Abstract

This package which requires ε-TEX, provides macros manipulating strings of tokens. For a basic use, tokens can be alphanumeric chars, but the macros can also be useful for manipulating tokens, i.e. TEX code. Main features are:

▷ tests:
  - does a string contains at least \( n \) times another?
  - does a string starts (or ends) with another? etc.
  - is a string an integer? A decimal?
  - are 2 strings equal?

▷ extractions of substrings:
  - what is on the left (or the right) of the \( n \)th occurrence of a substring;
  - what is between the occurrences of 2 substrings;
  - substring between 2 positions;
  - serach of a group with its identifier.

▷ substitution of all, or the \( n \) first occurrences of a substring for an other substring;

▷ calculation of numbers:
  - length of a string;
  - position of the \( n \)th occurrence of a substring;
  - how many times a string contains a substring?
  - comparison of 2 strings: position of the first difference;
  - identifier of the group in which a macro made a cut or a search.

Other macros allow to use special characters forbidden in arguments (# and %) and manage differences between catcodes for advanced programming purposes.
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This manual is a translation of the French manual. I apologize for my poor English but I did my best¹, and I hope that the following is comprehensible!

1 Presentation

1.1 Description

This extension² provides macros and testing operating on "strings of tokens", as other program languages have. They provide the usual strings operations, such as: test if a string contains another, begins or ends with another, extractions of strings, calculation of the position of a substring, of the number of occurrences, etc.

A "string of tokens" is a list of tokens of any nature, except that braces must be balanced and tokens catcode 6 and 14 (usually \% and #) are not allowed. Apart from this, any token is allowed (including \par), in any order in the list, whatever be the resulting code.

\xstring reads the arguments of the macros syntax unit by syntax unit³: when syntax units are "simple" chars (catcode 10, 11 and 12), \xstring logically read the argument char by char. \xstring can also be used for programming purpose, including in arguments other tokens such as control sequences, braces and tokens with other catcodes. See chapter on reading mode and arguments expansion (page 13), the command \verbtocs (page 17) and the command \scancs (page 18).

As the arguments may contain any token, advanced users could have problems with catcodes leading to unexpected behaviours. These behaviours can be controlled: read page 14.

Certainly, other packages exist (for example \substr and \stringstrings), but as well as differences on features, they do not take into account occurrences so I found them too limited and difficult to use for programming.

1.2 Motivation

I decided to write this package of macros because I have never really found tools in \LaTeX suiting my needs for strings. So, over the last few months, I wrote a few macros that I occasionally or regularly used. Their numbers have increased and become a little too dispersed in directories in my computer, so I have grouped them together in this package. Thus, writing a coherent set of macros forces more discipline and leads to necessary improvements, which took most of the time I spent writing this package. This package is my first one as I recently discovered \LaTeX⁴, so my main motivation was to make progress in programming with \TeX, and to tackle its specific methods.

2 The macros

For a better understanding, let’s see first the macros with the simpler arguments possible. No special catcode, no exotic token, no control sequence neither: only alphanumeric chars will be contained in the arguments.

In the following chapters, all the macros will be presented this plan:

- the syntax⁵ and the value of optional arguments
- a short description of the operation;
- the operation under special conditions. For each conditions considered, the operation described has priority on that (those) below;
- finally, several examples⁶ are given. I tried to find them most easily comprehensible and most representative of the situations met in normal use. If a doubt is possible with spaces in the result, this one will be delimited by "|", given that an empty string is represented by "||".

Important: in the following, a ⟨number⟩ can be an integer written with numeric chars, a counter, or the result of an arithmetic operation made with the command \numexpr.

All the macros of \xstring are displayed in blue.

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¹Any email to tell me errors would be appreciated!
²This extension does not require \LaTeX and can be compiled with Plain \TeX.
³In the \TeX code, a syntax unit is a control sequence, a group between brace or a single char. See also page 13.
⁴In November 2007, I will be a noob for a long time...
⁵The optional star, the optional argument in last position will be explained later. See page 14 for starred macros and page 13 for the optional argument.
⁶For much more examples, see the test file.
2.1 The tests

2.1.1 \IfSubStr

\IfSubStr[*]{\langle \text{number} \rangle}{\langle \text{string} \rangle}{\langle \text{stringA} \rangle}{\langle \text{true} \rangle}{\langle \text{false} \rangle}

The value of the optional argument \langle \text{number} \rangle is 1 by default.

Tests if \langle \text{string} \rangle contains at least \langle \text{number} \rangle times \langle \text{stringA} \rangle and runs \langle \text{true} \rangle if so, and \langle \text{false} \rangle otherwise.

- If \langle \text{number} \rangle \leq 0, runs \langle \text{false} \rangle;
- If \langle \text{string} \rangle or \langle \text{stringA} \rangle is empty, runs \langle \text{false} \rangle.

\begin{verbatim}
\IfSubStr{xstring}{tri}{true}{false}
\IfSubStr{xstring}{a}{true}{false}
\IfSubStr{a bc def }{c d}{true}{false}
\IfSubStr{a bc def }{cd}{true}{false}
\IfSubStr[2]{1a2a3a}{a}{true}{false}
\IfSubStr[3]{1a2a3a}{a}{true}{false}
\IfSubStr[4]{1a2a3a}{a}{true}{false}
\end{verbatim}

2.1.2 \IfSubStrBefore

\IfSubStrBefore[*]{\langle \text{number1} \rangle}{\langle \text{number2} \rangle}{\langle \text{string} \rangle}{\langle \text{stringA} \rangle}{\langle \text{stringB} \rangle}{\langle \text{true} \rangle}{\langle \text{false} \rangle}

The values of the optional arguments \langle \text{number1} \rangle and \langle \text{number2} \rangle are 1 by default.

In \langle \text{string} \rangle, tests if the \langle \text{number1} \rangle-th occurrence of \langle \text{stringA} \rangle is on the left of the \langle \text{number2} \rangle-th occurrence of \langle \text{stringB} \rangle. Runs \langle \text{true} \rangle if so, and \langle \text{false} \rangle otherwise.

- If one of the occurrences is not found, it runs \langle \text{false} \rangle;
- If one of the arguments \langle \text{string} \rangle, \langle \text{stringA} \rangle or \langle \text{stringB} \rangle is empty, runs \langle \text{false} \rangle;
- If one of the optional arguments is negative or zero, runs \langle \text{false} \rangle.

\begin{verbatim}
\IfSubStrBefore{xstring}{st}{in}{true}{false}
\IfSubStrBefore{xstring}{ri}{s}{true}{false}
\IfSubStrBefore{LaTeX}(LaT)(TeX){true}{false}
\IfSubStrBefore[a bc def ]{b}{ef}{true}{false}
\IfSubStrBefore[a bc def ]{ab}{ef}{true}{false}
\IfSubStrBefore[2,1]{babab}{b}{2}{true}{false}
\IfSubStrBefore[3,1]{babab}{b}{2}{true}{false}
\IfSubStrBefore[2,2]{babab}{a}{b}{true}{false}
\IfSubStrBefore[2,3]{babab}{a}{b}{true}{false}
\end{verbatim}

2.1.3 \IfSubStrBehind

\IfSubStrBehind[*]{\langle \text{number1} \rangle}{\langle \text{number2} \rangle}{\langle \text{string} \rangle}{\langle \text{stringA} \rangle}{\langle \text{stringB} \rangle}{\langle \text{true} \rangle}{\langle \text{false} \rangle}

The values of the optional arguments \langle \text{number1} \rangle and \langle \text{number2} \rangle are 1 by default.

In \langle \text{string} \rangle, tests if the \langle \text{number1} \rangle-th occurrence of \langle \text{stringA} \rangle is on the right of the \langle \text{number2} \rangle-th occurrence of \langle \text{stringB} \rangle. Runs \langle \text{true} \rangle if so, and \langle \text{false} \rangle otherwise.

- If one of the occurrences is not found, it runs \langle \text{false} \rangle;
- If one of the arguments \langle \text{string} \rangle, \langle \text{stringA} \rangle or \langle \text{stringB} \rangle is empty, runs \langle \text{false} \rangle;
- If one of the optional arguments is negative or zero, runs \langle \text{false} \rangle.

\begin{verbatim}
\IfSubStrBehind{xstring}{ri}{xs}{true}{false}
\IfSubStrBehind{xstring}{ri}{s}{true}{false}
\IfSubStrBehind{LaTeX}(LaT)(TeX){true}{false}
\IfSubStrBehind[a bc def ]{d}{a}{true}{false}
\IfSubStrBehind[a bc def ]{cd}{a b}{true}{false}
\IfSubStrBehind[2,1]{babab}{b}{2}{true}{false}
\IfSubStrBehind[3,1]{babab}{b}{2}{true}{false}
\IfSubStrBehind[2,2]{babab}{a}{b}{true}{false}
\IfSubStrBehind[2,3]{babab}{a}{b}{true}{false}
\end{verbatim}
2.1.4 \IfBeginWith

\IfBeginWith{[^*] \langle string \rangle \langle stringA \rangle \langle true \rangle \langle false \rangle}

Tests if \langle string \rangle begins with \langle stringA \rangle, and runs \langle true \rangle if so, and \langle false \rangle otherwise.

