An Event-B Specification of

Library

This project tests extracting information out from a machine through parameters prefixed with out_.

`VARIABLES`

books	All books that are owned by the library.
borrowers	All borrowers registered at the library.
loans	All books that are loaned out.

`INVARIANTS`

`inv1:`	$books \in \mathbb{P}(\mathbb{N})$	We represent books
`inv2:`	$borrowers \in \mathbb{P}(\mathbb{N})$	and borrowers using integers.
`inv3:`	$loans \in books \nrightarrow borrowers$	A book is only loaned to one borrower at a time.

`EVENT` INITIALISATION
`THEN`

`init1:`	$books := \varnothing$
`init2:`	$borrowers := \varnothing$
`init3:`	$loans := \varnothing$

`END`

`EVENT` addBook

Add a new book to the library, the book must not have been added before.

`ANY`

  b

`WHERE`

`grd1:`	$b \in \mathbb{N}$
`grd2:`	$b \notin books$

`THEN`

`act1:`	$books := books \cup \{b\}$

`END`

`EVENT` addBorrower

Add a new borrower to the library, the borrower must not have been added before.

`ANY`

  b

`WHERE`

`grd1:`	$b \in \mathbb{N}$
`grd2:`	$b \notin borrowers$

`THEN`

`act1:`	$borrowers := borrowers \cup \{b\}$

`END`

`EVENT` addLoan

Loan a book to a borrower, the book must not be on loan already.

`ANY`

  borr
  book

`WHERE`

grd1:	$borr \in borrowers$	Valid borrower.
grd2:	$book \in books$	Valid book.
grd3:	$book \mapsto borr \notin loans$	Not a necessary test, but used for this example anyway.
grd4:	$book \notin \mathrm{dom}(loans)$	The book is not loaned out already.

THEN

act1:	$loans(book) := borr$	Add a new loan in the storage.

END

EVENT returnBook $\boxed{1.5}$

Return a book, the book must be on loan.

ANY

$book$

WHERE

grd1:	$book \in books$	Valid book.
grd2:	$book \in \mathrm{dom}(loans)$	The book is on loan.

THEN

act1:	$loans := \{book\} \lhd loans$	Remove the loan from storage.

END

EVENT isBookOnLoan $\boxed{1.6}$

Check if a book is on loan.

ANY

$book$
out_onloan

WHERE

grd1:	$book \in books$
grd2:	$out\_onloan = \mathrm{bool}(book \in \mathrm{dom}(loans))$

END

EVENT whoBorrowsBook $\boxed{1.7}$

Return who is borrowing a book.

ANY

$book$
$out\_borrower$

WHERE

grd1:	$book \in books$	Querying a valid book?
grd2:	$book \in \mathrm{dom}(loans)$	That is on loan?
grd3:	$out\_borrower = loans(book)$	Return the result through out.

END