The pseudo Package

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Abstract

The pseudo package permits writing pseudocode without much fuss and with quite a bit of configurability. Its main environment combines aspects of `enumeration`, `tabbing` and `tabular` for nonintrusive line numbering, indentation and highlighting, and there is functionality for typesetting common syntactic elements such as keywords, identifiers and comments.

1 Introduction

The pseudo package lets you typeset pseudocode in a straightforward and not all too opinionated manner. You don't need to use separate commands for different constructs; the indentation level is controlled in a manner similar to in a `tabbing` environment:

1 **while** $a \neq b$
2 **if** $a > b$
3 $a = a - b$
4 **else** $b = b - a$
5 **return** a

```
\begin{pseudo}
    while $a \neq b$                    \\+
        if $a > b$                      \\+
            $a = a - b$                 \\-
        else $b = b - a$                \\-
    return $a$
\end{pseudo}
```

If you prefer having **end** at the end of blocks, or you'd rather wrap them in C-style braces, you just put those in. Fonts, numbering, indentation levels, etc., may be configured. You import pseudo with:

`\usepackage[`⟨*options*⟩`]{pseudo}`

The only option usable here at the moment is `kw` (used in the example above), as the `\usepackage` command is a bit too eager in expanding its arguments, but there are several options that may be provided to the `\pseudoset` command, to configure things (see section 3.2).

Alternatives

There are many ways of typesetting code and pseudocode in LaTeX, so if you're unhappy with pseudo, you have several alternatives to choose from. I wrote pseudo based on my needs and preferences, but yours may differ, of course. For example, I've built on tabular layouts to get (*i*) automatic width calculations; (*ii*) line/row highlighting; and (*iii*) easy embedding in tikz nodes and the like. I have also set things up inspired by existing mechanisms for numbering and indenting lines, and treat the pseudocode as a form of text, rather than as a form of markup in itself. The latter point means that I don't have separate commands for conditionals, loops, etc.

The basic style of pseudocode is inspired by the standard reference *Introduction to Algorithms* by Cormen et al. [1] (i.e., similar to that of newalg, clrscode and clrscode3e). Rather than locking down all aspects of pseudocode appearance, however, I've tried to make pseudo highly configurable, but if it's not flexible enough, or just not to your liking, you might want to have a look at the following packages:

> alg, algobox, algorithm2e, algorithmicx, algorithms, clrscode, clrscode3e, latex-pseudocode, newalg, program, pseudocode

There are also code-typesetting packages like listings and minted, of course.

2 Overview

The main component of the pseudo package is the `pseudo` environment, which is, in a sense, a hybrid of `enumerate`, `tabular` and `tabbing`, in that it provides numbered lines, each placed in a tabular row (for ease of highlighting and automatic column width calculation), with functionality for increasing and decreasing indentation similar to the `tabbing` commands `\+` and `\-` (in pseudo, combined with the row separator `\\`). Here, for example, is Euclid's algorithm for finding the gcd of a and b:

1 repeat the following while $a \neq b$
2 if $a > b$, let $a = a - b$
3 otherwise, let $b = b - a$

```
\begin{pseudo}
repeat the following while $a\neq b$            \\+
    if $a > b$, let $a = a - b$                 \\
    otherwise, let $b = b - a$
\end{pseudo}
```

Spacing is handled similarly to in LaTeX lists, with `\topsep` and `\parskip` added before and after, as well as `\partopsep` whenever the environment starts a new paragraph. The left margin (how much the pseudocode is indented wrt. the surrounding text) is set by the `left-margin` key (initially `0pt`).*

* If `pseudo` occurs in a box such as `fbox`, or a tikz node, this spacing is dropped. See also the `compact` key for overriding this behavior.

There are also some styling commands for special elements of the pseudocode:

while, FALSE, *rank*, "Hello!", EUCLID(a, b), *length*(A), (*Important!*)

```
\kw{while},          % or \pseudokw    -- keywords
\cn{false},          % or \pseudocn    -- constants
\id{rank},           % or \pseudoid    -- identifiers
\st{Hello!},         % or \pseudost    -- strings
\pr{Euclid}(a, b),   % or \pseudopr    -- procedures
\fn{length}(A),      % or \pseudofn    -- functions
\ct{Important!}      % or \pseudoct    -- comments
```

The longer names (`\pseudokw`, `\pseudocn`, etc.) are always available; the more convenient short forms (`\kw`, `\cn`, etc.) are prone to name collisions, and are only defined if the names are not already in use when pseudo is imported.

The `indent-length` option, which determines the length of each indentation step, is initially set via the secondary `indent-text` key, so that the any code after `\kw{else}` aligns with the indented text (a stylistic choice from clrscode3e):

1 **if** $x < y$
2 $\quad\quad x = x + 1$
3 **else** $x = x - 1$

```
\begin{pseudo}
\kw{if} $x < y$                                    \\+
    $x = x + 1$                                    \\-
\kw{else} $x = x - 1$
\end{pseudo}
```

If you want, you can certainly create shortcuts, e.g., `\def\While{\kw{while}}`, or using various declaration commands, such as `\DeclarePseudoKeyword` or `\DeclarePseudoConstant`. Procedures and functions capture parenthesized arguments and set them in math mode; this carries over in such shortcuts, so if you define `\Euclid` to mean `\pr{Euclid}`, then `\Euclid(a, b)` yields EUCLID(a, b).

These commands are not used in the internals of the package, so they may be freely redefined for different styling, such as `\let\id\textsf`. They generally do some extra work, though, such as wrapping the styled text in `\textnormal` to avoid having the styles blend, adding quotes (`\st`) and handling parenthesized arguments (`\pr`). To let you hook into their appearance without messing with their definitions, each command has a corresponding font command (`\kwfont`, `\cnfont`, `\idfont`, etc.), which you may redefine. These fonts may even be set using correspondingly named options, either with `\pseudoset` or via optional keyword arguments to the `pseudo` environment:*

Euclid's algorithm is initiated with the call Euclid(a, b).

* Because of LaTeX expansion behavior, they can *not* be set globally when importing pseudo.

```
\pseudoset{prfont=\textsf}
Euclid's algorithm is initiated with the call \pr{Euclid}(a, b).
```

You can also configure the quotes and comment markers:

1 **print** ‘*Hello, world!*’ // Greeting

```
\pseudoset{
    st-left=‘, st-right=’, stfont=\textit,
    ct-left=\texttt{/\!/}\,, ct-right=, ctfont=
}
\begin{pseudo}
\kw{print} \st{Hello, world!} \quad \ct{Greeting}
\end{pseudo}
```

Note that `\stfont` and friends may either be font-switching commands like `\itshape` or formatting commands like `\textit`, though the latter are generally preferable when available. They need not be restricted to actual fonts, but may include color commands, for example.

You can also set the font for the entire code lines, using the `font` option. The command you provide there should just switch the font (i.e., not take an argument to typeset); initially, `\kwfont` is such a command:

1 **while** $a \neq b$
2 **if** $a > b$
3 $a = a - b$
4 **else** $b = b - a$

```
\begin{pseudo}[font=\kwfont]
while $a \neq b$                                    \\+
    if $a > b$                                      \\+
        $a = a - b$                                 \\-
    else $b = b - a$
\end{pseudo}
```

Though not the default, this is in fact an intended configuration, to reduce the markup noise for pseudocode that consists primarily of keywords and mathematics. The setting `font = \kwfont` is also available by using the `kw` option (with no arguments), e.g., by importing the package with `\usepackage[kw]{pseudo}`. If you need to typeset normal text in your pseudocode after using `font`, you can use `\textnormal` or `\normalfont`, for which `pseudo` defines aliases `\tn` and `\nf`:

1 **for** each node $v \in V$
2 do something
3 **for** each edge $e \in E$
4 do something else

```
\begin{pseudo}[kw]
for \tn{each node} $v\in V$                    \\+
    \tn{do something}                          \\-
for \nf each edge $e \in E$                    \\+
    \nf do something else
\end{pseudo}
```

The row separator may have multiple pluses or (more commonly) multiple minuses appended, indicating multiple increments or decrements to the indentation level:

1 **for** $k = 1$ **to** n
2 **for** $i = 1$ **to** n
3 **for** $j = 1$ **to** n
4 $t_{ij} = t_{ij} \lor (t_{ik} \land t_{kj})$
5 **return** t

```
\begin{pseudo}[kw]
for $k = 1$ to $n$                             \\+
for $i = 1$ to $n$                             \\+
for $j = 1$ to $n$                             \\+
$t_{ij} = t_{ij} \lor (t_{ik} \land t_{kj})$   \\---
return $t$
\end{pseudo}
```

The code is normally typeset in a two-column `tabular` (whose preamble, and thus number of columns, is configurable via the option `preamble`), but the first column is handled by an automatic `prefix` inserted before each line, containing the numbering and column separator (`&`). You disable the prefix for the following line by using `\\*`:

1 this line has an automatic prefix
this line does not
2 but this one does

```
\begin{pseudo}
  this line has an automatic prefix            \\+*
& this line does not                           \\+
  but this one does
\end{pseudo}
```

This star also works after `\begin{pseudo}`. Note that in order to prevent your code from ending up in the numbering column, you must insert a column separator manually. A version of the `\pr` command, called `\hd` (or `\pseudohd`, where `\hd` stands for *header*) instead wraps a procedure call in a `multicolumn`, so it can be used, for example, as an unnumbered header line:

EUCLID(a, b)
1 **if** $b == 0$
2 **return** a
3 **else return** EUCLID$(b, a \bmod b)$

```
\begin{pseudo}[kw]*
\hd{Euclid}(a, b)                                   \\
if $b \== 0$                                        \\+
    return $a$                                      \\-
    else return \pr{Euclid}(b, a \bmod b)
\end{pseudo}
```

As can be seen in this example, `\==` (or `\eqs`) is a notational convenience defined by pseudo, along with interval dots `\..` (or `\dts`). Other special symbols may be found in other packages. For example, if you want to use $:=$ for assignment, you can use `\coloneqq` from mathtools (perhaps with `\let\gets\coloneqq`).*

As can be seen, one use of `\\*` is to get an unnumbered line, but you could also insert custom material in the first column. The lines are numbered by the counter `pseudoline`, so you could, for example, do:

A Look!
B We're using letters!

```
\begin{pseudo}*
\stepcounter{pseudoline}\Alph{pseudoline} & Look! \\*
\stepcounter{pseudoline}\Alph{pseudoline} & We're using letters!
\end{pseudo}
```

This is a bit cumbersome, so there are some shortcuts. First of all, rather than replacing the entire `prefix`, you can replace only a *part* of it, namely the `label`, retaining counter increments and column separators. You can set this key for each line individually with an optional argument to the row separator, i.e., `\\[label =` ⟨*commands*⟩`]`, or at some higher level. Within the `pseudo` environment, there is also a counter named `*` that is simply a local clone of `pseudoline`, letting you use starred versions of counter commands, similarly to how label definitions work in enumitem:†

1: Look!
2: We're using something custom!

```
\pseudoset{label=\small\arabic*:}
\begin{pseudo}
Look! \\
We're using something custom! \label{custom-line}
\end{pseudo}
```

* Tip: If you want to use a left-arrow for assignment, but think it's a bit large in Computer Modern or Latin Modern, you can use the old-arrows package, so `x \gets y` yields $x \leftarrow y$.
† Also like in enumitem, there's a `start` key for setting the first line number.

Note that if I refer to the labeled line with `\ref`, I'll just end up with 2, which is probably what I'd want in this case. If you want a custom reference format as well, you can set that with the `ref` key, in the same way as with `label`. If you use the key without arguments, it'll use the same format as the one provided to `label`:

(*i*) Look!
(*ii*) We're using Roman numerals!
(*iii*) And here's a reference to line (*ii*).

```
\pseudoset{label=(\textit{\roman*}), label-align=l, ref}
\begin{pseudo}
Look! \\
We're using Roman numerals! \label{roman-line} \\
And here's a reference to line \ref{roman-line}.
\end{pseudo}
```

The `label-align` key sets the alignment of the label column, and can be `l`, `r` or `c` (or really any other column type compatible with the array package; you could use a `p{...}` column to get fixed width, for example).

Highlighting can also be done in a similar manner, by, e.g., inserting a `\rowcolor` at the start of the first column. Rather than doing this manually, you could use the `bol` key, which inserts a command at the beginning of the line—or the `hl` key, which is equivalent to `bol-prepend = \pseudohl`:

I'm not highlighted
But I am!

```
\begin{pseudo*}
I'm not highlighted \\[hl]
But I am!
\end{pseudo*}
```

Initially, the `\pseudohl` command that is inserted is simply a `\rowcolor` that uses `hl-color`, but you're free to redefine this command to whatever you'd like.

In the previous example, there is no spacing to the sides of the table contents. This is normally what you'd want, for example, to keep the pseudocode aligned with the surrounding text. However, when using row highlighting (e.g., because you are stepping through the code in some presentation), that alignment may be less of an issue—and you'd rather widen the highlight a bit. The horizontal padding on each side is controlled by the `hpad` key. You can either specify a length, or just turn on the default, by not supplying an argument. There's a similar option, `hsep`, which controls the separation between the two columns.

