Event B Exercises 6

Refinement

The objective of this tutorial is to get some experience in using refinement.

1. (a) Develop some refinements of the following events.
   (b) Give an refinements for each of the events in the machine Q1 that would be acceptable in a refinement of Q1.
   (c) What are the rules for such a refinement?
   (d) How do you ensure that feasibility has not been diminished?

MACHINE Q1
This example is concerned with refinement of guards in events.
The actions are intended to be representative of general actions.
The main concern is with resolving nondeterminism.

VARIABLES
x
n
INVARIANTS
inv1 : x ∈ N ∧ n ∈ N

Event E1 ≡
when
grd1 : x = 1
then
act1 : n := 1
end

Event E2 ≡
when
grd1 : x < 5
then
act1 : n := 2
end

Event E3 ≡
when
grd1 : x > 3
then
act1 : n := 3
end

Event E4 ≡
when
grd1 : x ≥ 4
then
act1 : n := 4
end
END

2. Suppose you have a constant sequence \( s, \) \( s \in 1..n \rightarrow X \) and a constant \( x, x \in X \) and you want to find the value of \( \text{pos} \) such that \( s(\text{pos}) = x. \)

(a) Write an abstract specification of the problem.
(b) Develop a refinement.
(c) Discuss the difference between \( x \in \text{ran}(s) \) and \( x /\in \text{ran}(s). \)

3. Repeat the above exercise when it is known that \( s \) is ordered, that is \( \forall i,j.i \in \text{dom}(s) \land j \in \text{dom}(s) \land i \leq j \Rightarrow s(i) \leq s(j). \)

4. Similar to 2, but this time we replace the sequence by a function \( f, f \in Y \rightarrow X \) and there is no natural ordering of \( Y. \)