▷ If \langle string \rangle or \langle stringA \rangle is empty, runs \langle false \rangle.

\begin{verbatim}
\IfBeginWith{xstring}{xst}{true}{false}
\IfBeginWith{LaTeX}{a}{true}{false}
\IfBeginWith{a bc def}{a b}{true}{false}
\IfBeginWith{a bc def}{ab}{true}{false}
\end{verbatim}

\begin{tabular}{ll}
true & false \hline
false & true \\
false & false
\end{tabular}

2.1.5 \IfEndWith

\IfEndWith{[^*] \langle string \rangle \langle stringA \rangle \langle Behind \rangle \langle false \rangle}

Tests if \langle string \rangle ends with \langle stringA \rangle, and runs \langle true \rangle if so, and \langle false \rangle otherwise.

▷ If \langle string \rangle or \langle stringA \rangle is empty, runs \langle false \rangle.

\begin{verbatim}
\IfEndWith{xstring}{ring}{true}{false}
\IfEndWith{LaTeX}{a}{true}{false}
\IfEndWith{a bc def}{ef}{true}{false}
\IfEndWith{a bc def}{ef}{true}{false}
\end{verbatim}

\begin{tabular}{ll}
true & false \hline
false & true \\
false & false
\end{tabular}

2.1.6 \IfInteger

\IfInteger{\langle number \rangle \langle true \rangle \langle false \rangle}

Tests if \langle number \rangle is an integer (i.e. whose decimal part is empty or 0), and runs \langle true \rangle if so, and \langle false \rangle otherwise.

If test is false because unexpected characters, the control sequence \@xs@afterinteger and \afterinteger both contain the illegal part of \langle number \rangle.

\begin{verbatim}
\IfInteger{13}{true}{false}
\IfInteger{-2.19}{true}{false}
\IfInteger{+9}{true}{false}
\IfInteger{3.14}{true}{false}
\IfInteger{8.0}{true}{false}
\IfInteger{0}{true}{false}
\IfInteger{49a}{true}{false}
\IfInteger{+}{true}{false}
\IfInteger{a}{true}{false}
\IfInteger{0000}{true}{false}
\end{verbatim}

\begin{tabular}{ll}
true & false \hline
false & true \\
false & false
\end{tabular}

2.1.7 \IfDecimal

\IfDecimal{\langle number \rangle \langle true \rangle \langle false \rangle}

Tests if \langle number \rangle is a decimal, and runs \langle true \rangle if so, and \langle false \rangle otherwise.

Counters \integerpart and \decimalpart contain the integer part and decimal part of \langle number \rangle.

If test is false because unexpected characters, the control sequence \@xs@afterdecimal and \afterdecimal both contain the illegal part of \langle number \rangle, whereas if test is false because decimal part is empty after decimal separator, they contain "X".

▷ Decimal separator can be a dot or a comma;
▷ If what is on the right of decimal separator (if it exists) is empty, the test is false;
▷ If what is on the left of decimal separator (if it exists) is empty, the integer part is assumed to be 0;
2.1.10 \IfDecimal
\IfDecimal{3.14}{true}{false}
\IfDecimal{-0.5}{true}{false}
\IfDecimal{.7}{true}{false}
\IfDecimal{.9}{true}{false}
\IfDecimal{1.2}{true}{false}
\IfDecimal{6}{true}{false}
\IfDecimal{-15}{true}{false}
\IfDecimal{1.}{true}{false}
\IfDecimal{2.}{true}{false}
\IfDecimal{.}{true}{false}
\IfDecimal{+}{true}{false}
\IfDecimal{-}{true}{false}
\IfDecimal{+}{true}{false}
\IfDecimal{-}{true}{false}
\IfDecimal{13}{true}{false}
\IfDecimal{11}{true}{false}
\IfDecimal{10}{true}{false}
\IfDecimal{14}{true}{false}
\IfDecimal{9}{true}{false}
\IfDecimal{8}{true}{false}
\IfDecimal{7}{true}{false}
\IfDecimal{6}{true}{false}
\IfDecimal{5}{true}{false}
\IfDecimal{4}{true}{false}
\IfDecimal{3}{true}{false}
\IfDecimal{2}{true}{false}
\IfDecimal{1}{true}{false}
\IfDecimal{.}{true}{false}
\IfDecimal{0}{true}{false}
\IfDecimal{-0.0}{true}{false}
\IfDecimal{3*4+2}{true}{false}
\IfDecimal{14}{true}{false}
\IfDecimal{+0.5}{true}{false}
\IfDecimal{,5}{true}{false}
\IfDecimal{-10}{true}{false}
\IfDecimal{10}{true}{false}
\IfDecimal{12.34}{true}{false}
\IfDecimal{12.340}{true}{false}
\IfDecimal{3,14}{true}{false}
\IfDecimal{3,140}{true}{false}
\IfDecimal{\{0\}}{true}{false}
\IfDecimal{\{-0.0\}}{true}{false}

2.1.18 \IfStrEq
\IfStrEq{\[*\]}{(stringA)}{(stringB)}{(true)}{(false)}
Tests if the strings (stringA) and (stringB) are equal, i.e. if they contain successively the same syntax units in the same order. Runs (true) if so, and (false) otherwise.
\IfStrEq{a1b2c3}{a1b2c3}{true}{false}
\IfStrEq{abcdef}{abcd}{true}{false}
\IfStrEq{abc}{abcd}{true}{false}
\IfStrEq{3,14}{3.14}{true}{false}
\IfStrEq{12.34}{12.340}{true}{false}
\IfStrEq{abc}{true}{false}
\IfStrEq{abc}{true}{false}
\IfStrEq{}{false}
\IfStrEq{}{true}

2.1.9 \IfEq
\IfEq{(stringA)}{(stringB)}{(true)}{(false)}
Tests if the strings (stringA) and (stringB) are equal, except if both (stringA) and (stringB) contain numbers in which case the macro tests if these numbers are equal. Runs (true) if so, and (false) otherwise.
\IfEq{a1b2c3}{a1b2c3}{true}{false}
\IfEq{abcdef}{ab}{true}{false}
\IfEq{ab}{abcdef}{true}{false}
\IfEq{12.34}{12.34}{true}{false}
\IfEq{+12.34}{12.340}{true}{false}
\IfEq{10}{true}{false}
\IfEq{-10}{true}{false}
\IfEq{+0.5}{,5}{true}{false}
\IfEq{1.001}{1.01}{true}{false}
\IfEq{3+4+2}{14}{true}{false}
\IfEq{\texttt{number\numexpr3*4+2\}=14\}}{true}{false}
\IfEq{0}{true}{false}
\IfEq{}{false}
\IfEq{}{true}
\IfEq{}{true}

2.1.10 \IfStrEqCase
\IfStrEqCase{\[*\]}{(string)}{(true)}{(false)}
\IfStrEqCase{\{\texttt{code}\}}{(string)}{(true)}{(false)}
\IfStrEqCase{\{\texttt{code}\}}{(string2)}{(true)}{(false)}
\IfStrEqCase{\{\texttt{code}\}}{(stringN)}{(true)}{(false)}
\IfStrEqCase{\{\texttt{code}\}}{(other\ cases\ code)}
Tests successively if \( \langle \text{string} \rangle \) is equal to \( \langle \text{string1} \rangle \), \( \langle \text{string2} \rangle \), etc. Comparison is made with \texttt{\textbackslash IfStrEq} (see above). If the test number \( i \) is positive (the \( \langle \text{string} \rangle \) matches \( \langle \text{string} \rangle \)), the macro runs \( \langle \text{code} \rangle \) and ends. If all tests fail, the macro runs the optional \( \langle \text{other cases code} \rangle \), if present.

\begin{verbatim}
\texttt{\textbackslash IfEqCase(b){\{a\}{AA}\{b\}{BB}\{c\}{CC}}
\texttt{\textbackslash IfEqCase(abc){\{a\}{AA}\{b\}{BB}\{c\}{CC}}
\texttt{\textbackslash IfEqCase(c){\{a\}{AA}\{b\}{BB}\{c\}{CC}}}
\texttt{\textbackslash IfEqCase(d){\{a\}{AA}\{b\}{BB}\{c\}{CC}}}
\texttt{\textbackslash IfEqCase(+3){\{1\}{one}\{2\}{two}\{3\}{three}}}
\texttt{\textbackslash IfEqCase(0.5){\{0\}{zero}\{.5\}{half}\{1\}{one}}}
\end{verbatim}


\subsection*{2.11 \texttt{\textbackslash IfEqCase}}

\texttt{\textbackslash IfEqCase(\{\*\}){\langle \text{string} \rangle}{\%\langle \text{string1} \rangle}{\langle \text{code1} \rangle}{\%\langle \text{string2} \rangle}{\langle \text{code2} \rangle}{\%\etc\ldots}{\langle \text{stringN} \rangle}{\langle \text{codeN} \rangle}}