1 let's
2 use
3 some
4 padding!

```
\begin{pseudo}[hpad, hsep=1em, indent-length=1em]
    let's                                       \\+
        use                                     \\-
    some                                        \\+ [hl]
        padding!
\end{pseudo}
```

For ease of use with beamer, the various pseudo options support beamer overlay specifications. For example, using `hl<1>` means that the `hl` specification would only take effect on slide 1. If you use such an overlay specification on a key when *not* using beamer, the key is simply ignored.

What is more, the row separator *itself* takes an overlay specification as a shortcut for the one on `hl`, so `\\<1,2-4>` is equivalent to `\\[hl<1,2-4>]`. Just like with the optional arguments, space before the overlay specification is ignored, so you're free to put the specification in front of the line in question:

1 Go to line 3	1 Go to line 3	1 Go to line 3	1 Go to line 3
2 Go to line 4	2 Go to line 4	2 Go to line 4	2 Go to line 4
3 Go to line 2	3 Go to line 2	3 Go to line 2	3 Go to line 2
4 Go to line 1	4 Go to line 1	4 Go to line 1	4 Go to line 1

```
% In a beamer presentation
\begin{pseudo}
    <1>  Go to line 3                           \\
    <3>  Go to line 4                           \\
    <2>  Go to line 2                           \\
    <4>  Go to line 1                           \\
\end{pseudo}
```

You might have expected these overlay specifications to indicate *visibility*, as they do for the `\item` command in `\enumerate`, for example. However, in stepwise animations, highlighting patterns (showing which line is currently executed, for example) tend to be more complex than, say, a gradual uncovering—and therefore in greater need of abbreviation.

To control visibility, you could, for example, add `\pause` at the end of each line, before the row separator. You can also do this using the `eol` key, either per line or at the top level, with `eol = \pause`. There is even the shortcut key `pause` for this specific purpose (equivalent to `eol-append = \pause`):

1 Eeny	1 Eeny	1 Eeny	1 Eeny
2 Meeny	2 Meeny	2 Meeny	2 Meeny
3 Miny	3 Miny	3 Miny	3 Miny
4 Moe	4 Moe	4 Moe	4 Moe

```
% In a beamer presentation
\setbeamercovered{transparent}
\begin{pseudo}[pause]
    Eeny                                    \\
    Meeny                                   \\
    Miny                                    \\
    Moe                                     \\
\end{pseudo}
```

The `eol` value is only inserted wherever `\\` starts a new line (i.e., not at the end of the environment), so in this case only three `\pause` commands are inserted.

The previously discussed configuration keys are described in more detail in section 3. You can create your own presets or *styles* using `\pseudodefinestyle`. This command takes two arguments; the first is the name of a key, and the second is a key–value list, as you would have supplied it to `\pseudoset`. This is exactly how the `starred` style is defined (see page 58), clearing the prefix and reducing the preamble to a single column. This style is what's used in the starred, unnumbered version of the `pseudo` environment:

while $a \neq b$
    if $a > b$
        $a = a - b$
    else $b = b - a$
return a

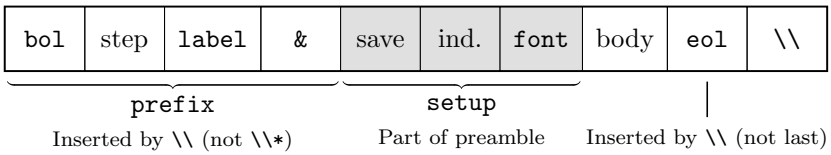
```
\begin{pseudo*}
    while $a \neq b$                        \\+
        if $a > b$                          \\+
            $a = a - b$                     \\-
        else $b = b - a$                    \\-
    return $a$
\end{pseudo*}
```

3 Reference

This section gives an overview of all the moving parts of the package. A *default* value is one used implicitly if the key is specified with no explicit value given, while an *initial* value is one provided to the key at the point where pseudo is imported. Several commands (such as, e.g., `\pseudoprefix`) may be modified using corresponding keys (e.g., `prefix`). When the behavior of such commands is described, the description references their initial behavior.

3.1 Line structure

Each line of a `pseudo` environment is (initially) structured as follows:



The components in the `prefix` are populated by the `\\` command (or the beginning of the environment), the ones in the `setup` by the `preamble`, and the actual body is supplied by the user, inside the environment, terminated by the row separator `\\` (which then goes on to populate the next row, and so on). The `eol` part is also inserted by `\\`, except if it's used after the last line (where it doesn't really do anything).* The following describes the default behavior, which can be modified substantially by setting the appropriate options (e.g., `prefix` and `setup`).

`bol` This field is inserted by `\\` (and `\begin{pseudo}`) at the beginning of the following line, using the `\pseudobol` command. Because it's a the very beginning of the tabular row, it may be used for things like `\rowcolor` when highlighting lines (as with the `hl` key).

step This refers to a call to `\stepcounter*` (where `*` is an alias for `pseudoline`), getting the counter ready for the label itself. Note that this does *not* use `\refstepcounter`, so at this point the counter has not been saved yet (and so you should not use `\label` to refer to it at this point).

`label` This is where the numbering label is inserted, using `\pseudolabel`; initially, this inserts `\arabic*`.

`&` At the end of the prefix is the column separator, closing the label column and beginning the code line column.

save Now that we're in the column where the user will normally insert text and code, we save `pseudoline` so it may be used with `\label` and `\ref`, etc. This is done using `\pseudosavelabel`, which first *decrements* the counter (to undo the increment before the label) and then calls `\refstepcounter`.

ind. Inserts the appropriate amount of indentation (with an indent step length set by `indent-length` or `indent-text` and the indentation level set by `+/-` flags or `indent-level`), using `\pseudoindent`.

`font` Inserts the base font, using `\pseudofont`.

body This is where the manually written body of the code line appears.

`eol` Inserted by the terminating `\\` (using `\pseudoeol`), unless we're at the end of the environment. Useful, e.g., for taking actions such as a beamer `\pause` (cf., `pause`) between the lines.†

`\\` The row/line separator. Ends one line (inserting `eol`) and begins another (inserting `prefix`). As in tabulars in general, this command is also permitted after the final line of the environment, but there it does no real work (i.e., it does not insert `eol` and does not start a new line).

* Thus, `eol` acts more as a line *separator* than a line *terminator*.

† If the same action must be taken after the last line, you can simply insert it there manually.

3.2 Command and key reference

In addition to descriptions of the various commands and options/keys (in alphabetical order), you'll find definitions of a couple of counters here (`*` and `pseudoline`).

`*`

This counter is a duplicate of `pseudoline`, available inside `pseudo`. It makes it possible to simplify calls such as `\arabic{pseudoline}` to starred forms such as `\arabic*`, like in `enumitem`. These short forms are available (and intended) for use in `label` and `ref`.

`\..`

This is a shortcut that hijacks the normal `\.` accent command, so that if it is called with `.` as an argument, the result is `\dts`. In other words, the command `\..` is really the call `\.{.}`. For any other arguments, the original `\.` is used, so while `$1\..n$` produces $1 \mathinner{..} n$, `\.o` still yields ȯ.

`\==`

This is a shortcut that hijacks the normal `\=` accent command, so that if it is called with `=` as an argument, the result is `\eqs`. In other words, the command `\==` is really the call `\={=}`. For any other arguments, the original `\=` is used, so while `$x\==y$` produces $x == y$, `\=o` still yields ō.
In some contexts, this may not work because `\=` has reverted to its original meaning (as is currently the case if you try to use it within a custom float, as in section 4.7, or a standard one such as `figure`). In this case, you can restore the `pseudo` meaning (and the `\==` shortcut) by using `\pseudoeq`. In some cases, you may want to just use `\eqs` instead.

`\\+-*<`⟨*overlay specification*⟩`>[`⟨*line options*⟩`]`

This row separator is the workhorse of the `pseudo` package. Just as in a `tabular` environment, it signals the end of a line. It is optional after the list line, where it doesn't do any work. The command may be followed by a series of one or more plus (`+`) signs, each of which will increment the indentation level before starting a new line; similarly, it may be followed by one or more minus (`-`) signs, each of which will decrement the indentation level. Normally, the command will insert a `prefix` at the beginning of the new line; if the star (`*`) flag is used, this prefix is not inserted.

The optional overlay specifications refer to the `hl` key, so `\\<3>` is equivalent to `\\[hl<3>]`. This applies to the following line, as do other options set explicitly as optional arguments. Note that options are set locally, *before* the new line (and a new scope) is started, so unless they are handled specifically (in order to carry over), they will have no effect. Thus, even though all options are available here, not all make sense. (Consult individual option keys for intended use.)

The pluses and minuses are conceptually part of the command name, and there should be no whitespace before the star (`*`). You are, however, free to insert whitespace before the overlay specification and the line options. This means that you may, for example, place the overlay specification at the beginning of the following line in the source.

`\arabic*`

See `*`.

`begin-tabular` = ⟨*commands*⟩ (no default)

The actual command for beginning the `tabular` or `tabular`-like environment used by `pseudo`. Normally not needed, as the `tabular` behavior may be modified by other keys, but could be used to use some other tabular environment, e.g., from packages such as tabularx or longtable.

`bol` = ⟨*commands*⟩ (no default, initially empty)

Used to set `\pseudobol`, which is inserted at the beginning of each line. See also `bol-append` and `bol-prepend`.

`bol-append` = ⟨*commands*⟩ (no default)

Locally appends ⟨*commands*⟩ to `bol`.

`bol-prepend` = ⟨*commands*⟩ (no default)

Similar to `bol-append`, except that ⟨*commands*⟩ are added to the *beginning* of `bol`.

`\cn{`⟨*name*⟩`}`

Indicates a constant (such as TRUE or NIL). First wraps the argument in `\textnormal` and then uses `\cnfont`. See also `\DeclarePseudoConstant`. This is a convenience for typesetting constants, and you may freely redefine it to whatever you prefer. If some package defines `\cn` before pseudo is loaded, pseudo will not overwrite it. The command will still be available, as `\pseudocn`.

`cnfont` = ⟨*command*⟩ (no default, initially `\textsc`)

Used to set `\cnfont`, which is used as part of `\cn`. May be set to take a single argument or none. Not restricted to actual font commands; you may also mix in `\textcolor` or the like.

`\cnfont`

The command set by the `cnfont` option. Used as part of `\cn`.

`compact` = ⟨*boolean*⟩ (default `true`, initially `false`)

The `pseudo` environment emulates the built-in LaTeX lists when it comes to spacing above and below, in normal text. If the environment is part of an ongoing paragraph, paragraphs will be inserted above and below, along with whitespace specified by `topsep` and `parskip`. If the environment begins a paragraph of its own, additional whitespace is added, as specified by `partopsep`. It is also possible to specify space to insert to the left of the environment, using `left-margin`.

However, these spacing commands don't work well inside `\mbox`, `\fbox`, etc. To avoid getting into trouble, pseudo determines that the environment should be *compact*, and drop this surrounding space, if we're in inner horizontal mode at the beginning of the environment.

```
1  if we're in a node
2      there's no added space
```

```
% In preamble:
% \usepackage{tikz}
\begin{tikzpicture}
    \draw (0,0) node [draw] {%
        \begin{pseudo}
            if we're in a node \\+
                there's no added space
        \end{pseudo}};
\end{tikzpicture}
```

This may not be enough, however. For example, if you're using standalone to produce individual pseudocode images, this compactness will *not* be triggered automatically. In such cases, you can override the behavior using the `compact` key, manually specifying whether you want the pseudocode to be compact or not.

`\ct{`⟨*text*⟩`}`

Indicates that ⟨*text*⟩ is a comment, (*typeset like this*). You can customize the comment appearance using `ctfont`, `ct-left` and `ct-right`:

```
1  y = 1
2  x = 2     /* this is a comment */
3  z = 345     /* this is another comment */
```

```
\pseudoset{
    ctfont=\color{black!75},
    ct-left=\unskip\qquad\texttt{/* },
    ct-right=\texttt{ */}
}
\begin{pseudo}
    $y=1$ \\
    $x=2$ \ct{this is a comment} \\
    $z=345$ \ct{this is another comment}
\end{pseudo}
```

An alternative to using `\ct` is to simply set comments in a separate column, as demonstrated in section 4.4. Or even without a separate column, if you use a `tabularx` as described there, and set the tabular width explicitly, you could insert an `\hfill` into `ct-right` and get all end-markers aligned at the right-hand side:

```
1  x = 1
2  y = 2     /* this is a comment                                  */
3  z = 345     /* this is another comment                          */
```

Or if you'd rather have the comments right-aligned (like you can in, e.g., algorithm2e), you could use insert the `\hfill` at the beginning of the `ct-left`:

1 $x = 1$
2 $y = 2$ `/*` this is a comment `*/`
3 $z = 345$ `/*` this is another comment `*/`

`ct-left` = ⟨*text*⟩ (no default, initially `()`)

Text or commands inserted at the start of a comment, when using `\ct`.

`ct-right` = ⟨*text*⟩ (no default, initially `)`)

Text or commands inserted at the end of a comment, when using `\ct`.

`ctfont` (no default, initially `\textit`)

The font of the main text of a comment, when using `\ct`.

`\ctfont`

The command set by the `ctfont` option. Used as part of `\ct`.

