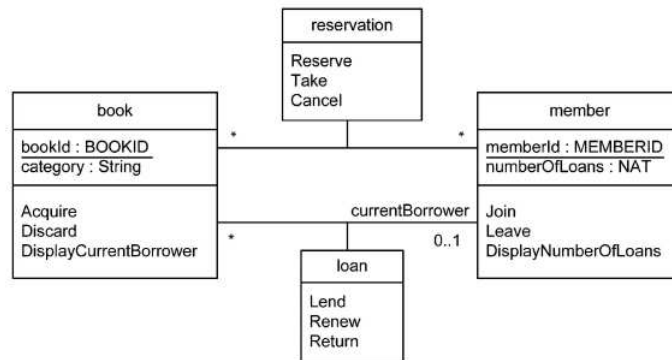


# Exemple de la bibliothèque

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## 1 Machine Interface

**MACHINE** *B.Library.Interface*

**INCLUDES** *B.Library*

**SETS** *RESULTAT* = {*ok*, *existe*, *nonexistent*, *erreur*}

### DEFINITIONS

*theMember* ==  $memberId^{-1}(mId)$ ;

*theBook* ==  $bookId^{-1}(bId)$

### OPERATIONS

*result*  $\leftarrow$  *Leave*(*mId*) =  
**pre** *mId*  $\in$  *MEMBERID*

```

then if  $mId \notin \text{RAN}(memberId)$  then
  result := erreur
else
  if  $theMember \in \text{RAN}(reservations) \vee theMember \in \text{RAN}(loans)$ 
  then result := existe
  else  $L\_Leave(mId) \parallel result := ok$ 
  end
end
end;

```

```

result  $\leftarrow Discard(bId) =$ 
pre  $bId \in BOOKID$ 
then if  $bId \notin \text{RAN}(bookId)$  then
  result := erreur
else
  if  $theBook \in \text{DOM}(reservations) \vee theBook \in \text{DOM}(loans)$ 
  then result := existe
  else  $L\_Discard(bId) \parallel result := ok$ 
  end
end
end;

```

```

result, mId  $\leftarrow DisplayCurrentBorrower(bId) =$ 
pre  $bId \in BOOKID$ 
then if  $bId \notin \text{RAN}(bookId)$  then
   $mId \in MEMBERID \parallel result := erreur$ 
else
  if  $theBook \notin \text{DOM}(loans)$ 
  then  $mId \in MEMBERID \parallel result := nonexistant$ 
  else  $mId \leftarrow B\_CurrentBorrower(bId) \parallel result := ok$ 
  end
end
end
end

```

## 2 Machine Library

MACHINE *B\_Library*

**INCLUDES** *B\_Loan*, *B\_Reservation*, *B\_Member*, *B\_Book*

**PROMOTES**

*B\_Join*, *B\_Acquire*, *B\_Cancel*, *B\_Reserve*, *B\_Lend*, *B\_Return*,  
*B\_CurrentBorrower*, *B\_NumberOfLoans*, *B\_BorrowerByCategory*

**DEFINITIONS**

*theMember* ==  $memberId^{-1}(mId)$ ;  
*theBook* ==  $bookId^{-1}(bId)$

**OPERATIONS**

*L\_Leave*(*mId*) =

**pre**

$mId \in \text{RAN}(memberId) \wedge$   
 $theMember \notin \text{RAN}(reservations) \wedge$   
 $theMember \notin \text{RAN}(loans)$

**then**

*B\_Leave*(*mId*)

**end;**

*L\_Discard*(*bId*) =

**pre**

$bId \in \text{RAN}(bookId) \wedge$   
 $theBook \notin \text{DOM}(reservations) \wedge$   
 $theBook \notin \text{DOM}(loans)$

**then**

*B\_Discard*(*bId*)

**end;**

*L\_Take*(*mId*, *bId*) =

**pre**

$mId \in \text{RAN}(memberId) \wedge$   
 $bId \in \text{RAN}(bookId) \wedge$   
 $bookId^{-1}(bId) \notin \text{DOM}(loans) \wedge$   
 $(theBook \mapsto theMember) \in reservations \wedge$   
 $numReserv(theBook, theMember) = \text{MIN}(numReserv[ \{theBook\} \triangleleft \text{DOM}(numReserv) ])$

**then**

*B\_Cancel*(*mId*, *bId*) ||  
*B\_Lend*(*mId*, *bId*)

