The lstEventB package[*]

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Abstract

This package provides macros for listing Event-B code. It was developed at the University of Southampton.

Contents

1 Introduction

This package was developed in order to ease the listing of Event-B code in LaTeX.

2 Usage

Just like any other package, you need to request this package with a `\usepackage` command in the preamble. So in the simpler case (i.e., without any options), one just types

   `\usepackage{lstEventB}`

to load the package.

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[*]This document corresponds to lstEventB v1.0, dated 2018/05/14.

3   Implementation

Our implementation is based on the `listings` package. Additionally, we also require `xspace` for spacing, `xcolor` for colouring, `bsymb` for typesetting Event-B mathematical symbols, and `xargs` for defining commands with argument lists.

```
\RequirePackage{listings}
\RequirePackage{xspace}
\RequirePackage{xcolor}
\RequirePackage{bsymb}
\RequirePackage{xargs}
```

3.1   Package Options

We define some options for customising the listing of Event-B code.

3.1.1   Colouring option

We first declare some internal macros that can be updated when accordingly to the option for colouring.

EventB@SetKeywordColour   Command `EventB@SetKeywordColour` is used to set the colour of the Event-B keywords, by default, it is set to `black`.

```
\newcommand{\EventB@SetKeywordColour}[1]{%
  \colorlet{EventB@keywordcolour}{#1}%
}
\EventB@SetKeywordColour{black}
```

EventB@SetNdKeywordColour   Command `EventB@SetNdKeywordColour` is used to set the colour of the secondary Event-B keywords, by default, it is set to `black`.

```
\newcommand{\EventB@SetNdKeywordColour}[1]{%
  \colorlet{EventB@ndkeywordcolour}{#1}%
}
\EventB@SetNdKeywordColour{black}
```

EventB@SetIdentifierColour   Command `EventB@SetIdentifierColour` is used to set the colour of Event-B identifiers, by default, it is set to `black`.

```
\newcommand{\EventB@SetIdentifierColour}[1]{%
  \colorlet{EventB@identifiercolour}{#1}%
}
\EventB@SetIdentifierColour{black}
```

EventB@SetCommentColour   Command `EventB@SetCommentColour` is used to set the colour of Event-B comments, by default, it is set to `black`.

```
\newcommand{\EventB@SetCommentColour}[1]{%
  \colorlet{EventB@commentcolour}{#1}%
}
\EventB@SetCommentColour{black}
```

EventB@SetFormulaColour   Command `EventB@SetFormulaColour` is used to set the colour of Event-B formulae, by default, it is set to `black`.

```
\newcommand{\EventB@SetFormulaColour}[1]{%
  \colorlet{EventB@formulacolour}{#1}%
```

```
}
\EventB@SetFormulaColour{black}
```

We now define the `colour` option and set the different colours accordingly. The keywords colour (both first primary and secondary keywords) is `red`. The identifier colour is `purple`. The comment colour is `green!50!black` (dark green). The formula colour is `blue`.

```
\DeclareOption{colour}{
  \EventB@SetKeywordColour{red}
  \EventB@SetNdKeywordColour{red}
  \EventB@SetIdentifierColour{purple}
  \EventB@SetCommentColour{green!50!black}
  \EventB@SetFormulaColour{blue}
}
```

Additionally, we define the `color` option as an alias of `colour`.

```
\DeclareOption{color}{
  \ExecuteOptions{colour}
}
```

3.1.2 Execution of options

```
\ProcessOptions
```

3.2 Typesetting of the Event-B language

In this section, we define how to typesetting Event-B code.

