

The sTeX3 Package Collection *

Michael Kohlhase, Dennis Müller
FAU Erlangen-Nürnberg
<http://kwarc.info/>

2022-05-20

Abstract

sTeX is a collection of L^AT_EX packages that allow to markup documents semantically without leaving the document format.

Running ‘pdflatex’ over sTeX-annotated documents formats them into normal-looking PDF. But sTeX also comes with a conversion pipeline into semantically annotated HTML5, which can host semantic added-value services that make the documents active (i.e. interactive and user-adaptive) and essentially turning L^AT_EX into a document format for (mathematical) knowledge management (MKM).

sTeX augments L^AT_EX with

- *semantic macros* that denote and distinguish between mathematical concepts, operators, etc. independent of their notational presentation,
- a powerful *module system* that allows for authoring and importing individual fragments containing document text and/or semantic macros, independent of – and without hard coding – directory paths relative to the current document, and
- a mechanism for exporting sTeX documents to (modular) XHTML, preserving all the semantic information for semantically informed knowledge management services.

This is the full documentation of sTeX. It consists of four parts:

- **Part I** is a general manual for the sTeX package and associated software. It is primarily directed at end-users who want to use sTeX to author semantically enriched documents.
- **Part II** documents the macros provided by the sTeX package. It is primarily directed at package authors who want to build on sTeX, but can also serve as a reference manual for end-users.
- **Part III** documents additional packages that build on sTeX, primarily its module system. These are not part of the sTeX package itself, but useful additions enabled by sTeX package functionality.
- **Part IV** is the detailed documentation of the sTeX package implementation.

*Version 3.1 (last revised 2022-05-20)

Contents

I	Manual	1
1	What is sTeX?	2
2	Quickstart	3
2.1	Setup	3
2.1.1	Minimal Setup for the PDF-only Workflow	3
2.1.2	GIT-based Setup for the sTeX Development Version	3
2.1.3	sTeX Archives (Manual Setup)	4
2.1.4	The sTeX IDE	4
2.1.5	Manual Setup for Active Documents and Knowledge Management Services	4
2.2	A First sTeX Document	5
2.2.1	OMDoc/xhtml Conversion	8
3	Creating sTeX Content	10
3.1	How Knowledge is Organized in sTeX	10
3.2	sTeX Archives	11
3.2.1	The Local MathHub-Directory	11
3.2.2	The Structure of sTeX Archives	11
3.2.3	MANIFEST.MF-Files	12
3.2.4	Using Files in sTeX Archives Directly	13
3.3	Module, Symbol and Notation Declarations	14
3.3.1	The smodule-Environment	14
3.3.2	Declaring New Symbols and Notations	16
	Operator Notations	19
3.3.3	Argument Modes	19
	Mode-b Arguments	20
	Mode-a Arguments	20
	Mode-B Arguments	22
3.3.4	Type and Definiens Components	22
3.3.5	Precedences and Automated Bracketing	23
3.3.6	Variables	25
3.3.7	Variable Sequences	26
3.4	Module Inheritance and Structures	28
3.4.1	Multilinguality and Translations	28
3.4.2	Simple Inheritance and Namespaces	29
3.4.3	The mathstructure Environment	31
3.4.4	The copymodule Environment	34
3.4.5	The interpretmodule Environment	35
3.5	Primitive Symbols (The sTeX Metatheory)	35
4	Using sTeX Symbols	36
4.1	\symref and its variants	36
4.2	Marking Up Text and On-the-Fly Notations	37
4.3	Referencing Symbols and Statements	39

