**schemata** — Generic package to aid construction of topical categories*

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**Abstract**

The schemata package helps the creation of topical outlines that illustrate the breakdown of concepts and categories in academic texts from the late medieval to early modern periods.

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**1 Introduction**

This package uses boxes and math mode to typeset schemata (plural of τό σχῆμα or schema, meaning form, shape, appearance, etc.). One sees them in academic literature from at least the seventeenth through the nineteenth centuries.¹

Packages like TikZ, PSTricks, METAPOST, or other solutions have advantages over this one, especially for those seeking a top-to-bottom diagram.² Yet these packages may present challenges if one has to implement both open and closed braces in a schema, which math mode allows.

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¹This file describes version 1.4, last revised 2021/02/27.
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¹Books that use this package include: Löhe, *The Pastor* [*Der evangelische Geistliche*] (St. Louis, 2015) and Schaum and Collver, *Breath of God, Yet Work of Man* (St. Louis, 2019).
²For example: H. Dembowski, *Einführung in die Christologie* (Darmstadt, 1993), 146.
2 Usage

2.1 Package Loading and Options

The schemata package is a minimal “wrapper” for math mode. It can be used with \LaTeX or with “generic” formats, including Plain \TeX, \Eplain, and Lollipop.\(^3\)

\begin{center}
\begin{tabular}{l}
For \LaTeX invoke: \usepackage\{\textit{options}\}\{schemata\} \\
For generic use: \input\{schemata.sty\}
\end{tabular}
\end{center}

\texttt{\schemataLaTeX} Normally, schemata uses generic \TeX macros if the format is not \LaTeX\texttt{2e}. When using a \LaTeX-like format with a different name than \LaTeX\texttt{2e}, one could insert the following before \usepackage{schemata}:

\begin{verbatim}
\edef\schemataLaTeX{\fmtname}
\end{verbatim}

Yet this is usually unneeded. Normally we want \schemataLaTeX to be undefined before schemata.sty is loaded to get the default value \LaTeX\texttt{2e}. We recommend not using this macro unless you know what you are doing.

\begin{itemize}
\item \LaTeX users can choose one among four package options: \texttt{braces}, \texttt{brackets}, \texttt{parens}, and \texttt{groups}. These set the defaults for the delimiters. If no options are chosen, the default is \texttt{braces}.
\end{itemize}

2.2 Macro Overview

One can describe schemata as a grouping of boxes that contain content, whose relationships are demonstrated by delimiters. We start with the boxes and their content. Subsequently, we deal with the delimiters, then later, the manner of grouping and arrangement, as well as tweaks and tutorials.

2.2.1 Containers: \texttt{schemabox}

\texttt{schemabox} Schemata contain vertically-centered lists of material in inner vertical mode. When in a \texttt{schema} or a \texttt{Schema} (see below), a \texttt{schemabox} stacks one or more lines of \texttt{hbox}-enclosed text in a \texttt{vbox}. It redefines the macro $\backslash$\texttt{\hbox} to close the current \texttt{hbox} and begin a new one, with some options that can be modified (Section 2.3).

\begin{verbatim}
\schemabox\{\langle width\rangle\}\{\langle text\rangle\}
\end{verbatim}

The $\langle width\rangle$ of a \texttt{schemabox} is a dimension, e.g., 3cm. No text wrapping (as in a \texttt{parbox}) takes place. If there is more than one line of text, each line of $\langle text\rangle$ must be terminated explicitly by $\backslash$, except the final line. Usually, the first line of a \texttt{schemabox} inserts a $\strut$ for aesthetic reasons.

When not in internal vertical mode, \texttt{schemabox} ignores $\langle width\rangle$, does not redefine $\backslash$, and prints its argument as text: \texttt{schemabox\{line-1\}\{line-2\}} line 1 line 2. This helps prevent errors.

\(^3\text{Con\TeXt does not like the way that schemata nests math-mode expressions within boxes.}\)
2.2.2 Delimiters

Both generic \TeX and \LaTeX users can use these four macros to set or change the type of delimiters. In both generic \TeX and \LaTeX, the default delimiter is braces.

\DoBraces, \DoBrackets, \DoParens, and \DoGroups do the same thing as the respective package options, except they also change the delimiters when used before \schema and \Schema. They remain in force until the end of a scope:

\[
\begin{array}{c}
a \{ \begin{array}{c} b \\ c \end{array} \} d \\
a \{ \begin{array}{c} b \\ c \end{array} \} d \\
a \left( \begin{array}{c} b \\ c \end{array} \right) d \\
a \left\{ \begin{array}{c} b \\ c \end{array} \right\} d
\end{array}
\]

Additionally, these macros can change the delimiter style within a schema. See Section 2.5, as well as the example below:

\[
\begin{array}{c}
\DoBrackets \\
\Schema{0ex}{2.4ex} \\
\{\schemabox{a}\} \\
\{\DoParens\Schema[close]{0ex}{2.3ex} \}
\{\schemabox{b\\c}\} \\
\{\schemabox{d}\} \\
\end{array}
\]

One can add new types by using eligible math-mode delimiters, e.g.:

\[
\begin{array}{c}
\makeatletter \\
\newcommand*{\DoVerts}% \\
\{\let\@schemata@LD\bracevert\} \\
\{\let\@schemata@RD\bracevert\} \\
\makeatother \\
\DoVerts \\
\Schema{0ex}{5ex} \\
\vskip0.6ex\schemabox{a} \\
\Schema[close]{0ex}{5ex} \\
\vskip0.4ex\schemabox{b\\c\\d\\e} \\
\vskip0.6ex\schemabox{f}
\end{array}
\]

2.2.3 Leaf Nodes: \schema

\schema A “simple” schema has a left-hand side with vertically-centered vertical material, a brace, and a right-hand side with vertically-centered vertical material:

\[
\text{\schema[(type)]{(left side)}{(right side)}}
\]

The (left side) and (right side) are vertical material in order to allow a \smallskip or other vertical adjustment as needed.

The (type) of a schema is open (the delimiter opens to the right) by default:

\[
\begin{array}{c}
\schema \\
\{\schemabox{a}\} \\
\{\schemabox{b\\c}\}
\end{array}
\]
Any value of \langle type\rangle other than the exact string \texttt{open} makes a “closed” schema (the delimiter opens to the left):

1 \texttt{\schema[closed]}
2 \{\texttt{\NudgeSB\schemabox{b\textbackslash c}}\}
3 \{\texttt{\schemabox{a}}\}

Using \texttt{\NudgeSB} above added a kern of 0.2em at the right of the \texttt{\schemabox} to offset an automatic kern of \texttt{-0.2em} that normally pulls the brace slightly closer to the left-hand side when it opens to the right. We cover such tweaks in Section 2.3.

In practice, \texttt{\schema} does not nest, so it is only useful for the right-hand “leaves” of a large schema. That makes formatting the “leaves” much faster. Thus, the \texttt{\schema} macro is used only in the framed sub-schemata at right.

The automatic sizing of \texttt{\schema} changes, depending on the height, depth, and even context of the letters. This can look ugly if uniformity is desired. Use \texttt{\Schema} (next section) to enforce uniform schemata.