Tests successively if \( \langle \text{string} \rangle \) is equal to \( \langle \text{string1} \rangle \), \( \langle \text{string2} \rangle \), etc. Comparison is made with \texttt{\textbackslash Eq} (see above). If the test number \( i \) is positive (the \( \langle \text{string} \rangle \) matches \( \langle \text{string} \rangle \)), the macro runs \( \langle \text{code} \rangle \) and ends. If all tests fail, the macro runs the optional \( \langle \text{other cases code} \rangle \), if present.

\begin{verbatim}
\texttt{\textbackslash IfEqCase(b){\{a\}{AA}\{b\}{BB}\{c\}{CC}}}
\texttt{\textbackslash IfEqCase(abc){\{a\}{AA}\{b\}{BB}\{c\}{CC}}}
\texttt{\textbackslash IfEqCase(c){\{a\}{AA}\{b\}{BB}\{c\}{CC}}}
\texttt{\textbackslash IfEqCase(d){\{a\}{AA}\{b\}{BB}\{c\}{CC}}}
\texttt{\textbackslash IfEqCase(+3){\{1\}{one}\{2\}{two}\{3\}{three}}}
\texttt{\textbackslash IfEqCase(0.5){\{0\}{zero}\{.5\}{half}\{1\}{one}}}
\end{verbatim}


\section*{2.2 Extraction of substrings}

\subsection*{2.2.1 \texttt{\textbackslash StrBefore}}

\texttt{\textbackslash StrBefore(\{\*\}){\langle \text{string} \rangle}{\langle \text{stringA} \rangle}{\langle \text{name} \rangle}}

The value of the optional argument \( \langle \text{number} \rangle \) is 1 by default.

In \( \langle \text{string} \rangle \), returns what is leftwards the \( \langle \text{number} \rangle \)th occurrence of \( \langle \text{stringA} \rangle \).

\begin{itemize}
  \item If \( \langle \text{string} \rangle \) or \( \langle \text{stringA} \rangle \) is empty, an empty string is returned;
  \item If \( \langle \text{number} \rangle < 1 \) then the macro behaves as if \( \langle \text{number} \rangle = 1 \);
  \item If the occurrence is not found, an empty string is returned.
\end{itemize}

\begin{verbatim}
\texttt{\textbackslash StrBefore\{xstring\}\{trix\}}
\texttt{\textbackslash StrBefore\{LaTeX\}\{e\}}
\texttt{\textbackslash StrBefore\{LaTeX\}\{p\}||}
\texttt{\textbackslash StrBefore\{LaTeX\}\{L\}||}
\texttt{\textbackslash StrBefore\{a bc def \}\{def\}||}
\texttt{\textbackslash StrBefore\{a bc def \}\{cd\}||}
\texttt{\textbackslash StrBefore\{1\}\{1b2b3\}\{b\}}
\texttt{\textbackslash StrBefore\{2\}\{1b2b3\}\{b\}}
\end{verbatim}

\subsection*{2.2.2 \texttt{\textbackslash StrBehind}}

\texttt{\textbackslash StrBehind(\{\*\}){\langle \text{number} \rangle}{\langle \text{string} \rangle}{\langle \text{stringA} \rangle}{\langle \text{name} \rangle}}

The value of the optional argument \( \langle \text{number} \rangle \) is 1 by default.

In \( \langle \text{string} \rangle \), returns what is rightwards the \( \langle \text{number} \rangle \)th occurrence of \( \langle \text{stringA} \rangle \).

\begin{itemize}
  \item If \( \langle \text{string} \rangle \) or \( \langle \text{stringA} \rangle \) is empty, an empty string is returned;
  \item If \( \langle \text{number} \rangle < 1 \) then the macro behaves as if \( \langle \text{number} \rangle = 1 \);
  \item If the occurrence is not found, an empty string is returned.
\end{itemize}

\begin{verbatim}
\texttt{\textbackslash StrBehind\{xs\}\{trix\}||}
\texttt{\textbackslash StrBehind\{LaTeX\}\{e\}||}
\texttt{\textbackslash StrBehind\{LaTeX\}\{p\}||}
\texttt{\textbackslash StrBehind\{LaTeX\}\{L\}||}
\texttt{\textbackslash StrBehind\{a bc def \}\{def\}||}
\texttt{\textbackslash StrBehind\{a bc def \}\{cd\}||}
\texttt{\textbackslash StrBehind\{1\}\{1b2b3\}\{b\}}
\texttt{\textbackslash StrBehind\{2\}\{1b2b3\}\{b\}}
\end{verbatim}
2.2.3 \StrCut

Here is the syntax of this macro:
\StrCut{[*]}{(number)}{(string)}{(stringA)}{(macroA)}{(macroB)}

The optional argument \texttt{(number)} is 1 by default.

The \texttt{(string)} is cut in two parts at the occurrence \texttt{(number)} of \texttt{(stringA)}. The left part is stored in the control sequence \texttt{(macroA)} and the right part in \texttt{(macroB)}.

Since this macro returns \textit{two strings}, it does not display anything. Consequently, it does not provide the optional argument in last position.

- If \texttt{(string)} or \texttt{(stringA)} is empty, \texttt{(macroA)} and \texttt{(macroB)} are empty;
- If \texttt{(number)} < 1, the macro behaves as if \texttt{(number)} = 1;
- If the occurrence is not found, \texttt{(macroA)} receives the whole \texttt{(string)} while \texttt{(macroB)} is empty.

2.2.4 \StrBetween

\StrBetween{[*]}{(number1)}{(number2)}{(string)}{(stringA)}{(stringB)}{(name)}

The values of the optional arguments \texttt{(number1)} and \texttt{(number2)} are 1 by default.

In \texttt{(string)}, returns the substring between\textsuperscript{7} the \texttt{(number1)}\textsuperscript{th} occurrence of \texttt{(stringA)} and \texttt{(number2)}\textsuperscript{th} occurrence of \texttt{(stringB)}.

- If the occurrences are not in this order — \texttt{(stringA)} followed by \texttt{(stringB)} — in \texttt{(string)}, an empty string is returned;
- If one of the 2 occurrences doesn’t exist in \texttt{(string)}, an empty string is returned;
- If one of the optional arguments \texttt{(number1)} or \texttt{(number2)} is negative or zero, an empty string is returned.

\footnote{\textsuperscript{7}In a strict sense, i.e. without the strings \texttt{(stringA)} and \texttt{(stringB)}

\begin{verbatim}
\StrBehind{xstring}{tri} \StrBehind{LaTeX}{e} \StrBehind{LaTeX}{p} \StrBehind{LaTeX}{X} \StrBehind{a bc def}{bc} \StrBehind{a bc def}{cd} \StrBehind[1]{12b3}{b} \StrBehind[2]{12b3}{b} \StrBehind[3]{12b3}{b}
\end{verbatim}

\begin{verbatim}
\StrCut{abracadabra}{a}{csA|csB}|csA|csB|\par [bracadabra]
\StrCut[2]{abracadabra}{a}{csA|csB}|csA|csB|\par [abr|cadabra]
\StrCut[3]{abracadabra}{a}{csA|csB}|csA|csB|\par [abracadabra]
\StrCut[4]{abracadabra}{a}{csA|csB}|csA|csB|\par [abracadabra]
\StrCut[5]{abracadabra}{a}{csA|csB}|csA|csB|\par [abracadabra]
\StrCut[6]{abracadabra}{a}{csA|csB}|csA|csB|\par [abracadabra]
\StrCut[-4]{abracadabra}{a}{csA|csB}|csA|csB|\par [abracadabra]
\StrCut{abracadabra}{brac}{csA|csB}|csA|csB|\par [brac|adabra]
\StrCut{abracadabra}{foo}{csA|csB}|csA|csB|\par [a|adabra]
\StrCut{abracadabra}{}{csA|csB}|csA|csB|\par [bracadabra]
\end{verbatim}

\begin{verbatim}
\StrBetween{xstring}{xs}{ng} \StrBetween{xstring}{i}{n} \StrBetween{xstring}{a}{tring} \StrBetween{a bc def}{a}{d} \StrBetween{a bc def}{a}{f} \StrBetween[1]{a b1a2b2a3b3}{a}{b} \StrBetween[2]{a b1a2b2a3b3}{a}{b} \StrBetween[1]{a b1a2b2a3b3}{a}{b} \StrBetween[3]{a b1a2b2a3b3}{a}{b} \StrBetween[3]{abracadabra}{a}{bra}
\end{verbatim}

\begin{verbatim}
\StrBetween{xstring}{xs}{ng} \StrBetween{xstring}{i}{n} \StrBetween{xstring}{a}{tring} \StrBetween{a bc def}{a}{d} \StrBetween{a bc def}{a}{f} \StrBetween[1]{a b1a2b2a3b3}{a}{b} \StrBetween[2]{a b1a2b2a3b3}{a}{b} \StrBetween[1]{a b1a2b2a3b3}{a}{b} \StrBetween[3]{a b1a2b2a3b3}{a}{b} \StrBetween[3]{abracadabra}{a}{bra}
\end{verbatim}

\begin{verbatim}
\StrBetween{xstring}{xs}{ng} \StrBetween{xstring}{i}{n} \StrBetween{xstring}{a}{tring} \StrBetween{a bc def}{a}{d} \StrBetween{a bc def}{a}{f} \StrBetween[1]{a b1a2b2a3b3}{a}{b} \StrBetween[2]{a b1a2b2a3b3}{a}{b} \StrBetween[1]{a b1a2b2a3b3}{a}{b} \StrBetween[3]{a b1a2b2a3b3}{a}{b} \StrBetween[3]{abracadabra}{a}{bra}
\end{verbatim}
2.2.5 \texttt{\StrSubstitute}

\texttt{\StrSubstitute}\{\langle number\rangle\}\{\langle string\rangle\}\{\langle stringA\rangle\}\{\langle stringB\rangle\}\{\langle name\rangle\}

The value of the optional argument \langle number\rangle is 0 by default.