3.2.1 Defining the Event-B language

We first define the Event-B language using `lstdefinelanguage`.

```
\def\lst@visiblespace{\hspace{0.2em}}
\lstdefinelanguage{Event-B}{%
  basicstyle=\rmfamily\footnotesize,
```

Subsequently, we define the keywords of Event-B and how to typeset them. Note that the keywords are insensitive.

```
keywords={%
  % Keywords for contexts
  context,extends,sets,constants,axioms,theorem,end,%
  % Keywords for machines
  machine,sees,refines,variables,invariants,variant,events,%
},%
keywordstyle=\color{EventB@keywordcolour}\bfseries\sffamily,%
sensitive=false,
```

We also define the secondary keywords of Event-B and how to typeset them.

```
ndkeywords={%
  % Keywords for events
  extended,theorem,any,where,when,with,begin,then%
},%
ndkeywordstyle=\color{EventB@ndkeywordcolour}\bfseries\sffamily,%
```

Next, we define how to typeset Event-B identifiers.

```
identifierstyle=\color{EventB@identifiercolour}\sffamily,
```

We define how comments are typeset.

```
comment=[l]{//},%
morecomment=[s]{/*}{*/},%
commentstyle=\color{EventB@commentcolour}\rmfamily,%
```

Furthermore, we define the appearance of formulae (which are typeset strings).

```
stringstyle=\color{EventB@formulacolour}\sffamily,
string=[b]",
showstringspaces=true, % Do not show the space in formulae
```