5	sTeX Statements	40
5.1	Definitions, Theorems, Examples, Paragraphs	40
6	Highlighting and Presentation Customizations	47
7	Additional Packages	49
7.1	Tikzinput: Treating TIKZ code as images	49
7.2	Modular Document Structuring	50
7.3	Slides and Course Notes	52
7.4	Representing Problems and Solutions	56
7.5	Homeworks, Quizzes and Exams	59
II	Documentation	62
8	sTeX-Basics	63
8.1	Macros and Environments	63
8.1.1	HTML Annotations	63
8.1.2	Babel Languages	64
8.1.3	Auxiliary Methods	64
9	sTeX-MathHub	65
9.1	Macros and Environments	65
9.1.1	Files, Paths, URIs	65
9.1.2	MathHub Archives	66
9.1.3	Using Content in Archives	67
10	sTeX-References	68
10.1	Macros and Environments	68
10.1.1	Setting Reference Targets	68
10.1.2	Using References	69
11	sTeX-Modules	70
11.1	Macros and Environments	70
11.1.1	The <code>smodule</code> environment	72
12	sTeX-Module Inheritance	74
12.1	Macros and Environments	74
12.1.1	SMS Mode	74
12.1.2	Imports and Inheritance	75
13	sTeX-Symbols	77
13.1	Macros and Environments	77
14	sTeX-Terms	79
14.1	Macros and Environments	79
15	sTeX-Structural Features	81
15.1	Macros and Environments	81
15.1.1	Structures	81

16	<code>sTeX</code>-Statements	82
16.1	Macros and Environments	82
17	<code>sTeX</code>-Proofs: Structural Markup for Proofs	83
18	<code>sTeX</code>-Metatheory	84
18.1	Symbols	84
III	Extensions	85
19	<code>Tikzinput</code>: Treating <code>TIKZ</code> code as images	86
19.1	Macros and Environments	86
20	<code>document-structure</code>: Semantic Markup for Open Mathematical Documents in <code>LaTeX</code>	87
21	<code>NotesSlides</code> – Slides and Course Notes	88
22	<code>problem.sty</code>: An Infrastructure for formatting Problems	89
23	<code>hwexam.sty/cls</code>: An Infrastructure for formatting Assignments and Exams	90
IV	Implementation	91
24	<code>sTeX</code>-Basics Implementation	92
24.1	The <code>sTeXDocument</code> Class	92
24.2	Preliminaries	93
24.3	Messages and logging	94
24.4	HTML Annotations	95
24.5	Babel Languages	96
24.6	Persistence	97
24.7	Auxiliary Methods	98
25	<code>sTeX</code>-MathHub Implementation	102
25.1	Generic Path Handling	102
25.2	PWD and <code>kpsewhich</code>	104
25.3	File Hooks and Tracking	105
25.4	MathHub Repositories	106
25.5	Using Content in Archives	111
26	<code>sTeX</code>-References Implementation	115
26.1	Document URIs and URLs	115
26.2	Setting Reference Targets	117
26.3	Using References	119
27	<code>sTeX</code>-Modules Implementation	122
27.1	The <code>smodule</code> environment	126
27.2	Invoking modules	132

28	sTeX-Module Inheritance Implementation	134
28.1	SMS Mode	134
28.2	Inheritance	138
29	sTeX-Symbols Implementation	144
29.1	Symbol Declarations	144
29.2	Notations	152
29.3	Variables	160
30	sTeX-Terms Implementation	168
30.1	Symbol Invocations	168
30.2	Terms	175
30.3	Notation Components	179
30.4	Variables	181
30.5	Sequences	184
31	sTeX-Structural Features Implementation	185
31.1	Imports with modification	186
31.2	The feature environment	194
31.3	Structure	194
32	sTeX-Statements Implementation	205
32.1	Definitions	205
32.2	Assertions	211
32.3	Examples	214
32.4	Logical Paragraphs	217
33	The Implementation	222
33.1	Proofs	222
33.2	Justifications	233
34	sTeX-Others Implementation	234
35	sTeX-Metatheory Implementation	236
36	Tikzinput Implementation	239
37	document-structure.sty Implementation	242
37.1	Package Options	242
37.2	Document Structure	243
37.3	Front and Backmatter	247
37.4	Global Variables	249
38	NotesSlides – Implementation	250
38.1	Class and Package Options	250
38.2	Notes and Slides	252
38.3	Header and Footer Lines	256
38.4	Frame Images	258
38.5	Colors and Highlighting	259
38.6	Sectioning	260
38.7	Excursions	262