2.2.4 Branches and Root: \texttt{\Schema}

\texttt{\Schema} The “complex” form of a schema also has a left-hand side with vertically-centered vertical material, a brace, and a right-hand side of vertically-centered vertical material, along with two arguments that adjust the layout:

\begin{verbatim}
\Schema[(type)]{(adjust)}{(size)}{(left side)}{(right side)}
\end{verbatim}

The \langle type\rangle is \texttt{open} by default. As above, any other \langle type\rangle except the exact string \texttt{open} will make it a “closed” schema. Both \langle adjust\rangle and \langle size\rangle are dimensions. We recommend expressing them as \texttt{ex}. This allows for easier scaling of the schema when changing the font size. Here is how to set \langle adjust\rangle:\footnote{Instead of setting \langle adjust\rangle, one could put vertical skips either before or after \texttt{\schemabox}, \texttt{\schema}, or \texttt{\Schema}. Yet using braces as delimiters tends to draw material toward the center cusp, where \langle adjust\rangle keeps that centered look while allowing some adjustments.}

\begin{itemize}
  \item \textbf{negative} left side and delimiter up right side down
  \item \textbf{positive} left side and delimiter down right side up
\end{itemize}

Set the delimiter \langle size\rangle to be a scaled value of \texttt{ex} just a bit larger than the number of lines of text that the delimiter spans.

By using \texttt{\Schema} to adjust the delimiter height and centering, one can bypass the shortcomings of \texttt{\schema}, but at the cost of time. One has to traverse the schema at least twice to get the desired layout. \texttt{\Schema} lets one produce multiple schemata with the same look. This method allows complex layouts:

\begin{verbatim}
main idea \{ part 1 \{ detail a \} detail b \} \{ part 2 \{ detail c \} detail d \} synonym \{ part 3 \{ detail e \} detail f \} \{ part 4 \{ detail g \} detail h \}
\end{verbatim}
The source for that complex schema looks like:

```latex
\begin{verbatim}
  \begin{schema}
    \{\SwitchSB\schemabox{main idea}}
    \{\schema\schemabox{part 1}}
    \{\SwitchSB\NudgeSB\schemabox{detail a\ detail b}}\smallskip
    \schema\schemabox{part 2}}
    \{\SwitchSB\NudgeSB\schemabox{detail c\ detail d}}
  \}
  \end{verbatim}
```

Both `\schema` and `\Schema` will stack vertically if set sequentially as paragraphs in running text:

```latex
\begin{verbatim}
\begin{array}{ll}
  \text{a} & b \\
  \text{c} & e \\
  \text{d} & f \\
\end{array}
\end{verbatim}
```

They can be on a line of text: Does this look ugly?

Certainly, one need not use a `\schemabox` in either `\schema` or `\Schema`. For example, we make a macro `\Box` below to create one square centimeter of content:

```latex
\begin{verbatim}
\def\Box{%
  \hbox{%
    \vrule
    \vbox to 1cm{\hrule\hbox to 1cm{\hfil}\vfil\hrule}%
    \vrule
  }%}
\end{verbatim}
```

Now we begin with the trivial example of one `\Box` on each side of the delimiter:
This example is more complex, showing how each side stacks \Boxes vertically:

\begin{verbatim}
9 \schema{\Box}{\Box\Box}
\end{verbatim}

Finally we use \Schema to get a schema that is both open and closed:

\begin{verbatim}
10 \Schema{-0.2ex}{0.9cm}
11 {\Box}
12 {\Box}
13 \Schema[close]
14 {-0.2ex}{0.9cm}
15 {\Box\hbox{\Box\kern0.2em}}
16 {\Box}
17 }
\end{verbatim}

A kern of \texttt{0.2em} was added above to compensate for the automatic kern of \texttt{-0.2em}, as Section 2.3 explains in more detail. If not expressed in \texttt{ex} height, \langle \texttt{size} \rangle should be slightly less than half the height of the contents, e.g., \texttt{0.9cm} for a height of \texttt{2cm}.

### 2.3 Romancing the \texttt{\schema}

\texttt{\LCschema} By default, a \texttt{\schemabox} adds a \texttt{\strut} to the first line because the topics in a schema often start with a capital letter. The \texttt{\strut} causes the delimiter of a \texttt{\schema} to have the proper size.

If the first letter is not a capital or if the text seems a little off-center, you can turn off this default feature of \texttt{\schemabox} by placing \texttt{\LCschema} immediately before \texttt{\schemabox}. \texttt{\LCschema} will prevent all subsequent uses of \texttt{\schemabox} from adding \texttt{\strut} until you restore the default behavior with \texttt{\UCschema}, also best placed before the intended \texttt{\schemabox}. Here is an example where an entire schema is in lowercase, so we change the look of the whole thing.\footnote{Based on axioms in August Pfeiffer, \textit{Thesaurus Hermeneuticus} (Frankfurt am Main, 1698).}

\begin{verbatim}
1 \LCschema
2 \Schema{0.1ex}{4.8ex}
3 {\hbox{sensus literalis}}
4 {\hbox{sensus literalis}}
5 \schema{\schemabox{sensus\\literalis\{improprie}}} \{\schemabox{e parallelismo clarior\\ex analogia fidei\ex evidentia rei}}
6 \smallskip \schemabox{sensus literae}
9 }
10 \UCschema
\end{verbatim}

\begin{verbatim}
sensus literalis \{e parallelismo clarior \ex analogia fidei \ex evidentia rei
sensus literae
\end{verbatim}
\SwitchSB The macro \SwitchSB is a per-use toggle. It causes a particular \schemabox to do the opposite of whatever \LCschema and \UCschema call for. It should be placed immediately before the \schemabox to be affected and its effect is reset when that particular \schemabox terminates.

Note, however, that mixing lowercase and uppercase-styles of \schemabox may put parts of a schema slightly off-center, meaning that one must \langle\textit{adjust}\rangle a \Schema by a tenth of an ex, give or take. Also remember that one can add \strut as needed to make manual adjustments.

\NudgeSB The macro \NudgeSB is another “per-use” macro that causes a particular \schemabox to add a default 0.2em kern at the end of every line of text, then is reset thereafter. It “corrects a corrective.”

\NudgeSB is meant to be used on the left-hand side of a closed \schema or \Schema. Both macros insert a kern of -0.2em to draw the cusp or flexion point of the delimiter closer to the left-hand side. This corrects the spacing of delimiters that open to the right. When a delimiter opens to the left, the kern may be needed if there is punctuation, or it may throw off the spacing.

\SBNudgeFactor This macro is the kern used by \NudgeSB to make its corrective. Sometimes you feel like a nudge, sometimes you don’t, and sometimes you just want a little nudge. We used the example below on page \textit{3} before the schema with two braces, all in a group to localize any changes:

\renewcommand\SBNudgeFactor{\kern0.08em}

2.4 Tutorial
Now that we have explained what all the macros are supposed to do, let’s take a journey together in establishing and practicing a methodology for creating general forms of schemata.

