

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	1
2	Usage	1
3	Implementation	2
3.1	Package Options	2
3.1.1	Colouring option	2
3.1.2	Execution of options	3
3.2	Typesetting of the Event-B language	3
3.2.1	Defining the Event-B language	3
3.2.2	Typesetting Event-B Code	7

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.

*This document corresponds to `lstEventB` v1.0, dated 2018/04/28.

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 `lstdefinlanguage`.

```

\lstdefinlanguage{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=false, % 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
{}{{{\bf false$}}1% False
{}{{{\bf true$}}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
{}{{{\neq$}}1% Inequality
% Sets
{}{{{\emptyset$}}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% Difference
{}{{\*$}}1% Product
{}{{\div$}}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
{!}{{{\forall$}}1% Universal quantification
{#}{{{\exists$}}1% Existential quantification (note the backslash)
{.}{{{\qdot$}}1% Quantification dot
{/=}{{{\neq$}}1% Inequality
% ASCII Sets
{*}{{{\$*$}}1% Product (This is moved here from ASCII Numbers)
{\{\}}{{{\emptyset$}}1% Empty set (note the backslashes)
{\|}{{{\mid$}}1% Vertical bar, e.g., in set comprehension (not the backslash)
{\setminus}{{{\setminus$}}1% Difference
{\cup}{{{\cup$}}1% Union
{\cap}{{{\cap$}}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
{<<->}{{{\tre$}}1% Total relations
{<->}{{{\srel$}}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{EventBNoInline}
{\lstDeleteShortInline$}
{\lstMakeShortInline[language=Event-B, breaklines=f, basicstyle=\rmfamily\normalsize]$}

```

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

```

```
\end{mdframed}
}
```

Event@SetKeywordColour

```
\let\EventBSetKeywordColour\EventB@SetKeywordColour
\newcommand{\EventB}{Event-B\xspace}
```

Change History

v0.1

General: Initial version 1

v1.0

General: First release version 1
Event@SetKeywordColour: Added . . 8