

Exercise Sheet 8: Development of a Library

1 Purpose

The purpose of this exercise is to make you developing a little system for handling a library

2 Description of the Library

A library contains some books. New books can be acquired by the library. People can be made members of this library. Members can also leave the library.

Books can be borrowed by members. Members return books which they have borrowed.

When a book which a member wants to borrow is not available (borrowed by another member), the asking member of this book is put on a waiting queue associated with this borrowed book. Members can quit a waiting queue. The member with the longest waiting time in a waiting queue is served when the book is returned.

3 Your Task

Your task is the following:

- Define a proper requirement document for this system.
- Develop a model on the Rodin Platform by means of several refinements.
- Follow the refinement strategy defined below.

4 Refinement Strategy

4.1 Initial Model

In the initial model you are concerned with the following only:

- The library can acquire new books
- The library can accept new members
- A member can leave the library (not being a member any more)

4.2 First Refinement

In the first refinement, members can do the following:

- To borrow a book,
- To return a borrowed book
- To wait in a queue if the book they want to borrow is not available

In this refinement, the queue of members waiting for a borrowed book is just a set (no ordering). When a book is returned, any member waiting for it can be served.

Prove that the waiting "queue" is finite. Add this property as an invariant. You might have to do two interactive proofs here.

4.3 Second Refinement

We introduce a variable "date". The variable "date" is a natural number (initially set to 0). The variable date is used as follows:

- The date is incremented when a member is made waiting for a book.
- Each member waiting in a queue is associated with the corresponding date.
- The member that will be served when a book is returned is the one whose date is the smallest one.

4.4 Note

All proof obligations should be proved automatically except the two mentioned in the first refinement.