`\DeclarePseudoComment{`⟨*shortcut*⟩`}{`⟨*comment*⟩`}`

Used to declare a macro that expands to a comment. For example:

$x = y$ (*Important!*)

```
\DeclarePseudoComment \Imp {Important!}
$x = y$ \qquad \Imp
```

See also `\ct`. (Note that `\pseudoct` is used internally here.)

`\DeclarePseudoConstant{`⟨*shortcut*⟩`}{`⟨*constant*⟩`}`

Used to declare a macro that expands to a constant. For example:

FALSE

```
\DeclarePseudoConstant \False {false}
\False
```

See also `\cn`. (Note that `\pseudocn` is used internally here.)

`\DeclarePseudoFunction{`⟨*shortcut*⟩`}{`⟨*function*⟩`}`

Used to declare a macro that expands to a function. For example:

length(A) or *length*$[A]$

```
\DeclarePseudoFunction \Ln {length}
\Ln(A) or \Ln[A]
```

See also `\fn`. (Note that `\pseudofn` is used internally here.)

\DeclarePseudoIdentifier{⟨*shortcut*⟩}{⟨*identifier*⟩}

Used to declare a macro that expands to a identifier. For example:

rank

```
\DeclarePseudoIdentifier \Rank {rank}
\Rank
```

See also \id. (Note that \pseudoid is used internally here.)

\DeclarePseudoKeyword{⟨*shortcut*⟩}{⟨*keyword*⟩}

Used to declare a macro that expands to a keyword. For example:

while

```
\DeclarePseudoKeyword \While {while}
\While
```

See also \kw. (Note that \pseudokw is used internally here.)

\DeclarePseudoNormal{⟨*shortcut*⟩}{⟨*text*⟩}

Used to declare a macro that expands to normal text. For example:

if x == NIL
    halt with an error message

```
\DeclarePseudoNormal \Error {halt with an error message}
\begin{pseudo*}[kw]
    if $x \== \cn{nil}$ \\+
        \Error
\end{pseudo*}
```

See also \tn. (Note that \pseudotn is used internally here.)

\DeclarePseudoProcedure{⟨*shortcut*⟩}{⟨*procedure*⟩}

Used to declare a macro that expands to a procedure. For example:

EUCLID(a, b)

```
\DeclarePseudoProcedure \Euclid {Euclid}
\Euclid(a, b)
```

See also \pr. (Note that \pseudopr is used internally here.)

\DeclarePseudoString{⟨*shortcut*⟩}{⟨*string*⟩}

Used to declare a macro that expands to a string. For example:

"Hello!"

```
\DeclarePseudoString \Hello {Hello!}
\Hello
```

See also `\st`. (Note that `\pseudost` is used internally here.)

`dim`

Dims the following line. Equivalent to:

```
\pseudodefinestyle{dim}{
    bol-append   = \color{\pseudodimcolor},
    setup-append = \color{\pseudodimcolor}
}
```

May be used to dim out inactive or currently less relevant lines (possibly using overlays; see page 8).

GNOME-SORT(A)
1 $i = 1$
2 **while** $i \leq length[A]$
3 **if** $i == 1$ **or** $A[i] \geq A[i-1]$
4 $i = i + 1$
5 **else** swap $A[i]$ and $A[i-1]$
6 $i = i - 1$

```
\begin{pseudo}[kw, dim-color=black!25]*
\hd{Gnome-Sort}(A)                              \\
[dim]  $i = 1$                                  \\
[dim]  while $i \leq \fn{length}[A]$            \\+
           if $i \== 1$ or $A[i] \geq A[i-1]$   \\+
               $i = i + 1$                      \\-
[dim]      else \nf swap $A[i]$ and $A[i-1]$    \\+
[dim]           $i = i - 1$
\end{pseudo}
```

See also `bol-append`, `setup-append` and `dim-color`.

`dim-color` = ⟨*color*⟩ (no default, initially `\pseudohlcolor`)

Sets the color used by `dim` (available as `\pseudodimcolor`). The initial value is the one set by `hl-color`.

`\dts`

A two-dot ellipsis, for use in the Wirth interval notation $1\,..\,n$, typeset as Graham, Knuth, and Patashnik did in *Concrete Mathematics* [2]. Its definition is the same as in `gkpmac`. Also accessible via the `\..` shortcut.

`end-tabular` (no default, initially `\end{tabular}`)

The actual command for ending the `tabular` or `tabular`-like environment used by `pseudo`. (See `begin-tabular`.)

`eol` = ⟨*commands*⟩ (no default, initially empty)

Sets `\pseudoeol`, which is inserted at the end of all but the last line by `\\`. See also `eol-append` and `eol-prepend`.

`eol-append` = ⟨*commands*⟩ (no default)

Locally appends ⟨*commands*⟩ to `eol`.

`eol-prepend` = ⟨*commands*⟩ (no default)

Similar to `eol-append`, except that ⟨*commands*⟩ are added to the *beginning* of `eol`.

`\eqs`

Two equality signs typeset together as a binary relation, as in $x == y$ (as opposed to the wider $x == y$, resulting from `$x == y$`). It emulates the stix symbol `\eqeq`, but for use with Computer Modern (the default LaTeX font) or Latin Modern (available via the lmodern package). It should work just fine with other fonts. Also accessible via the `\==` shortcut, and configurable via `eqs-pad`, `eqs-scale` and `eqs-sep`.

`eqs-pad` = ⟨*length*⟩ (no default, initially `0.28mu`)

The amount of space inserted on each side of `\eqs`.

`eqs-scale` = ⟨*number*⟩ (no default, initially `0.6785`)

The amount of horizontal scaling applied to the `=` signs in `\eqs`.

`eqs-sep` = ⟨*length*⟩ (no default, initially `0.63mu`)

The amount of space inserted between the two `=` signs in `\eqs`.

`\fn{`⟨*name*⟩`}(`⟨*arguments*⟩`)`

Indicates a function name, such as *length*, and is initially more or less an alias for `\id`. The optional arguments (given in parentheses) are typeset in math mode, so `\fn{length}(A)` yields *length*(A). Sometimes square brackets are used with functions that are meant to indicate array lookups or some property access or the like. This works in the same manner, so `\fn{length}[A]` yields *length*$[A]$. This behavior of picking up arguments carries over if you define a shortcut, of course:

We're not in math mode, but the argument of *length*$[A]$ is.

```
\def\Ln{\fn{length}}
We're not in math mode, but the argument of \Ln[A] is.
```

See also `\DeclarePseudoFunction`. This is a convenience for typesetting function names, and you may freely redefine it to whatever you prefer. If some package defines `\fn` before pseudo is loaded, pseudo will not overwrite it. The command will still be available, as `\pseudofn`.

`fnfont` = ⟨*font*⟩ (no default, initially `\idfont`)

Used to set `\fnfont`, which is used as part of `\fn`. May be set to take a single argument or none. Not restricted to actual font commands; you may also mix in `\textcolor` or the like.

`\fnfont`

The command set by the `fnfont` option. Used as part of `\fn`.

`font` = ⟨*command*⟩ (no default, initially `\normalfont`)

Sets the base font used in the code lines. Initially, this is just `\normalfont`, but the `kw` switch is a convenient way to set it to the keyword font `\kwfont`. This is presumed to be a common case, under the assumption that most of the pseudocode will consist of either keywords or mathematics. If you'd rather explicitly mark up your keywords, leaving `font` as it is, you could use `\kw` (or `\DeclarePseudoKeyword` for common cases):

while pigs don't fly
    keep waiting

```
\begin{pseudo*}
\kw{while} pigs don't fly                    \\+
    keep waiting
\end{pseudo*}
```

`\hd{`⟨*name*⟩`}(`⟨*arguments*⟩`)`

Typesets a procedure signature, like `\pr`, but is intended for use as a *header* for a procedure, rather than a procedure call. The difference is that `\hd` wraps its contents in a `\multicolumn`, spanning two columns (i.e., both the label column and the main code column, but not any additional columns added using `preamble` or `begin-tabular`), using the preamble set with `hd-preamble`. For this to work, you need to use the star flag (`*`) to suppress the automatic insertion of the `prefix`:

ALGORITHM(x, y, z)
1 setup
2 **while** condition
3 iterative step
4 **return** result

```
\begin{pseudo}*
    \hd{Algorithm}(x, y, z)                  \\
    setup                                    \\
    \kw{while} condition                     \\+
        iterative step                       \\-
    \kw{return} result
\end{pseudo}
```

Note that the arguments are mandatory; in order to function properly, `\hd` must be *expandable*, and therefore cannot end with an optional argument, the way `\pr` does. If some package defines `\pr` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\pseudopr`.

`hd-preamble` = ⟨*columns*⟩ (no default)

Sets the preamble used by `\hd`. Initially, a single left-aligned column with `\pseudohpad` on either side (see page 50). If you introduce more columns in `preamble`, you might want to increase the number of columns in `hd-preamble` as well, or at least remove the right-hand `\pseudohpad`.

`hl` (takes no value)

Prepends `\pseudohl` to `bol`. Normally used with `beamer` (see page 8).

`hl-color` = ⟨*color*⟩ (no default, initially `black!12`)

Sets the color used by `\pseudohl` (available as `\pseudohlcolor`).

`hpad` = ⟨*length*⟩ (default `0.3em`, initially `0em`)

Horizontal padding on either side of the pseudocode. Useful, among other things when highlighting lines, to have some of the highlighting (i.e., row color) protrude beyond the text.

`hsep` = ⟨*length*⟩ (no default, initially `0.75em`)

The space between the line labels and the code lines, i.e., between the two columns of numbered `pseudo` environments.

`\id{`⟨*name*⟩`}`

Indicates an identifier, and is simply an alias for `\textit` wrapped in `\textnormal`. See also `\DeclarePseudoIdentifier`. This is a convenience for typesetting identifiers, and you may freely redefine it to whatever you prefer. If some package defines `\id` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\pseudoid`.

It might seem more natural to use `\mathit` (without `\tn`), but that may not give the desired results. First of all, special characters will not behave as if they're parts of a name:

foo − *bar* : *baz*

```
$\mathit{foo-bar:baz}$
```

This may be remedied, e.g., by using the (internal) command `\newmcodes@` from `amsopn`, but the kerning, spacing and font application in the result still leaves something to be desired:

foo-*bar*: *baz*

```
$\mathit{\newmcodes@ foo-bar:baz}$
```

Compare this to a simple `\textit`:

foo-bar:baz

```
$\textit{foo-bar:baz}$
```

The decision to use `\textit` means that you can't use, say, subscripts or the like as pars of an identifier, or mix in greek letters or other mathematical symbols. Though you can still easily typeset things like *foo-*α, you'll have to mix in the math mode more explicitly (in this case, `$\id{foo-$\alpha$}$`). If some package defines `\id` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\pseudoid`.

`idfont` = ⟨*font*⟩ (no default, initially `\textit`)

Used to set `\idfont`, which is used as part of `\id`. May be set to take a single argument or none. Not restricted to actual font commands; you may also mix in `\textcolor` or the like.

`\idfont`

The command set by the `idfont` option. Used as part of `\id`.

`indent-length` = ⟨*length*⟩ (no default, initially empty)

How large each indentation step is. If this key is not specified, `indent-text` is used to calculate one the indent length instead.

`indent-level` = ⟨*length*⟩ (no default, initially `0`)

Sets the current indentation level. This is most usefully set on `pseudo` environment, in concert with `start`:*

1 this is
2 the first part

This is some text interrupting the code.

3 this is the
4 second part

* The `\strut` here is just to even out spacing above and below the text, which doesn't have fixed-height lines like the pseudocode.

```
\begin{pseudo}
    this is                                          \\+
    the first part
\end{pseudo}

\medskip \strut
This is some text interrupting the code.
\medskip

\begin{pseudo}[start=3, indent-level=1]
    this is the                                      \\-
    second part
\end{pseudo}
```

`indent-text` = ⟨*text*⟩ (no default, initially `\pseudofont\kw{else}\␣`)

The size of each indentation step is set to the width of the ⟨*text*⟩. The default is set up so that code following on the same line as **else** will be properly aligned, as in:

if condition
    something
else something else

If you're not going to put code on the same line as **else**, for example, you might want a different indentation size. To set it to some specific length, you could use the `indent-length` key.

`kw` (takes no value)

Sets `font` to `\kwfont`.

`\kw{`⟨*name*⟩`}`

Indicates a keyword. First wraps the argument in `\textnormal` and then adds `\kwfont`. See also `\DeclarePseudoKeyword`. This is a convenience for typesetting keywords, and you may freely redefine it to whatever you prefer. If some package defines `\kw` before pseudo is loaded, pseudo will not overwrite it. The command will still be available, as `\pseudokw`.

`kwfont` = ⟨*font*⟩ (no default, initially `\fontseries{b}\selectfont`)

Used to set `\kwfont`, which is used as part of `\kw`. May be set to take a single argument or none. Not restricted to actual font commands; you may also mix in `\textcolor` or the like. Note, however, that with the `kw` switch, you set `font = \kwfont`, which is then applied as a font-switching command for each entire line, taking no argument. If you provide an command requiring an argument, the `\kw` command will still work, but the `kw` switch won't:

foo bar

vs.

foo bar

```
\pseudoset{kw}
\begin{pseudo*}[kwfont=\textsf]    % breaks kw option
    foo \kw{bar}
\end{pseudo*}
vs.\
\begin{pseudo*}[kwfont=\sffamily]  % works with kw option
    foo \kw{bar}
\end{pseudo*}
```

The initial value isn't *quite* as straightforward as indicated, however. For more info, see `\kwfont`.

