A Sample Document for the Usages of lstEventB Package

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For convenient, we define macro `\EventB` for Event-B.

We start first with some inline Event-B code by embedding them using a pair of `|`, for example `|@grd1: "SNSR = FALSE"|` gives @grd1: "SNSR = FALSE". Any Event-B formulae including Unicode symbols will be typeset using the `bsymb` package accordingly.

ASCII	Symbols	Explanation
`!:`	$\in$	Set membership
`/:`	$\notin$	Set non-membership
`<:`	$\subseteq$	Subset
`/<:`	$\not\subseteq$	Not a subset
`<<:`	$\subset$	Proper subset
`/<<:`	$\not\subset$	Not a proper subset
`!finite`	finite	Finite
`!partition`	partition	Partition

Table 1: Set predicates

ASCII	Symbols	Explanation
`!BOOL`	BOOL	BOOL set
`!TRUE`	TRUE	TRUE
`!FALSE`	FALSE	FALSE
`!bool`	bool	bool predicate

Table 2: BOOL and bool

More complete piece of code (including the Unicode symbols) can be typeset using the `EventBcode` environment. Below is the typesetting of an Event-B machine.

ASCII	Symbols	Explanation
`!INT`	$\mathbb{Z}$	Set of integer numbers
`!NAT`	$\mathbb{N}$	Set of natural numbers
`!NAT1`	$\mathbb{N}_1$	Set of positive natural numbers
`!min`	min	Mininum
`!max`	max	Maximum
`-`	$-$	Difference
`*`	$*$	Product
`!/`	$\div$	Quotient
`!mod`	mod	Remainder
`..`	$..$	Interval

Table 3: Numbers

ASCII	Symbols	Explanation
`>`	$>$	Greater
`<`	$<$	Less
`>=`	$\geq$	Greater or equal
`<=`	$\leq$	Less or equal

Table 4: Number predicates

<table>
<tr><th>ASCII</th><th>Symbols</th><th>Explanation</th></tr>
<tr><td><code><-></code></td><td>$\leftrightarrow$</td><td>Relations</td></tr>
<tr><td><code>!dom</code></td><td>dom</td><td>Domain</td></tr>
<tr><td><code>!ran</code></td><td>ran</td><td>Range</td></tr>
<tr><td><code><<-></code></td><td>$\trel$</td><td>Total relations</td></tr>
<tr><td><code><->></code></td><td>$\srel$</td><td>Surjective relations</td></tr>
<tr><td><code><<->></code></td><td>$\strel$</td><td>Total surjective relations</td></tr>
<tr><td><code>!circ</code></td><td>$\circ$</td><td>Backward composition</td></tr>
<tr><td><code>!id</code></td><td>id</td><td>Identity</td></tr>
<tr><td><code><|</code></td><td>$\lhd$</td><td>Domain restriction</td></tr>
<tr><td><code><<|</code></td><td>$\domsub$</td><td>Domain subtraction</td></tr>
<tr><td><code>|></code></td><td>$\rhd$</td><td>Range restriction</td></tr>
<tr><td><code>|>></code></td><td>$\ransub$</td><td>Range subtraction</td></tr>
<tr><td><code>~</code></td><td>$^{-1}$</td><td>Inverse</td></tr>
<tr><td><code><+</code></td><td>$\ovl$</td><td>Overriding</td></tr>
<tr><td><code>><</code></td><td>$\otimes$</td><td>Direct product</td></tr>
<tr><td><code>||</code></td><td>$\|$</td><td>Parallel product</td></tr>
<tr><td><code>!prj1</code></td><td>prj_1</td><td>First projection</td></tr>
<tr><td><code>!prj2</code></td><td>prj_2</td><td>Second projection</td></tr>
</table>

Table 5: Relations

ASCII	Symbols	Explanation
+->	$\nrightarrow$	Partial functions
-->	$\rightarrow$	Total functions
>+>	$\rightarrowtail$	Partial injections
>->	$\rightarrowtail$	Total injections
+>>	$\twoheadrightarrow$	Partial surjections
->>	$\twoheadrightarrow$	Total surjections
>->>	$\rightarrowtail\!\!\!\!\twoheadrightarrow$	Bijections
%	λ	Lambda abstraction

Table 6: Functions

ASCII	Symbols	Explanation
:=	$:=$	Becomes equal to
::	$:\in$	Choice from a set
:|	$:\mid$	Choice by predicate

Table 7: Functions

```
machine Sensor_m0_SNSR
variables
 SNSR
invariants
 @thm0_1: "SNSR ∈ BOOL" theorem
events

 INITIALISATION
 begin
  @act1: "SNSR := FALSE"
 end

 SNSR_on
 when
  @grd1: "SNSR = FALSE"
 then
  @act1: "SNSR := TRUE"
 end

 SNSR_off
 when
  @grd1: "SNSR = TRUE"
 then
  @act1: "SNSR := FALSE"
 end

end
```

One can change the different colour options. For example, `\EventBSetKeywordColour{blue!50!black}` will change the keyword colour to dark blue. (This has effects only when

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```
machine Sensor_m0_SNSR
variables
```

```
3  SNSR
4 invariants
5  @thm0_1: "SNSR ∈ BOOL" theorem
```

One can includes external file containing Event-B code using the `\EventBinputlisting` command. For example the following is the result of including the code in the file `Sensor_m1_DEP.bumx` using `\EventBinputlisting{Sensor_m1_DEP.bumx}`.

