

Inside a redefinition, it remains possible to access the former definition using the keyword `former`. In particular, the code

```
(tm-define (hello)
  (if (in-math?)
      (insert-go-to "hello()" '(6))
      (former)))
```

is equivalent to the second declaration in our example.

Contextual overloading generalizes traditional overloading on types of arguments, as in C++ and various other languages. On the one hand, it becomes possible to overload on the “context”, such as the cursor being inside a mathematical formula. On the other hand, you may use conditions that do not only take into account the types of function arguments, but also their values. For instance, consider a routine `my-replace` that replaces a tree `what` by another tree `by` in the current document. Then it is easy to add an optimization for the case when `what` and `by` coincide:

```
(tm-define (my-replace what by)
  default-implementation)

(tm-define (my-replace what by)
  (:require (= what by))
  (noop))
```

Besides `tm-define` and `tm-define-macro`, several other $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ extensions of SCHEME support the contextual overloading mechanism. For instance, `kbd-map` and `menu-bind` support overloading on mode.

14.4 Typesetting via SCHEME

The $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ stylesheet language is very convenient for the design of simple and moderately complex macros. Certain macros however may require rewritings that are easier to program in a full-fledged language like SCHEME. In this section, we give a few examples of how this can be done.

14.4.1 Hello world!

Let us start with the traditional “hello world” example. Using the $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ stylesheet language, one may implement a macro `hello` as follows:

```
<assign|hello|<macro|name|Hello name!>>
```

The same effect can be achieved using the following external SCHEME function:

```
(tm-define (ext-hello t)
  (:secure #t)
  '(concat "Hello " ,t "!"))
```

The `:secure` directive is added in order to indicate that the function can safely be used from within the stylesheet language: you don't want to destroy your hard disk merely by opening a $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ document. In order to use the function `ext-hello`, we still need to create a $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ macro `hello` that calls this function. This is done as follows:

```
<assign|hello|<macro|body|<extern|ext-hello|<quote-arg|body|>>>
<drd-props|hello|arity|1|accessible|all>
```

The `drd-props` command is used in order to specify useful properties of the `hello` macro: the macro takes one argument and “all” arguments are “accessible” in the sense that they can be edited from within $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ in the same way as usual macro arguments.

14.4.2 Integration into the editor

In order to play with the examples in this section, $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ includes a special SCHEME module that can be found in $\$ \text{T}_{\text{E}}\text{X}_{\text{MACS}}_{\text{PATH}}/\text{progs}/\text{utils}/\text{misc}/\text{extern-demo.scm}$ and a corresponding style package `extern-demo`. When selecting the style package using Document ▶ Style ▶ Add package ▶ Example ▶ `extern-demo`, the SCHEME module `extern-demo.scm` is loaded automatically; this is due to the following instruction at the start of the style package:

```
<use-module|(utils misc extern-demo)>
```

The header of the `extern-demo` style package also declares a variable `extern-demo-dtd` that can be used to conditionally define editing functions for this style package. First of all, we may introduce a new editing mode for the style package:

```
(texmacs-modes
  (in-extern-demo% (style-has? "extern-demo-dtd")))
```

The `%` suffix is reserved for mode declarations. The above declaration also defines the corresponding predicate `in-extern-demo?`. At a second stage, we may add a keyboard shortcut for the macro `hello` from the previous subsection:

```
(kbd-map
  (:mode in-extern-demo?)
  ("H i" (make 'hello)))
```

In a similar way, you may create personal style packages and SCHEME modules in the directories

```
$TEXMACS_HOME_PATH/packages
$TEXMACS_HOME_PATH/progs
```

We recall that `$TEXMACS_HOME_PATH` defaults to the `.TeXmacs` subdirectory of your home directory.

14.4.3 Highlighting subexpressions

Let us now consider a more useful example of how to extend the typesetter with functionality that is written in SCHEME. Assume that we wish to highlight all occurrences of a subexpression such as x inside a given mathematical formula. This might for instance be handy for laptop presentations.

We start with the SCHEME function `ext-highlight` that recursively traverses a given $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ tree `t` and marks all subtrees that are equal to `st`:

```
(tm-define (ext-highlight t st)
  (:secure #t)
  (cond ((tm-equal? t st) '(marked ,t)) ;; t = st
        ((tree-atomic? t) t) ;; t ≠ st and t is a leaf
        (else
         (let* ((m (lambda (u) (ext-highlight u st)))
                (l (map m (tree-children t))))
           (if (forall? tree? l) t
               '(', (tree-label t) ',@l))))))
```

The condition `(forall? tree? l)` checks whether all elements in the list `l` are $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ trees. It can recursively be verified that our routine returns the original tree `t` if and only if no hits were found. This property is important because it ensures that the highlighted tree remains accessible.

Next we add the following code to the corresponding stylesheet:

```
<assign|highlight|<macro|body|sub|<extern|ext-highlight|<quote-arg|body|
<quote-arg|sub|>>>
<drd-props|highlight|arity|2|accessible|0>
```

We consider `body` as the 0-th argument, so the `drd-props` command specifies that `body` is indeed accessible.

We may now use the routine to mark all variables x inside a formula:

$$\sin(x) + \frac{x-y}{\sqrt{x}}.$$

The implementation of `ext-highlight` actually contains a problem, since the x in the numerator $x-y$ did not get highlighted. Do you understand the reason behind this “bug”?^{14.1}

14.4.4 Circulant matrices

For our last example, we show how to create a macro with arguments $x_1, x_2, x_3, \dots, x_n$ that displays the corresponding circulant matrix

$$\begin{pmatrix} x_1 & x_2 & x_3 & \cdots & x_n \\ x_n & x_1 & x_2 & x_3 & \cdots \\ \cdots & x_n & x_1 & x_2 & x_3 \\ x_3 & \cdots & x_n & x_1 & x_2 \\ x_2 & x_3 & \cdots & x_n & x_1 \end{pmatrix}$$

The SCHEME code is as follows:

```
(tm-define ((circulant-row l) i)
  (let* ((n (length l))
        (h (sublist l (- n i) n))
        (t (sublist l 0 (- n i)))
        (m (append h t))
        (r (map (lambda (x) '(cell ,x)) m)))
    '(row ,@r)))

(tm-define (ext-circulant t)
  (:secure #t)
  (let* ((l (tree-children t))
        (n (length l))
        (m (map (circulant-row l) (.. 0 n))))
    '(matrix (table ,@m))))
```

The corresponding $\text{T}_{\text{EX}}\text{MACS}$ macro `circulant` with an arbitrary number of arguments is created using the `xmacro` primitive:

```
<assign|circulant|<xmacro|/|<extern|ext-circulant|<quote-arg|/|>>>
<drd-props|circulant|arity|<tuple|repeat|1|1|>|accessible|all>
```

When evaluating a circulant matrix such as `<circulant | a | b | c >`, we note that the argument `/` of `xmacro` contains `<circulant | a | b | c >` itself. The `drd-props` command specifies that a circulant matrix has $1 + 1 \cdot n$ accessible arguments for some $n \in \{0, 1, 2, \dots\}$.










14.1. Answer: this is due to the fact that x is a *substring* of $x + y$, but not a *subtree*. In order to correct the bug, we would need to add extra cases in the routine `ext-highlight` that also treat occurrences of `st` as a substring of `t`.


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