`\kwfont`

The command set by the `kwfont` option. Used as part of `\kw`. Its initial definition is *essentially* `\fontseries{b}\selectfont`, except the first time it's called (normally when evaluating the initial value of `indent-text`), it also runs a check to see if the font selection *worked*, as in some cases (such as in a default beamer presentation), the non-extended bold may not be available. In that case, it defaults to an extended bold (`\bfseries`) instead. At this point, the command is redefined to `\fontseries{b}\selectfont` or `\bfseries`, as appropriate (i.e., without this check). So, while `\kw{hello}` produces the non-extended **hello** in a default LaTeX document, it yields the extended **hello** in a default beamer presentation. Perhaps more clearly, this is the result in plain LaTeX (using lmodern):

while
while
while

```
\textbf{while}\\                    % Extended
\kw{while}\\                        % Keyword
{\fontseries{b}\selectfont while} % Non-extended
```

The same code results in the the following in beamer:

while
while
while

You'll also get a font warning,* though only once, as it's suppressed after the first occurrence, so the fact that the font selection doesn't work on the last line isn't reported. Note, however, that the current implementation

* Of course, if you use a different font or theme, e.g., with the beamer command `\usefonttheme{serif}`, you may not have any issues to begin with.

of `\kwfont` actually *piggybacks* on this warning to determine if the non-extended bold is available. This means that if you've tried (and failed) to use `\fontseries{b}` *before* the fist use of `\kwfont`, the fallback (i.e., extended bold) won't be triggered.

Also note that `indent-text` (which will tend to be the first occurrence use of `\kwfont`) won't be evaluated (to determine `indent-length`) until you actually start a `pseudo` environment, so if you're *aware* that you don't have non-extended bold available, and you set `kwfont = \bfseries`, for example, there will be no attempt to use the non-extended version, and you won't get the font warning that the default implementation produces in that case.

`label` = ⟨*commands*⟩ (no default, initially `\arabic*`)

1: **print** "Hello, label!"
2: **goto** 1

```
\pseudoset{kw, label=\footnotesize\arabic*:}

\begin{pseudo}
print \st{Hello, label!} \label{li:label} \\
goto \tn{\ref{li:label}}
\end{pseudo}
```

Note that `\label` should be used in the actual code line, as here, and not in the number cell (which is generally not explicitly written, anyway).

As kan be seen from the example, `\ref` is unaffected by `label`, and in many cases that's what you want—as apposed to, say, "**goto** 1:". In some cases, however (especially when using one of the other formatting commands, such as `\alph` or `\roman`), you *do* want the reference format to reflect the original, or be similar in some way. To do that, you use the `ref` key.

`label-align` = ⟨*column*⟩ (no default, initially `r`)

Used to specify the alignment of the `label` of each line. Whatever is provided is stored as a column type (named `\pseudolabelalign`), which is a part of the default `preamble`. In other words, beyond the basic `l` and `r` (for left- and right-justified), you can supply anything that would be valid as part of the preamble (possibly using functionality from the `array` package). If you want to get creative here, though, it might be easier to get the results you want by specifying your own `preamble` in full.

`left-margin` = ⟨*length*⟩ (no default, initially `0pt`)

Sets the left margin of the `pseudo` environment, i.e., how far it is indented wrt. the surrounding text:

Lorem ipsum dolor sit amet:

1 consetetur sadipscing elitr
2 sed diam nonumy eirmod tempor

Invidunt ut labore et dolore magna.

```
Lorem ipsum dolor sit amet:

\begin{pseudo}[left-margin=1.25em]
consetetur sadipscing elitr \\
sed diam nonumy eirmod tempor
\end{pseudo}

Invidunt ut labore et dolore magna.
```

To have the environment indented as (the beginning of) any normal paragraph, you could use `left-margin = \parindent`. Note that `left-margin`, as well as the spacing above and below the `pseudo` environment, is turned off inside `\mbox` and the like:

I'm a livin' in a box
I'm a livin' in a cardboard box

```
\pseudoset{left-margin=1cm} % Won't affect box contents
\fbox{\begin{pseudo*}
I'm a livin' in a box \\
I'm a livin' in a cardboard box
\end{pseudo*}}
```

Note that as opposed to `topsep`, `parskip` and `partopsep`, we are *not* working with one of the built-in list spacing commands; `\leftmargin` has no effect on this key (which is why the hyphenated naming style of other keys such as `label-align` or `indent-text` is also adopted for `left-margin`). See also `compact`.

`line-height` = ⟨*factor*⟩ (no default, initially `1`)

The ⟨*factor*⟩ with which to multiply the ordinary line height. For simple, sparse pseudocode, the oridnary line height works well, but if your code gets too crowded with text and notation, you may wish to increase `line-height`. To emulate, e.g., the `\jot` set by `amsmath` (which is `0.25\baselineskip`), you could use `1.25`, though even `1.1` should help in many cases.

`\nf`

Switch to the normal font (i.e., without bold or italics, etc.). If some package defines `\nf` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\normalfont`. See also `\tn`.

`parskip` = ⟨*length*⟩ (no default, initially `\parskip`)

Sets a `pseudo`-local copy of `\parskip` for use in vertical spacing above and below the `pseudo` environment. See also `compact`.

`partopsep` = ⟨*length*⟩ (no default, initially `\partopsep`)

Sets a `pseudo`-local copy of `\partopsep` for use in vertical spacing above and below the `pseudo` environment. See also `compact`.

`pause` (takes no value)

Equivalent to `eol-append = \pause` (see section 2).

`\pr{`⟨*name*⟩`}(`⟨*arguments*⟩`)`

Indicates a procedure name, such as QUICKSORT, and is initially more or less an alias for `\cn`. The optional arguments (in parentheses) are typeset in math mode, so `\pr{Quicksort}(A,p,r)` yields QUICKSORT(A, p, r). See also `\DeclarePseudoProcedure`. This is a convenience for typesetting procedure names, and you may freely redefine it to whatever you prefer. If some package defines `\pr` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\pseudopr`.

`preamble` = ⟨*columns*⟩ (no default)

Sets the preamble to be used by the internal `tabular`. The result is available as the column type with name `\pseudopreamble`. (Note that this is the literal column name, and not a macro containing the name. Initially, `pseudo` uses a `tabular` as redefined by the `array`, which prevents the expansion of whatever is provided as its preamble, and so we supply the preamble in the form of a single "column" instead.) For the default value, see the actual implementation on page 50 as well as the explanation in section 3.1.

`prefix` = ⟨*commands*⟩ (no default)

This is the text inserted at the beginning of the following line by `\\` (and by `\begin{pseudo}`), unless you use the star (`*`) flag. Unless modified, it inserts the code necessary to label the line and to move into the second column, where the actual code is inserted by the user. For the default value, see the actual implementation on page 50 as well as the explanation in section 3.1.

`prfont` = ⟨*font*⟩ (no default, initially `\cnfont`)

Used to set `\prfont`, which is used as part of `\pr`. May be set to take a single argument or none. Not restricted to actual font commands; you may also mix in `\textcolor` or the like.

`\prfont`

The command set by the `prfont` option. Used as part of `\pr`.

`\begin{pseudo}[`⟨*options*⟩`] * <`⟨*overlay specification*⟩`> [`⟨*line options*⟩`]`
⟨*pseudocode*⟩
`\end{pseudo}`

The actual environment in which the pseudocode is typeset. The ⟨*options*⟩ are local to the environment, while the ⟨*line options*⟩ are local to the following line (in the same manner as those set in `\\`; i.e., only some will actually have any effect). The star (`*`) and ⟨*overlay specification*⟩ act just

like those on \\. Note that if you wish to specify ⟨*line options*⟩ without the star or the ⟨*overlay specification*⟩, you need to supply at least an empty pair of brackets for the global options:

```
1  First line
2  Second line
```

vs.

```
1  First line
2  Second line
```

```
\begin{pseudo}[][hl]
First line \\
Second line
\end{pseudo}
vs.\
\begin{pseudo}[hl]
First line \\
Second line
\end{pseudo}
```

There are no `+`/`-` flags here, unlike for \\; if needed, you can use `indent-level`.

\begin{pseudo*}[⟨*options*⟩] *<⟨*overlay specification*⟩>[⟨*line options*⟩]
⟨*pseudocode*⟩
\end{pseudo*}

An unnumbered version of the `pseudo` environment. Equivalent to `pseudo`, but with the `starred` style applied (see page 58). Unless this style is altered, this means that the label column is removed from the preamble, and the prefix is reduced to only `bol`.

\pseudobol

The command set by the `bol` option. Used as part of \pseudoprefix.

\pseudodefinestyle{⟨*name*⟩}{⟨*options*⟩}

Used to define "styles" or meta-keys, i.e., shortcuts for setting several keys to given values (used, e.g., to define `starred`). The ⟨*name*⟩ is simply the name of the new meta-key, and the ⟨*options*⟩ are just what you'd provide to, e.g., \pseudoset.

\pseudoeol

The command set by the `eol` option. Used as part of \\. It is inserted between lines, but not after the last one.

\pseudoeq

Similar to \pseudoslash. Switches the definition of \= to the one used by pseudo. Useful if \= reverts to its original definition in some context (see \==).

\pseudofont

The command set by the `font` option. Used as part of `\pseudosetup`. It is used to set up the font for each pseudocode line. (See also `kw`.)

\pseudohl

This is the command inserted as `bol` by the `hl` switch. Initially, it's just a `\rowcolor` using the color set by `hl-color`, but you could redefine it to whatever you wish.

\pseudohpad

Used on the left- and right-hand sides of `preamble`. Conceptually, it inserts the horizontal space specified by `hpad`. To play nice with `\rowcolor`, however, it is not used in a `@{...}` column; rather, it's placed in `>{...}` and `<{...}` modifiers, and the actual space inserted has `\tabcolsep` subtracted.

\pseudoindent

The command set by the `indent-length` option. Used in `\pseudosetup`. More precisely, `indent-length` is stored textually, and is converted to the length `\pseudoindentlength` when entering a `pseudo` environment (so that units like `em` and `ex` adapt to the current font). The `\pseudoindent` command then inserts a horizontal space of length `\pseudoindentlength` × *current indent level*.

\pseudolabel

The command set by the `label` option. Used as part of `\pseudoprefix`.

pseudoline

Counter for pseudocode lines. See also `*`.

\pseudoprefix

The command set by the `prefix` option. Used as part of `\\`.

\pseudosavelabel

Used as part of `\pseudosetup` to save the `pseudoline` counter for use in `\label` and `\ref`. The `pseudoline` counter is *incremented* as part of the `\pseudolabel` command, but that's done using a plain `\stepcounter`, as any use of `\label` will presumably be placed in the pseudocode line (i.e., the next column). To save the value there, `\pseudosavelabel` first *decrements* the counter, and then uses `\refstepcounter`.

\pseudoset{⟨*options*⟩}

Used to set the configuration keys of the pseudo package (using l3keys with `pseudo` as the module). These may also be set as optional arguments to the `pseudo` and `pseudo*` environments. For example, if you'd like to switch to `\rm` as your base font, you could use `\pseudoset{font = \rm}`.

`\pseudosetup`

The command set by the `setup` option. Used as part of the `preamble`.

Not to be confused with `\pseudoset`.

`\pseudoslash`

Command similar to the `\arrayslash` of the `array` package. Switches the definition of `\\` to the one used by `pseudo`. Useful if you've used some code that modifies `\\` for its own purposes (such as `\raggedleft` or the like).

`ref` = ⟨*commands*⟩ (initially empty, default `\pseudolabel`)

Shortcut for setting the `\thepseudoline` command. If used without arguments, it will use the value supplied to `label`.

(A) print "Hello, ref!"
(B) goto A

```
\pseudoset {
    label = (\textsc{\alph*}),
    ref   = \Alph*,
    hsep  = .5em
}

\begin{pseudo}
print \st{Hello, ref!} \label{li:ref} \\
goto \tn{\ref{li:ref}}
\end{pseudo}
```

`setup` = ⟨*commands*⟩ (no default)

The setup part of each pseudocode line: Save the line counter (using the `\pseudosavelabel` command), insert the proper indentation (with `\pseudoindent`) and switch to the correct font (`\pseudofont`).

Rather than setting `setup` directly, you may wish to add commands using `setup-append` or `setup-prepend`.

`setup-append` = ⟨*commands*⟩ (no default)

Locally appends ⟨*commands*⟩ to `setup`.

`setup-prepend` = ⟨*commands*⟩ (no default)

Similar to `setup-append`, except that ⟨*commands*⟩ are added to the *beginning* of `setup`.

`\st{`⟨*string*⟩`}`

Typesets ⟨*string*⟩ with added quotes using `\stfont`. (The entire thing is wrapped in `\textnormal`.) For example, `print \st{42}` yields

print "42"

. See also `\DeclarePseudoString`. This is a convenience for typesetting strings, and you may freely redefine it to whatever you prefer. If some package defines `\st` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\pseudost`.

