Event-B Example

Michael Butler, from an example by Mike Poppleton
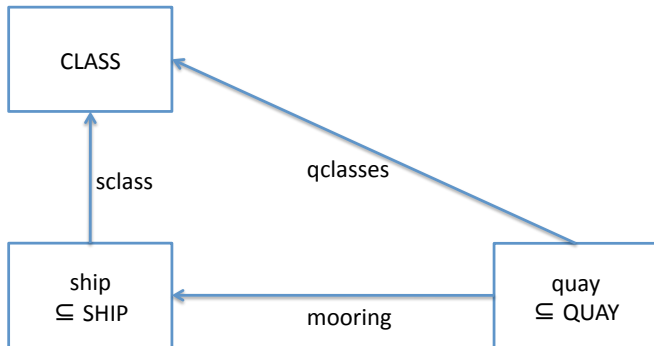
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Port Management System

1. A shipping port provides a limited number of quays at which ships may dock. A quay can hold one ship

2. Each ship belongs to a class (denoting its physical berthing requirements, eg length, draught)

3. A ship can only dock at a quay supporting that class

Class diagram for the port management system

Injective Functions

One-to-one function: different domain elements are mapped to different range elements.
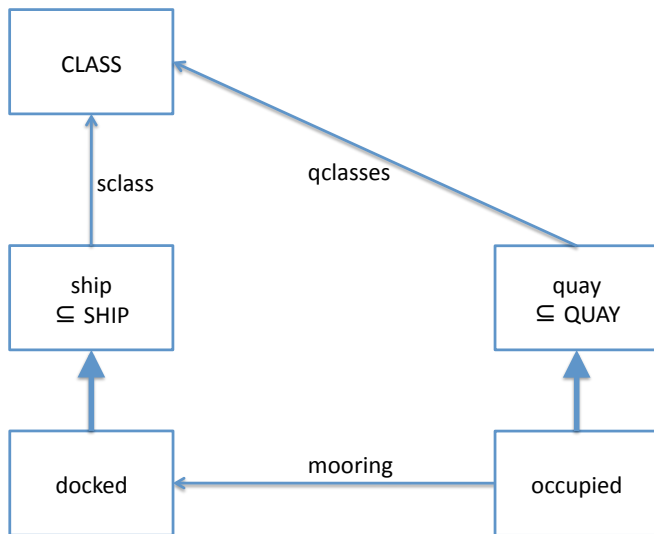In other words, in inverse is also a function.

To declare f as an injective function:

$$\boxed{f \in X \rightarrowtail Y}$$

This is defined in terms of the inverse of f as follows:

Predicate	Definition
$f \in X \rightarrowtail Y$	$f \in X \nrightarrow Y \ \land \ f^{-1} \in Y \nrightarrow X$

Class diagram with subsetting (inheritance)

Total Injective Functions

Just as for standard total functions, we can declare an injective funciton to be total on some set.

To declare f as a total injective function:

$$f \in S \rightarrowtail Y$$

This is defined i as follows:

Predicate	Definition
$f \in S \rightarrowtail Y$	$f \in S \rightarrowtail\!\!\!\rightarrow Y \ \wedge \ dom(f) = S$

Extending the Port Management System

1. Besides a class, each ship has a number of processing requirements

2. Thus a ship can only dock at a quay supporting all its processing requirements

3. An arriving ship will either
   - dock immediately, if a suitable quay is available, or
   - join a queue of ships waiting to berth, subject to a defined queue capacity for later docking