2.4.1 Starting Off Basic
Let’s ignore pretty much everything that we learned so far and attempt to typeset a schema with the following:

1 \schema{a}{b\c}
   \hfill \{ \begin{array}{c} b \\ c \end{array} \}

Oh dear, that went badly. Oh, wait! Schemata hold internal vertical lists. That weird \schemabox thing handles just that case:

1 \schema
   2 \{\schemabox{a}\}
   3 \{\schemabox{b\c}\}

Now we are getting somewhere! But if we do not have a “big” side we get:

1 \schema
   2 \{\schemabox{a}\}
   3 \{\schemabox{b}\}

Now we are getting somewhere! But if we do not have a “big” side we get:

1 \schema
   2 \{\schemabox{a}\}
   3 \{\schemabox{b}\}

When there is no “big” side of a schema, perhaps use inline math mode:

\langle\hbox{a}\rangle\langle\hbox{\strut gib}\rangle\langle\text{.}\rangle \quad a \{\text{gib}\}
2.4.2  Loci 101

We move on from trivial examples to several real-world examples based on published material. Let’s try a few examples from Loci Theologici by Martin Chemnitz. We begin by using only \schema:

\begin{verbatim}
\textsc{Essentiam,} \\
Subjectum theologiae est Notitia Dei. Considerat ergo, Dei, vel
\textsc{Voluntatem,} \\
manifestatam in operibus ad extra; ut in
\textsc{Creatione,} \\
Sustentatione naturae lapsae.
\textsc{Reparatione,} \\
\textsc{Conversione,} \\
\textsc{Justificatione,} \\
\textsc{Sanctificatione \\& Glorificatione ejusdem.}
\end{verbatim}

Subjectum theologiae est Notitia Dei. Considerat ergo, Dei, vel

\begin{verbatim}
\textsc{Essentiam,} \\
\textsc{Unitate naturae.} \\
\textsc{Trinitate personarum.} \\
\textsc{Operibus ad intra.}
\textsc{Voluntatem,} \\
manifestatam in operibus ad extra; ut in
\textsc{Creatione.} \\
\textsc{Sustentatione naturae lapsae.} \\
\textsc{Reparatione.} \\
\textsc{Conversione.} \\
\textsc{Justificatione.} \\
\textsc{Sanctificatione \\& Glorificatione ejusdem.}
\end{verbatim}

This is not what we want; \schema works for the “leaves” on the right, but not for the “root” on the left. The brace adjusts to the entire right-hand side.
Before we address the brace, we adjust the spacing, starting from the “leaves” at right, going to the “root” on the left. We add a `\smallskip` after a `\schema` to space out the “leaves”:\footnote{Using `\vskip` in \LaTeX{} starts a new paragraph, so `\smallskip` cannot be used within the horizontal mode `\schemabox` when using Plain \TeX{}. In some cases, putting vertical space in the first or last lines of a `\schemabox`, regardless of format, will affect centering.}

\begin{verbatim}
17 `\smallskip`

We have two `\schema` “leaves” and one “root,” so we only change one `\schema` into a `\Schema`. We count the lines of text, estimate, then revise. Below we have 8–9 lines of text from “ESSENTIAM” to “ut in.” We estimate ⟨\textit{size}⟩ at 8.5\textit{ex} and ⟨\textit{adjust}⟩ at 0\textit{ex}. The large brace is too low, so we ⟨\textit{adjust}⟩ to -1\textit{ex}, raising the left side and the delimiter, while lowering the right. We then refine ⟨\textit{size}⟩ to 8.7\textit{ex}.\footnote{Changes in \TeX{} distributions can change font metrics and thus, the metrics of your schemata.}

\begin{verbatim}
1 `\Schema{-1ex}{8.7ex}
\end{verbatim}

After those two line changes, we have the finished schema that now looks like it is supposed to appear:

\begin{verbatim}
\begin{equation}
\begin{aligned}
\text{Subjectum theologæ est Notitia Dei. Considerat ergo, Dei, vel }&\text{ESSENTIAM,}
\text{Unitate naturæ.} \\
\text{Dei.} &\text{Trinitate personarum.} \\
\text{Considerat ergo, Dei, vel} &\text{Operibus ad intra.} \\
\text{VOLUNTATEM,} &\text{Creatione.}
\text{manifestatam in} &\text{Sustentatione naturæ lapsæ.}
\text{operibus ad extra;} &\text{Reparatione.}
\text{ut in} &\text{Conversione.}
\end{aligned}
\end{equation}
\end{verbatim}

\begin{verbatim}
\text{Voluntatem,} \text{manifestatam in operibus ad extra; ut in Creatione.}
\text{Sustentatione naturæ lapsæ.}
\text{Reparatione.}
\text{Conversione.}
\text{Justificatione.}
\text{Sanctificatione & Glorificatione ejusdem.}
\end{verbatim}

2.4.3 Going Big

Thus far, we have dealt with many trivial examples. We have amassed a significant body of knowledge:

1. We usually use `\schemabox` for the contents of a schema.
2. Schemata usually “open” from left to right, from “root” to “leaves.”
3. We typeset “leaves” with `\schema` to save time.
4. We typeset other parts with `\Schema`.
5. We adjust spacing and delimiter size by working from the “leaves” to the “root” to minimize the number of corrective passes.
6. We may need to consider differences between \LaTeX{} and Plain \TeX{} when using `\vskip`, `\smallskip`, etc., as well as `\newbox`, which is an `\outer` macro in Plain \TeX{}. These differences can cause unexpected errors.
7. We may need to use the tweaking macros `\UCschema`, `\LCschema`, `\SwitchSB`, and `\NudgeSB`.
Armed with this information, we sally forth to reproduce the following schema found on page 13 of Martin Chemnitz, *Loci Theologici* (Frankfurt, 1653).  

- As you see, the braces were composed of various type sorts, mainly smaller rules and assorted curly and bendy bits.

- Because this is Latin we will see roman, italic and small caps, but little of other typefaces. We do see *s-medialis* and many old-style ligatures.

- In the reproduction we will use *s-finalis* only, but we will retain some ligatures.

- We will improve spacing between elements.

- We will not aim for an exact reproduction of line breaks and such.

---

8 This image was created from a photograph taken by the author. It is the victim of a few cage transforms, despeckling, color selection and fill, color equalization, cleanup, scaling, and reduction to a two-color indexed palette.
We begin by looking at the “leaves,” the rightmost bits of text enclosed by braces. We can use \texttt{\textbackslash schema} in these cases. That results in the following:

\begin{verbatim}
\texttt{\textbackslash schema
{\texttt{schemabox{\textsc{Per se}: \textsc{scilicet}.}}}
{\texttt{schemabox{Unus in essentia.}}}
\texttt{schemabox{Trinus in personis.}}
}

PER SE: \begin{align*}
\text{Unus in essentia.} \\
\text{scilicet.} \\
\text{Trinus in personis.}
\end{align*}