In \langle string\rangle, substitute the \langle number\rangle first occurrences of \langle stringA\rangle for \langle stringB\rangle, except if \langle number\rangle = 0 in which case all the occurrences are substituted.

\begin{itemize}
  \item If \langle string\rangle is empty, an empty string is returned;
  \item If \langle stringA\rangle is empty or doesn’t exist in \langle string\rangle, the macro is ineffective;
  \item If \langle number\rangle is greater than the number of occurrences of \langle stringA\rangle, then all the occurrences are substituted;
  \item If \langle number\rangle < 0 the macro behaves as if \langle number\rangle = 0;
  \item If \langle stringB\rangle is empty, the occurrences of \langle stringA\rangle, if they exist, are deleted.
\end{itemize}

\begin{verbatim}
\texttt{\StrSubstitute}\{\langle string\rangle\}\{\langle i\rangle\}\{a\}\\
\texttt{\StrSubstitute}\{\langle abracadabra\rangle\}\{\langle o\rangle\}\\
\texttt{\StrSubstitute}\{\langle abracadabra\rangle\}\{\langle br\rangle\}\{\langle TeX\rangle\}\\
\texttt{\StrSubstitute}\{\langle LaTeX\rangle\}\{\langle m\rangle\}\{\langle n\rangle\}\\
\texttt{\StrSubstitute}\{\langle a\ \ bc\ \ def \ \ \rangle\}\{\langle \{\ \rangle\}\{\langle M\rangle\}\\
\texttt{\StrSubstitute}\{\langle a\ \ bc\ \ def \ \ \rangle\}\{\langle ab\rangle\}\{\langle AB\rangle\}\\
\texttt{\StrSubstitute}\{\langle 1\rangle\}\{\langle a\ \ la\ 2\ 3\rangle\}\{\langle a\rangle\}\{\langle B\rangle\}\\
\texttt{\StrSubstitute}\{\langle 2\rangle\}\{\langle a\ \ la\ 2\ 3\rangle\}\{\langle a\rangle\}\{\langle B\rangle\}\\
\texttt{\StrSubstitute}\{\langle 3\rangle\}\{\langle a\ \ la\ 2\ 3\rangle\}\{\langle a\rangle\}\{\langle B\rangle\}\\
\texttt{\StrSubstitute}\{\langle 4\rangle\}\{\langle a\ \ la\ 2\ 3\rangle\}\{\langle a\rangle\}\{\langle B\rangle\}
\end{verbatim}

2.2.6 \texttt{\StrDel}

\texttt{\StrDel}\{\langle *\rangle\}\{\langle number\rangle\}\{\langle string\rangle\}\{\langle stringA\rangle\}\{\langle name\rangle\}

The value of the optional argument \langle number\rangle is 0 by default.

Delete the \langle number\rangle first occurrences of \langle stringA\rangle in \langle string\rangle, except if \langle number\rangle = 0 in which case all the occurrences are deleted.

\begin{itemize}
  \item If \langle string\rangle is empty, an empty string is returned;
  \item If \langle stringA\rangle is empty or doesn’t exist in \langle string\rangle, the macro is ineffective;
  \item If \langle number\rangle greater then the number of occurrences of \langle stringA\rangle, then all the occurrences are deleted;
  \item If \langle number\rangle < 0 the macro behaves as if \langle number\rangle = 0;
\end{itemize}

\begin{verbatim}
\texttt{\StrDel}\{\langle abracadabra\rangle\}\{\langle a\rangle\}\\
\texttt{\StrDel}\{\langle 1\rangle\}\{\langle abracadabra\rangle\}\{\langle a\rangle\}\\
\texttt{\StrDel}\{\langle 4\rangle\}\{\langle abracadabra\rangle\}\{\langle a\rangle\}\\
\texttt{\StrDel}\{\langle a\ \ bc\ \ def \ \ \rangle\}\{\langle \{\ \rangle\}\{\langle \}\}\\
\texttt{\StrDel}\{\langle a\ \ bc\ \ def \ \ \rangle\}\{\langle \{\ \rangle\}\{\langle def\rangle\}\\
\end{verbatim}

2.2.7 \texttt{\StrGobbleLeft}

\texttt{\StrGobbleLeft}\{\langle string\rangle\}\{\langle number\rangle\}\{\langle name\rangle\}

In \langle string\rangle, delete the \langle number\rangle first characters on the left.

\begin{itemize}
  \item If \langle string\rangle is empty, an empty string is returned;
  \item If \langle number\rangle \leq 0, no character is deleted;
  \item If \langle number\rangle \geq \langle lengthString\rangle, all the characters are deleted.
\end{itemize}

\begin{verbatim}
\texttt{\StrGobbleLeft}\{\langle xstring\rangle\}\{\langle 2\rangle\}\\
\texttt{\StrGobbleLeft}\{\langle xstring\rangle\}\{\langle 9\rangle\}\\
\texttt{\StrGobbleLeft}\{\langle LaTeX\rangle\}\{\langle 4\rangle\}\\
\texttt{\StrGobbleLeft}\{\langle LaTeX\rangle\}\{\langle -2\rangle\}\\
\texttt{\StrGobbleLeft}\{\langle a\ \ bc\ \ def \ \ \rangle\}\{\langle 4\rangle\}\\
\end{verbatim}
2.2.8 \texttt{StrLeft}

\texttt{StrLeft}\{(\texttt{string})\}\{(\texttt{number})\}\{(\texttt{name})\}

In \texttt{\{string\}}, returns the \texttt{\{number\}} first characters on the left.

▷ If \texttt{\{string\}} is empty, an empty string is returned;
▷ If \texttt{\{number\}} \leq 0, no character is returned;
▷ If \texttt{\{number\}} \geq \texttt{\{lengthString\}}, all the characters are returned.

\begin{verbatim}
1 \StrLeft{xstring}{2}
2 \StrLeft{xstring}{9}
3 \StrLeft{LaTeX}{4}
4 \StrLeft{LaTeX}{-2}|
5 \StrLeft{a bc def \{}{5}|
\end{verbatim}

2.2.9 \texttt{StrGobbleRight}

\texttt{StrGobbleRight}\{(\texttt{string})\}\{(\texttt{number})\}\{(\texttt{name})\}

In \texttt{\{string\}}, delete the \texttt{\{number\}} last characters on the right.

\begin{verbatim}
1 \StrGobbleRight{xstring}{2}
2 \StrGobbleRight{xstring}{9}|
3 \StrGobbleRight{LaTeX}{4}|
4 \StrGobbleRight{LaTeX}{-2}|
5 \StrGobbleRight{a bc def \}{4}|
\end{verbatim}

2.2.10 \texttt{StrRight}

\texttt{StrRight}\{(\texttt{string})\}\{(\texttt{number})\}\{(\texttt{name})\}

In \texttt{\{string\}}, returns the \texttt{\{number\}} last characters on the right.

\begin{verbatim}
1 \StrRight{xstring}{2}
2 \StrRight{xstring}{9}
3 \StrRight{LaTeX}{4}
4 \StrRight{LaTeX}{-2}|
5 \StrRight{a bc def \}{4}|
\end{verbatim}

2.2.11 \texttt{StrChar}

\texttt{StrChar}\{[*]\}\{(\texttt{string})\}\{(\texttt{number})\}\{(\texttt{name})\}

Returns the syntax unit at the position \texttt{\{number\}} in \texttt{\{string\}}.

▷ If \texttt{\{string\}} is empty, no character is returned;
▷ If \texttt{\{number\}} \leq 0 or if \texttt{\{number\}} > \texttt{\{lengthString\}}, no character is returned.

\begin{verbatim}
1 \StrChar{xstring}{4}
2 \StrChar{xstring}{9}|
3 \StrChar{xstring}{-5}|
4 \StrChar{a bc def \}{6}|
\end{verbatim}

2.2.12 \texttt{StrMid}

\texttt{StrMid}\{(\texttt{string})\}\{(\texttt{numberA})\}\{(\texttt{numberB})\}\{(\texttt{name})\}

In \texttt{\{string\}}, returns the substring between\(^8\) the positions \texttt{\{numberA\}} and \texttt{\{numberB\}}.

