TESTING YOUR UNDERSTANDING

Exercise 1-1

A school is planning some outdoor activities for its students. The staff wants to create a database of how parents can help. The secretary sets up the database table in Figure 1-7 to keep the information.

last_name	first_name	phone	contribution	contribution2
Smith	Jane	4623598	Food preparation	Driving
Green	Rob	8965431	Transport	
Henry	James	9576342	Camping Gear	Cooking
Wang	Li	9612345	Cooking	

Figure 1-7. *Initial database table for recording parent contributions*

What problems can you foresee in making good use of this information?

Suggest some better ways that this information could be stored.

Exercise 1-2

A small library keeps a roster of who will be at the desk each day. They have a database table as shown in Figure 1-8.

week_start	Mon	Tue	Wed	Thur	Fri
17/10/2011	Jane	Sue	George	Sue	Jane
24/10/2011	Jane	Sue	Linda	Sue	Lee
31/10/2011	Sue	Sue	Lee	George	George

Figure 1-8. *An initial database table to record roster duties*

What problems can you foresee in making good use of this information?

Suggest some better ways that this information could be stored.

TESTING YOUR UNDERSTANDING

Exercise 2-1

A small sports club keeps information about its members and the fees they pay. The secretary wants to be able to record when members pay and print a report similar to that in Figure 2-20.

last_name	first_name	phone	type	gender	fee	date_paid
Smith	Jane	563201	Full	F	220	21/09/2011
Wilson	Harry	375967	Full	M	220	19/09/2011
Green	Bert	439871	MidWeek	M	150	
Jones	Bert	295784	Social	F	80	
Smith	Sharon	387648	MidWeek	F	150	16/08/2011

Figure 2-20. *Membership data for a small club*

a) Think about when the different pieces of data might be entered. Sketch an initial use case diagram for data entry.

b) Consider what different things you are keeping information about and sketch a simple class diagram.

c) What options could you suggest to the club for different ways a report could be presented? Does your class diagram have the information readily available?

- Brainstorm the data that could be associated with each job.
- Agree on the scope of the project and decide on the relevant data.
- Sketch data input use cases, consider exceptions, and check existing forms.
- Sketch a first data model.
- Brainstorm the possible outputs given the data being collected.
- Sketch information output use cases.
- Check that the data model can readily provide the output information

TESTING YOUR UNDERSTANDING

Exercise 3-1.

Consider the scenario described at the beginning of this chapter:

> *When parents call to say that children are sick, we have to let their classroom teachers know, and if it's sports day and the child is on a school team, the sports teacher might have to sort out substitutes. Then we need to count up all the days missed to put on the child's report. The Department of Education needs the totals each term, too.*

Run through the steps in the summary section and sketch some use cases and an initial data model. Assume that the main objectives are to record the absences for the classroom teacher, for school reports, and for statistics given to the Department of Education.

TESTING YOUR UNDERSTANDING

Exercise 4-1.

Figure 4-23 shows a first draft of modeling the situation where a publishing company wants to keep information about authors and books. Consider the possible optionalities at each end of the relationship `writes` and so determine some possible definitions for a book and an author.

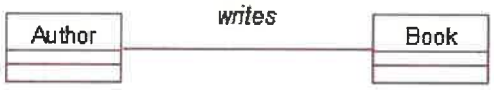

Figure 4-23. *Consider possible optionalities for authors writing books.*

Exercise 4-2.

Figure 4-24 shows a possible data model for cocktail recipes. The Many–Many relationship `uses` can be navigated in either direction. To find out the ingredients in a Manhattan or to discover the possible uses for that bottle of Vermouth. What is missing?

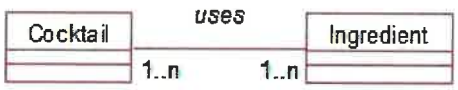

Figure 4-24. *Cocktails and their ingredients. What is missing?*

Exercise 4-3.

Part of the data model about guests at a hostel is shown in Figure 4-25. How could the model be amended to keep historical information about room occupancy?