\texttt{\textbackslash schema
{\texttt{schemabox{Ad hominem\textbackslash quem vel}}}
{\texttt{schemabox{Accusat \& terret, \textsc{Per Legem},\textbackslash Consolatur \& erigit, \textsc{Per Evangelium}.\\
Salvat, \textsc{Per Christum}.\\
Renovat, \textsc{Per Spiritum Sanctum}.\\
Sanctificat, \textsc{Per Verbum} \& \textsc{Sacramenta}.\\
Castigat, tentat \& exercet, \textsc{Per Crucem}.\\
Glorificat \textsc{Per Resurrectionem Carnis}\textbackslash }
\texttt{\textbackslash textsc{\quad Ad Vitam \AE{}ternam}.}}
\end{verbatim}

\begin{verbatim}
\texttt{\textbackslash schemabox{Ante lapsum.}}
\texttt{\textbackslash schemabox{Post lapsum:}}
\texttt{schemabox{Ante Regenerationem \&\textbackslash
Renovationem S. Sancti.}}
\texttt{schemabox{Post Regenerationem \&\textbackslash
Renovationem S. Sancti.}}
\end{verbatim}

\texttt{\textbackslash schemabox{Ante lapsum.\textsuperscript{9}}}

\texttt{\textbackslash schemabox{Post lapsum:}}
\begin{align*}
\text{Ante Regenerationem} & \text{&}
\text{Renovationem S. Sancti.} \\
\text{Post Regenerationem} & \text{&}
\text{Renovationem S. Sancti.}
\end{align*}

\texttt{\textbackslash schemabox{\quad Ante Regenerationem \&
Renovationem S. Sancti.}}

\texttt{\textbackslash schemabox{\quad Post Regenerationem \&
Renovationem S. Sancti.}}

\textsuperscript{9}
\textit{We delete line 2 after Ante lapsum in the large example on page 13 and thereafter.}
Deum,

\begin{itemize}
\item Pœnitentia agens, agnitis peccatis \& ira Dei cognita Ex Lege.
\item Erigens se Voce Evangelii.
\item Credens In Christum Salvatorem.
\item Non repugnans Spiritui Sancto impellenti.
\item Audiens Verbum: \& utens Sacramentis.
\item Patienter \& constanter sufferens Crucem.
\item Sperans \& expectans glorificationem
\item \textsc{Ex Lege}.
\item \textsc{Voce Evangelii}.
\item \textsc{In Christum Salvatorem}.
\item \textsc{Sacramentis}.
\item \textsc{Crucem}.
\item \textsc{Glorificationem}.
\end{itemize}

seipsum ratione

\begin{itemize}
\item Animaæ
\item vel
\item Corporis
\end{itemize}

Amicum rati

\begin{itemize}
\item Religionis.
\item Politicæ \& Economicæ.
\item Cognitionis.
\item Agnationis.
\end{itemize}

Inimicum.\footnote{We delete line 9 before \textit{Inimicum} in the large example on page 13 and thereafter.}
Below we build all of the “leaves” into the larger schema using \(\text{Schema}\). The braces all have dummy values of \(0\text{ex}\) \(<\text{adjust}\rangle\) and \(5\text{ex}\) \(<\text{size}\rangle\). Please do not be alarmed at how bad this looks right now! We will adjust the layout shortly. We just want to see the general look of things:

Below we have the code listing for the schema above. One can see that there is much correlation between the listing and the printed result:

```
1     \text{Schema}\{0\text{ex}\}{5\text{ex}}
2     \{ 
3     \text{schemabox}\{\text{Subjectum} & \\
4     \text{summa univer-} \\
5     \text{sae Scripturae,} \\
6     \text{est Cognitio} \\
7     \text{vel} \\
8     \} 
9     \{ 
10    \text{PER se:} \\
11    \{ 
12    \text{Unus in essentia.} \\
13    \text{Trinus in personis.} \\
14    \} \\
15    \text{Accusat & terret, PER LEGEM,} \\
16    \text{Consolatur & erigit, PER EVANGELIUM.} \\
17    \text{Salvat, PER CHRISTUM.} \\
18    \text{Renovat, PER SPIRITUM SANC'TUM.} \\
19    \text{Sanctificat, PER VERBUM & SACRAMENTA.} \\
20    \text{Castigat, tentat & exercet, PER CRUCEM.} \\
21    \text{Glorificat PER RESURRECTIONEM CARNIS} \\
22    \text{AD VITAM ÆTERNAM.} \\
23    \} \\
24    \{ 
25    \text{Ante lapsum.} \\
26    \text{Ante Regenerationem &} \\
27    \text{Renovationem S. Sancti.} \\
28    \text{Post Regenerationem &} \\
29    \text{Renovationem S. Sancti.} \\
30    \} \\
31    \text{PER se:} \\
32    \{ 
33    \} \\
34    \text{Post lapsum:} \\
35    \{ 
36    \text{Deum,} \\
37    \text{Non repugnans SPIRITUI SANCTO impellenti.} \\
38    \text{Audiens VERBUM: & utens SACRAMENTIS.} \\
39    \text{Patienter & constanter sufferens CRUCEM.} \\
40    \text{Sperans & expectans glorificationem} \\
41    \text{IN RESURRECTIO CARNIS} \\
42    \text{AD VITAM ÆTERNAM.} \\
43    \} \\
44    \{ 
45    \text{Hominis,} \\
46    \text{qualis sit} \\
47    \} \\
48    \{ 
49    \text{Amicus ratione vel} \\
50    \text{Religionis.} \\
51    \text{Politicæ & Æconomicæ.} \\
52    \text{Cognitionis.} \\
53    \text{Agnationis.} \\
54    \} \\
55    \{ 
56    \text{Proximum,} \\
57    \text{Inimicum.} \\
58    \} 
59 
60 \} 
```


\Schema{0ex}{5ex}
\{\schemabox{\textsc{Dei}, qua-\lis sit, aut} \}
\}
\schema
\{\schemabox{\textsc{Per se}:
\ scilicet.}}
\{\schemabox{Unus in essentia.}
\schemabox{Trinus in personis.}
\}
\schema
\{\schemabox{Ad hominem\ quem vel}}
\{\schemabox{Accusat \& terret, \textsc{Per Legem},\\}
Consolatur \& erigit, \textsc{Per Evangelium}.\\
Salvat, \textsc{Per Christum}.\\
Renovat, \textsc{Per Spiritum Sanctum}.\\
Sanctificat, \textsc{Per Verbum} \& \textsc{Sacramenta}.\\
Castigat, tentat \& exercet, \textsc{Per Crucem}.\\
Glorificat \textsc{Per Resurrectionem Carnis}\\
\textsc{\quad Ad Vitam \AE{}ternam}.}\\
\schemabox{\textsc{Hominis},\ qualis sit}\\
\{\schemabox{\textsc{Per se}:}}\\
\schemabox{Ante lapsum.}
\schema
\{\schemabox{Post lapsum:}}\\
\schemabox{Ante Regenerationem \&\\
Renovationem S. Sancti.}\\
\schemabox{Post Regenerationem \&\\
Renovationem S. Sancti.}
\}
\}
\Schema{0ex}{5ex}
\{\schemabox{\textsc{Ad}}
\}
\schema
\{\schemabox{\textsc{Deum},}}
\{\schemabox{P\oe{nitentia agens, agnitis peccatis \&\\}
ira Dei cognita \textsc{Ex Lege}.\\
Erigens se \textsc{Voce Evangelii}.\\
Credens \textsc{In Christum Salvatorem}.\\
Non repugnans \textsc{Spiritus Sancto} impellenti.\\
Audis \textsc{Verbum}: \& utens \textsc{Sacramentis}.\\
Patientes \& constanter sufferens \textsc{Crucem}.\\
Pater \& expectans glorificationem\"}
First, we add space between the “leaves” of the tree. If you do not work from right to left, you will waste time revising the “leaves” and “branches.” The following lines, shown with some surrounding context, were changed.