39 The Implementation	264
39.1 Package Options	264
39.2 Problems and Solutions	265
39.3 Multiple Choice Blocks	272
39.4 Including Problems	273
39.5 Reporting Metadata	275
40 Implementation: The hwexam Package	277
40.1 Package Options	277
40.2 Assignments	278
40.3 Including Assignments	281
40.4 Typesetting Exams	282
40.5 Leftovers	284
41 References	285

Part I

Manual



Boxes like this one contain implementation details that are mostly relevant for more advanced use cases, might be useful to know when debugging, or might be good to know to better understand how something works. They can easily be skipped on a first read.



Boxes like this one explain how some $\text{\texttt{STeX}}$ concept relates to the MMT/OMDoc system, philosophy or language; see [MMT; Koh06] for introductions.

Chapter 1

What is sTeX?

Formal systems for mathematics (such as interactive theorem provers) have the potential to significantly increase both the accessibility of published knowledge, as well as the confidence in its veracity, by rendering the precise semantics of statements machine actionable. This allows for a plurality of added-value services, from semantic search up to verification and automated theorem proving. Unfortunately, their usefulness is hidden behind severe barriers to accessibility; primarily related to their surface languages reminiscent of programming languages and very unlike informal standards of presentation.

sTeX minimizes this gap between informal and formal mathematics by integrating formal methods into established and widespread authoring workflows, primarily L^AT_EX, via non-intrusive semantic annotations of arbitrary informal document fragments. That way formal knowledge management services become available for informal documents, accessible via an IDE for authors and via generated *active* documents for readers, while remaining fully compatible with existing authoring workflows and publishing systems.

Additionally, an extensible library of reusable document fragments is being developed, that serve as reference targets for global disambiguation, intermediaries for content exchange between systems and other services.

Every component of the system is designed modularly and extensibly, and thus lay the groundwork for a potential full integration of interactive theorem proving systems into established informal document authoring workflows.

The general sTeX workflow combines functionalities provided by several pieces of software:

- The sTeX package collection to use semantic annotations in L^AT_EX documents,
- RuS_{TeX} [RT] to convert `tex` sources to (semantically enriched) `xhtml`,
- The MMT system [MMT], that extracts semantic information from the thus generated `xhtml` and provides semantically informed added value services.

Chapter 2

Quickstart

2.1 Setup

There are two ways of using $\text{\texttt{sTeX}}$: as a

1. way of writing $\text{\texttt{L\text{A}TeX}}$ more modularly (object-oriented Math) for creating PDF documents or
2. foundation for authoring active documents in HTML5 instrumented with knowledge management services.

Both are legitimate and useful. The first requires a significantly smaller tool-chain, so we describe it first. The second requires a much more substantial (and experimental) toolchain of knowledge management systems. Both workflows profit from an integrated development environment (IDE), which (also) automates setup as far as possible (see [subsection 2.1.4](#)).

2.1.1 Minimal Setup for the PDF-only Workflow

In the best of all worlds, there is no setup, as you already have a new version of $\text{\texttt{TeXLive}}$ on your system as a $\text{\texttt{L\text{A}TeX}}$ enthusiast. If not now is the time to install it; see [\[TL\]](#). You can usually update $\text{\texttt{TeXLive}}$ via a package manager or the $\text{\texttt{TeXLive}}$ manager **tlmgr**.

Alternatively, you can install $\text{\texttt{sTeX}}$ from CTAN, the Comprehensive $\text{\texttt{TeX}}$ Archive Network; see [\[ST\]](#) for details.