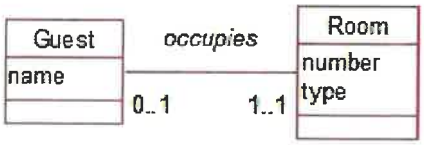

Figure 4-25. *How could this be amended to keep historical information about room occupancy?*

Exercise 5-2.

A university wants to model information about the teaching of courses. A number of staff members may contribute to providing lectures, and one staff member is denoted as the course supervisor. Suggest an initial data model.

Exercise 5-3.

How would you model information about marriages- who marries whom and when? Think about all the different situations that could eventuate (for simplicity, do not worry at this stage about the gender of the participants).

Exercise 5-4.

An orchestra keeps information about its musicians, its repertoire and concerts. A partial data model is shown in Figure 5-22. The relationships store information such as that Joe Smith is required for Saturday's concert and that Beethoven's violin sonata is to be performed at Saturday's concert.

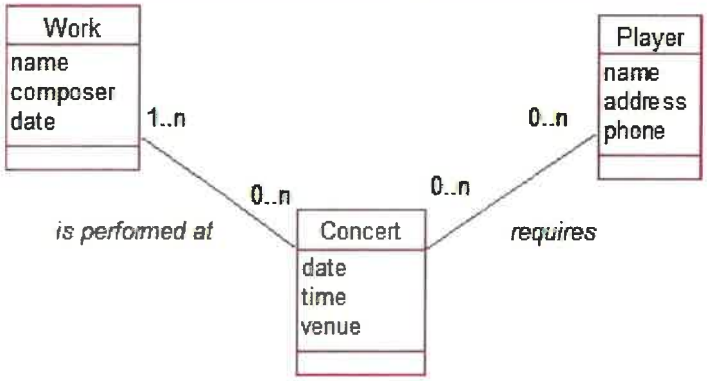

Figure 5-22. *A partial data model for an orchestra's repertoire and concerts*

What false information could be deduced from this initial model?
Amend the model so that it can maintain the following information correctly:

- Which players are involved in particular works in a concert
- The works being presented at a concert
- The fee a player receives for appearing in a particular concert

Other considerations:

- Classes that have subclasses should be abstract, which means they will never have any objects. This allows the problem to be more readily extended.
- Consider associations with roles when you come across the *my object is a member of both these classes* dilemma.
- Don't introduce the complexity of inheritance unless the specialized data in the subclasses is important to the main objectives of the project.

TESTING YOUR UNDERSTANDING

Exercise 6-1.

Consider the model in Figure 6-24 which describes purchases of a product by customers of a small mail order company selling toys. For simplicity, each purchase is for one or more of a single toy. Each transaction must have a customer so that he or she can be invoiced and the product delivered. The data will be used to prepare statistics about the different products sold, values of purchases, and the spending habits of customers.

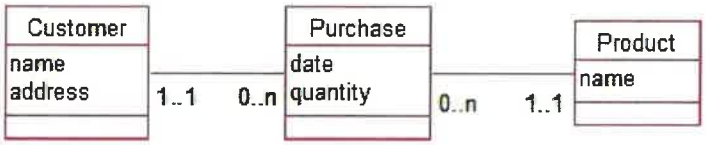

Figure 6-24. *Customers purchase products.*

The company changes the way it does business to allow customers to walk in off the street and pay cash. No customer needs to be associated with a cash purchase. Discuss how effective the following changes to the data would be.

- Change the optionality at the customer end of the relationship to 0 so not all purchases need a customer.
- Leave the optionality as 1 but include a dummy customer object, with name CashCustomer.
- Create subclasses of `Customer`: `Cash_Customer` and `Account_Customer`.
- Create subclasses of `Purchase`: `Cash_Purchase` and `Account_Purchase`.

Exercise 6-2.