Remember that you can add a \texttt{\smallskip} within a \texttt{\schemabox} in \LaTeX, but not in \texttt{Plain} \TeX. We have split the text below into two boxes to make it format-agnostic. See also how the second \texttt{\smallskip} follows the closing brace of the right-hand side, not the \texttt{\schemabox}. That adjusts the entire \texttt{\schema}.

\begin{verbatim}
  { \schemabox{Unus in essentia.}\smallskip \schemabox{Trinus in personis.}  }\smallskip
  \texttt{\schemabox{Post lapsum:}}
  \texttt{\schemabox{Ante Regenerationem \& Renovationem S. Sancti.}}\medskip
\end{verbatim}

Again, below, the skip comes at the close of a \texttt{\schema}.

Below, the first skip helps to separate the lone \texttt{\schemabox} from the \texttt{\schema} beneath it. This illustrates how the internal vertical lists of schemata can contain heterogeneous material.

A medium skip is placed between two \texttt{\schemaboxes}, which slightly throws off the way the brace spans the boxes. A small skip is put at the end of the last \texttt{\schemabox} to correct that. Sometimes putting skips within a \texttt{\schema} can be tricky. Then a \texttt{\smallskip} is added again at the end of the right-hand side.
The skips below generally follow the same patterns that we have seen above.

The resulting schema looks better already:

\[\textsc{Ad Vitam æternam}.\]
Next we estimate the lines of text and blank lines from the top of a `\Schema` brace to the bottom, e.g., from “Per se:” to “quem vel”. We use those “ex” height figures for ⟨size⟩. The following lines illustrate our “ball park” figures:

1 \Schema{0ex}{23ex}
10 \Schema{0ex}{8ex}
34 \Schema{0ex}{16ex}
39 \Schema{0ex}{5ex}
52 \Schema{0ex}{16ex}
72 \Schema{0ex}{5ex}

PER SE: Unus in essentia.
scilicet. Trinus in personis.

DEI, qualis sit, aut
Accusat & terret, Per Legem,
Consolatur & erigit, Per Evangelium.
Salvat, Per Christum.
Renovat, Per Spiritum Sanctum.
Sanctificat, Per Verbum & Sacramenta.
Castigat, tentat & exercet, Per Crucem.
Glorificat Per Resurrectionem Carnis
Ad Vitam æternam.

Ad hominem
Ante Regenerationem &
Renovationem S. Sancti.
Post Regenerationem &
Renovationem S. Sancti.

quem vel
Poenitentia agens, agnitis peccatis &
ira Dei cognita Ex Lege.
Erigens se Voce Evangeli.
Credens In Christum Salvatorem.
Non repugnans Spiritui Sancto impellenti.
Audiens Verbum: & utens Sacramentis.
Patienter & constanter sufferens Crucem.
Sperans & expectans glorificationem
In Resurrectione Carnis
Ad Vitam æternam.

Subjectum & summa universalis Scripture, est Cognitio vel

PER SE:

Deum,
Credens In Christum Salvatorem.
Non repugnans Spiritui Sancto impellenti.
Audiens Verbum: & utens Sacramentis.
Patienter & constanter sufferens Crucem.
Sperans & expectans glorificationem
In Resurrectione Carnis
Ad Vitam æternam.

Hominis, qualis sit

Ad seipsum ratione
Animæ vel
Corporis

Proximum, Amicum ratione vel
Religionis,
Politicae & Economiae.
Cognitionis,
Agnationis.

Inimicum.
Next we tweak \langle\textit{adjust}\rangle\textit{ values by counting the lines (ex) in the direction the left side needs to move relative to the right, multiply the result by two, and make it negative for up and positive for down. Using an editor, e.g., \texttt{texworks} makes this fairly easy. We also adjust the final \langle\textit{size}\rangle\textit{ of the braces. Work from leaves to root:}

\begin{verbatim}
1 \texttt{\textbackslash Schema\{-25ex\}{20.6ex}\% Do this one last. \textquote{Subjectum'}}
10 \texttt{\textbackslash Schema\{-6.4ex\}{8.5ex}\% Do this one first. \textquote{Dei'}}
34 \texttt{\textbackslash Schema\{-13.4ex\}{17.4ex}\% Do this one fifth. \textquote{Hominis'}}
39 \texttt{\textbackslash Schema\{-4.4ex\}{5ex}\% Do this one second. \textquote{Per se'}} (lower)
52 \texttt{\textbackslash Schema\{4.2ex\}{14.4ex}\% Do this one fourth. \textquote{Ad'}}
72 \texttt{\textbackslash Schema\{2ex\}{5.1ex}\% Do this one third. \textquote{Proximum'}}
\end{verbatim}

\begin{verbatim}
PER SE: \begin{cases}
\text{Unus in essentia.} \\
\text{Trinus in personis.}
\end{cases}
\end{verbatim}

\begin{verbatim}
DEI, qualsit, aut
\begin{cases}
\text{Accusat \& terret, \textit{PER LEGEM},} \\
\text{Consolatur \& erigit, \textit{PER EVANGELIUM}.} \\
\text{Salvat, \textit{PER CHRISTUM}.} \\
\text{Renovat, \textit{PER SPIRITUM SANCTUM}.} \\
\text{Sanctificat, \textit{PER VERBUM \& SACRAMENTA}.} \\
\text{Castigat, tentat \& exercet, \textit{PER CRUCEM}.} \\
\text{Glorificat \textit{PER RESURRECTIOEM CARNIS}} \\
\text{\textit{AD VITAM \AETERNAM}.}
\end{cases}
\end{verbatim}

\begin{verbatim}
\textit{Ad hominem quem vel}
\end{verbatim}

\begin{verbatim}
Subjectum \&
\begin{cases}
\text{summa universae Scripture,} \\
\text{est COGNITIO vel}
\end{cases}
\end{verbatim}

\begin{verbatim}
\textit{PER SE:}
\begin{cases}
\text{Ante lapsum.} \\
\text{Post lapsum:}
\begin{cases}
\text{Ante Regenerationem \&} \\
\text{Renovationem S. Sancti.} \\
\text{Post Regenerationem \&} \\
\text{Renovationem S. Sancti.}
\end{cases}
\end{cases}
\end{verbatim}

