
TMA 02 (2016J)

Question 1 (40 marks)

You should be able to answer this question when you have completed Parts 8 to 14 of the module.

This question is intended to test your understanding of different database structures.

This question tests the following learning outcomes:

- Understand the similarities and differences between at least two different database models, and how they are used to manage data collections.
- Select an appropriate database model for a data collection.

You should spend no more than four hours on this question.

This question does not require you to work through a Notebook. Write your answers to all parts of Question 1 directly into your *Solution Document*.

Scenario for Question 1

A large service sector is that of commercial babysitting services. A typical example is www.sitters.co.uk. Upon registering, a family can book a babysitter for a given timeslot. The service selects a babysitter, handles the booking details and makes appropriate arrangements with the babysitter. The service also handles payments by the client families, and ensures that all its registered babysitters have been cleared by the Disclosure and Barring Service (DBS)¹.

The data stored by the service needs to be accessed by several different groups of people with different requirements and responsibilities, including the office manager, the finance manager, the line managers for the babysitters, and the person tasked with maintaining the data storage services.

In this question, you should imagine that you have been recruited to set up the data management system for a local babysitting service, called Open Sitters. One of your tasks is to create a data storage system to store the relevant data about the clients and the babysitters. Open Sitters has stated that they need to store data about the various families who use the service, the babysitters managed by the service, and details of each booking made by each family.

- The TM351 module materials and Ponniah (2003) identify several potential difficulties of using file-oriented systems to store data for such scenarios.
 - Give two potential difficulties from a practical point of view in using a file-oriented system for managing the Open Sitters data.
 - Give one potential difficulty from a legal point of view in using a file-oriented system for managing the Open Sitters data.

(6 marks)

- You now need to consider how you might implement the database to store the service's data.

A mock-up of the family registration page is shown in Figure 1. The site allows arbitrary numbers of children to be registered with each family; the “Add a child” and “Remove a child” buttons are used to set the total number of children to be registered with the family.

Registration

(*) denotes a compulsory field

Primary parent or carer

* Title

* First name

* Surname

* Mobile phone number

Landline

* email

Secondary parent or carer

Title

First name

Surname

Mobile phone number

email

Children

First name

Date of birth

First name

Date of birth

First name

Date of birth

Add a child

Remove a child

Register

Figure 1 Example of Open Sitters family registration site (adapted from a similar page on sitters.co.uk)

Suppose that you decided that you decided to store the data from this web form in a document database, and chose MongoDB. Outline a possible structure for the data if you were to store it in a MongoDB database. You may use a diagram.

(4 marks)

- c. Now, imagine that you decide to store the data from this web form in a relational database instead. You decide to use two relational tables: a “family” table, which stores information about the carers, and a “child” table to store the information about the children.

List the columns you would include in each table. What would you choose for the primary key of each table? How would you declare the relationship between the two tables? Describe all the constraints on the data that are implied by the above

scenario. State any assumptions you make. If you make no assumptions, state this.

(12 marks)

- d. Highlight the key differences between your document-based model of the data, and your relational model of the data.

(4 marks)

- e. Suppose that, in the relational model, there is another relation “booking”, in which each row represents a distinct booking made. You decide to add an extra column to the “family” table which stores the total number of bookings made by each family. If a registered family has not yet made a booking, the stored value of their total number of bookings is zero. When a registered family makes a new booking, the booking is recorded in the “booking” table, and the value in the extra column in the “family” table is increased by 1.

What DBMS function ensures that this two-step process maintains data integrity, i.e. that the total number of bookings recorded in the family table is equal to the total number of bookings recorded in the “booking” table? Briefly explain how data integrity can be maintained.

(4 marks)

- f. Relational databases can enforce more regularity on the data they contain than document databases can. Give three examples of relational properties that help constrain the data in a relational database.

In contrast, document databases are generally ‘schema free’. Give one advantage and one disadvantage of using this approach.

Draw on examples from the babysitting service scenario to illustrate your answers.

(10 marks)

1 A DBS check is required under UK law for employees whose job involves working with children.