▷ If \texttt{\{string\}} is empty, an empty string is returned;
▷ If \texttt{\{numberA\}} > \texttt{\{numberB\}}, an empty string is returned;
▷ If \texttt{\{numberA\}} < 1 and \texttt{\{numberB\}} < 1 an empty string is returned;

\(^8\)In the broad sense, i.e. that the strings characters of the "border" are returned.
If \(\langle\text{numberA}\rangle > \langle\text{lengthString}\rangle\) et \(\langle\text{numberB}\rangle > \langle\text{lengthString}\rangle\), an empty string is returned; 
If \(\langle\text{numberA}\rangle < 1\), the macro behaves as if \(\langle\text{numberA}\rangle = 1\); 
If \(\langle\text{numberB}\rangle > \langle\text{lengthString}\rangle\), the macro behaves as if \(\langle\text{numberB}\rangle = \langle\text{lengthString}\rangle\).

\[
\begin{align*}
\text{\textbackslash StrMid} & \{xstring\}\{2\}\{5\} \\
\text{\textbackslash StrMid} & \{xstring\}\{-4\}\{2\} \\
\text{\textbackslash StrMid} & \{xstring\}\{5\}\{1\} \\
\text{\textbackslash StrMid} & \{xstring\}\{6\}\{15\} \\
\text{\textbackslash StrMid} & \{\text{a bc def}\}\{2\}\{7\} \\
\end{align*}
\]

2.3 Macros returning a number

2.3.1 \text\textbackslash StrLen
\text\textbackslash StrLen\{\langle\text{string}\rangle\}\{\langle\text{name}\rangle\}
Return the length of \(\langle\text{string}\rangle\).

\[
\begin{align*}
\text{\textbackslash StrLen} & \{xstring\} \\
\text{\textbackslash StrLen} & \{A\} \\
\text{\textbackslash StrLen} & \{\text{a bc def}\} \\
\end{align*}
\]

2.3.2 \text\textbackslash StrCount
\text\textbackslash StrCount\{\langle\text{string}\rangle\}\{\langle\text{stringA}\rangle\}\{\langle\text{name}\rangle\}
Counts how many times \(\langle\text{stringA}\rangle\) is contained in \(\langle\text{string}\rangle\).

\[
\begin{align*}
\text{\textbackslash StrCount} & \{\text{abracadabra}\}\{a\} \\
\text{\textbackslash StrCount} & \{\text{abracadabra}\}\{bra\} \\
\text{\textbackslash StrCount} & \{\text{abracadabra}\}\{tic\} \\
\text{\textbackslash StrCount} & \{\text{aaaaaa}\}\{aa\} \\
\end{align*}
\]

2.3.3 \text\textbackslash StrPosition
\text\textbackslash StrPosition\{\langle\text{number}\rangle\}\{\langle\text{string}\rangle\}\{\langle\text{stringA}\rangle\}\{\langle\text{name}\rangle\}
The value of the optional argument \(\langle\text{number}\rangle\) is 1 by default.
In \(\langle\text{string}\rangle\), returns the position of the \(\langle\text{number}\rangle\)th occurrence of \(\langle\text{stringA}\rangle\).

\[
\begin{align*}
\text{\textbackslash StrPosition} & \{\text{xstring}\}\{\text{ring}\} \\
\text{\textbackslash StrPosition} & \{4\}\{\text{abracadabra}\}\{a\} \\
\text{\textbackslash StrPosition} & \{2\}\{\text{abracadabra}\}\{bra\} \\
\text{\textbackslash StrPosition} & \{9\}\{\text{abracadabra}\}\{a\} \\
\text{\textbackslash StrPosition} & \{\text{a bc def}\}\{d\} \\
\text{\textbackslash StrPosition} & \{3\}\{\text{aaaaaa}\}\{aa\} \\
\end{align*}
\]

2.3.4 \text\textbackslash StrCompare
\text\textbackslash StrCompare\{\langle\text{*}\rangle\}\{\langle\text{stringA}\rangle\}\{\langle\text{stringB}\rangle\}\{\langle\text{name}\rangle\}
This macro has 2 tolerances: the "normal" tolerance, used by default, and the "strict" tolerance.

- The normal tolerance is activated with \text\texttt{\textbackslash comparenormal}.

The macro compares characters from left to right in \(\langle\text{stringA}\rangle\) and \(\langle\text{stringB}\rangle\) until a difference appears or the end of the shortest string is reached. The position of the first difference is returned and if no difference is found, the macro return 0.
• The strict tolerance is activated with \comparestrict.
The macro compares the 2 strings. If they are equal, it returns 0. If not, the position of the first difference is returned.

It is possible to save the comparison mode with \savecomparemode, then modify this comparison mode and come back to the situation when it was saved with \restorecomparemode.

Examples with the normal tolerance:

\begin{verbatim}
\StrCompare{abcd}{abcd} \noexpandarg \StrCompare{abcd}{abc} \StrCompare{abcd}{ab} \StrCompare{a b c}{abc} \StrCompare{aaa}{baaa} \StrCompare{abc}{xyz} \StrCompare{123456}{123457} \StrCompare{abc}{}
\end{verbatim}

Examples with the strict tolerance:

\begin{verbatim}
\StrCompare{abcd}{abcd} \StrCompare{abcd}{abc} \StrCompare{abcd}{ab} \StrCompare{a b c}{abc} \StrCompare{aaa}{baaa} \StrCompare{abc}{xyz} \StrCompare{123456}{123457} \StrCompare{abc}{}
\end{verbatim}

3 Operating modes

3.1 Expansion of arguments

3.1.1 The commands \fullexpandarg, \expandarg and \noexpandarg

The command \fullexpandarg is called by default, so all the arguments are fully expanded (an \edef is used) before the macro works on them. In most of the cases, this expansion mode avoids chains of \expandafter and allows lighter code.

Of course, the expansion of argument can be canceled to find back the usual behaviour of \TeX with the commands \noexpandarg or \normalexpandarg.

Another expansion mode can be called with \expandarg. In this case, the first token of each argument is expanded one time while all other tokens are left unchanged (if you want the expansion of all tokens one time, you should call the macro \StrExpand, see page 18).

The commands \fullexpandarg, \noexpandarg, \normalexpandarg and \expandarg can be called at any moment in the code; they behave as "switches" and they can be locally used in a group.

It is possible to save the expansion mode with \saveexpandmode, then modify this expansion mode and come back to the situation when it was saved with \restoreexpandmode.

In the following list, for every macro of the previous chapter, the arguments colored in purple will possibly be expanded, according to the expansion mode:

• \IfSubStr([*])(\{number\})(\{string\})(\{stringA\})(\{true\})(\{false\})
• \IfSubStrBefore([*])(\{number1\},\{number2\})(\{string\})(\{stringA\})(\{stringB\})(\{true\})(\{false\})
• \IfSubStrBehind([*])(\{number1\},\{number2\})(\{string\})(\{stringA\})(\{stringB\})(\{true\})(\{false\})
• \IfBeginWith([*])(\{string\})(\{stringA\})(\{true\})(\{false\})
• \IfEndWith([*])(\{string\})(\{stringA\})(\{true\})(\{false\})
• \IfInteger(\{number\})(\{true\})(\{false\})
• \IfDecimal(\{number\})(\{true\})(\{false\})
• IfStrEq([*]){⟨stringA⟩}{⟨stringB⟩}{⟨true⟩}{⟨false⟩}
• IfEq([*]){⟨stringA⟩}{⟨stringB⟩}{⟨true⟩}{⟨false⟩}
• IfStrEqCase([*]){⟨string⟩}{⟨stringI⟩}{⟨codeI⟩}
  {⟨string2⟩}{⟨code2⟩}
  ...
  {⟨string n⟩}{⟨code n⟩}{{other cases code}}
• IfEqCase([*]){⟨string⟩}{⟨stringI⟩}{⟨codeI⟩}
  {⟨string2⟩}{⟨code2⟩}
  ...
  {⟨string n⟩}{⟨code n⟩}{{other cases code}}
•ToStrBefore([*]){⟨number⟩}{⟨string⟩}{⟨stringA⟩}{⟨name⟩}
•ToStrBehind([*]){⟨number⟩}{⟨string⟩}{⟨stringA⟩}{⟨name⟩}
•ToStrBetween([*]){⟨number1⟩,⟨number2⟩}{⟨string⟩}{⟨stringA⟩}{⟨stringB⟩}{⟨name⟩}
•ToStrSubstitute({⟨number⟩}{⟨string⟩}{⟨stringA⟩}{⟨stringB⟩}{⟨name⟩}
•ToStrDel{⟨number⟩}{⟨string⟩}{⟨stringA⟩}{⟨name⟩}
•ToStrSplit{⟨string⟩}{⟨number⟩}{⟨stringA⟩}{⟨stringB⟩} (see macro StrSplit page 16)
•ToStrGobbleLeft{⟨string⟩}{⟨number⟩}{⟨name⟩}
•ToStrLeft{⟨string⟩}{⟨number⟩}{⟨name⟩}
•ToStrGobbleRight{⟨string⟩}{⟨number⟩}{⟨name⟩}
•ToStrRight{⟨string⟩}{⟨number⟩}{⟨name⟩}
•ToStrChar{⟨string⟩}{⟨number⟩}{⟨name⟩}
•ToStrMid{⟨string⟩}{⟨number1⟩}{⟨number2⟩}{⟨name⟩}
•ToStrLen{⟨string⟩}{⟨name⟩}
•ToStrCount{⟨string⟩}{⟨stringA⟩}{⟨name⟩}
•ToStrPosition{⟨number⟩}{⟨string⟩}{⟨stringA⟩}{⟨name⟩}
•ToStrCompare{⟨stringA⟩}{⟨stringB⟩}{⟨name⟩}

3.1.2 Chars and tokens allowed in arguments

First of all, whatever be the current expansion mode, tokens with catcode 6 and 14 (usually \# and %) are forbidden in all the arguments\(^9\).