2.1.2 GIT-based Setup for the $\text{\texttt{sTeX}}$ Development Version

If you want use the latest and greatest $\text{\texttt{sTeX}}$ packages, you can that have not even been released to CTAN, then you can directly clone them from the $\text{\texttt{sTeX}}$ development repository [\[sTeX\]](#) by the following command-line instructions:

```
cd <stexdir>
git clone https://github.com/slatex/sTeX.git
```

and keep it updated by pulling updates via `git pull` in the cloned $\text{\texttt{sTeX}}$ directory. Then update your `TEXINPUTS` environment variable, e.g. by placing the following line in your `.bashrc`:

¹NEW PART: MK: reorganized, we do not need the full MKM tool chain

```
export TEXINPUTS="$(TEXINPUTS):<sTeXDIR>//:"
```

2.1.3 sTeX Archives (Manual Setup)

Writing semantically annotated sTeX becomes much easier, if we can use well-designed libraries of already annotated content. sTeX provides such libraries as sTeX archives – i.e. GIT repositories at <https://gl.mathhub.info> – most prominently the SMGLoM libraries at <https://gl.mathhub.info/smgglom>.

To do so, we set up a **local MathHub** by creating a MathHub directory `<mhdir>`. Every sTeX archive as an **archive path** `<apath>` and a name `<archive>`. We can clone the sTeX archive by the following command-line instructions:

```
cd <mhdir>/<apath>
git clone https://gl.mathhub.info/smgglom/<archive>.git
```

Note that sTeX archives often depend on other archives, thus you should be prepared to clone these as well – e.g. if `pdflatex` reports missing files. To make sure that sTeX too knows where to find its archives, we need to set a global system variable `MATHHUB`, that points to your local MathHub-directory (see [section 3.2](#)).

```
export MATHHUB="<mhdir>"
```

2.1.4 The sTeX IDE

We are currently working on an sTeX IDE as an sTeX plugin for VScode; see [\[Sla\]](#). It will feature a setup procedure that automates the setup described above (and below). For additional functionality see the (now obsolete) plugin for sTeX 1 [\[SLS; Stb\]](#).

2.1.5 Manual Setup for Active Documents and Knowledge Management Services

Foregoing on the sTeX IDE, we will need several additional (on top of the minimal setup above) pieces of software; namely:

- **The Mmt System** available [here](#)². We recommend following the setup routine documented [here](#).

Following the setup routine (Step 3) will entail designating a **MathHub**-directory on your local file system, where the MMT system will look for sTeX/MMT content archives.

- **sTeX Archives** If we only care about L^AT_EX and generating pdfs, we do not technically need MMT at all; however, we still need the `MATHHUB` system variable to be set. Furthermore, MMT can make downloading content archives we might want to use significantly easier, since it makes sure that all dependencies of (often highly interrelated) sTeX archives are cloned as well.

Once set up, we can run `mmt` in a shell and download an archive along with all of its dependencies like this: `lmh install <name-of-repository>`, or a whole *group* of archives; for example, `lmh install smglom` will download all `smglom` archives.

- **RuSTeX** The MMT system will also set up RuSTeX for you, which is used to generate (semantically annotated) `xhtml` from tex sources. In lieu of using MMT, you can also download and use RuSTeX directly [here](#).

²EdNOTE: For now, we require the `sTeX`-branch, requiring manually compiling the MMT sources

2.2 A First sTeX Document

Having set everything up, we can write a first sTeX document. As an example, we will use the `smglom/calculus` and `smglom/arithmetics` archives, which should be present in the designated MathHub-folder, and write a small fragment defining the *geometric series*:

TODO: use some sTeX-archive instead of `smglom`, use a convergence-notion that includes the limit, mark-up the theorem properly

```

1 \documentclass{article}
2 \usepackage{stex,xcolor,stexthm}
3
4 \begin{document}
5 \begin{smodule}{GeometricSeries}
6   \importmodule[smglom/calculus]{series}
7   \importmodule[smglom/arithmetics]{realarith}
8
9   \symdef{geometricSeries}[name=geometric-series]{\comp{S}}
10
11   \begin{sdefinition}[for=geometricSeries]
12     The \definame{geometricSeries} is the \symname{?series}
13     \[\defeq{\geometricSeries}{\definiens{
14       \infinitesum{\svar{n}}{1}{
15         \realdivide[frac]{1}{
16           \realpower{2}{\svar{n}}
17         }
18       }}
19     \end{sdefinition}
20
21     \begin{sassertion}[name=geometricSeriesConverges,type=theorem]
22       The \symname{geometricSeries} \symname{converges} towards $1$.
23     \end{sassertion}
24 \end{smodule}
25 \end{document}