`st-left` = ⟨*text*⟩ (no default, initially ``)

Text or commands inserted at the start of a string, when using `\st`.

`st-right` = ⟨*text*⟩ (no default, initially '')

Text or commands inserted at the end of a string, when using `\st`.

`starred` (takes no value)

The style (defined by `\pseudodefinestyle`) used by the `pseudo*` environment. You may modify this (again using `\pseudodefinestyle`) if you wish.

`start` = ⟨*number*⟩ (no default, initially `1`)

Sets the starting line number:

10 Maybe we're continuing from some earlier code?
11 Anyway, let's keep going!

```
\begin{pseudo}[start=10]
Maybe we're continuing from some earlier code?  \\
Anyway, let's keep going!
\end{pseudo}
```

See also `indent-level`.

`stfont`

Used to set `\stfont`, which is used as part of `\st`. May be set to take a single argument or none. Not restricted to actual font commands; you may also mix in `\textcolor` or the like.

`\stfont`

The command set by the `stfont` option. Used as part of `\st`.

`\tn{`⟨*text*⟩`}`

An alias for `\textnormal`, to break out of the font set using the `font` key, for inserting ordinary prose between the keywords. For example, to get the result "**for** every node $v \in V$", one might write:

```
for \tn{every node} $v\in V$
```

This is equivalent to using `\textnormal{every node}`. If some package defines `\tn` before `pseudo` is loaded, `pseudo` will not overwrite it. The command will still be available, as `\textnormal`.

`topsep` = ⟨*length*⟩ (no default, initially `\topsep`)

Sets a pseudo-local copy of `\topsep` for use in vertical spacing above and below the `pseudo` environment. See also `compact`.

`unknown`

Unknown keys are checked for beamer overlay specifications. That is, if an unknown key has the form

⟨*name*⟩`<`⟨*overlay specification*⟩`>` = ⟨*value*⟩

then it does not trigger an error, but, if beamer is used, is rewritten to:

`\only<`⟨*overlay specification*⟩`>{\pseudoset{`⟨*name*⟩ = ⟨*value*⟩`}}`

If beamer is *not* used, the key is simply ignored. Note that because of current limitations on how keys are handled, unknown keys cannot have defaults, and so there is no way to insert a marker for when no value is provided, which could be used to determine whether to use `\pseudoset{`⟨*name*⟩ = ⟨*value*⟩`}` or simply `\pseudoset{`⟨*name*⟩`}`. Instead, if an empty value is provided to the unknown key, that is treated in the same way as when the key is used without a value, resulting in `\pseudoset{`⟨*name*⟩`}` rather than `\pseudoset{`⟨*name*⟩ = `}`.

4 But how do I . . .

Some functionality is not built in, but is still fairly easy to achieve. Some streamlining may be added in future versions.

4.1 . . . prevent paragraph indentation after `pseudo`?

If you want to keep the pseudocode as part of a surrounding paragraph, you could have it not start its own, i.e., not have an empty line before it. This will reduce the amount of spacing as well; if you'd rather have that reduced, you could simply drop the empty line *after* the environment:

```
Text before

\begin{pseudo}
    pseudocode
\end{pseudo}
%
Text after
```

The effect would then be the following:

1 pseudocode

No indentation here, and normal spacing. If, however, you wish to suppress indentation after *all* instances of `pseudo`, you could use the noindentafter package, as follows:

```
\usepackage{noindentafter}
\NoIndentAfterEnv{pseudo}
```

If you wish to override this, and indent a given paragraph after all, you can simply use the `\indent` command.

4.2 . . . get log-like functions?

There's no built-in command for math-roman function names, as used in log and sin, etc. (other than just setting `fnfont`, if you want it everywhere). If you wish to define your own, you could use `\operatorname` or `\DeclareMathOperator`. For example:

1 **if** my-func $x == 1$
2 $\quad y =$ my-func$(z + 1)$

```
% In preamble:
% \usepackage{amsmath}
% \DeclareMathOperator{\MyFunc}{my-func}
\begin{pseudo}[kw]
if $\MyFunc x \== 1$ \\+
    $y = \MyFunc(z + 1)$
\end{pseudo}
```

The spacing is then correct whether you enclose the arguments in parentheses or not.

4.3 . . . unbold punctuation?

If you use the `kw` key, all pseudocode not in math mode will end up using the keyword font (`\kwfont`), which initially is bold. Though some *do* typeset, e.g., grouping braces in boldface, you might not want to do that; the same goes for, say, line-terminating semicolons. The `theoremfont` option of, e.g., `newtx` does something similar (for italics), but uses a custom font for that. Packages like `emrac` rely on straightforward textual substitution, replacing certain characters with marked-up ones, but the way things are set up at the moment, our font command won't have access to the entire line when it's executed.

If you're adventurous, it's not hard (using the `xparse` argument type `u`) to make a version that *does* gobble up the entire line, up to and including `\\` (and you could then use the regular expression functionality from `expl3`, presumably also reinserting `\\`). A simpler solution is to just use `\DeclarePseudoNormal`. Here's an example based on pseudocode from Knuth [3]:

procedure *printstatistics*;
begin integer j;
    write(“Closed sets for rank”, r, “:”);
    $j \coloneqq L[h]$;
    while $j \neq h$ **do**
        begin *writeon*($S[j]$); $j \coloneqq L[j]$ **end**;
end;

```
% \usepackage{mathtools}
\let\gets\coloneqq

\pseudoset{kw, indent-length=2em, line-height=1.1}

\DeclarePseudoNormal \; ;

\begin{pseudo*}
procedure \id{printstatistics}\;                              \\
begin integer $j$\;                                           \\+
    $\id{write}(\st{Closed sets for rank}, r, \st{:})$\;      \\
    $j \gets L[h]$\;                                          \\
    while $j \neq h$ do                                       \\+
        begin $\id{writeon}(S[j])$\; $j\gets L[j]$ end\;      \\--
end\;
\end{pseudo*}
```

If you’d really like to avoid the extra backslashes, you could make the relevant punctuation active (though that’s probably a bit risky; make sure to only do it locally, at the very least):

begin integer j;

```
\DeclarePseudoNormal \semi ;

\catcode`\;=\active
\let;\semi

\begin{pseudo*}[kw]
    begin integer $j$; % Look! The semicolon isn't bold!
\end{pseudo*}
```

4.4 ... use `tabularx`?

You can use other tabular packages such as tabularx via `begin-tabular` and `end-tabular`. Let’s say, for example, that you wish to extend the `pseudo` environment to fill out the entire line, and set up a new column for comments. You could achieve that as follows:

COUNTING-SORT(A, k) Find positions by counting
1 $C =$ an array of k zeros Element frequencies
2 **for** $i = 1$ **to** $A.length$ Count all elements
3 ... Etc.

```
\pseudodefinestyle{fullwidth}{
    begin-tabular =
    \tabularx{\linewidth}{@{}
        r                                       % Labels
        >{\pseudosetup}                         % Indent, font, ...
        X                                       % Code (flexible)
        >{\leavevmode\small\color{black!60}}    % Comment styling
        p{0.45\linewidth}                       % Comments (fixed)
        @{}},
    end-tabular = \endtabularx,
    setup-append = \pseudoeq
}
\begin{pseudo}[kw, fullwidth, line-height=1.1]*
    \hd{Counting-Sort}(A, k) & Find positions by counting \\
    $C = \tn{an array of $k$ zeros}$ & Element frequencies \\
    for $i = 1$ to $A.\id{length}$ & Count all elements \\+
    $\dots$ & Etc.
\end{pseudo}
```

Note that using the `\color` command in a `>{...}` modifier with a `p` column places the text in a new paragraph, on the next line; you'll need to insert `\leavevmode` or the like to prevent that. This is true also of normal `tabular` environments. Also note that `tabularx` environments with `X` columns don't interact nicely with `\=`; so i you wish to use `\==`, you can reassert the definition by adding `>{\pseudoeq}` before each column.

See the tabularx documentation (page 4) for an explanation of why we can't use `\begin{tabularx}` and `\end{tabularx}`. Also note that because tabularx passes its contents as the argument to a macro, the parsing pseudo uses to determine if `\\` is at the end of the last line doesn't work; if you add `\\` at the end here, you'll introduce an empty line.

For simplicity, I've used `@{}` to remove space on either side. For `hpad` to work, you should use `>{\pseudohpad}` and `<{\pseudohpad}` instead, as in the standard `preamble` (see page 50). To keep things configurable, you might also want to use `\pseudolabelalign`, rather than `r`.

4.5 ... get tab stops?

Some packages, such as clrscode3e, use an actual `tabbing` environment internally. While this may be a bit brittle (e.g., creating problems if you wish to insert your pseudocode into a tikz node—one of the goals of pseudo), it does mean that you can use the tabbing command `\>` manually, to align various construct.

If all your tabbing is done *before* the text on a given code line, you can achieve this in pseudo as well, by using the `+` and `-` modifiers. (For example, the

tab stops in clrscode3e are set at fixed intervals, just like in pseudo.) But what if you'd like to align something that comes later, such as comments after code lines? You can't simply use `\hspace`, of course, unless the code lines themselves have exactly the same length.

One solution is to use an additional column, as discussed in section 4.4, but you could also make creative use of the `\rlap` command, which prevents its contents from taking up horizontal space:*

This is some text And here is some more

```
\noindent\rlap{This is some text}%
And here is some more
```

By using `\rlap` on the code lines in question, you can insert `\hspace` that begins at the beginning of the code line (here with an example convenience command defined using xparse):

1 $x = 42$ (*first comment*)
2 $y = \sin x$ (*second comment*)

```
\NewDocumentCommand \C { +u{/* } +u{ */} } {%
    \rlap{#1}\hspace{3cm}\ct{#2}\\%
}
\begin{pseudo}
\C $x = 42$      /* first comment */
\C $y = \sin x$  /* second comment */
\end{pseudo}
```

See also the discussion of the `\ct` command for ideas on typesetting comments. If you wish to align things across different indentation levels, you'll have to add or subtract multiples of `\pseudoindentlength` (see `\pseudoindent`).

4.6 . . . use horizontal lines?

Many opt for a table-like appearance when typesetting algorithms, with horizontal lines above and below, and generally a header row on top. While this may be part of a surrounding floating environment (see section 4.7), you may also wish to include such lines in your actual pseudocode. In this case, you can simply use existing `tabular`-based tools such as booktabs, making sure to suppress the pseudo `prefix` using the star flag (`*`):

* Note that `\rlap` doesn't start a new paragraph, which is why I use `\noindent`, here. You could replace `\noindent\rlap{...}` with `\makebox[0pt][l]{...}`. This isn't an issue in `pseudo` code lines, however.

BORŮVKA(G, w)

1 **while** $E(G)$ is not empty
2 **for** each $u \in V(G)$
3 add light $uv \in E(G)$ to T
4 **for** each $e \in T$
5 contract e

```
% \usepackage{booktabs}
\begin{pseudo}*
\toprule

    \hd{Bor\r{u}vka}(G, w)                          \\
                                                    %
[bol=\midrule]

    \kw{while} $E(G)$ is not empty                  \\+
        \kw{for} each $u\in V(G)$                   \\+
            add light $uv \in E(G)$ to $T$          \\-
        \kw{for} each $e \in T$                     \\+
            contract $e$                            \\*

\bottomrule
\end{pseudo}
```

Rather than `\\[bol=\midrule]`, you could also have used `\\*`, followed by `\midrule\pseudoprefix`. (Note that the paragraph break between `\\` and its argument has been commented out.)

4.7 . . . get an algorithm float?

There are (at least) two different ways of viewing a block of pseudocode: As an inline element, like equations, or as a float, like figures and tables. For example, Cormen et al. [1] place their pseudocode inline, and refer to the algorithms by name (e.g., DIJKSTRA), while Williamson and Shmoys [4] place them in floats, and refer to them by number (e.g., Algorithm 3.1).* Some pseudocode packages have a custom float environment (à la `table` and `figure`) for use with algorithms described by pseudocode. Beyond having a new float name (such as "Algorithm") with its own numbering and the like, they at times have rather distinct styling (horizontal lines in algorithms and algorithmicx, and a surrounding box in algorithm2e), which may or may not suit the styling of the rest of your document.

Rather than getting into the business of float environments, I leave such things to separate packages designed for that use. A basic solution would be to simply use the float package (which also provides ruled and boxed floats, should you wish to have those), but a quick CTAN search for "float", or a look at the recommendations related to the float package, will give you many options, with varying functionality.

* A third option that is sometimes used is to use a theorem-like environment for your algorithms. There are many packages to help with this; just search CTAN for "theorem".

Algorithm 4.1: Borůvka's algorithm for finding minimum spanning trees. For a node u, a *light* edge is an edge uv of minimum weight $w(u, v)$. Contracting uv deletes it, identifies u and v, and removes resulting loops. The result T is initially empty.