When full expansion mode is activated with \fullexpandarg, arguments are expanded with an \edef before they are read by the macro. Consequently, are allowed in arguments:

- letters (uppercase or lowercase, accented\(^10\) or not), figures, spaces, and any other character with a catcode of 10, 11 ou 12 (punctuation signs, calculation signs, parenthesis, square bracket, etc.);
- tokens with catcode 1 to 4, usually : { }\(^11\) $ &
- tokens with catcode 7 and 8, usually : ^ _
- any purely expandable control sequence\(^12\) or tokens with catcode 13 (active chars) whose expansion is allowed chars.

\(^9\)Maybe, the token \# will be allowed in a future version.
\(^10\)For a reliable operation with accented letters, the \fontenc package with option [T1] and \inputenc with appropriated option must be loaded
\(^11\)Warning : braces must be balanced in arguments !
\(^12\)i.e. this control sequence can be \edefed.
When arguments are not expanded with the use of \noexpandarg, other tokens can be put in a string whatever be the code they make: any control sequence, even undefined, any token catcode 13. Moreover, test tokens are allowed like \if or \ifx, even without their \fi. On the same way, a \csname without its \endcsname is allowed.

In this example, the argument contains a \ifx without the \fi: the \StrBetween command extracts and displays what is between \ifx and \else:

```
\noexpandarg
\StrBetween{\ifx ab false \else true}{\ifx}{\else}
```

When \expandarg is used, the first token needs precaution since it is expanded one time: it must be defined. The other tokens are left unchanged like with \noexpandarg.

### 3.2 Expansion of macros, optional argument

The macros of this package are not purely expandable, i.e. they cannot be put in the argument of an \edef. Nestling macros is not possible neither.

For this reason, all the macros returning a result (i.e. all excepted the tests) have an optional argument in last position. The syntax is [{⟨name⟩}], where ⟨name⟩ is the name of the control sequence that will receive the result of the macro: the assignment is made with an \edef which make the result of the macro ⟨name⟩ purely expandable. Of course, if an optional argument is present, the macro does not display anything.

Thus, this structure not allowed, supposed to assign to \Result the 4 chars on the left of xstring:

```
\edef\Result{\StrLeft{xstring}{4}}
```

is equivalent to:

```
\StrLeft{xstring}{4}[\Result]
```

And this nested structure, not allowed neither, supposed to remove the first and last char of xstring:

```
\StrGobbleLeft{\StrGobbleRight{xstring}{1}}{1}
```

should be written like this:

```
\StrGobbleRight{xstring}{1}[\mystring]
\StrGobbleleft{\mystring}{1}
```

### 3.3 How does xstring read the arguments?

#### 3.3.1 Syntax unit by syntax unit

The macros of xstring read their arguments syntax unit par syntax unit. In the TeX code, a syntax unit is either:

- a control sequence;
- a group, i.e. what is between 2 balanced braces (usually tokens catcode 1 and 2);
- a char.

Let's see what is a syntax unit with an example. Let's take this argument: "ab\textbf{xyz}cd"

It has 6 syntax units: "a", "b", \textbf{"xyz"}, "c" and "d".

What will happen if, while \noexpandarg is active, we ask xstring to find the length of this argument and find its 4th "char"

```
\noexpandarg
\StrLen{ab\textbf{xyz}cd}\par
\StrChar{ab\textbf{xyz}cd}{4}[\mychar]
\meaning\mychar
```

It is necessary to use \meaning to see the real expansion of \mychar, and not simply call \mychar to display it, which make loose informations (braces here). We do not obtain a "char" but a syntax unit, as expected.

---

13For advanced users used to \TeX programming, a syntax unit is what is gobbled by the macro \@gobble whose code is: \def\@gobble#1{}
3.3.2 Exploration of groups

By default, the command `\noexploregroups` is called, so in the argument containing the string of tokens, xstring does not look into groups, and simply consider them as a syntax unit.

For specific uses, it can be necessary to look into groups: `\exploregroups` changes the exploration mode and forces the macros to look inside groups.

What does this exploration mode in the previous example? xstring does not count the group as a single syntax unit but looks inside it and counts the syntax unit found inside (x, y and z), and so on if there were several nested groups:

```latex
\noexpandarg
\exploregroups
\StrLen{ab\textbf{xyz}cd}\par
\StrChar{ab\textbf{xyz}cd}{4}\{\mychar\}
\meaning\mychar
```

Exploring the groups can be useful for counting a substring in a string (`\StrCount`), for the position of a substring in a string (`\StrPosition`) or for tests, but has a severe limitation with macros returning a string: when a string is cut inside a group, the result does not take into account what is outside this group. This exploration mode must be used knowingly this limitation when calling macros returning a string.

Let’s see what this means with an example. We want to know what is on the left of the second appearance of `\a` in the argument `\a1{\b1\a2}\a3`. As groups are explored, this appearance is inside this group: `{\b1\a2}`. The result will be `\b1`. Let’s check:

```latex
\noexpandarg
\exploregroups
\StrBefore[2]{\a1{\b1\a2}\a3}\{\a}{\mycs}
\meaning\mycs
```

Exploring the groups\(^\text{14}\) can change the behaviour of most of the macros of xstring, excepted these macros untouched by the exploration mode; their behaviour is the same in any case: `\IfInteger`, `\IfDecimal`, `\IfStrEq`, `\StrEq` et `\StrCompare`.

Moreover, 2 macros run in `\noexploregroups` mode, whatever be the current mode: `\StrBetween` et `\StrMid`.

It is possible to save the exploration mode with `\saveexploremode`, then modify it and come back to the situation when it was saved with `\restoreexploremode`.

3.4 Catcode and starred macros

Macros of this package take the catcodes of tokens into account. To avoid unexpected behaviour (particularly with tests), you should keep in mind that tokens and their catcodes are examined.

For instance, these two arguments:

```latex
{\string a}{\string b}
```

do not expand into equal strings for xstring! Because of the command `\string`, the first expands into “ab” with catcodes 12 while the second have characters with their natural catcodes 11. Catcodes do not match! It is necessary to be aware of this, particularly with \TeX\ commands like `\string` whose expansions are a strings with chars catcodes 12 and 10:

```latex
\detokenize, \meaning, \jobname, \fontname, \roman\numeral, \textendash, \emph, \textsuperscript, \textsubscript
```

Starred macros do not take catcodes into account. They simply convert some arguments into arguments with catcodes 10, 11 and 12, and call the non-starred macros with these modified arguments. The optional arguments are not modified and the catcodes are left unchanged.

Here is an example:

```latex
\IfStrEq{\string a}{\string b}{a}{true}{false}\par
```

The strings do not match because of catcode differences: the test is negative in the non-starred macro.

**Warning:** the use of a starred macro has consequences! The arguments are “detokenized”, thus, there is no more control sequences, groups, neither any special char: everything is converted into chars with "harmless" catcodes.

\(^\text{14}\)The file test of xstring has many examples underlining differences between exploration modes.
For the macros returning a string, if the starred version is used, the result will be a string in which chars have catcodes 12 and 10 for space. For example, after a \texttt{StrBefore}{{a \ b c \ d} {c} {mytext}}", the control sequence \texttt{mytext} expands to \texttt{a_{12,10} b_{12,10}}.

