CHAPTER 5

The example extended

5.1 Full definition of boarding operation

The definitions of the operations for boarding and disembarking from the aircraft in the example of Chapter 3 did not consider what was to happen if the precondition of an operation was not fulfilled. Now this will be rectified. Each operation will have an additional variable, *reply*, which gives a response to indicate what happened during the operation. The response will be a value of the type *RESPONSE*:

RESPONSE ::= OK | twoErrors | onBoard | full | notOnBoard

5.1.1 Board

The operation to board the aircraft can now be given. Either:

- *p* is not on board and the aircraft full and *p* gets included in *onboard* and reply is *OK*;
- or *p* is already on board and the aircraft is full and the set *onboard* is unchanged and reply is *twoErrors*;
- or *p* is already on board and the aircraft is not full and the set *onboard* is unchanged and reply is *onBoard*;
- or p is not on board and the aircraft is full and the set *onboard* is unchanged and reply is *full*.

p: PERSON
reply: RESPONSE

(p ∉ onboard ∧ #onboard < capacity ∧
onboard' = onboard ∪ {p} ∧ reply = OK)
∨
(p ∈ onboard ∧ #onboard = capacity ∧
onboard' = onboard ∧ reply = twoErrors)
∨
(p ∈ onboard ∧ #onboard < capacity ∧
onboard' = onboard ∧ reply = onBoard)
∨
(p ∉ onboard ∧ #onboard = capacity ∧
onboard' = onboard ∧ reply = full)

5.1.2 Disembark

The operation to disembark from the aircraft can now be given. Either:

- p is on board and p gets removed from *onboard* and reply is *OK*;
- or p is not on board and the set *onboard* is unchanged and reply is *notOnBoard*.

$$
\begin{aligned}
&p: \mathrm{PERSON} \\
&reply: \mathrm{RESPONSE} \\
&\\
&(p \in onboard \land \\
&onboard' = onboard \setminus \{p\} \land reply = OK) \\
&\lor \\
&(p \notin onboard \land \\
&onboard' = onboard \land reply = notOnBoard)
\end{aligned}
$$

5.2 A better way

As can be seen, this way of defining the operations in full begins to get complicated. A much better, *modular*, approach using *schemas* will be introduced in the next chapter.

EXERCISES

Referring to Question 1, Chapter 2, and its development in exercises of Chapter 3, give full descriptions in the manner of this chapter for:

1. A suitable type for the response from any of the following operations.
2. The operation to register a new user.
3. The operation to remove a user's registration.
4. The operation to log in.
5. The operation to log out.