```

Compiling this document with `pdflatex` should yield the output

Definition 0.1. The **geometric series** is the **series**

$$S := \sum_{n=1}^{\infty} \frac{1}{2^n}.$$

Theorem 0.2. The **geometric series converges** towards 1.

Move your cursor over the various highlighted parts of the document – depending on your pdf viewer, this should yield some interesting (but possibly for now cryptic) information.

Remark 2.2.1:

Note that all of the highlighting, tooltips, coloring and the environment headers come from `stexthm` – by default, the amount of additional packages loaded is kept to a minimum and all the presentations can be customized, see [chapter 6](#).

Let's investigate this document in detail to understand the respective parts of the \TeX markup infrastructure:

```
\begin{smodule}{GeometricSeries}
...
\end{smodule}
```

smodule First, we open a new *module* called `GeometricSeries`. The main purpose of the `smodule` environment is to group the contents and associate it with a *globally unique* identifier (URI), which is computed from the name `GeometricSeries` and the document context. (Depending on your pdf viewer), the URI should pop up in a tooltip if you hover over the word `geometric series`.

```
\importmodule[smglom/calculus]{series}
\importmodule[smglom/arithmetics]{realarith}
```

\importmodule Next, we *import* two modules – `series` from the \TeX archive `smglom/calculus`, and `realarith` from the \TeX archive `smglom/arithmetics`. If we investigate these archives, we find the files `series.en.tex` and `realarith.en.tex` (respectively) in their respective source-folders, which contain the statements `\begin{smodule}{series}` and `\begin{smodule}{realarith}` (respectively).

The `\importmodule`-statements make all \TeX symbols and associated semantic macros (e.g. `\infinitesum`, `\realdive`, `\realpower`) in the imported module available to the current module `GeometricSeries`. The module `GeometricSeries` “exports” all of these symbols to all modules imports it via an `\importmodule{GeometricSeries}` instruction. Additionally it exports the local symbol `\geometricSeries`.

\usemodule If we only want to *use* the content of some module `Foo`, e.g. in remarks or examples, but none of the symbols in our current module actually *depend* on the content of `Foo`, we can use `\usemodule` instead – like `\importmodule`, this will make the module content available, but will *not* export it to other modules.

```
\symdef{GeometricSeries}[name=geometric-series]{\comp{S}}
```

\symdef Next, we introduce a new *symbol* with name `geometric-series` and assign it the semantic macro `\geometricSeries`. `\symdef` also immediately assigns this symbol a *notation*, namely `S`.

\comp The macro `\comp` marks the `S` in the notation as a *notational component*, as opposed to e.g. arguments to `\geometricSeries`. It is the notational components that get highlighted and associated with the corresponding symbol (i.e. in this case `geometricSeries`). Since `\geometricSeries` takes no arguments, we can wrap the whole notation in a `\comp`.

```

\begin{sdefinition}[for=geometricSeries]
...
\end{sdefinition}
\begin{sassertion}[name=geometricSeriesConverges,type=theorem]
...
\end{sassertion}

```

What follows are two \LaTeX -statements (e.g. definitions, theorems, examples, proofs, ...). These are semantically marked-up variants of the usual environments, which take additional optional arguments (e.g. `for=`, `type=`, `name=`). Since many \LaTeX templates predefine environments like `definition` or `theorem` with different syntax, we use `sdefinition`, `sassertion`, `sexample` etc. instead. You can customize these environments to e.g. simply wrap around some predefined `theorem`-environment. That way, we can still use `sassertion` to provide semantic information, while being fully compatible with (and using the document presentation of) predefined environments.