The macro with a starred version are listed below. For these macros, if starred version is used, the purple arguments will be detokenized:

- \texttt{\IfSubStr{{*}}{number}{string}{stringA}{true}{false}}
- \texttt{\IfSubSubStrBefore{{*}}{number1}{number2}{string}{stringA}{stringB}{true}{false}}
- \texttt{\IfSubSubStrBehind{{*}}{number1}{number2}{string}{stringA}{stringB}{true}{false}}
- \texttt{\IfBeginWith{{*}}{string}{stringA}{true}{false}}
- \texttt{\IfEndWith{{*}}{string}{stringA}{true}{false}}
- \texttt{\IfStrEq{{*}}{string}{stringA}{true}{false}}
- \texttt{\IfEqCase{{*}}{string}{stringA}{true}{false}}
- \texttt{\IfEq{{*}}{string}{stringA}{true}{false}}
- \texttt{\IfStrEqCase{{*}}{string}{string1}{code1}}
- \texttt{\IfStrEqCase{{*}}{string}{string2}{code2}}
- \texttt{\IfEqCase{{*}}{string}{true}{false}}
- \texttt{\StrAfter{{*}}{number}{true}{false}}
- \texttt{\StrBefore{{*}}{number}{string}{true}{false}}
- \texttt{\StrBetween{{*}}{number1}{number2}{string}{true}{false}}
- \texttt{\StrCompare{{*}}{string}{true}{false}}

4 Advanced macros for programming

Though xstring is able to read arguments containing \TeX or \LaTeX code, for some advanced programming needs, it can be insufficient. This chapter presents other macros able to get round some limitations.

4.1 Finding a group, macros \texttt{StrFindGroup} and \texttt{groupID}

When \texttt{exploregroups} mode is active, the macro \texttt{StrFindGroup} finds a group between braces with its identifier:
\texttt{\StrFindGroup{argument}{identifier}{name}}

When the group matching the identifier does not exist, an empty string is assigned to \texttt{name}. If the group is found, this group with its braces is assigned to \texttt{name}.

This identifier characterizes the nesting position of the group. It is a list of one or several integers separated with commas. \texttt{n_1}, the first integer is the number of the group (not nested in another) in which the sought group is. Inside this group, the second integer \texttt{n_2} is the number of the group (not nested in another) in which the sought group is...and so on until the necessary nesting depth is reached to obtain the sougth after group.

Let’s take an example with 3 levels of nested groups. In this example, braces delimiting groups are colored in red for nesting level 1, in blue for level 2 and in green for level 3. The groups are numbered with the rule seen above:

\!
\begin{center}
\begin{tikzpicture}
\draw[red, thick] (0,0) -- (1,0) -- (1,1) -- (0,1) -- cycle;
\draw[blue, thick] (1,0) -- (2,0) -- (2,1) -- (1,1) -- cycle;
\draw[green, thick] (2,0) -- (3,0) -- (3,1) -- (2,1) -- cycle;
\end{tikzpicture}
\end{center}

In this example:
• the group \{bc\}d\{efg\} has the identifier: \textcolor{red}{1}
• the group \{ij\} has the identifier: \textcolor{red}{2,1}
• the group \{no\} has the identifier: \textcolor{red}{2,3,2}
• the whole argument a\{bc\}d\{efg\}h\{(ij)\}k\{l(m)\}{no\}p has the identifier 0, only case where the integer 0 is appears in the identifier of a group.

Here is the full example:

```latex
\def\mystr{a\{bc\}d\{efg\}h\{(ij)\}k\{l(m)\}{no\}p}
\def\mygroup{1}
\edef\result{\StrFindGroup{\mystr}{1}{1}\mygroup}
```

The reverse process exists, and several macros of xstring provide the identifier of the group in which they made a cut or they found a substring. These macros are: \texttt{\IfSubStr}, \texttt{\StrBefore}, \texttt{\StrBehind}, \texttt{\StrSplit}, \texttt{\StrLeft}, \texttt{\StrGobbleLeft}, \texttt{\StrRight}, \texttt{\StrGobbleRight}, \texttt{\StrChar}, \texttt{\StrPosition}.

After these macros, the control sequence \texttt{\groupID} expands to the identifier of the group where the cut has been done or the search has succeeded. When not cut can be done or the search fails, \texttt{\groupID} is empty. Obviously, the use of \texttt{\groupID} has sense only when \texttt{\exploregroups} mode is active and when no starred macros are used.

Here are some examples with the macro \texttt{\StrChar}:

```latex
\def\mystr{a\{bc\}d\{efg\}h\{(ij)\}k\{l(m)\}{no\}p}
\edef\mygroup{1}
\edef\result{\StrFindGroup{\mystr}{1}{1}\mygroup}
```

### 4.2 Splitting a string, the macro \texttt{\StrSplit}

Here is the syntax:

\texttt{\StrSplit{\langle string\rangle}\{\langle number\rangle\}\{\langle stringA\rangle\}\{\langle stringB\rangle\}}

The \texttt{\langle string\rangle}, is splitted after the syntax unit at position \texttt{\langle number\rangle}. The left part is assigned to the control sequence \texttt{\langle stringA\rangle} and the right part is assigned to \texttt{\langle stringB\rangle}.

This macro returns two strings, so it does not display anything. Consequently, it does not provide the optional argument in last position.

- If \texttt{\langle number\rangle} \leq 0, \texttt{\langle stringA\rangle} is empty and \texttt{\langle stringB\rangle} is equal to \texttt{\langle string\rangle};
- If \texttt{\langle number\rangle} \geq \texttt{\langle lengthString\rangle}, \texttt{\langle stringA\rangle} is equal to \texttt{\langle string\rangle} and \texttt{\langle stringB\rangle} is empty;
- If \texttt{\langle string\rangle} is empty, \texttt{\langle stringA\rangle} and \texttt{\langle stringB\rangle} are empty, whatever be the integer \texttt{\langle number\rangle}.

```latex
\edef\redsep{\color{red}}
\edef\result{\StrSplit{abcdef}{4}\{csA\}\{csB\}\redsep{csB}}
\edef\result{\StrSplit{a b c }{2}\{csA\}\{csB\}\redsep{csB}}
\edef\result{\StrSplit{abcdef}{1}\{csA\}\{csB\}\redsep{csB}}
\edef\result{\StrSplit{abcdef}{5}\{csA\}\{csB\}\redsep{csB}}
\edef\result{\StrSplit{abcdef}{9}\{csA\}\{csB\}\redsep{csB}}
\edef\result{\StrSplit{abcdef}{-3}\{csA\}\{csB\}\redsep{csB}}
```
When the exploration of groups is active and the cut is made at the end of a group, the content of the left string will be the entire group while the right string will be empty. The example shows this:

\begin{verbatim}
\explore\groups
\texttt{StrSplit}(ab\{cd(ef)gh\}ij)\{6\}\strA\strB
\meaning\strA\par
\meaning\strB
\end{verbatim}

This macro provides a star version: in this case, the cut is made just before the syntax unit which follows the syntax unit at position (number). Both version give same results, except when the cut is made at the end of a group; in that case, \texttt{StrSplit} closes as many group as necessary until it finds the next syntax unit: the cut is made just before this syntax unit.

\begin{verbatim}
\explore\groups
\texttt{StrSplit}(ab\{cd(ef)gh\}ij)\{6\}\strA\strB
\meaning\strA\par
\meaning\strB
\end{verbatim}

4.3 Assign a verb content, the macro \verb\tocs

The macro \verb\tocs allow to read the content of a “verb” argument containing special characters: &, \, , { }, __, $, ^ and %. The catcodes of “normal” characters are left unchanged while special characters take a catcode 12. Then, these characters are assigned to a control sequence. The syntax is:

\verb\tocs\{\langle\text{name}\rangle\}|(\langle\text{characters}\rangle)\}

\langle\text{name}\rangle is the name of the control sequence receiving, with an \texttt{edef}, the \langle\text{characters}\rangle. \langle\text{name}\rangle thus contains tokens with catcodes 12 (or 10 for space).

By default, the token delimiting the verb content is ”|”. Obviously, this token cannot be both delimiting and being contained into what it delimits. If you need to verbatimize strings containing ”|”, you can change at any time the token delimiting the verb content with the macro:

\verb\setverbdelim\{\langle\text{character}\rangle\}

Any \langle\text{token}\rangle can be used. For example, after \verb\setverbdelim\{=\}, a verb argument look like this: =\langle\text{characters}\rangle=.

About verb arguments, keep in mind that:

- all the characters before |\langle\text{characters}\rangle| are ignored;
- inside the verb argument, all the spaces are taken into account, even if they are consecutive.

Example:

\begin{verbatim}
\verb\tocs\{\langle\result\rangle\} |a & b\{c%\ d$ e \f|
I display the result : \verb\par\result
\end{verbatim}

4.4 Tokenization of a text to a control sequence, the macro \texttt{\tokenize}

The reverse process of what has been seen above is to transform chars into tokens. This is done by the macro:

\verb\tokenize\{\langle\text{name}\rangle\}|(\langle\text{control sequences}\rangle)

\langle\text{control sequences}\rangle is fully expanded if \texttt{fullexpandarg} has been called, and is not expanded if \texttt{noexpandarg} or \texttt{expandarg} are active. After expansion, the chars are tokenized to tokens and assigned to \langle\text{name}\rangle with a \texttt{def}.

\footnote{Several tokens can be used, but the syntax of \verb\tocs becomes less readable ! For this reason, a warning occurs when the argument of \verb\setverbdelim contains more than a single token.}
15
14
13
12
10
9
8
7
6
5
4
3
2
1
The default behaviour can be recovered with \newcommand{\resultat} can be called at the last line since the control sequences it contains are defined.