1. A farmer keeps information about the application of fertilizer (e.g. amount, date) to his crops. His farm is made up of large sections which are divided into fields. Usually an application of fertilizer is applied to an entire section, but occasionally it is to an individual field. How would you model this?

Exercise 6-3.

2. A volunteer library has staff, members, and books. It wants to know which books are on loan to whom, know how to contact the borrower, and charge fees for overdue books. Reference books cannot be borrowed. Members are fined $5 per day for overdue books, but staff do not receive fines. How might you model this situation? Some intial classes are shown in Figure 6-25.

Figure 6-25. *People can borrow books.*

TESTING YOUR UNDERSTANDING

Exercise 7-1.

Figure 7-25 shows an initial data model for a small library. It is incomplete, so as you answer the questions below consider what else might need to be included.

a) Explain to the librarian what the initial data model means.

b) Design tables for a relational database which would capture the information represented by the model. Include primary and foreign keys and other appropriate constraints.

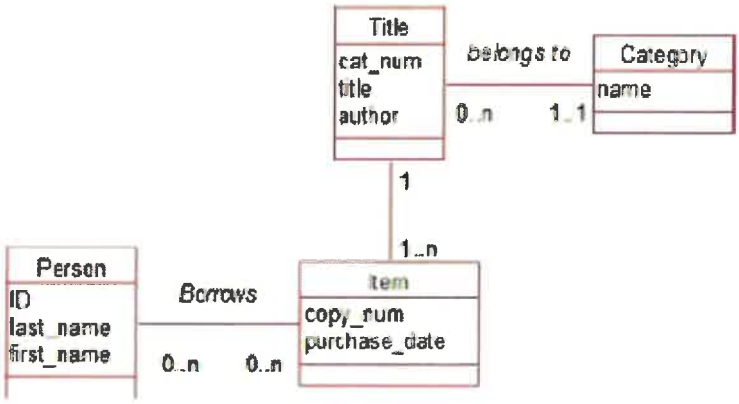

Figure 7-25. Draft data model for a small library

TESTING YOUR UNDERSTANDING

Exercise 8-1.

Example 1-3 back in Chapter 1 is a good real–life example of unnormalized data. To recap: Farms are visited and a number of samples are taken from different fields. The number of each species (just Springtail and

FarmID	FarmName	Field	Date	Visit	SampleID	Insect	Count
1	HighGate	F2	12-Mar-11	14	3	Beetle	2
1	HighGate	F2	09-Feb-11	14	2	Beetle	4
1	HighGate	F1	09-Feb-11	14	1	Beetle	4
1	HighGate	F1	18-Mar-11	15	1	Springtail	5
1	HighGate	F2	09-Feb-11	14	3	Springtail	3
1	HighGate	F2	09-Feb-11	14	2	Springtail	5
1	HighGate	F1	09-Feb-11	14	1	Springtail	6
1	High Gate	F1	18-Mar-11	15	1	Beetle	7
2	Greyton	F2	09-Feb-11	16	1	Beetle	2
2	Greyton	F1	09-Feb-11	16	2	Beetle	4
2	Greyton	F1	09-Feb-11	16	2	Springtail	5
2	Greyton	F2	09-Feb-11	16	1	Springtail	3

Figure 8-14. Unnormalized version of insect data

Beetle for now) in each sample is recorded. A version of the data is shown in Figure 8-14.

Consider the following questions:

a) What are some of the updating problems that could occur with the table in Figure 8-14?

b) Which of the following functional dependencies hold for the insect data?

- FarmID → FarmName?
- FarmID → Visit?

- Visit → Date?
- Date → Visit?
- Visit → FarmID?
- Sample → Field?
- (Sample, VisitID) → Field?
- (Sample, Insect) → Count?

c) (VisitID, Sample, Insect) → Count? (VisitID, Sample, Insect) is suggested as an appropriate primary key. Can you determine all the other values from knowing the values of these three fields? Would it be a suitable primary key?

d) Using the fields in Part C as a primary key use the normalization rules to decompose the table in Figure 8-14 into a set of tables in third normal form.