**end;**

$L\_Renew(mId, bId) =$

**pre**

$mId \in \text{RAN}(memberId) \wedge$

$bId \in \text{RAN}(bookId) \wedge$

$(theBook, theMember) \in loans$

**then**

SKIP

**end**

**end**

### 3 Machine Loan

**MACHINE**  $B\_Loan$

**USES**  $B\_Member, B\_Book$

**VARIABLES**  $loans$

**INVARIANT**  $loans \in books \leftrightarrow members$

**DEFINITIONS**

$theMember == memberId^{-1}(mId);$

$theBook == bookId^{-1}(bId)$

**INITIALISATION**  $loans := \emptyset$

**OPERATIONS**

$B\_Lend(mId, bId) =$

**pre**

$mId \in \text{RAN}(memberId) \wedge$

$bId \in \text{RAN}(bookId) \wedge$

$theBook \notin \text{DOM}(loans)$

**then**

$loans(theBook) := theMember$

**end;**

```

B_Return(mId, bId) =
pre
  mId ∈ RAN(memberId) ∧
  bId ∈ RAN(bookId) ∧
  (theBook, theMember) ∈ loans
then
  loans := {theBook} ◁ loans
end;

mId ← B_CurrentBorrower (bId) =
pre
  bId ∈ RAN(bookId) ∧ theBook ∈ DOM(loans)
then
  mId := memberId(loans(theBook))
end;

nol ← B_NumberOfLoans (mId) =
pre
  mId ∈ RAN(memberId) ∧ theMember ∈ RAN(loans)
then
  nol := CARD(loans-1[{theMember}])
end;

report ← B_BorrowerByCategory =
begin
  report := { cat, bId, mId |
    bId ∈ RAN(bookId) ∧
    bookId-1(bId) ∈ DOM(loans) ∧
    cat = category(bookId-1(bId)) ∧
    mId = loans(bookId-1(bId)) }
end
end

```

## 4 Machine Reservation

**MACHINE** *B\_Reservation*

**USES** *B\_Member*, *B\_Book*

**VARIABLES** *reservations*, *numReserv*

## INVARIANT

$reservations \in books \leftrightarrow members \wedge$   
 $numReserv \in reservations \rightarrow \mathbb{Z}$

## DEFINITIONS

$theMember == memberId^{-1}(mId);$   
 $theBook == bookId^{-1}(bId)$

## INITIALISATION

$reservations := \emptyset \parallel$   
 $numReserv := \emptyset$

## OPERATIONS

$B\_Reserve(mId, bId) =$

**pre**

$mId \in \text{RAN}(memberId) \wedge$   
 $bId \in \text{RAN}(bookId) \wedge$   
 $(theBook \mapsto theMember) \notin reservations$

**then**

$reservations := reservations \cup \{ theBook \mapsto theMember \} \parallel$   
 $numReserv := numReserv \cup$   
 $\{ (theBook \mapsto theMember) \mapsto (\text{MAX}(\text{RAN}(numReserv) \cup \{0\}) + 1) \}$

**end;**

$B\_Cancel(mId, bId) =$

**pre**

$mId \in \text{RAN}(memberId) \wedge$   
 $bId \in \text{RAN}(bookId) \wedge$   
 $(theBook \mapsto theMember) \in reservations$

**then**

$reservations := reservations - \{ theBook \mapsto theMember \} \parallel$   
 $numReserv := \{ theBook \mapsto theMember \} \triangleleft numReserv$

**end**

**end**

## 5 Machine Member

MACHINE *B\_Member*

SETS *MEMBER*; *MEMBERID*

VARIABLES *members*, *memberId*

INVARIANT

$members \subseteq MEMBER \wedge memberId \in members \mapsto MEMBERID$

INITIALISATION  $members := \emptyset \parallel memberId := \emptyset$

OPERATIONS

*B\_Join*(*mId*) =

**pre**

$mId \in MEMBERID - \text{RAN}(memberId) \wedge$   
 $members \subseteq MEMBER$

**then**

**any** *memb* **where**  $memb \in MEMBER - members$

**then**

$memberId := memberId \cup \{memb \mapsto mId\} \parallel$   
 $members := members \cup \{memb\}$

**end**

**end;**

*B\_Leave*(*mId*) =

**pre**  $mId \in \text{RAN}(memberId)$

**then**

$members := members - \{memberId^{-1}(mId)\} \parallel$   
 $memberId := memberId \triangleright \{mId\}$

**end**

**end**

## 6 Machine Book

MACHINE *B\_Book*

SETS *BOOK*; *BOOKID*; *STR*

**VARIABLES**  $books, bookId, category$

**INVARIANT**

$books \subseteq BOOK \wedge bookId \in books \mapsto BOOKID \wedge$   
 $category \in books \longrightarrow STR$

**INITIALISATION**  $books := \emptyset \parallel bookId := \emptyset \parallel category := \emptyset$

**OPERATIONS**

$B\_Acquire(bId, cat) =$

**pre**

$bId \in BOOKID - \text{RAN}(bookId) \wedge$

$cat \in STR \wedge$

$books \subseteq BOOK$

**then**

**any**  $book$  **where**  $book \in BOOK - books$

**then**

$bookId := bookId \cup \{book \mapsto bId\} \parallel$

$category := category \cup \{book \mapsto cat\} \parallel$

$books := books \cup \{book\}$

**end**

**end;**

$B\_Discard(bId) =$

**pre**

$bId \in \text{RAN}(bookId)$

**then**

$books := books - \{bookId^{-1}(bId)\} \parallel$

$bookId := bookId \triangleright \{bId\} \parallel$

$category := bookId^{-1}[\{bId\}] \triangleleft category$

**end**

**end**