\begin{verbatim}
HOMINIS, qualsit
\begin{cases}
\text{Penitentia agens, agnitis peccatis \&} \\
\text{ira Dei cognita \textit{EX LEGE}.} \\
\text{Erigens se \textit{VOCE EVANGELI}.} \\
\text{Credens \textit{IN CHRISTUM SALVATOREM}.} \\
\text{Non repugnans \textit{SPIRITUI SANCTO impellenti}.} \\
\text{Audien \textit{VERBUM:} \&} \textit{utens SACRAMENTIS}. \\
\text{Patier \& constanter sufferers \textit{CRUCEM}.} \\
\text{Sperans \& expectans glorificationem} \\
\text{\textit{IN RESURRECTIOEM CARNIS}} \\
\text{\textit{AD VITAM \AETERNAM}.}
\end{cases}
\end{verbatim}

\begin{verbatim}
\textit{DEUM,}
\begin{cases}
\text{Animae} \\
\text{vel} \\
\text{Corporis}
\end{cases}
\end{verbatim}

\begin{verbatim}
\textit{Ad}
\begin{cases}
\text{Amicum ratione vel} \\
\text{Corporis}
\end{cases}
\end{verbatim}

\begin{verbatim}
Proximum, \\
\begin{cases}
\text{Religionis.} \\
\text{Politicæ \& \textit{Economicæ.}} \\
\text{Cognitionis.} \\
\text{Agnationis.}
\end{cases}
\end{verbatim}

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2.4.4 Big Schema with Groups

The next example illustrates everything that we have covered so far, plus \DoGroups, all inside a local scope:

\begin{verbatim}
2.4.5 Open and Closed Schemata

Now we look at schemata that have both open and closed braces. One must use \Schema to get delimiters to be the same height. These schemata take the form:

\begin{verbatim}
\Schema{⟨adjust⟩}{⟨height⟩}
{⟨left1⟩}
{\Schema[close]{⟨adjust⟩}{⟨height⟩}
{⟨left2⟩}
{⟨right2⟩}
\end{verbatim}
\end{verbatim}
We use a modified version of our \Box macro from above to show how each part nests within the other. Below we do not use \NudgeSB from Section 2.3 because we are not using \schemabox; instead we directly add the kern: \hbox{\Box{\,$left_2$}\kern0.2em} within the closed schema. The result is:

```
left_1 { left_2 } right_2
```

Here is another, more complex example:

```
1 \newbox\mybox
2 \def\Box#1{%
3 \setbox\mybox=\hbox{\vrule vbox\hrule% 
4 \vfil hbox{\strut space #1\space}% 
5 \vfil\hrule\vrule}%
6 \dimen0=\ht\mybox%
7 \advance\dimen0 by2ex%
8 \hbox{\vrule vbox to \dimen0\hrule% 
9 \vfil hbox{\Large\strut\space #1\space}% 
10 \vfil\hrule\vrule}\
11 \Schema{0ex}{6ex}\
12 {\Box{a}}\
13 {%
14 \Box{%
15 \Schema[close]{0ex}{6ex}\
16 {%
17 \Box{%
18 \Schema{0ex}{3ex}\
19 {\Box{b}}\
20 {%
21 \Box{%
22 \Schema[close]{0ex}{3ex}\
23 {\hbox{\Box{c}\kern0.2em}}}\
24 {\Box{d}}\
25 }\
26 }\
27 }\
28 }\
29 {\Box{e}}\
30 }
31 }
```
This is more of a real-world example. As above, one must use `\Schema` to prevent the opening braces from being slightly larger than the closing braces.

This listing of the example above illustrates closed schemata. The macro `\gk` uses either polyglossia or babel. We cannot show Unicode Greek text in the verbatim environment; we substitute `xxxxx` for `ὁμοουσίος`.

```latex
\begin{align}
\text{Quæ sit Dei, vel} & \quad \text{You sit, Dei, vel} \\
\vspace{1ex}
\text{Essentia, in} & \quad \text{Essentia, in} \\
\vspace{1ex}
\text{Unitate divina,} & \quad \text{Unitate divina,} \\
\text{Tribus personas divinitatis} & \quad \text{Tribus personas divinitatis} \\
\text{Patre, Filio, Spiritui Sancto} & \quad \text{Patre, Filio, Spiritui Sancto} \\
\text{ὁμοουσίος} & \quad \text{ὁμοουσίος} \\
\text{& coæternis} & \quad \text{& coæternis} \\
\text{Voluntas, } & \quad \text{Voluntas, } \\
\text{revelatur in actione, sive} & \quad \text{revelatur in actione, sive} \\
\text{Universali} & \quad \text{Universali} \\
\text{Creationis, Sustenationis, Propagationis,} & \quad \text{Creationis, Sustenationis, Propagationis,} \\
\text{rerum creatarum.} & \quad \text{rerum creatarum.} \\
\text{Speciali, in beneficiis} & \quad \text{Speciali, in beneficiis} \\
\text{erga Ecclesiam, eam} & \quad \text{erga Ecclesiam, eam} \\
\text{Colligendo, Justificando, Conservando, Glorificando.} & \quad \text{Colligendo, Justificando, Conservando, Glorificando.}
\end{align}
```

1 \Schema{-1.4ex}{10ex}
2 {\schemabox{Quæ sit\textsc{Dei}, vel}}
3 {  
4 \Schema{-1ex}{5ex}
5 {\schemabox{\textsc{Essentia}, in}}
6 {  
7 \vskip1ex\schemabox{Unitate divina,}
8 \medskip
9 \Schema{0ex}{3.4ex}
10 {\schemabox{\textsc{Tribus personas divinitatis}}}  
11 {  
12 \Schema[close]{0ex}{3.4ex}
13 {\NudgeSB\schemabox{Patre, Filio, Spiritui Sancto}}
14 {\schemabox{\gk{xxxxx}{<omoous’iois}\ & co\ae{}{ternis}}} 
15 }
16 }
17 \medskip
18 \Schema{-0.2ex}{6.4ex}
19 {\schemabox{\textsc{Voluntas,}\ revelatur in\ actione, sive}}
20 {  
21 \Schema{0ex}{3.4ex}
22 {\schemabox{\textsc{Universali}}}  
23 {  
24 \Schema[close]{0ex}{3.4ex}
25 {\schemabox{\textsc{Creationis,}\ Sustenationis,\ Propagationis,}}
26 {\schemabox{\textsc{rerum creatarum.}}} 
27 }
28 \medskip
29 \schema
30 {\schemabox{\textsc{Speciali, in beneficiis}\ erga Ecclesiam, eam}}
31 {\schemabox{\textsc{Colligendo,\ Justificando,\ Conservando,\ Glorificando.}}}
2.5 Final features

This final example illustrates how one can set the width of a \schemabox, and for what sort of use that might be. Below we invoke \DoBrackets after the start of the group containing the right-hand side of the first \Schema.

\begin{verbatim}
1 \Schema{-0.2ex}{14.4ex}
2 \{\schemabox{\bfseries Curricula\\\bfseries Texts}}
3 \{
4 \DoBrackets%
5 % newbox here is doable in LaTeX, not in Plain TeX,
6 % where it must be used as an \outer macro.
7 \newbox\mybox%
8 \setbox\mybox=\hbox{\bfseries III. Philosophical }% 
9 \dimen0=\wd\mybox%
10 \schema
11 \{\schemabox[\dimen0]{\bfseries I. General\\Studies}}
12 \{\schemabox{1. Collected Works\2. Encyclopedias}}
13 \smallskip
14 \schema
15 \{\schemabox[\dimen0]{\bfseries II. Literary\\Disciplines}}
16 \{\schemabox{1. Philology\}
17 2. Historical Introduction\}
18 3. Literary Theory\}
19 4. Application\}
20 \smallskip
21 \schema
22 \{\schemabox[\dimen0]{\bfseries III. Philosophical\\Disciplines}}
23 \{\schemabox{1. Source Texts\}
24 2. History of Philosophy\}
25 3. General Surveys\}
26 4. Specific Studies\}
27 \smallskip
28 \schema
29 \{\schemabox[\dimen0]{\bfseries IV. Historical\\Disciplines}}
30 \{\schemabox{1. General Surveys\2. Specialized Works}}
31 \}
\end{verbatim}
3 Implementation

Shorter macros are written in both \LaTeX{} and generic \TeX{}. Longer macros implement both a \LaTeX{} and a generic front end with a common back end.

