

G51DBS – Database Systems – Coursework 1 (v1.1)

This coursework is worth 20% of your module mark. It is marked out of 100. Example files which you can fill in with your answers are available on the moodle page.

Questions 2 and 3 will be used by the markers to help us to understand how you think that your answer to Question 1 will work and whether it is correct (in case you give a different answer to us). Obviously, you will probably want to use the answers to Q2 and Q3 to refine/correct your answer to Q1: inserting the data into your database is an ideal way to find out if you missed something.

Problem description/ database requirements:

You are required to create a database for a company to manage their **projects**. The company has **employees** and **projects**, and will assign employees to complete projects. Employees have **skills** of various levels of ability, and projects need various skills. The aim of the company will be to ensure that all of the skill requirements of the project are met by the employees who are assigned to it.

A number of named skills exist, such as **'PHP'**, **'SQL admin'**, **'SQL query'**, **'Database design'**, etc. Each employee may have **one or more skills**, in each of which he/she has a skill level which is measured **from 1 (novice) to 3 (expert)**. A project has a **name** and **requires certain skills** for a specified **duration** (in terms of working **days**), starting on a specific date. For example, a project may need three people with PHP skill of at least level 2 for three weeks, **starting from** December 1st 2014 and for another person with PHP skill of at least level 2 for 3 days starting from January 1st 2015. All of this information (the **skill**, the **level**, the **number of people** and the **duration**) must be stored in the database.

Each employee also has an **employee id**, a **surname**, **first name** and **job title**. Each employee can be the **line manager** of one or more other employees, but each employee only has a single line manager. (The managing director is assumed to be their own line manager, for simplicity, so that everyone has a line manager.)

Each employee can be allocated to **one or more projects** for specified durations on each, and this allocation will satisfy a **specific skill** need on the project. Multiple employees may be needed in order to allocate a single skill requirement. E.g. a requirement of for 4 days could be met by allocating 2 employees for 2 days each. **Which employees are meeting which** needs must also be stored. *(Note: You may notice an issue with start date here if you have multiple employees doing a few days each. Ignore the problem and just assume that all start on the start date of the skill requirement. If you didn't notice the potential problem then you can ignore this note anyway ☺.)*

Important: You can see in Q3 some examples of data which must be stored. This may help you to understand these requirements.

Plagiarism: Working together on this coursework means that what you submit will not be all your own work. This is plagiarism and is taken extremely seriously. You must not copy someone else's work or allow somebody else to copy yours.

Late penalties: Your mark will be reduced by 5 percentile points per working day late (any day except a weekend or bank holiday) that you submit. If you submit late then your mark and feedback may be significantly delayed.

Timing: It took me about 20 mins to do part 1, 20 mins for part 2 and almost an hour to do and test part 3, including writing queries to check that I got the model answer correct (and correct the requirements for data I had missed out – oops) once I had written the coursework. Getting the data right and writing the statements takes time, but allows 'debugging' of the design). Please ensure that you leave enough time because it will take you a lot longer while learning!

Question 1: ER-diagram, 60 marks

From the problem description, start by identifying the entities that need to be represented in the database, the attributes of each entity, the relationships between the entities, and the cardinality ratios of each relationship.

Use the above information to draw an ER diagram for the database which is described in the database requirements:

- Show all entities, attributes and relationships (including cardinalities of relationships).
- Use the same symbols as were used in the lectures on ER-diagrams.
- Ensure that you appropriately remove any many-to-many relationships so that the resulting database design could be implemented using SQL.
- Ensure that you include in your ER-diagram all foreign key attributes which will be required in order to handle the relationships.
- You may add additional unique id attributes to entities if you wish.

Submit your diagram as either a pdf file or a word document. You should call your file either cw1_2014_ERDiagram.docx or cw1_2014_ERDiagram.pdf as appropriate for the file format. An example word document which you could edit is available on the module web page.

Note: You only need to submit the ER diagram, not the list of entities and attributes.

Question 2: SQL to create database: 25 marks

Download the file: cw1_2014_SQL.sql file from the module page. Add SQL code to the file to create the database tables for a database which will match your design in Question 1. Ensure that you include all constraints (including primary keys) and foreign keys and that you use appropriate column types.

Question 3: SQL to insert data: 15 marks

Write SQL code (in your cw1_2014_SQL.sql file from Q2) to insert the following information into your database:

- Adam Smith, the Managing director, employee ID 1, is his own manager and has the skills 'Management' at level 3 and 'Leadership' at level 3.
- Beryl Jones (ID 2), the IT manager, has the skills 'Management' at level 2, and 'SQL query' at level 3.
- Cyril Green (ID 3), the Personnel manager, has the skills 'Management' at level 3 and 'Communication' level 1.
- Dennis Brown (ID 4), the developer, has the skills 'SQL admin' level 2, 'SQL Query' level 3 and 'Database Design' level 3.
- Edward White (ID 5), the intern, has no skills which are relevant for projects at the moment.
- Adam is the line manager for Beryl and Cyril. Beryl is the line manager for Dennis and Edward.
- A project currently exists, named 'Design the project management system'. It requires someone for three days to design the database, starting from August 12th 2014, needing the 'Database Design' skill of at least level 2 (Dennis has been assigned to this for all three days), someone for two days to implement the database (from November 1st 2014), needing someone with 'SQL admin' skill of at least level 3 (Dennis has been assigned to this as well for one of the days) and someone to test the database design for five days (starting December 5th 2014), needing 'Database Testing' skill of at least level 1 (nobody has been assigned to this role yet).
- A second project exists, named 'Advertise the project management system'. It requires someone with the 'Advertising' skill of at least level 1 for 35 days, from 5th January 2015.
- A skill called 'User Interface Programming' exists, but no existing employee has the skill.

Version 1.1.

Modifications for v1.1: Moved the text "Each employee may have one or more skills, in each of which he/she has a skill level which is measured from 1 (novice) to 3 (expert)" earlier to prevent some repetition and some confusion where something else said skill levels were 1 to 10. This did not change the meaning of or answer to the coursework, but was a little confusing for readers.