In our case, the `stexthm`-package patches e.g. `\begin{sassertion}[type=theorem]` to use a `theorem`-environment defined (as usual) using the `amsthm` package.

```
... is the \symname{?series}
```

`\symname`

The `\symname`-command prints the name of a symbol, highlights it (based on customizable settings) and associates the text printed with the corresponding symbol.

Note that the argument of `\symref` can be a local or imported symbol (here the `series` symbol is imported from the `series` module). \LaTeX tries to determine the full symbol URI from the argument. If there are name clashes in or with the imported symbols, the name of the exporting module can be prepended to the symbol name before the `?` character.

If you hover over the word `series` in the pdf output, you should see a tooltip showing the full URI of the symbol used.

`\symref`

The `\symname`-command is a special case of the more general `\symref`-command, which allows customizing the precise text associated with a symbol. `\symref` takes two arguments the first is the symbol name, and the second a variant verbalization of the symbol, e.g. an inflection variant, a different language or a synonym. In our example `\symname{?series}` abbreviates `\symref{?series}{series}`.

```
The \definame{geometricSeries} ...
```

`\definame`
`\definiendum`

The `sdefinition`-environment provides two additional macros, `\definame` and `\definiendum` which behave similarly to `\symname` and `\symref`, but explicitly mark the symbols as *being defined* in this environment, to allow for special highlighting.

```

\[\defeq{\geometricSeries}{\definiens{
  \infinitesum{\svar{n}}{1}{
    \realdivide[frac]{1}{
      \realpower{2}{\svar{n}}
    }
  }}
\}.\]

```

The next snippet – set in a math environment – uses several semantic macros imported from (or recursively via) `series` and `realarithmetics`, such as `\defeq`, `\infinitesum`, etc. In math mode, using a semantic macro inserts its (default) definition. A semantic

macro can have several notations – in that case, we can explicitly choose a specific notation by providing its identifier as an optional argument; e.g. `\realdivide[frac]{a}{b}` will use the explicit notation named `frac` of the semantic macro `\realdivide`, which yields $\frac{a}{b}$ instead of a/b .

`\svar` The `\svar{n}` command marks up the `n` as a variable with name `n` and notation `n`.

`\definiens` The `sdefinition`-environment additionally provides the `\definiens`-command, which allows for explicitly marking up its argument as the *definiens* of the symbol currently being defined.

2.2.1 OMDoc/xhtml Conversion

So, if we run `pdflatex` on our document, then \TeX yields pretty colors and tooltips¹. But \TeX becomes a lot more powerful if we additionally convert our document to `xhtml` while preserving all the \TeX markup in the result.

TODO VSCode Plugin

Using `Ru\TeX` [RT], we can convert the document to `xhtml` using the command `rustex -i /path/to/file.tex -o /path/to/outfile.xhtml`. Investigating the resulting file, we notice additional semantic information resulting from our usage of semantic macros, `\symref` etc. Below is the (abbreviated) snippet inside our `\definiens` block:

```
<mrow resource="" property="stex:definiens">
  <mrow resource="...?series?infinitiesum" property="stex:OMBIND">
    <munderover displaystyle="true">
      <mo resource="...?series?infinitiesum" property="stex:comp">\Sigma</mo>
      <mrow>
        <mrow resource="1" property="stex:arg">
          <mi resource="var://n" property="stex:OMV">n</mi>
        </mrow>
        <mo resource="...?series?infinitiesum" property="stex:comp">=</mo>
        <mi resource="2" property="stex:arg">1</mi>
      </mrow>
      <mi resource="...?series?infinitiesum" property="stex:comp">\infty</mi>
    </munderover>
    <mrow resource="3" property="stex:arg">
      <mfrac resource="...?realarith?division#frac#" property="stex:OMA">
        <mi resource="1" property="stex:arg">1</mi>
        <mrow resource="2" property="stex:arg">
          <msup resource="...realarith?exponentiation" property="stex:OMA">
            <mi resource="1" property="stex:arg">2</mi>
            <mrow resource="2" property="stex:arg">
              <mi resource="var://n" property="stex:OMV">n</mi>
            </mrow>
          </msup>
        </mrow>
      </mfrac>
    </mrow>
  </mrow>
```

¹...and hyperlinks for symbols, and indices, and allows reusing document fragments modularly, and...