If the format is “LaTeX2e” then the macros use the \LaTeX{} front end. Otherwise they use generic \TeX{}, meaning Plain \TeX{}, eplain, and Lollipop—maybe others too, but they are not supported.

In order to support such a diversity of formats and \TeX{} engines, we must avoid newer primitives like \unless{} and \ifdef. Thus, we must revert to the “old” way of testing whether or not a macro is defined.

\LaTeX{} Below we manually duplicate with verbatim material what we put early in the dtx file for the versioning information to work. The \LaTeX{} macro normally is undefined until it is assigned the value of LaTeX2e, to be compared with \fmtname. If we are not using \LaTeX{}, we do the equivalent of \makeatletter in either Plain \TeX{} or eplain.

\begin{verbatim}
1 \%<package>\expandafter\ifx \csname schemataLaTeX\endcsname\relax
2 \%<package> \def\schemataLaTeX{LaTeX2e}\fi
3 \%<package>\ifx\fmtname\schemataLaTeX
4 \%<package>\expandafter\NeedsTeXFormat\expandafter{\schemataLaTeX}[2005/12/01]
5 \%<package>\ProvidesPackage{schemata}
6 \%<package>
7 \%<package>\catcode'@=11\relax
8 \%<package>\else
9 \%<package>\fi
\end{verbatim}

3.1 Internal Variables

\LaTeX{} We declare the internal macro \LaTeX{} to be the value of \LaTeX{} to safeguard package operation. From this point onward we can display or query \LaTeX{} for user-side tests without affecting package internals.

\begin{verbatim}
12 \edef\LaTeX{}{\LaTeX{}}
\end{verbatim}

Two box registers and two dimen registers are used to analyze the left-hand and right-hand vertical sizes of the boxes in a schema. Three more dimen registers are for scratchwork.

\begin{verbatim}
13 \newbox\@schemata@rhs
14 \newbox\@schemata@lhs
15 \newdimen\@schemata@rheight
16 \newdimen\@schemata@lheight
17 \newdimen\@schemata@one
18 \newdimen\@schemata@two
19 \newdimen\@schemata@three
\end{verbatim}

Two Boolean flags affect the height of a \LaTeX{}, respectively setting and toggling that height for lowercase and uppercase content in order to add or remove space for boxes with only lowercase text.

\begin{verbatim}
20 \newif\if@schemata@LCBox
21 \newif\if@schemata@SWBox
\end{verbatim}

This Boolean flag determines if a kern should be added to the end of each line in a \LaTeX{} (helps with closed braces).

\begin{verbatim}
22 \newif\if@schemata@NudgeBox
\end{verbatim}
3.2 Package Options

We set braces to be the default set of delimiters. Apart from \TeX\ we ignore the options. Three options are implemented, namely, \texttt{braces} (the default), \texttt{brackets}, and \texttt{parens}. Since the options are used infrequently, we naively process them in whatever order we get, each overwriting the last.

\begin{verbatim}
23 \ifx\fmtname@schemata@LaTeX
24 \DeclareOption{braces}\
25 \let@schemata@LD\lbrace
26 \let@schemata@RD\rbrace
27 \DeclareOption{brackets}\
28 \let@schemata@LD\lbrack
29 \let@schemata@RD\rbrack
30 \DeclareOption{parens}\
31 \let@schemata@LD(\
32 \let@schemata@RD)
33 \DeclareOption{groups}\
34 \let@schemata@LD\{\
35 \let@schemata@RD\}
36 \ExecuteOptions{braces}\
37 \ProcessOptions\relax
38 \else
39 \let@schemata@LD\lbrace
40 \let@schemata@RD\rbrace
41 \fi

3.3 Macros

\texttt{\DoBraces} Set the delimiters to be braces. This is local to a scope, including within a schema.

\begin{verbatim}
42 \ifx\fmtname@schemata@LaTeX
43 \newcommand*{\DoBraces}\
44 \let@schemata@LD\lbrace\
45 \let@schemata@RD\rbrace
46 \else
47 \def\DoBraces\
48 \let@schemata@LD\lbrace\
49 \let@schemata@RD\rbrace
50 \fi

\DoBrackets Set the delimiters to be brackets. This is local, as above.

\begin{verbatim}
51 \ifx\fmtname@schemata@LaTeX
52 \newcommand*{\DoBrackets}\
53 \let@schemata@LD\lbrack\
54 \let@schemata@RD\rbrack
55 \else
56 \def\DoBrackets\
57 \let@schemata@LD\lbrack\
58 \let@schemata@RD\rbrack
59 \fi

\DoParens Set the delimiters to be parentheses. This is local, as above.

\begin{verbatim}
60 \ifx\fmtname@schemata@LaTeX
61 \newcommand*{\DoParens}\
62 \let@schemata@LD(\
63 \let@schemata@RD)
64 \fi
\end{verbatim}
\end{verbatim}
\DoGroups Set the delimiters to be parentheses. This is local, as above.

\LCschema Prevent \schemabox from adding a \strut in the first line.

\UCschema Permit \schemabox to add a \strut in the first line (default).

\SwitchSB Flip the UC/LC settings for one \schemabox, which will reset this value on exit.

\NudgeSB Add a kern to the end of each line in one \schemabox. This will be reset on exit from that \schemabox.