BORŮVKA(G, w)		Construct MST T for G wrt. w
1	**while** $E(G)$ is not empty	Not all are contracted yet
2	**for** each $u \in V(G)$	One light edge per node
3	add light $uv \in E(G)$ to T	T is the tree we're building
4	**for** each $e \in T$	These edges are already used
5	contract e	We focus on the remaining ones

Note: The definition of `\==` doesn't properly carry over into floats. It's properly redefined inside `pseudo`, so you probably won't notice, but if you wish to use the symbol outside the `pseudo` environment, but in a float (e.g., inside `\caption`), you'll need to either call `\pseudoeq` to re-establish the definition of `\=` or simply use `\eqs` instead of `\==`.

Here's a simple example using the float and caption packages, reusing the `fullwidth` style example from section 4.4 and the horizontal line ideas from section 4.6:

```
% \usepackage{float}
% \usepackage{caption}
\floatstyle{plaintop}
\newfloat{algorithm}{tbp}{alg}[section]
\floatname{algorithm}{Algorithm}

\begin{algorithm}
\begin{pseudo}[fullwidth]*

% Insert pseudocode and comments

\end{pseudo}
\caption{...}
\end{algorithm}
```

You can see the result in algorithm 4.1.

4.8 ... handle object attributes?

In the clrscode3e package, you'll find an assortment of commands for handling object attributes such as $A.length$. The manual says (here with emulated kerning of the dot operator):

> You might think you could typeset $A.length$ by `$A.\id{length}$`, but that would produce $A.length$, which has not quite enough space after the dot. (page 3)

However, this is a font issue, more than anything. If, for example, if you want Times New Roman (like Cormen et al.) and use mathptm, you at times run

into the problem described; with newtx it's less pronounced. With other fonts (e.g., fourier, mathpple or newtxmath with libertine), or even without any font packages (or possibly using lmodern), the kerning works just fine.

In general, then, I suggest you try to use `$A.\id{length}$` and the like, and see if the result is satisfactory:

$v.prev.next = v.next$

```
$v.\id{prev}.\id{next} = v.\id{next}$
```

If you *do* need to adjust the kerning (with `\mkern` commands or perhaps using microtype), you may of course do so, but pseudo does not (at present) include any special attribute lookup commands that do it for you.

4.9 ... get vertical lines or braces?

Some packages (such as algorithm2e) have support for using vertical lines to indicate the block structure; pseudocode uses large braces. At least in the current version, there is no such built-in functionality in pseudo. This could be added in a future version, but if you want to play around with it yourself, you could use tikz. For example, you could add a `node` at the start of each code line, containing an `\@arstrut`, the (array) strut used to indicate the extent of a tabular row:

```
% \usepackage{xparse,tikz}
% \usetikzlibrary{decorations.pathreplacing,calligraphy}
\makeatletter
\NewDocumentCommand \pseudoanchor { m } {%
    \tikz[baseline, overlay, remember picture]
        \node[anchor=base, inner sep=0] (#1) {\@arstrut};%
    \ignorespaces
}
\makeatother
```

We can then use the resulting nodes to draw braces or lines or whatever. First some example setup:

```
\pseudoset{
    kw,
    indent-length = 3.5em,
    setup-append = {\pseudoanchor{L-\arabic*}}
}
\tikzset{
    braces/.style =
    {thick, decoration = {calligraphic brace, raise=.2em}},
    label/.style =
    {midway, left=3em, anchor=west, font=\strut\kwfont}
}
```

You would then get something like the following:

1 **if** $x < y$
2 **then** $\begin{cases} x = y \\ y = 0 \end{cases}$
3

```
\begin{pseudo}
if $x < y$                                          \\+
    $x = y$                                         \\
    $y = 0$
\end{pseudo}
\tikz[overlay, remember picture, braces] {
    \draw[decorate] (L-3.south) -- (L-2.north) node[label] {then};
}
```

If multiple blocks are closed at the same time, the bottom coordinates could be things like `(L-2.north |- L-3.south)` instead. To adjust the end points, you could also use things like `($(L-3.south)+(0,.2em)$)`.

The actual drawing of the brace (or line or whatever) isn't automated here, of course. This could be done by some hook triggered by the `-` flags in `\\`. If it turns out there's a demand for something like that, I might add it in a future version.

5 Implementation

Note: In the following, `_@@` and `@@` represent an internal prefix (`__pseudo`), the same way they do with l3docstrip.

First, we just define some metadata:

```
\def \pseudoversion {1.1.2}
\def \pseudodate    {2019-10-17}
```

The pseudo package is implemented using experimental LaTeX 3, so we start by importing expl3:

```
\RequirePackage{expl3}
```

Then we're ready start the package:

```
\ProvidesExplPackage
    {pseudo}
    {\pseudodate}
    {\pseudoversion}
    {Straightforward pseudocode}
```

Tools for defining user commands:

```
\RequirePackage{xparse}
```

The `pseudo` environment is built upon tabular functionality, and we're using some extensions:

```
\RequirePackage{array, xcolor, colortbl}
```

Though *most* keys aren't available as `\usepackage` arguments, we still use the mechanism:

```
\RequirePackage{l3keys2e}
```

Inside the `pseudo` environment, `*` is an alias for `pseudoline`. To perform the proper aliasing, we use aliascnt:

```
\RequirePackage{aliascnt}
```

As part of the initial setup, we also record whether we're part of a beamer presentation; this will affect the overlay functionality:

```
\bool_new:N \c_@@_beamer_bool
\@ifclassloaded{beamer}
    {\bool_set_true:N  \c_@@_beamer_bool}
    {\bool_set_false:N \c_@@_beamer_bool}
```

We're now ready to begin the actual implementation.

5.1 Variable declarations

Many variables are created as needed by various `set` commands, but some are declared initially. First, we create a plain-vanilla LaTeX counter for the line number, as well as an outer one for the environment, the latter just to avoid duplicate labels:

```
\newcounter{pseudoenv}
\newcounter{pseudoline}[pseudoenv]
```

Eventually, we'll be saving the line counter so that `\label` commands will work, but we'll only do so if the counter has *changed* (again, to avoid duplicate labels). To determine whether, in fact, it has, we keep the previous one we saved:

```
\int_new:N \g_@@_last_saved_line_int
```

Normally a counter is just saved when it's incremented (with `\refstepcounter`), but in our case, we want to increment and typeset it based on a (potentially) user-configured `label`, and then actually save it and make it the target of `\label` commands in a *different scope* (i.e., the next cell in the tabular row).

The indent size is set through the configuration key `indent-length` (or indirectly through `indent-text`), while the current indent level is manipulated by `\\`; their product determines the actual length by which the current line is indented. The initial indent level may be set using `indent-level`.

```
\dim_new:N  \pseudoindentlength
\int_new:N  \g_@@_indent_level_int
\int_new:N  \l_@@_initial_indent_level_int
```

5.2 Utilities

Variants. First, let's just generate a couple of expansion variants we'll need of some standard commands:

```
\cs_generate_variant:Nn \tl_if_novalue:nTF        { VTF   }
\cs_generate_variant:Nn \tl_set:Nn                { Ne    }
\cs_generate_variant:Nn \regex_extract_once:nnNTF { nVNTF }
```

Defining columns. The `preamble` is is configurable, but the array package makes sure it doesn't expand any part of its preamble. One way of inserting a dynamically generated one is to simply define it all as a single column type. To avoid getting an error when overwriting this definition through the configuration, we'll also need to be able to *un*-define column types:

```
\cs_new:Nn \@@_undef_col:n {
    \tl_set_eq:cN { NC@find@ \token_to_str:N #1 } \scan_stop:
}
```

Note that the implementation specifically targets the array package. The following command then will either define or *re*-define a column type:

```
\cs_new:Nn \@@_def_col:nn {
    \@@_undef_col:n { #1 }
    \newcolumntype  { #1 } { #2 }
}
```

Defining commands. This command creates a new command with a `pseudo` prefix, and defines the prefixless version as well, *if the name is available* (i.e., undefined):

```
\cs_new:Nn \@@_meta_new_cmd:NNnn {
    \tl_set:Nn \l_tmpa_tl {pseudo \cs_to_str:N #2}
    \exp_args:Nc
        #1 \l_tmpa_tl {#3} {#4}
    \cs_if_free:NT #2 {\cs_gset_eq:Nc #2 \l_tmpa_tl}
}

\cs_new:Nn \@@_new_cmd:Nnn {
    \@@_meta_new_cmd:NNnn
    \NewDocumentCommand #1 {#2} {
        #3
    }
}
```

```
\cs_new:Nn \@@_new_ecmd:Nnn {
    \@@_meta_new_cmd:NNnn
    \NewExpandableDocumentCommand #1 {#2} {
        #3
    }
}
```

This is for defining commands that declare styled shortcuts:

```
\cs_new:Nn \@@_new_dec:nn {
    \tl_set:Nn \l_tmpa_tl { DeclarePseudo #1 }
    \exp_args:Nc
    \DeclareDocumentCommand \l_tmpa_tl { mm } {
        \DeclareDocumentCommand ##1 { } {
            \use:c { #2 } { ##2 }
        }
    }
}
```

You use this with a capitalized name for the kind of thing you're declaring, and the name of the style command to use. For example,

```
\@@_new_dec:nn{Keyword}{kw}
```

will create the command `\DeclarePseudoKeyword`, which takes a csname and a word, and binds the csname as a shortcut for the word, properly styled as a keyword.

Argument parsing. In processing the multiple `+` and `-` arguments to `\\`, we'll gobble up one character at a time, each time performing some action. We also supply code to be performed once we're done.

```
\cs_new:Nn \@@_per_char:nnn {
    \peek_charcode_remove:NTF { #1 } {
        #2 % body
        \@@_per_char:nnn{#1}{#2}{#3}
    } {
        #3 % tail
    }
}
```

Indentation. The indent size (i.e., the length of a single step of indentation) is either set directly through `indent-length`, or indirectly through `indent-text`. The latter is there the default is provided, but `indent-text` is only used if there is no `indent-length`.

```
\cs_new:Nn \@@_set_indent_length: {

    \tl_if_novalue:VTF \l_@@_indent_length_tl {
        \hbox_set:Nn \l_tmpa_box { \l_@@_indent_text_tl }
        \dim_set:Nn \pseudoindentlength { \box_wd:N \l_tmpa_box }
```

```
    } {
        \dim_set:Nn \pseudoindentlength \l_@@_indent_length_tl
    }

}
```

Note that the configured indent length is stored in a `tl`, which is expanded in the `pseudo` environment.

The indent size is subsequently used by the indent command, which takes the number of indentation steps as its only argument:

```
\cs_new:Nn \@@_indent:N {
    \skip_horizontal:n{ \pseudoindentlength * #1 }
    \ignorespaces
}
```

Counter copying. Inside the `pseudo` environment, we want `*` to be a duplicate of `pseudoline`, for convenience. This requires a bit of work. We use the aliascnt package to deal with much of the book-keeping, but in order for `\newaliascnt` to work whenever a counter already exists, we need to undefine it first. (Here we're relying on the internal LaTeX convention of using `c@` as a prefix to counter names.)

```
\cs_new:Nn \@@_drop_ctr:n {
    \cs_undefine:c { c@ #1 }
}

\cs_new:Nn \@@_copy_ctr:nn {
    \@@_drop_ctr:n { #1 }
    \newaliascnt   { #1 } { #2 }
}

\cs_new:Nn \@@_star_setup: {

    \cs_if_exist:cT { c@ * } {
        \@@_copy_ctr:nn { @@_orig_* } { * }
    }
    \@@_copy_ctr:nn { * } { pseudoline }

    \group_insert_after:N \@@_star_reset:

}

\cs_new:Nn \@@_star_reset: {
    \cs_if_exist:cT { c@ @@_orig_* } {
        \@@_copy_ctr:nn { * } { @@_orig_* }
        \cs_undefine:c { c@ @@_orig_* }
    }
}
```

Label saving. In the body of each line, we make sure to save the counter, so

it's available for the `\label` command. We've aready incremented `pseudoline` with `\stepcounter` in the label, so we first need to decrement it before we again increment it, this time with `\refstepcounter`. However, we only do so if the counter actually *was* incremented, i.e., if it's different from the last one we saved.

```
\cs_new:Nn \@@_save_label: {

    \int_set:Nn \l_tmpa_int {\arabic{pseudoline}}

    \int_compare:nF {\l_tmpa_int = \g_@@_last_saved_line_int} {
        \addtocounter{pseudoline}{-1}
        \refstepcounter{pseudoline}
        \int_gset_eq:NN \g_@@_last_saved_line_int \l_tmpa_int
    }

}

\DeclareDocumentCommand \pseudosavelabel { } {
    \@@_save_label:
}
```

Saving and restoring. In general, we could just use local variables and trust the scope mechanism, but if we use global assignments inside the scope (e.g., because of where in a tabular we must assign things and use them), the original meaning *won't* be restored. Of course, this should *not* be used if assignments are local, as it will globally set the original name to the meaning it had when we entered the scope.