Finally, we define the Event-B mathematical symbols using the `bsymb` package as follows.

```
inputencoding=utf8, % Allow UTF-8 input encoding
extendedchars=true, % Use extended characters
literate= % Event-B mathematical symbols
% Short sequences should appear before long sequences containing them
% Predicates
{}{{$\bfalse$}}1% False
{}{{$\btrue$}}1% True
{}{{$\land$}}1% Conjunction
{}{{$\lor$}}1% Disjunction
{}{{$\limp$}}1% Implication
{}{{$\leqv$}}1% Equivalence
{}{{$\lnot$}}1% Negation
{}{{$\forall$}}1% Universal quantification
{}{{$\exists$}}1% Existential quantification
{}{{$\qdot$}}1% Quantification dot
{=}{{$=$}}1% Equality
{}{{$\neq$}}1% Inequality
% Sets
{!}{{$\forall$}}1% Universal quantification (This is moved here from ASCII perdicates)
{}{{$\emptyset$}}1% Empty set
{}{{$\mid$}}1% Vertical bar, e.g., in set comprehension
{}{{$\bunion$}}1% Union
{}{{$\binter$}}1% Intersection
{}{{$\setminus$}}1% Set difference
{}{{$\mapsto$}}1% Ordered pair
{}{{$\cprod$}}1% Cartesian product
{}{{$\pow$}}1% Powerset
{1}{{$\pown$}}1% Non-empty subsets
{!card}{{$\card$}}1% Cardinality
{!union}{{$\union$}}1% Generalised union
{!inter}{{$\inter$}}1% Generalised intersection
{}{{$\Union$}}1% Quantified union
{}{{$\Inter$}}1% Quantified intersection
% Set predicates
{}{{$\in$}}1% Set membership
{}{{$\notin$}}1% Set non-membership
{}{{$\subseteq$}}1% Subset
{}{{$\nsubseteq$}}1% Not a subset
{}{{$\subset$}}1% Proper subset
{}{{$\nsubset$}}1% Not a proper subset
{!finite}{{$\finite$}}1% Finite set
{!partition}{{$\partition$}}1% Partition
% Bool and bool
```

```
{!BOOL}{{$\Bool$}}1% BOOL set
{!TRUE}{{$\True$}}1% TRUE
{!FALSE}{{$\False$}}1% FALSE
{!bool}{{$\bool$}}1% bool predicate set
% Numbers
{}{{$\intg$}}1% Set of integer numbers
{}{{$\nat$}}1% Set of natural numbers
{1}{{$\natn$}}1% Set of positive natural numbers
{!min}{{$\min$}}1% Minimum
{!max}{{$\max$}}1% Maximum
{+}{{$+$}}1% Sum
{}{{$-$}}1% Difference
{}{{$\times$}}1% Product
{}{{$\div$}}1% Quotient
{!mod}{{$\textrm{mod}$}}1% Remainder
{}{{$\upto$}}1% Interval
% Number predicates
{}{{$\geq$}}1% Greater or equal
{}{{$\leq$}}1% Less or equal
% Relations
{}{{$\rel$}}1% Relations
{!dom}{{$\dom$}}1% Domain
{!ran}{{$\ran$}}1% Range
{}{{$\trel$}}1% Total relations
{}{{$\srel$}}1% Surjective relations
{}{{$\strel$}}1% Total surjective relations
{}{{$\circ$}}1% Backward composition
{!id}{{$\id$}}1% Identity
{}{{$\domres$}}1% Domain restriction
{}{{$\domsub$}}1% Domain subtraction
{}{{$\ranres$}}1% Range restriction
{}{{$\ransub$}}1% Range subtraction
{}{{$^{-1}$}}1% Inverse
{}{{$\ovl$}}1% Overriding
{}{{$\dprod$}}1% Direct product
{}{{$\pprod$}}1% Parallel product
{!prj1}{{$\prjone$}}1% First projection
{!prj2}{{$\prjtwo$}}1% Second projection
% Functions
{}{{$\pfun$}}1% Partial functions
{}{{$\tfun$}}1% Total functions
{}{{$\pinj$}}1% Partial injections
{}{{$\tinj$}}1% Total injections
{}{{$\psur$}}1% Partial surjections
{}{{$\tsur$}}1% Total surjections
{}{{$\tbij$}}1% Bijections
{}{{$\lambda$}}1% Lambda abstraction
% Assignment
{}{{$\bcmeq$}}1% Becomes equal to
{:}{{$\bcmin$}}1% Choice from a set
{:}{{$\bcmsuch$}}1% Choice by predicate
% ASCII Number predicates (This has to be before ASCII Predicates)
{>}{{$>$}}1% Greater
{<}{{$<$}}1% Less
```

```
{>=}{{$\geq$}}1% Greater or equal
{<=}{{$\leq$}}1% Less or equal
% ASCII Predicates
{/}{{$\div$}}1% Quotient (This is moved here from ASCII Numbers)
{!false}{{$\bfalse$}}1% False
{!true}{{$\btrue$}}1% True
{\&}{{$\land$}}1% Conjunction (note the backslash)
{!or}{{$\lor$}}1% Disjunction
{=>}{{$\limp$}}1% Implication
{<=>}{{$\leqv$}}1% Equivalence
{!not}{{$\lnot$}}1% Negation
{\#}{{$\exists$}}1% Existential quantification (note the backslash)
{.}{{$\qdot$}}1% Quantification dot
{/=}{{$\neq$}}1% Inequality
% ASCII Sets
{*}{{$\times$}}1% Product (This is moved here from ASCII Numbers)
{\{\}}{{$\emptyset$}}1% Empty set (note the backslashes)
{\|}{{$\mid$}}1% Vertical bar, e.g., in set comprehension (not the backslash)
{\\}{{$\setminus$}}1% Difference
{\\/}{{$\bunion$}}1% Union
{/\\}{{$\binter$}}1% Intersection
{|->}{{$\mapsto$}}1% Ordered pair
{**}{{$\cprod$}}1% Cartesian product
{!POW}{{$\pow$}}1% Powerset
{!POW1}{{$\pown$}}1% Non-empty subsets
{!UNION}{{$\Union$}}1% Quantified union
% ASCII Set predicates
{/:}{{$\notin$}}1% Set non-membership
{/<:}{{$\not\subseteq$}}1% Not a subset
{/<<:}{{$\not\subset$}}1% Not a proper subset
{<<:}{{$\subset$}}1% Proper subset
{<:}{{$\subseteq$}}1% Subset
{!:}{{$\in$}}1% Set membership
% ASCII Numbers
{!INT}{{$\intg$}}1% Set of integer numbers
{!INTER}{{$\Inter$}}1% Quantified intersection (This is moved here from ASCII Sets)
{!NAT}{{$\nat$}}1% Set of natural numbers
{!NAT1}{{$\natn$}}1% Set of positive natural numbers
{-}{{$-$}}1% Difference
{..}{{$\upto$}}1% Interval
% ASCII Relations
{<->}{{$\rel$}}1% Relations
{<<->}{{$\trel$}}1% Total relations
{<->>}{{$\srel$}}1% Surjective relations
{<<->>}{{$\strel$}}1% Total surjective relations
{!circ}{{$\circ$}}1% Backward composition
{<|}{{$\domres$}}1% Domain restriction
{<<|}{{$\domsub$}}1% Domain subtraction
{|>}{{$\ranres$}}1% Range restriction
{|>>}{{$\ransub$}}1% Range subtraction
{~}{{$^{-1}$}}1% Inverse
{<+}{{$\ovl$}}1% Overriding
{><}{{$\dprod$}}1% Direct product
{||}{{$\pprod$}}1% Parallel product
```

```
% ASCII Functions
{+->}{{$\pfun$}}1% Partial functions
{-->}{{$\tfun$}}1% Total functions
{>+>}{{$\pinj$}}1% Partial injections
{>->}{{$\tinj$}}1% Total injections
{+>>}{{$\psur$}}1% Partial surjections
{->>}{{$\tsur$}}1% Total surjections
{>->>}{{$\tbij$}}1% Bijections
{\%}{{$\lambda$}}1% Lambda abstraction
% ASCII Assignment
{:=}{{$\bcmeq$}}1% Becomes equal to
{::}{{$\bcmin$}}1% Choice from a set
{:|}{{$\bcmsuch$}}1% Choice by predicate
, % End of Event-B mathematical symbols
}
```

