other diagrams are enhanced and refined as development progresses. The main UML models are cross-referenced via entries in the data dictionary, which thus provides a valuable means of ensuring consistency between them.

The data dictionary notation that we use in this book is semi-formal, and suitable for documenting the data of a small information system, such as the Wheels case study. In this section we only cover classes and their attributes; describing operations is discussed in Chapter 6.

We want to be able to define classes in terms of their attributes including:

- The order in which they are listed (e.g. name, address, phone number)
- Whether an attribute is repeated (e.g. a customer may have more than one phone number)
- Any restrictions on the number of repetitions
- Whether an attribute is optional (e.g. a customer may or may not have an email address)
- The set of possible values for an attribute (e.g. in some businesses a customer may be individual or wholesale)
- Selection between alternative values for an attribute (e.g. a customer is either individual or wholesale).

We also want to be able to include comments where needed to explain some aspect of the definition.

One notation that allows us to do all these things is shown in Table 5.1.

Notice that in this notation most items are in lower case. An initial capital for the first word indicates that a class is being described (e.g. Customer). Where a description consists of more than one word, the words are run together with no spaces but with a capital letter at the start of the second and every subsequent new word, e.g. houseNumber. As an example, let us look at a simple definition of a customer.

Customer = customerID + name + address + $\{phone\}_2$ + (email)

Notice that there is a restriction of two on the possible number of phone numbers; this is indicated by the subscript after the second curly bracket. If we want to indicate a minimum number of phone numbers, we can do this with a subscript before the first curly bracket. For example, $_1\{phone\}_2$ would mean that there had to be at least one phone number.