FMSE Exercise Course 2: Z Exercises

1. Specify an initial state of the library system where the initial collection can be given via an input variable.

2. In a schema a function $hasVideo : USER \pfun \mathbb{P}\ VIDEO$ registrates which videos have been borrowed by a user. In an operation where user u borrows an additional video v this is modelled as
   $hasVideo' = hasVideo \oplus \{(u, \{v\})\}$.
   Why is this wrong? How should it be done?

3. Specify the following operations for the library system (in lecture 2):

   (a) a reader returns a book

   (b) enquire which titles are in the collection

4. Given sequences $s, t : \operatorname{seq} \mathbb{Z}$. Give an invariant that specifies:

   (a) the elements of s are in an ascending order, so increasing

   (b) s contains at least two zero's

   (c) s and t contain the same elements

5. (a) Specify a supermarket where the customer has to wait in a checkout queue, before he can pay at the checkout (Dutch: "kassa"). There are several checkouts. Hint: assume types $CUSTOMER$ and $CHECKOUT$.

   (b) Specify an operation where a customer joins a queue for a checkout (so the customer and the checkout are inputs).

   (c) Specify an operation where a queue closes, and all the waiting customers in the queue are appended to another queue (so two checkouts as input).

6. Give an axiomatic description of a function *sum* that gives the sum of the elements of a sequence of integers.