4.5 Expansion of a control sequence before verbatimize, the macros \StrExpand and \scancs

The macro \StrExpand expands the tokens of a string:

\StrExpand{(\number)}{(\string)}{(\name)}

By default, (\number) is 1 and represents the number of times each token of (\string) has to be expanded. The (\name) is a control sequence receiving the result of the expansions.

Macro works sequentially and by pass: in a pass, each token from left to right is replaced by its 1-expansion. After this expansion, if the (\number) of expansions is not reached, another pass starts, and so on.

Here is an example:

```
\def\csA{1 2}
\def\csB{a \csA}
\def\csC{\csB\space}
\def\csD{x{\csA y}\csB{\csC z}}
\StrExpand{}{(\csD)}{(\csE)}\resultat
```

Expansion of \csD at
depth 0 : \csD
depth 1 : x{\csA y}\csB{\csC z}
depth 2 : x{1 2 y}{\csA \csB \space z}
depth 3 : x{1 2 y}{a 1 2}{\csA z}
depth 4 : x{1 2 y}{a 1 2}{1 2 z}

The macro expands each token consecutively, and does not see what follows: tokens whose expansion depends on other tokens cannot be expanded with this macro. For instance, though "\iftrue A\else B\fi" has a natural expansion ("A"), it cannot be put in the argument of \StrExpand and:

\StrExpand{\iftrue A\else B\fi}\resultat

provokes an error because the first token "\iftrue" is expanded alone without seeing its \fi which makes \TeXX angry.

Expansion inside groups is independant of the exploration mode: this macro has its own command to expand or not what is inside the groups. By default, tokens inside groups are expanded, but this can be changed with the macro \noexpandgroups. The default behaviour can be recovered with \expandinggroups.

The \scancs macro returns the detokenized result:

\scancs{(\number)}{(\name)}{(\string)}

The (\number) is 1 by default and represents the number of expansions.

\scancs has been kept for compatibility with older versions of \xstring. This macro now unnecessary, simply takes the result of \StrExpand and \detokenize it.

4.6 Inside the definition of a macro

Some difficulties arise inside the definition of a macro, i.e. between braces following a \def{\macro} or a \newcommand{\macro}.

It is forbidden to use the command \verb inside the definition of a macro. For the same reasons:

Do not use \verb\textbackslash{basis} inside the definition of a macro.

But then, how to manipulate special characters and "verbatimize" inside the definition of macros?

The \detokenize primitive of \eXeTeX can be used but it has limitations:
• braces must be balanced;
• consecutive spaces make a single space;
• the % sign is not allowed;
• a space is inserted after each control sequence;
• # signs become ##.

It is better to use `\scancs` and define outside the definition of the macros control sequences containing special characters with `\verbhtocs`. It is also possible to use `\tokenize` to transform the final result (which is generally `text_{10,11,12}`) into control sequences. See example using these macros at the end of this manual, page 19.

In the following teaching example\(^{16}\), the macro `\bracearg` adds braces to its argument. To make this possible, 2 control sequences `\Ob` and `\Cb` containing "{" and "}" are defined outside the definition of `\bracearg`, and expanded inside it:

```latex
\begin{verbatim}
\verbhtocs\{\Ob\}\{|\{\result\}\}|\Ob\text\Cb\{|\\result\}|\Ob\text\Cb|\Verbtocs\{\Ob\}\{|\{\result\}\}|\Ob\text\Cb|\Verbtocs\{\Ob\}\{|\{\result\}\}|\Ob\text\Cb
\bracearg{xstring}\par
\bracearg{a}
\end{verbatim}
```

4.7 The macro `\StrRemoveBraces`

Advanced users may need to remove the braces of an argument. The macro `\StrRemoveBraces` does this. Its syntax is:

`\StrRemoveBraces\{string\}\{(name)\}`

This macro is sensitive to exploration mode and will remove all the braces with `\expregroups` while it will remove braces of lower level with `\xexpregroups`.

```latex
\begin{verbatim}
\noexpregroups
\StrRemoveBraces\{a\{b\{c\}\}d\{e\{f\}\}g\}\{mycs\}
\meaning\mycs
\expregroups
\StrRemoveBraces\{a\{b\{c\}\}d\{e\{f\}\}g\}\{mycs\}
\meaning\mycs
\end{verbatim}
```

4.8 Examples

Here are some very simple examples involving the macros of this package in programming purposes.

4.8.1 Example 1

We want to substitute the 2 first `\textit` by `\textbf` in the control sequence `\myCS` which contains

`\textit{A}\textit{B}\textit{C}`

We expect: `ABC`

```latex
\begin{verbatim}
\expandarg
\def\myCS{\textit{A}\textit{B}\textit{C}}
\def\pattern{\textit{}}
\def\replace{\textbf{}}
\StrSubstitute[2]{\myCS}{\pattern}{\replace}
```

It is possible to avoid to define `\pattern` and `\replace`: a "snare" can be used. It can be a control sequence which expansion is empty, like the famous `\empty`. The code would have been:

`\StrSubstitute[2]{\myCS}{\empty\textit}{\empty\textbf}`

\(^{16}\)It is possible to make much more simple using `\tokenize`. The macro becomes:

`\newcommand\bracearg[1]{\tokenize[#1]{}}`
With this code, in both arguments, the first token \empty is expanded to "nothing" and the following significant tokens \textit and \textbf are left unchanged. By this way, \empty is a way to "hack" \expandarg: it allows to avoid the expansion of all the other tokens. The control sequence \noexpand can be used instead of \empty for the same result.

### 4.8.2 Exemple 2

Here, we try to write a macro which gobbles \textit{n} syntax units in a string from a given position, and assigns the result to a control sequence. Let’s call this macro \StringDel and let’s give it this syntax:

\begin{verbatim}
\StringDel{string}{position}{n}{\name_of_result}
\end{verbatim}

We can proceed like this: take the string before the position and save it. Then remove \textit{n + position} syntax units from the initial string, and add (concatenate) this result to the string previously saved. This gives the following code:

\begin{verbatim}
\newcommand\StringDel[4]{%
  \begin{group}
  \expandafter\StrLeft{\empty#1}{\numexpr#2-1}[\StrA]%
  \expandafter\StrGobbleLeft{\empty#1}{\numexpr#2+#3-1}[StrA]
  \expandafter\expandafter\expandafter\endgroup
  \expandafter\expandafter\expandafter\def\noexpand\expandafter\expandafter\expandafter#4
  \expandafter\expandafter\expandafter\{StrA\}%
  \expandafter\expandafter\expandafter\endgroup
  \expandafter\expandafter\expandafter\def
  \expandafter\expandafter\expandafter\{#4\StrA\}%
\end{verbatim}

To concatenate, the \LaTeX macro \g@addto@macro could have been used, leading to a lighter code without the huge bridge of \expandafter. The assignment\footnote{The macro \g@addto@macro can be used if the catcode of \texttt{`@'} is temporarily changed with \makeatletter and restored with \makeatother} can be written like this:

\begin{verbatim}
\expandafter\expandafter\expandafter\{#4\StrA\}
\end{verbatim}

### 4.8.3 Example 3

Let’s try to write a macro \tofrac that transforms an argument of this type "a/b" into "\frac{a}{b}".

First of all, let’s cancel the expansion of arguments with \noexpandarg, we do not need expansion here. Then, it’s easy to cut what is before and behind the first occurrence of "/" (assumed there is a single occurrence) and assign it to \num and \den and simply call the macro \frac:

\begin{verbatim}
\noexpandarg
\newcommand\tofrac[1]{%
  \StrBefore{#1}{}\num%
  \StrBehind{#1}{}\den%
  $\frac{\num}{\den}$%
}\end{verbatim}

\begin{verbatim}
\tofrac{15/9}
\tofrac{\textbf{u}_n+1/\textbf{u}_n}
\tofrac{\textbf{a}^m/\textbf{a}^n}
\tofrac{x/\sqrt{x}/\sqrt{x^2+x+1}}
\end{verbatim}

### 4.8.4 Example 4

Let’s try to write a macro \boldafter which writes in bold the first word that follows the word contained in the expansion of \texttt{word}.

\footnote{The macro \g@addto@macro can be used if the catcode of \texttt{`@'} is temporarily changed with \makeatletter and restored with \makeatother}
4.8.5 Example 5

How to reverse the order of the 2 first control sequences? For this, a macro \swaptwofirst does the job and displays the result. But this time, it is not possible to seek the token \ (catcode 0) with the macros of xstring. This is why the use of \scancs is necessary: after the detokenization of the argument, it becomes possible to search the char \ (catcode 12).
At line 5, a retokenization is done by \tokenize and \before and \after are swapped at this moment.

4.8.6 Example 6

In a string, we want to find the $n$th word between 2 given delimiters. For this, let’s write a macro \findword with an optional argument which content is the delimiter (space by default), 1 argument containing the string and an other argument containing the number $n$.

The macro \findword artfully uses \StrBetween and \numexpr:

That’s all, I hope you will find this package useful!
Please, send me an email if you find a bug or if you have any idea of improvement...

Christian Tellechea