

An Event-B Specification of Vectors

This project tests code generation for vectors.

1	CONTEXT Context	2
1.1	hi hii index lo loo	2
2	MACHINE Test	3
2.1	bytes bytes_size	3
2.2	cut(new_size)	3
2.3	split(left_size new_size out_msg)	3
3	REFINEMENT Test1	4
3.1	4
3.2	split extends split	4
4	MACHINE Vectors	5
4.1	bytes bytes_size heights	5
4.2	setHeight(at h)	5
4.3	setHeights(hs)	5
4.4	findHeight(h out_i)	5
4.5	addByte(b)	6
4.6	cut(new_size)	6

CONSTANTS

1.1

lo
hi
index
loo
hii

AXIOMS

axm1: lo = 1
axm2: hi = 10
axm3: index = lo..hi
axm4: loo $\in \mathbb{Z}$
axm5: hii $\in \mathbb{Z}$
axm6: hii > loo

THEOREM

thm1: card(index) = max(index)
thm2: lo = min(index)
thm3: hi = max(index)
thm4: 5 = card(5..9)
thm5: 9 = max(5..9)
thm6: hii = max(loo..hii)

END

VARIABLES

bytes
bytes_size

INVARIANTS

inv1: $bytes \in 1..bytes_size \rightarrow 0..255$
inv2: $bytes_size = \text{card}(\text{dom}(bytes))$

EVENT INITIALISATION

THEN

init1: $bytes := 1..10 \times \{1\}$
init2: $bytes_size := 10$

END

EVENT cut

ANY

new_size

WHERE

grd1: $bytes_size > 1$
grd2: $new_size = bytes_size - 1$
grd3: $new_size \in \mathbb{N}_1$

THEN

act1: $bytes_size := new_size$
act2: $bytes := \{x \cdot x \in 1..new_size \mid x \mapsto bytes(x + 1)\}$

END

EVENT split

ANY

new_size
left_size
out_msg

WHERE

grd1: $new_size \in \mathbb{N}_1$
grd2: $left_size \in \mathbb{N}_1$
grd3: $bytes_size > left_size$
grd4: $new_size = bytes_size - left_size$
grd5: $out_msg = 1..new_size \triangleleft bytes$

THEN

act1: $bytes_size := new_size$
act2: $bytes := \{x \cdot x \in 1..new_size \mid x \mapsto bytes(x + left_size)\}$

END

2.2

2.3

REFINEMENT **Test1**

1 **a**

3

REFINES **Test**

VARIABLES

3.1

EVENT **split**

3.2

EXTENDS **split**

WHERE

grd1_1: **2** $\in \text{dom}(\text{bytes})$

grd1_2: $\text{left_size} = \text{bytes}(\text{1})$

END

VARIABLES

4.1

heights A fixed size vector of heights.
bytes_size Size of the bytes vector
bytes A vector of bytes

INVARIANTS

inv_he: $heights \in (1..100) \rightarrow \mathbb{N}$
inv_bs: $bytes_size \in \mathbb{N}$
inv_by: $bytes \in (1..bytes_size) \rightarrow 0..255$

EVENT **INITIALISATION**

THEN

init_he: $heights := 1..100 \times \{0\}$
init_ws: $bytes_size := 0$
init_we: $bytes := \emptyset$

END

EVENT **setHeight**

4.2

ANY

at
h

WHERE

grd_p: $at \in \text{dom}(heights)$
grd_h: $h \in \mathbb{N}$

THEN

act_1: $heights(at) := h$

END

EVENT **setHeights**

4.3

ANY

hs

WHERE

grd_hs: $hs \in (1..100) \rightarrow \mathbb{N}$

THEN

act_1: $heights := hs$

END

EVENT **findHeight**

4.4

ANY

h
out_i

WHERE

grd1: $h \in \mathbb{N}$
grd3: $out_i \in \text{dom}(heights)$
grd4: $\exists x. x \in \text{dom}(heights) \wedge height(x) = h \wedge out_i = x$

END

EVENT **addByte**

4.5

ANY

b

WHERE

grd1: $b \in 0..255$

THEN

act1: $bytes := bytes \cup \{bytes_size + 1 \mapsto b\}$

act2: $bytes_size := bytes_size + 1$

END

EVENT **cut**

4.6

ANY

new_size

WHERE

grd1: $bytes_size > 1$

grd2: $new_size \in \mathbb{N}_1$

grd3: $new_size = bytes_size - 1$

THEN

act1: $bytes_size := new_size$

act2: $bytes := \{x \cdot x \in 1..new_size \mid x \mapsto bytes(x + 1)\}$

END

addByte, 6

bytes, 3, 5

bytes_size, 3, 5

Context, 2

cut, 3, 6

findHeight, 5

heights, 5

INITIALISATION, 3, 5

setHeight, 5

setHeights, 5

split, 3, 4

Test, 3, 4

Test1, 4

Vectors, 5