In saving a macro, we also supply a name for the original, which may then be used to refer to it until it's restored.

```
\cs_new:Nn \@@_gsave_as:NN {
    \cs_gset_eq:NN #2 #1
    \group_insert_after:N \cs_gset_eq:NN
    \group_insert_after:N #1
    \group_insert_after:N #2
}
```

5.3 Styles

The first text styling commands are only straight-up shortcuts for normal font commands:

```
\@@_new_cmd:Nnn \nf {   } { \normalfont          }
\@@_new_cmd:Nnn \tn { m } { \textnormal { #1 }   }
\@@_new_cmd:Nnn \kw { m } { \textnormal {\kwfont { #1 } } }
\@@_new_cmd:Nnn \cn { m } { \textnormal {\cnfont { #1 } } }
\@@_new_cmd:Nnn \id { m } { \textnormal {\idfont { #1 } } }
```

(As a side-effect, we've now also defined `\pseudonf` and `\pseudotn`, which we don't really need.) While we're at it, we'll define the initial value for `\kwfont`,

which is generally non-extended bold, if that's available, but extended bold otherwise:

```
\cs_new:Nn \@@_b_or_bx: {

    % Note: We're relying on the warning text in \@defaultsubs
    % being defined by \selectfont if the desired font isn't
    % found. This won't happen, however, if the same
    % \curr@fontshape combination has been attempted before
    % (cf. source2e.pdf page 179).

    \group_begin:

    \cs_if_exist:NT \@defaultsubs {
        \@@_gsave_as:NN \@defaultsubs \@@_defaultsubs
        \cs_gset_eq:NN \@defaultsubs \relax
    }

    % This is what we'd like:
    \cs_gset:Nn \@@_b_or_bx: { \fontseries{b}\selectfont }

    % Try it:
    \@@_b_or_bx:

    % Fallback, if that failed:
    \cs_if_exist:NT \@defaultsubs {
        \cs_gset_eq:NN \@@_b_or_bx: \bfseries
        \group_insert_after:N \@@_b_or_bx:
    }

    \group_end:

}
```

Note that the command redefines itself after the first use, so as not to execute the check every time.

The `\pr` command is also a font shortcut, but in addition takes optional parenthesis-delimited arguments, which are set in math mode:

```
\cs_new:Nn \@@_fmt_pr:n {
    \textnormal{\prfont{ #1 }}
}
\cs_new:Nn \@@_fmt_pr:nn {
    \@@_fmt_pr:n { #1 }
    \ensuremath{ ( #2 ) }
}
\@@_new_cmd:Nnn \pr { m !+d() } {
    \IfNoValueTF { #2 } {
        \@@_fmt_pr:n  { #1 }
    } {
        \@@_fmt_pr:nn { #1 } { #2 }
    }
}
```

The `\fn` command is similar, but alternatively permits arguments in square brackets.

```
\cs_new:Nn \@@_fmt_fn:n {
    \textnormal{\fnfont{ #1 }}
}
\cs_new:Nn \@@_fmt_fn:nn {
    \@@_fmt_fn:n { #1 }
    \ensuremath{ ( #2 ) }
}
\cs_new:Nn \@@_fmt_ar:nn {
    \@@_fmt_fn:n { #1 }
    \ensuremath{ [ #2 ] }
}
\@@_new_cmd:Nnn \fn { m !+o !+d() } {
    \IfNoValueTF { #2 } {
        \IfNoValueTF { #3 } {
            \@@_fmt_fn:n  { #1 }
        } {
            \@@_fmt_fn:nn { #1 } { #3 }
        }
    } {
        \@@_fmt_ar:nn { #1 } { #2 }
        \IfNoValueF { #3 } {
            ( #3 )
        }
    }
}
```

The `\hd` command is similar to `\pr` command, except that it spans two columns (effectively ignoring the labeling column). Because it needs to be expandable in order to insert the multicolumn, the final, parenthesis-enclosed argument can not be optional (unlike for `\pr`).

```
\@@_new_ecmd:Nnn \hd { m +r() } {
    \multicolumn{2}
        {\@@_hd_preamble}
        {\@@_fmt_pr:nn{#1}{#2}}
}
```

Finally, `\st` and `\ct` add quotes and comment delimiters, respectively, to the typeset string, keeping it all in `\textnormal`:

```
\@@_new_cmd:Nnn \st { +m } {
    \textnormal {
    \l_@@_st_left_tl {\stfont{#1}} \l_@@_st_right_tl }
}
\@@_new_cmd:Nnn \ct { +m } {
    \textnormal {
    \l_@@_ct_left_tl {\ctfont{#1}} \l_@@_ct_right_tl }
}
```

Beyond text styling, we also have styling for entire rows, i.e., highlighting:

```
\NewExpandableDocumentCommand \pseudohl { } {
    \rowcolor{\pseudohlcolor}
}
```

Declarations. To declare shortcuts using the various styles, commands à la `DeclareMathOperator` and `DeclareDocumentCommand` are provided:

```
\@@_new_dec:nn { Comment    } { ct }
\@@_new_dec:nn { Constant   } { cn }
\@@_new_dec:nn { Function   } { fn }
\@@_new_dec:nn { Identifier } { id }
\@@_new_dec:nn { Keyword    } { kw }
\@@_new_dec:nn { Normal     } { tn }
\@@_new_dec:nn { Procedure  } { pr }
\@@_new_dec:nn { String     } { st }
```

5.4 Notation

Here we'll define a couple of symbols that are useful for pseudocode but that are not necessarily entirely standard mathematical notation. First, the double equals sign, ubiquitous in modern programming languages, and useful if `=` is used for assignment. The horizontal scaling of the equals signs, as well as the space between them and the padding on both sides may be adjusted by using the keys `eqs-scale`, `eqs-sep` and `eqs-pad`. Initially, these are set to emulate the `\eqeq` symbol from stix when used with Computer Modern, Latin Modern or the like (though the command works just fine with other fonts as well).

```
\NewDocumentCommand \eqs { } {
    \group_begin:
    \muskip_set:Nn \l_tmpa_muskip \l_@@_eqs_pad_tl
    \muskip_set:Nn \l_tmpb_muskip \l_@@_eqs_sep_tl
    \hbox_set:Nn   \l_tmpa_box {\(=\)}
    \box_scale:Nnn \l_tmpa_box {\l_@@_eqs_scale_fp}{1}
    \mathrel{
        \tex_mskip:D     \l_tmpa_muskip
        \box_use:N       \l_tmpa_box
        \tex_mskip:D     \l_tmpb_muskip
        \box_use_drop:N  \l_tmpa_box
        \tex_mskip:D     \l_tmpa_muskip
    }
    \group_end:
}
```

For convenience and source-code clarity, the following shortcut (i.e., `\==`) is defined (hijacking the `\=` accent command):

```
\cs_gset_eq:NN \c_@@_orig_eq_cs \=

\DeclareDocumentCommand \= { m } {
```

```
    \tl_if_eq:nnTF { #1 } { = } {
        \eqs
    } {
        \c_@@_orig_eq_cs{#1}
    }
}

\cs_gset_eq:NN \@@_eq: \= % Stored for \pseudoeq
```

Similarly, there's the Pascal two-dot interval notation, whose implementation mirrors Knuth's `\dts` command from Concrete Mathematics (see gkpmac.tex).

```
\cs_new:Nn \@@_dts: {
    \mathinner {
        \ldotp
        \ldotp
    }
}

\NewDocumentCommand \dts { } { \@@_dts: }
```

There's a shortcut (`\..`) defined for this as well (this time hijacking `\.`):

```
\cs_gset_eq:NN \c_@@_dot_cs \.

\DeclareDocumentCommand \. { m } {
    \tl_if_eq:nnTF { #1 } { . } {
        \dts
    } {
        \c_@@_dot_cs{#1}
    }
}
```

5.5 Options

Much of the behavior of pseudo may be configured through various options, and these are defined below. You provide these either through `\pseudoset` or (where applicable) as optional arguments to `\\` or the `pseudo` environment itself.

The `\usepackage` options (handled by l3keys2e) are subject to full expansion, an so many options simply won't work. In order to make the `kw` option as easily available as possible, however, we permit it here, by way of a `bool` that triggers the *actual* key later on:

```
\keys_define:nn { pseudo/package } {
    kw              .bool_gset:N    = \g_@@_kw_bool,
    kw              .default:n      = true
}
\ProcessKeysOptions{ pseudo/package }
```

We now define the actual keys used by `\pseudoset`. Note that `hpad` and `hsep` do *not* use `.dim_set:N`. This is because the `dim` would then be interpreted at the point where it's *set*, and not where it's *used*. If we use units like `em` and `ex`, which depend on the font and font size, the spacing would not be updated if we change these things between setting `hpad` and `hsep` and actually typesetting the pseudocode.

```
\keys_define:nn { pseudo } {

    font            .tl_set:N       = \pseudofont,
    font            .initial:n      = \normalfont,

    hpad            .tl_set:N       = \l_@@_hpad_tl,
    hpad            .initial:n      = 0.0em,
    hpad            .default:n      = 0.3em,

    hsep            .tl_set:N       = \l_@@_hsep_tl,
    hsep            .initial:n      = .75em,

    left-margin     .tl_set:N       = \l_@@_left_margin_tl,
    left-margin     .initial:n      = 0pt,

    label           .tl_set:N       = \l_@@_label_tl,
    label           .initial:n      = \arabic*,

    label-align     .code:n         =
        \@@_def_col:nn{ \pseudolabelalign }{#1},
    label-align     .initial:n      = r,

    ref             .tl_set:N       = \thepseudoline,
    ref             .default:n      = \l_@@_label_tl,

    indent-length   .tl_set:N       = \l_@@_indent_length_tl,
    indent-length   .initial:V      = \c_novalue_tl,

    indent-text     .tl_set:N       = \l_@@_indent_text_tl,
    indent-text     .initial:n      = { \pseudofont\kw{else}\ },

    indent-level    .int_set:N      =
    \l_@@_initial_indent_level_int,

    kwfont          .tl_set:N       = \kwfont,
    kwfont          .initial:n      = \@@_b_or_bx:,

    kw              .meta:n         = { font = \kwfont },
    kw              .value_forbidden:n = true,

    hl              .meta:n         = { bol-prepend = \pseudohl },
    hl              .value_forbidden:n = true,

    bol             .tl_set:N       = \l_@@_bol_tl,
    bol-append      .code:n         = {
        \tl_put_right:Nn \l_@@_bol_tl {#1}
```

```
},
bol-prepend     .code:n         = {
    \tl_put_left:Nn \l_@@_bol_tl {#1}
},

eol             .tl_set:N       = \l_@@_eol_tl,
eol-append      .code:n         = {
    \tl_put_right:Nn \l_@@_eol_tl {#1}
},
eol-prepend     .code:n         = {
    \tl_put_left:Nn \l_@@_eol_tl {#1}
},

% Defined differently in beamer -- see below
pause           .meta:n         = ,
pause           .value_forbidden:n = true,

cnfont          .tl_set:N       = \cnfont,
cnfont          .initial:n      = \textsc,

idfont          .tl_set:N       = \idfont,
idfont          .initial:n      = \textit,

stfont          .tl_set:N       = \stfont,
stfont          .initial:n      = \textnormal,

st-left         .tl_set:N       = \l_@@_st_left_tl,
st-left         .initial:n      = ``,

st-right        .tl_set:N       = \l_@@_st_right_tl,
st-right        .initial:n      = '',

prfont          .tl_set:N       = \prfont,
prfont          .initial:n      = \cnfont,

fnfont          .tl_set:N       = \fnfont,
fnfont          .initial:n      = \idfont,

ctfont          .tl_set:N       = \ctfont,
ctfont          .initial:n      = \textit,

ct-left         .tl_set:N       = \l_@@_ct_left_tl,
ct-left         .initial:n      = (,

ct-right        .tl_set:N       = \l_@@_ct_right_tl,
ct-right        .initial:n      = ),

hl-color        .tl_set:N       = \pseudohlcolor,
hl-color        .initial:n      = black!12,

dim-color       .tl_set:N       = \pseudodimcolor,
dim-color       .initial:n      = \pseudohlcolor,
```

```
dim             .meta:n         = {
    bol-append   = \color{\pseudodimcolor},
    setup-append = \color{\pseudodimcolor}
},

line-height     .fp_set:N       = \l_@@_line_height_fp,
line-height     .initial:n      = 1,

start           .tl_set:N       = \l_@@_start_tl,
start           .initial:n      = 1,
```

Line structure. The preamble for the internal `tabular` is defined as a single column type, to make it easier to apply it despite the array protections against expansion.

```
preamble        .code:n         =
    \@@_def_col:nn{ \pseudopreamble }{#1},
```

The preamble is laid out as described in section 3:

```
preamble        .initial:n      = {
    >{ \pseudohpad }
    \pseudolabelalign
    >{ \pseudosetup }
    l
    <{ \pseudohpad }
},
setup           .tl_set:N       = \l_@@_setup_tl,
setup           .initial:n      = {
    \pseudoindent \pseudofont \pseudosavelabel
},

setup-append    .code:n         = {
    \tl_put_right:Nn \l_@@_setup_tl {#1}
},
setup-prepend   .code:n         = {
    \tl_put_left:Nn \l_@@_setup_tl {#1}
},
```

The preamble used for multicolumns is treated similarly:

```
hd-preamble     .code:n         =
    \@@_def_col:nn{ \@@_hd_preamble }{#1},
hd-preamble     .initial:n      = {
    >{\pseudohpad} l <{\pseudohpad}
},
```

