

FMSE Exercise Course 3: Z Exercises

1. The schemas S , T , and U are defined by

S
$a, b : \mathbb{N}$
$a \leq b$

T
$a, b : \mathbb{N}$
$a \geq b$

U
$a : \mathbb{N}$
$c : \mathbb{P}\mathbb{N}$
$a \in c$

Expand the expressions $S \wedge T$, $S \vee T$ and $S \wedge U$.

2. In specifying a card game (like bridge) the playing of a card is modelled as follows:

$HasColor$
$\exists InHand$
$c? : COLOR$
$c? is_in_hand$

$PlaysColor$
$\Delta InHand$
$c? : COLOR$
$card? : CARD$
\dots
$hand' = hand \setminus \{card?\}$

$$Plays \hat{=} (HasColor \wedge PlaysColor) \vee (NotHasColor \wedge PlaysSomething)$$

What is wrong with this approach?

3. At the Drienerlo railway station one can hire a locker to store one's bicycle. You have been asked to design a system that supports this service.

A person may hire at most one locker. If all lockers are given away, new applicants are placed on a waiting list (you cannot be on the waiting list if you already hire a locker). If there are free lockers the waiting list is empty.

- (a) Specify the system and the initial state (hint: define basic types *LOCKER* and *PERSON*).
- (b) Specify an operation, with as input a person and as output a locker, that assigns a locker to a person who wants to hire one. If there are no free lockers the person is placed on the waiting list. Use schema composition, make sure the operation is robust, and give the precondition for each schema involved in the composition.
- (c) Someone returns his locker. Possibly this locker is given to the first person in the waiting list. Specify an operation for this.
- (d) Hooligans have completely destroyed some lockers. Give an operation that removes these lockers from the system, and outputs the set of persons that hired these lockers.