3.2.2 Typesetting Event-B Code

We first create a short inline Event-B code with | using `lstMakeShortInline` command.

```
\lstMakeShortInline[language=Event-B, breaklines=f, basicstyle=\rmfamily\normalsize]|
```

We then create a dedicated `EventBcode` environment using `lstnewenvironment`.

```
\lstnewenvironment{EventBcode}{\lstset{language=Event-B}}{}
```

We then create a dedicated `EventBNoInline` environment using `newenvironment`.

```
\newenvironment{EventBNoShortInline}
{
  \lstDeleteShortInline|
  \lstset{language=Event-B, breaklines=f, basicstyle=\rmfamily\normalsize}
}
{\lstMakeShortInline[language=Event-B, breaklines=f, basicstyle=\rmfamily\normalsize]|}
```

Finally, we set some appearance parameters for display the code.

```
\lstset{%
  columns=fullflexible, % The columns are fully flexible.
  numberbychapter=false,
  frame=top,frame=bottom, % There are line (frame at top and bottom).
  stepnumber=1, % the step between two line-numbers. If it is 1 each line will be numbered
  numberstyle=\tiny,
  numbersep=5pt, % how far the line-numbers are from the code
  tabsize=2, % tab size in blank spaces
  breaklines=true, % sets automatic line breaking
  captionpos=b, % sets the caption-position to top
  mathescape=false,
  showspaces=true, % Do not show spaces
  showtabs=false, % Do not show tabs
  xleftmargin=10pt,
  framexleftmargin=10pt,
  framexrightmargin=0pt,
  framexbottommargin=5pt,
  framextopmargin=5pt,
  escapechar=\%,
  numbers=left, % where to put the line-numbers; possible values are (none, left, right)
  numbersep=5pt,
```

```
}
\newcommandx{\EventBinputlisting}[2][1=]{%
  \begin{mdframed}[backgroundcolor=yellow!10, rightline=false,leftline=false]
    \lstinputlisting[language=Event-B,mathescape,frame={},#1]{#2}
  \end{mdframed}
}
```

Event@SetKeywordColour

```
\let\EventBSetKeywordColour\EventB@SetKeywordColour

\newcommand{\EventB}{Event-B\xspace}
```

Change History