gas, water and telecoms companies; removal of vermin from the private sector food-processing and brewing industries (whose core activities are a magnet for rats and mice) and even bird removal from airports (military and commercial) so planes can take off and land safely (nobody wants a bird-strike) – where they employ falconers to scare away unwanted birds like pigeons using a range of birds-of-prey like hawks, kestrels, buzzards and falcons. This is much more lucrative than taking down a wasps' nest at someone's home!

The latest channel of income-generation is actually in the commercial (freshwater) fisheries sector. Angling is the world's most popular (participant) hobby – by a huge margin. There are 3-4 million anglers in the UK alone. These anglers have to fish somewhere and they expect to catch fish when they go. This represents a huge financial market and means that many commercial fisheries (primarily owners of lakes, reservoirs and, to a lesser extent, canals) are very keen to minimize or even completely remove any predatory fish like pike and zander, who can decimate other fish stocks such as roach, bream and trout if left unchecked.

Environmental Angels offer a bespoke service whereby they can use small boats with sonar-scanning technology to get a pretty good estimate on the population and size of the predatory fish living in a given water. They can then use electro-stunning technology (which stuns but does not kill the fish) along with large nets to remove most, if not all, the predatory fish safely. These extracted fish are not killed or harmed. They are transferred - in the company's own specialized tanker lorries – to third-party fisheries (who may actually want to promote their own predator fishing) or more commonly to fish farms and specialist breeders. So, Environmental Angels gets paid at both ends - to take these fish out in the first place and then again to sell them to someone else. How good is that financial model?

As part of all the above activities the company has to work with a wide range of external clients – such as private individuals, large corporations, small companies or various types of local and central government. *However, just doing the pest removal is not the whole story.* Many jobs and contracts demand environmental and regulatory oversight. For example, bats are protected, so if they need to remove them for a client, they must have a local authority 'bat preservation and protection survey' carried out. If they are dealing with vermin in a food-processing or brewing context then the local authority environmental health officer must attend the premises and sign-off that the work is satisfactory.



Even removing fish from one fishery to another has a lot of red tape. The danger of disease being carried from water to water is too dangerous and so again, a government inspector must supervise and check the fish being moved. Similar rules, regulations and supervisory oversight apply to most commercial and industrial work. All this activity – scheduling meetings, arranging visits, writing reports, actioning reports, issuing of certificates etc. has to be carefully tracked and documented. Otherwise, the company leaves itself open to legal action.

Imagine not fully clearing vermin out of a bakery, transferring diseased fish to a new fishery or maybe, in an extreme case, failing to clear birds from an airport. That leaves you with some dubious bread, a ruined fishery and even a plane crash. Not good.

The company also uses many chemicals and poisons to kill wasps, bees etc. as well as specialist equipment to trap and remove bats, moles and other larger animals – even badgers and 'urban foxes'. All supplies and equipment must be carefully tracked, from initial purchase, through allocation to each job, through to final decommissioning. Even not cleaning up wasp poison powder fully can kill any dogs or cats living in the home. This is serious and it needs to be treated as such.

The company is based in Birmingham, UK but services the whole United Kingdom. The Birmingham head office has 15 admin and IT support staff who look after core functions like HR, payroll, marketing, legal (contracts and compliance), purchasing and central IT support and website. Out in the field, each job will be staffed by between one and ten 'pest control officers' – depending on the job. Removing a wasps' nest from a garden shed needs only one, clearing out a rat infestation from a food factory maybe demands four or five but clearing 100s of pike from a large reservoir will need at least ten staff – maybe more.

In terms of vehicles, the company has small vans (domestic work), mid-large vans (commercial and industrial) and specialized items like boats and fish-tankers. These are all purchased from and maintained by external third-party companies on long-term contracts.

Lastly, travel and accommodation is a major issue as the company often has to send staff long distances to jobs or some jobs demand several day's work – such as airport, factory and large fishery contracts. In such situations, staff will stay away from home in hotels and guest houses of various types and all incurred expenses must be carefully recorded and authorized.

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### Final Point

The organisation needs a **database** to run all the above operations. Your job is to design and build this database. The above is simply an outline of the company and you will need to make your own assumptions and interpret or even extend the scenario as you go. *Use your imagination as you see fit, but you must clearly document all assumptions and extensions.*

The specific tasks you need to satisfy are listed below...



### Question 1 (Covers LO 1)

(a) Summarize the key benefits that the database approach to data management offers over traditional file-based data management. Answer with regards to this case study.

**(5 Marks)**

(b) List and briefly describe the major features to be found in a commercial database management system (DBMS).

**(5 Marks)**

### Question 2 (Covers LO 2)

Develop a semantically rich data model that captures the above scenario in the form of an entity-relationship diagram (ERD). You should note (and number) all assumptions you make about the data and the reasoning behind your design choices. Also, include (and number) any appropriate constraints and a list of entity types showing their attributes and identifiers.