The prefix is inserted by the row separator command.

```
prefix          .tl_set:N       = \pseudoprefix,
prefix          .initial:n      = {
```

```
    \pseudobol \stepcounter* \pseudolabel &
},

begin-tabular   .tl_set:N       = \l_@@_begin_tabular_tl,
begin-tabular   .initial:n      =
\begin{tabular}{\pseudopreamble},

end-tabular     .tl_set:N       = \l_@@_end_tabular_tl,
end-tabular     .initial:n      = \end{tabular},
```

List-like spacing. Space above and below is handled similarly to in the built-in LaTeX lists, with the option of locally overriding `\topsep`, `\parskip` and `\partopsep`, with `compact` used to control the presence of this spacing (overriding the ordinary automatic choice based on the current mode).

```
topsep          .tl_set:N       = \l_@@_topsep_tl,
topsep          .initial:n      = { \topsep },

parskip         .tl_set:N       = \l_@@_parskip_tl,
parskip         .initial:n      = { \parskip },

partopsep       .tl_set:N       = \l_@@_partopsep_tl,
partopsep       .initial:n      = { \partopsep },

compact         .meta:n         = {
    compact-val = #1,
    compact-def = true,
},
compact         .default:n      = true,

% For internal use:
compact-val     .bool_set:N     = \l_@@_compact_bool,
compact-def     .bool_set:N     = \l_@@_compact_def_bool,
```

Details. Finally, some tweakable parameters.

```
eqs-scale       .fp_set:N       = \l_@@_eqs_scale_fp,
eqs-scale       .initial:n      = 0.6785,

eqs-sep         .tl_set:N       = \l_@@_eqs_sep_tl,
eqs-sep         .initial:n      = 0.63mu,

eqs-pad         .tl_set:N       = \l_@@_eqs_pad_tl,
eqs-pad         .initial:n      = 0.28mu,


}
```

Now that we've defined the real `kw` key, we reexamine the placeholder handled by l3keys2e:

```
\bool_if:NT \g_@@_kw_bool {
    \keys_set:nn { pseudo } { kw }
}
```

Beamer overlays. We redefine the pause key if we're using beamer:

```
\bool_if:NT \c_@@_beamer_bool {
    \keys_define:nn { pseudo } {
        pause .meta:n = { eol-append = \pause }
    }
}
```

There's also the mechanism for handling overlay specifications on keys. Here we handle unknown keys by checking if they end with an overlay specification, and if they do, and we're in beamer, we extract it. Outside beamer, keys with overlays are simply ignored.

Note that because unknown keys currently can't have a default (which we could, in this case, use for some kind of marker, indicating no value was supplied), the only solution is to treat an empty value the same way as no value, in this case. This means that `foo<1>` and `foo<1>={}` are equivalent, and both will trigger the default of `foo`, even though the latter of the two really shouldn't.*

```
\cs_new:Nn \@@_keys_set_overlay:nnn {
    \bool_if:NT \c_@@_beamer_bool {
        \only<#1>{ \keys_set:nn { #2 } { #3 } }
    }
}
\cs_generate_variant:Nn \@@_keys_set_overlay:nnn  { VnV }
\msg_new:nnn { pseudo } { unknown-key } {
    Unknown~key~'#1'~ignored.
}
\keys_define:nn { pseudo } {
    unknown .code:n = {
        \tl_set_eq:NN \l_tmpa_tl \l_keys_key_tl
        \regex_extract_once:nVNTF {\A (.*) < (.*) > \Z}
                                  \l_tmpa_tl \l_tmpa_seq {
            \seq_pop_right:NN \l_tmpa_seq \l_tmpb_tl
            \seq_pop_right:NN \l_tmpa_seq \l_tmpa_tl
            \tl_if_blank:nF{#1} {
                \tl_put_right:Nn \l_tmpa_tl {= #1}
            }
            \@@_keys_set_overlay:VnV
                \l_tmpb_tl { pseudo } \l_tmpa_tl
        }{
            \msg_error:nnx
                { pseudo } { unknown-key } { \l_keys_path_tl }
        }
    }
}
```

Option processing. To let the user work with the options (other than when

* See `https://github.com/latex3/latex3/issues/67`.

they're available as optional arguments to other commands), we supply a command for setting them.

```
\cs_new:Nn \@@_set:n { \keys_set:nn { pseudo } { #1 } }
```

5.6 The row separator

Much of the work of the `pseudo` environment is performed by the row separator, that is, the `\\` command; whatever part of the line structure (see section 3) that's not in the `preamble` must be handled by `\\`. For example, this is where the `prefix` gets inserted. One reason for this is that there is no straightforward way to insert the column separator (`&`) from the `preamble` itself; and if you want to prevent the column separator insertion because you need to to some custom work in the first column, you'll probably want to suppress other parts of the `prefix` as well, so they might as well be collected in one place.

Beyond inserting material such as `\tabularnewline`s and `prefix` contents, `\\` is also an entrypoint for local customization, i.e., modifying the indentation level and setting any locally meaningful keys.

Indentation utilities. First we have some functions for modifying the indentation level—essentially just incrementing, decrementing and setting it to zero.

```
\cs_new:Nn \@@_inc_indent: {
    \int_gincr:N \g_@@_indent_level_int
}

\cs_new:Nn \@@_dec_indent: {
```

If the user happens to dedent too much, we might as well be a bit forgiving, and clamp the indent level to non-negative values:

```
    \int_compare:nNnT \g_@@_indent_level_int > \c_zero_int {
        \int_gdecr:N \g_@@_indent_level_int
    }
}
```

The actual row separator. The command consists of a few interacting macros. The implementation of `\\` is `@@_eol:`, but that is just a thin wrapper that counts pluses and minuses, before handing the control over to `@@_eol_tail`. This is where the remaining argument parsing takes place, and the `\tabularnewline` is inserted, after which controll is passed to `\@@_bol:` in order to begin a new line—unless we're at the end of the environment.

```
\cs_new:Nn \@@_eol_handle_args:nnn {
    \@@_keys_set_overlay:nnn { #2 } { pseudo } { hl }
    \keys_set:nn { pseudo } { #3 }
```

The variables underlying the keys (`\l_@@_label_tl`, etc.) are kept local, so they'll be restored after the environment, but in order to carry over to the next line and its preamble, we need to perform some global assignments here.

```
        \tl_gset_eq:NN \pseudolabel   \l_@@_label_tl
        \tl_gset_eq:NN \pseudobol     \l_@@_bol_tl
        \tl_gset_eq:NN \pseudoeol     \l_@@_eol_tl
        \tl_gset_eq:NN \pseudosetup   \l_@@_setup_tl
```

If starred, clear out the prefix:

```
        \IfBooleanTF { #1 } {
            \tl_gclear:N \g_@@_cur_prefix_tl
        } {
            \tl_gset_eq:NN \g_@@_cur_prefix_tl \pseudoprefix
        }
    }
    \NewDocumentCommand \@@_eol_tail { !s d<> +O{ } } {
        \@@_eol_handle_args:nnn{#1}{#2}{#3}
```

A new line is begun only if we're not at the end of the (or, at least of *some*) environment. (We could have put the `\tabularnewline` outside, but then we'd have a conditional at the beginning of the next line, which would mess up `\bottomrule` or the like. We need to keep `\@@_bol:` alone at the start of the line.)

```
        \peek_meaning_ignore_spaces:NF \end {
            \pseudoeol
            \tabularnewline
            \@@_bol:
        }
    }
```

And here is the actual `\@@_eol:` command:

```
    \cs_new:Nn \@@_eol: {

        \@@_per_char:nnn { + } {
            \@@_inc_indent:
        } {
        \@@_per_char:nnn { - } {
            \@@_dec_indent:
        } {
            \@@_eol_tail
        } }

    }
```

The `\@@_bol:` command (currently) just inserts the `prefix`:

```
    \cs_new:Nn \@@_bol: {
        \g_@@_cur_prefix_tl
    }
```

5.7 Various user commands

A few user-level wrappers around internal commands. First, a couple primarily for use in the `preamble`, together with `\pseudosavelabel` and `\pseudofont`:

```
\NewDocumentCommand \pseudohpad { } {
    \skip_horizontal:n { \l_@@_hpad_tl - \tabcolsep }
}
\NewDocumentCommand \pseudoindent { } {
    \@@_indent:N { \g_@@_indent_level_int }
}
```

The `\pseudoslash` command simply redefines the row separator, and is used at the start of the `pseudo` environment. It may be useful for the user if some other construct redefines `\\` as well. (This is similar to the `\arraycr` command of the array package.)

```
\NewDocumentCommand \pseudoslash { } {
    \cs_gset_eq:NN \\ \@@_eol:
}
```

We also have a command for restoring our definition of `\=` if it has been overwritten:

```
\NewDocumentCommand \pseudoeq { } {
    \cs_gset_eq:NN \= \@@_eq:
}
```

Finally, two utilities for working with options. The first (`\pseudoset`) directly sets a collection of keys, while the second (`\pseudodefinestyle`) defines a new key which can be used as a shortcut for setting multiple keys at some later point:

```
\NewDocumentCommand \pseudoset { +m }
    { \@@_set:n { #1 } }

\NewDocumentCommand \pseudodefinestyle { m +m } {
    \keys_define:nn { pseudo } {
        #1 .meta:n = {
            #2
        }
    }
}
```

5.8 The `pseudo` environment

While this is the main attraction, it's essentially just an augmented `tabular` environment, which does a bit of setup initially, using the various macros already described.

```
\NewDocumentEnvironment { pseudo } { !+o !s d<> +O{ } } {

    \group_begin:

    \@@_gsave_as:NN \\ \c_@@_saved_cr_cs
    \@@_gsave_as:NN \= \c_@@_saved_eq_cs

    % \pseudoslash is inside the tabular
    \pseudoeq

    \int_set:Nn \g_@@_last_saved_line_int {\arabic{pseudoline}}
    \@@_star_setup:

    \IfNoValueF { #1 } {
        \pseudoset { #1 }
    }
    \@@_set_indent_length:

    % If not manually set as compact/noncompact, set
    automatically:
    \bool_if:NF \l_@@_compact_def_bool {
        \bool_set:Nn \l_@@_compact_bool {
            \mode_if_horizontal_p: && \mode_if_inner_p:
        }
    }

    \bool_if:nF { \l_@@_compact_bool } {

        \skip_set:Nn \l_tmpa_skip {
            \l_@@_topsep_tl + \l_@@_parskip_tl
        }
        \mode_if_vertical:TF {
            \skip_add:Nn \l_tmpa_skip { \l_@@_partopsep_tl }
        } {
            \unskip \par
        }

        \addvspace { \l_tmpa_skip }

        \noindent
        \skip_horizontal:n{ \dim_eval:n { \l_@@_left_margin_tl } }

    }


    \dim_set:Nn \tabcolsep    { \l_@@_hsep_tl / 2 }
    \tl_set:Nn  \arraystretch
        { \fp_to_decimal:n { \l_@@_line_height_fp } }

    \stepcounter{pseudoenv}
    \setcounter{pseudoline}{\l_@@_start_tl}
    \addtocounter{pseudoline}{-1}
```

```
        \tl_use:N \l_@@_begin_tabular_tl
```

We use `\noalign` to be able to place these definitions inside the tabular, without messing up `\multicolumn` or `\hline` or the like. It's not really supposed to be used in expl3; the alternative would be to create an extra dummy line, like:

```
\skip_vertical:n{ -\dim_eval:n{ \box_ht:N \@arstrutbox +
                                \box_dp:N \@arstrutbox } }
\tabularnewline
```

This would give us a fresh start, without moving vertically. It's probably more hacky than just using `\noalign` here, though, so . . .

```
        \tex_noalign:D {
```

We keep the `\\`-definition inside the `tabular`, to override the redefinition placed there by array, without patching any internals:

```
            \pseudoslash
```

In a `tabularx`, for example, the body is executed multiple times, so we must make sure that any resets that are performed—such as setting the initial indentation level—are performed each time:

```
            \int_gset_eq:NN \g_@@_indent_level_int
                            \l_@@_initial_indent_level_int
```

Finally, we handle the line arguments, just like with the row separator:

```
            \@@_eol_handle_args:nnn{#2}{#3}{#4}
        }
```

Definitions and setup are done, we've left the `\noalign`, and we can start the line:

```
        \@@_bol:

    } {

        \tl_use:N \l_@@_end_tabular_tl


        \bool_if:nF { \l_@@_compact_bool } {

            \mode_if_vertical:F {
                \unskip \par
                \group_insert_after:N \@endparenv
            }

            \addvspace{ \l_tmpa_skip }
```

```
    }

    \group_end:

}
```

The starred version of the environment is just a wrapper that uses the custom (and overridable) `starred` style:

```
\pseudodefinestyle{starred}{
    preamble={
        >{\pseudohpad\pseudoindent\pseudofont}
        l
        <{\pseudohpad}
    },
    prefix={\pseudobol},
}

\NewDocumentEnvironment { pseudo* } { +O{} } {
    \begin{pseudo}[starred, #1]
    % \begin{pseudo} will "eat" any remaining arguments to pseudo*
} {
    \end{pseudo}
}
```

References

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[3] D. E. Knuth. "Random Matroids". *Discrete Mathematics* 12.4 (1975), pp. 341–358.

[4] D. P. Williamson and D. B. Shmoys. *The Design of Approximation Algorithms*. Cambridge University Press, 2011.