```
1  machine Sensor_m1_DEP
2  refines Sensor_m0_SNSR
3  variables
4   SNSR
5   DEP
6  invariants
7   @inv0_1: "DEP ∈ ℕ"
8  events
9
10  INITIALISATION extended
11  begin
12   @act2: "DEP := 0"
13  end
14
15  SNSR_on extended
16  refines SNSR_on
17  end
18
19  SNSR_off extended
20  refines SNSR_off
21  begin
22   @act2: "DEP := DEP + 1"
23  end
24
25 end
```

More specifically, one can specify more details on the inclusion, e.g., the ranges, as the following example `\EventBinputlisting[firstline=16,lastline=20]{Sensor_m2_snsr.bumx}` gives

```
1   @inv1_1: "Snsr_01 = TRUE ⇒ SNSR = TRUE"
2
3   @inv1_2: "Snsr_10 = TRUE ⇒ SNSR = FALSE"
4
5   @inv1_3: "Snsr_01 = FALSE ∨ Snsr_10 = FALSE"
```

```
1 machine Sensor_m3_Ctrl
2
3 refines
4
5  Sensor_m2_Snsr
```

```
6
7  variables
8
9   SNSR
10
11  DEP
12
13  Snsr_01
14
15  Snsr_10
16
17  ctrl_snsr
18
19  ctrl_dep
20
21  ctrl_snsr_01
22
23  ctrl_snsr_10
24
25 invariants
26
27  @inv2_1:
28  "Snsr_01 = FALSE ∧ Snsr_10 = FALSE ∧ ctrl_snsr_01 = FALSE ∧ ctrl_snsr_10 = FALSE
        ⇒ ctrl_snsr = SNSR"
29
30  @inv2_2: "ctrl_dep ∈ ℕ"
31
32  @inv2_3: "Snsr_10 = FALSE ∧ ctrl_snsr_10 = FALSE ⇒ ctrl_dep = DEP"
33
34  @inv2_4: "Snsr_10 = TRUE ∨ ctrl_snsr_10 = TRUE ⇒ ctrl_dep = DEP − 1"
35
36  @inv2_5: "ctrl_snsr_01 = TRUE ⇒ SNSR = TRUE"
37
38  @inv2_6: "ctrl_snsr_10 = TRUE ⇒ SNSR = FALSE"
39
40  @inv2_7: "ctrl_snsr_01 = TRUE ⇒ Snsr_01 = FALSE"
41
42  @inv2_8: "ctrl_snsr_10 = TRUE ⇒ Snsr_10 = FALSE"
43
44 events
45
46  INITIALISATION extended
47  refines INITIALISATION
48  begin
49   @act5: "ctrl_snsr := FALSE"
50   @act6: "ctrl_dep := 0"
51   @act7: "ctrl_snsr_01 := FALSE"
52   @act8: "ctrl_snsr_10 := FALSE"
53  end
54
55  SNSR_on extended
56  refines SNSR_on
57  when
58   @grd3: "ctrl_snsr_10 = FALSE"
59  end
60
```

```
61  SNSR_off extended
62  refines SNSR_off
63  when
64   @grd3: "ctrl_snsr_01 = FALSE"
65  end
66
67  ctrl_Senses_Snsr_01 extended
68  refines ctrl_Senses_Snsr_01
69  begin
70   @act2: "ctrl_snsr_01 := TRUE"
71  end
72
73  ctrl_Senses_Snsr_10 extended
74  refines ctrl_Senses_Snsr_10
75  begin
76   @act2: "ctrl_snsr_10 := TRUE"
77  end
78
79  ctrl_on
80  when
81   @grd1: "ctrl_snsr_01 = TRUE"
82  then
83   @act1: "ctrl_snsr_01 := FALSE"
84   @act2: "ctrl_snsr := TRUE"
85  end
86
87  ctrl_off
88  when
89   @grd1: "ctrl_snsr_10 = TRUE"
90  then
91   @act1: "ctrl_snsr_10 := FALSE"
92   @act2: "ctrl_snsr := FALSE"
93   @act3: "ctrl_dep := ctrl_dep + 1"
94  end
95
96 end
```