\SBNudgeFactor Define the \kern to be added to the end of each line in one \schemabox. The default is 0.2em, equal to the horizontal corrective.
\indent If in internal vertical mode, restricted horizontal mode, or math mode, wrap a stack of \hbox\s in a \vbox, then put that inside an \hbox. The first argument sets an optional width for those \hboxs. Normally insert a \strut in the first \hbox. The second argument contains the rows of horizontal material, where \ is redefined to end one \hbox and begin another. When in any other mode mode, just display the second argument as text.

```latex
\def\schemabox#1#2{\@schemata@schemabox[#1]{#2}}
\def\@schemata@schemab@x{%\if\text\let
ext\@schemata@schemabox%\else\let
ext\@schemata@@schemab@x%\fi
\next%}
\def\@schemata@@schemab@x#1{\@schemata@schemabox[0pt]{#1}}
\def\@schemata@schemabox[#1]#2{%\ifinner\if@schemata@LCBox\def\@schemata@Adj{}%\if@schemata@SWBox\def\@schemata@Adj{\strut}\fi\else\def\@schemata@Adj{\strut}\if@schemata@SWBox\def\@schemata@Adj{}}%\fi\ifdim#1<1pt\def\{\@schemata@Nudge\SBNudgeFactor%\else\def\{\hfill%\fi\ifdim#1<1pt\def\{\@schemata@Nudge\egroup\hbox\bgroup\ignorespaces }%\vbox\bgroup%\@schemata@Adj\ignorespaces #2\@schemata@Nudge%\egroup}%\else\def\{\hfill\egroup\hbox to #1\bgroup\ignorespaces }%\vbox\hbox to #1\bgroup%\@schemata@Adj\ignorespaces #2\hfill%\egroup}%\fi\else\#2\fi\@schemata@SWBoxfalse%\@schemata@NudgeBoxfalse%}
```

This “simple” schema vertically centers two boxes of internal vertical material and puts a “simple” brace between the boxes based on the height of the box and the options passed to the schema.

There is something of a “magic” value for adjusting the height used for the larger side of a \(\text{schema}\), namely \(1.44265\text{ex}\). By using this adjustment, which is slightly larger than \(\sqrt{2}\) times the ex-height of the font, the results look more aesthetically pleasing in terms of centering and size of the braces.

By default, a schema has a box to the left, an open delimiter, and a box to the right. If any optional argument other than open is used, the schema prints a box to the left, a close brace, and a box to the right.

```latex
\ifx\fmtname@\schemata@LaTeX
\newcommand{\schema}[3][open]{\schemata@schema[#1]{#2}{#3}}
\else
\long\def\schema{\futurelet@\next@schemata@testchar\schemata@schema}
\long\def\schemata@schema[#1]{\next@schemata@testchar\next@schemata@option[#1]{\schemata@open}{#2}{#3}}
\fi
\ifx\@schemata@option\@schemata@open
\setbox@schemata@rheight=\vbox{#3}\kern-0.2em\@schemata@rbrace{\@schemata@rheight}\vcenter{#3}
\else
\setbox@schemata@lheight=\vbox{#2}\kern-0.2em\@schemata@lbrace{\@schemata@lheight}\vcenter{#3}
\fi
```
\textbf{\texttt{\Schema}}  This is the general-purpose form of schemata. The arguments include whether it is an open or closed schema, the vertical adjustment of the left-hand side and delimiter over against the right-hand side, the size of the brace, and the contents of the left and right-hand sizes. It works about the same as above, but requires manual adjustment of the braces. Again we see the “magic” height adjustment value of 1.44265ex.

\begin{verbatim}
184 \ifx\fmtname\@schemata@LaTeX
185  \newcommand{\Schema}[5][open]{%
186    //@schemata@Schema[#1]{#2}{#3}{#4}{#5}
187  }else
188  \long\def\Schema{\futurelet@schemata@testchar//@schemata@Schem@}
189  \long\def//@schemata@Schem@{%
190    \ifx[//@schemata@testchar
191      \let\next//@schemata@Schema%
192    \else
193      \let\next//@schemata@@Schem@%
194    \fi
195  }
196
197  \long\def//@schemata@@Schem@#1#2#3#4{%
198    //@schemata@Schema[open]{#1}{#2}{#3}{#4}
199  }fi
200 \long\def//@schemata@Schema[#1]{#2#3#4#5{%
201    //@schemata@Option[#1]%
202    //@schemata@open%
203    //@schemata@one=#2%
204    \ifx//@schemata@option//@schemata@open
205      \bbox{$vcenter{\vskip1.44265//@schemata@one#4}$}
206      //@schemata@biglbrace{#2}{#3}vcenter(#5}%
207    \else
208      \bbox{$vcenter{\vskip1.44265//@schemata@one#4}\kern-0.2em$
209        //@schemata@bigrbrace{#2}{#3}vcenter(#5}%
210  \fi
211}\end{verbatim}

\textbf{//@schemata@lbrace} Draw an on-center delimiter to the left of a simple box.

\begin{verbatim}
212 \ifx\fmtname//@schemata@LaTeX
213  \newcommand*{//@schemata@lbrace}[1]{%
214    \ifmmode
215      \left.vcenter{\bbox to #1{\vfil}}\right//@schemata@LD%
216  \fi
217  \}else
218  \def//@schemata@lbrace#1{%
219    \ifmmode
220      \left.vcenter{\bbox to #1{\vfil}}\right//@schemata@LD%
221  \fi
222  \}fi
223 \end{verbatim}
\@schemata@rbrace
Draw an on-center delimiter to the right of a simple box.

\iffalse
@schemata@rbrace
\else
\def\@schemata@rbrace#1{\ifmmode
\left\@schemata@RD\vcenter{\vbox to #1{\vfil}}\right.\fi}
\fi
\else
\def\@schemata@rbrace#1{\ifmmode
\left\@schemata@RD\vcenter{\vbox to #1{\vfil}}\right.\fi}
\fi

\@schemata@bigrbrace
Draw a vertically-adjustable delimiter to the left of a complex assortment of boxes. Again
we see the “magic” height adjustment value of 1.44265ex, but both positive and negative.

\iffalse
@schemata@bigrbrace
\else
\def\@schemata@bigrbrace#1#2{\@schemata@@bigrbrace{#1}{#2}}
\fi
\def\@schemata@@bigrbrace#1#2{\@schemata@one=#1\@schemata@two=#2\@schemata@three=-\@schemata@two\ifdim\@schemata@three>\@schemata@two\@schemata@two=\@schemata@three\fi\ifdim\@schemata@one<0pt\ifmmode\vcenter{\hbox{$\left.\vbox to 1.44265\@schemata@two{\vfil}\atop\vbox to -1.44265\@schemata@one{\vfil}$}}\fi\else\ifmmode\vcenter{\hbox{$\vbox to 1.44265\@schemata@one{\vfil}\atop\left.\vbox to 1.44265\@schemata@two{\vfil}$}}\fi\fi\fi\fi
\fi
\fi
Draw a vertically-adjustable delimiter to the right of a complex assortment of boxes. Again we see the “magic” height adjustment value of 1.44265ex, but both positive and negative.

\def\schemata@bigrbrace#1#2{\@schemata@@bigrbrace{#1}{#2}}
\@schemata@one=#1\@schemata@two=#2\@schemata@three=-\@schemata@two\ifdim\@schemata@three>\@schemata@two\@schemata@two=\@schemata@three\fi\ifdim\@schemata@one<0\vcenter{$\left.\vbox to 1.44265\@schemata@two{\vfil}\right\@schemata@RD$}\if\ifmmode\vbox to 1.44265\@schemata@one{\vfil}\atop\left.\vbox to 1.44265\@schemata@two{\vfil}\right\@schemata@RD$\fi\else\ifmmode\vcenter{\hbox{$\vbox to 1.44265\@schemata@two{\vfil}$}}\fi\else\fi\fi\fi\fi\fi

If we are not using \LaTeX, we do the equivalent of \texttt{\makeatother}.

\catcode‘@=12\relax
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