**(20 Marks)**

### Question 3 (Covers LO 2)

Once you are satisfied that the ER diagram is a good representation of the organisation's data requirements, produce a logical design by mapping the ER diagram to a set of normalized relations – to third normal form (3NF). *You should annotate and explain this process.*

**(15 Marks)**

### Question 4 (Covers LO 3)

Take each of the normalized relations and implement them as SQL tables using an appropriate DBMS – such as Oracle, MySQL or another one you have access to – and a series of CREATE TABLE statements. You must include all primary and foreign keys as well as any other table or column constraints you feel are appropriate such as NOT NULL, CHECK, UNIQUE and DEFAULT. Provide screenshots of the working code. *Ensure your user name or some other distinguishing aspect is included in the screenshot to verify it is your code.*

**(15 Marks)**

### Question 5 (Covers LO 4)

Using appropriate sample data and *your own imagination based on this case study*, populate your finished tables with at least 10 rows of data in each table. Provide screenshots of the working code. When done, display the full contents of each populated table to screen and take screenshots. *Ensure your user name or some other distinguishing aspect is included in the screenshot to verify it is your code.*

**(10 Marks)**



### Question 6 (Covers LO 5)

To demonstrate that your final database is useful, write a set of realistic sample SQL queries based on the above scenario (use your imagination for details of each query) but they should include the following techniques:

- SELECT...FROM...WHERE...
- Joins (using two, three or more tables)
- Ordering output (ORDER BY)
- Grouping output (GROUP BY)
- Aggregate functions (MIN, MAX, AVG, COUNT, SUM)

You should aim to write a minimum of **ten** sample queries – ranging from basic SELECT...FROM...WHERE queries to more advanced ones using the above techniques. Be sure to fully evidence all SQL work by taking screenshots of the inputted code and the outputted results. *Ensure your user name or some other distinguishing aspect is included in the screenshot to verify it is your code.*

**(30 Marks)**



## Formative Feedback

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You have the opportunity to submit a single draft of your report to receive formative feedback.

The feedback is designed to help you develop areas of your work and it helps you develop your skills as an independent learner.

If you are a distance learning student, you should submit your work, by email, to your tutor, no later than 2 weeks before the actual submission deadline. If you are a blended learning student, your tutor will give you a deadline for formative feedback and further details.

Formative feedback will not be given to work submitted after the above date or the date specified by your tutor - if a blended learning student

## Guidelines

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You **MUST** underpin your analysis and evaluation of the key issues with appropriate and wide ranging academic research and ensure this is referenced using the AU Harvard system.

The My Study Skills Area on iLearn contains useful resources relating to referencing.

### ***Additional notes:***

*Students are required to indicate the exact word count on the title page of the assessment.*

*The word count excludes the **title page, executive summary, tables, figures, diagrams, footnotes, reference list and appendices.** Where assessment questions have been reprinted from the assessment brief these will also be excluded from the word count. **ALL other printed words ARE included in the word count.** See 'Word Count Policy' on the homepage of this module for more information.*

### **Submission Guidance:**

**Assignments submitted late will not be accepted and will be marked as a 0% fail.**

Your assessment should be submitted as a single *Word (MS Word) or PDF* file. For more information please see the "Guide to Submitting an Assignment" document available on the module page on iLearn.

You must ensure that the submitted assignment is all your own work and that all sources used are correctly attributed. Penalties apply to assignments which show evidence of academic unfair practice. (See the Student Handbook which is on the homepage of your module and also in the Induction Area).



### Assessment Criteria (Learning objectives covered - all)

**Level 4** is the first stage on the student journey into undergraduate study. At Level 4 students will be developing their knowledge and understanding of the discipline and will be expected to demonstrate some of those skills and competences. Student are expected to express their ideas clearly and to structure and develop academic arguments in their work. Students will begin to apply the theory which underpins the subject and will start to explore how this relates to other areas of their learning and any ethical considerations as appropriate. Students will begin to develop self-awareness of their own academic and professional development.

Grade	Mark Bands	Generic Assessment Criteria
First (1)	80%+	Outstanding performance which demonstrates the ability to analyse the subject area and to confidently apply theory whilst showing awareness of any relevant ethical considerations. The work shows an excellent level of competence and confidence in managing appropriate sources and materials, initiative and excellent academic writing skills and professional skills (where appropriate). The work shows originality of thought.
	70-79%	Excellent performance which demonstrates the ability to analyse the subject and apply theory whilst showing some awareness of any relevant ethical considerations. The work shows a high level of competence in managing sources and materials, initiative and very good academic writing skills and professional skills (where appropriate). The work shows originality of thought.
Upper second (2:1)	60-69%	Very good performance which demonstrates the ability to analyse the subject and apply some theory. The work shows a good level of competence in managing sources and materials and some initiative. Academic writing skills are good and expression remains accurate overall. Good professional skills (where appropriate). The work shows some original thought.
Lower second (2:2)	50-59%	A satisfactory to good performance which begins to analyse the subject and apply some underpinning theory. The work shows a sound level of competence in managing basic sources and materials. Academic writing skills are satisfactory and expression remains accurate overall although the piece may lack structure. Satisfactory professional skills (where appropriate). The work lacks some original thought.
Third (3)	40-49%	Basic level of performance in which there are some omissions in understanding the subject, its underpinning theory and ethical considerations. The work shows a basic use of sources and materials. Academic writing skills are limited and there are some errors in expression and the work may lack structure overall. There are some difficulties in developing professional skills (where appropriate). The work lacks original thought and is largely imitative.
Marginal fail	30-39%	Limited performance in which there are omissions in understanding the subject, its underpinning theory and ethical considerations. The work shows a limited use of sources and materials. Academic writing skills are weak and there are errors in expression and the work may lack structure overall. There are difficulties in developing professional skills (where appropriate). The work lacks original thought and is largely imitative.
	29% and below	A poor performance in which there are substantial gaps in knowledge and understanding, underpinning theory and ethical considerations. The work shows little evidence in the use of appropriate sources and materials. Academic writing skills are very weak and there are numerous errors in expression. The work lacks structure overall. Professional skills (where appropriate) are not developed. The work is imitative.