...containing all the semantic information. The MMT system can extract from this the following OPENMATH snippet:

```
<OMBIND>
  <OMID name="...?series?infinitesum"/>
  <OMV name="n"/>
  <OMLIT name="1"/>
  <OMA>
    <OMS name="...?realarith?division"/>
    <OMLIT name="1"/>
    <OMA>
      <OMS name="...realarith?exponentiation"/>
      <OMLIT name="2"/>
      <OMV name="n"/>
    </OMA>
  </OMA>
</OMBIND>
```

...giving us the full semantics of the snippet, allowing for a plurality of knowledge management services – in particular when serving the **xhtml**.

Remark 2.2.2:

Note that the **html** when opened in a browser will look slightly different than the **pdf** when it comes to highlighting semantic content – that is because naturally **html** allows for much more powerful features than **pdf** does. Consequently, the **html** is intended to be served by a system like MMT, which can pick up on the semantic information and offer much more powerful highlighting, linking and similar features, and being customizable by *readers* rather than being prescribed by an author.

Additionally, not all browsers (most notably Chrome) support MATHML natively, and might require additional external JavaScript libraries such as MathJax to render mathematical formulas properly.

Chapter 3

Creating sTeX Content

We can use sTeX by simply including the package with `\usepackage{stex}`, or – primarily for individual fragments to be included in other documents – by using the sTeX document class with `\documentclass{stex}` which combines the `standalone` document class with the `stex` package.

Both the `stex` package and document class offer the following options:

lang ($\langle\textit{language}\rangle*$) Languages to load with the `babel` package.

mathhub ($\langle\textit{directory}\rangle$) MathHub folder to search for repositories – this is not necessary if the `MATHHUB` system variable is set.

sms ($\langle\textit{boolean}\rangle$) use *persisted* mode (not yet implemented).

image ($\langle\textit{boolean}\rangle$) passed on to `tikzinput`.

debug ($\langle\textit{log-prefix}\rangle*$) Logs debugging information with the given prefixes to the terminal, or all if `all` is given. Largely irrelevant for the majority of users.

3.1 How Knowledge is Organized in sTeX

sTeX content is organized on multiple levels:

1. sTeX **archives** (see [section 3.2](#)) contain individual `.tex`-files.
2. These may contain sTeX **modules**, introduced via `\begin{smodule}{ModuleName}`.
3. Modules contain sTeX **symbol declarations**, introduced via `\symdecl{symbolname}`, `\symdef{symbolname}` and some other constructions. Most symbols have a *notation* that can be used via a *semantic macro* `\symbolname` generated by symbol declarations.
4. sTeX **expressions** finally are built up from usages of semantic macros.

$\hookrightarrow M \rightarrow$

$\hookrightarrow M \rightarrow$

$\hookrightarrow T \rightarrow$

- sTeX archives are simultaneously MMT archives, and the same directory structure is consequently used.

- sTeX modules correspond to OMDoc/MMT *theories*. `\importmodules` (and

$\hookrightarrow M \rightarrow$
 $\hookrightarrow M \rightarrow$
 $\hookrightarrow T \rightarrow$

similar constructions) induce MMT `includes` and other *theory morphisms*, thus giving rise to a *theory graph* in the OMDOC sense [RK13].

- Symbol declarations induce OMDOC/MMT *constants*, with optional (formal) *type* and *definiens* components.
- Finally, $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ expressions are converted to OMDOC/MMT terms, which use the abstract syntax (and XML encoding) of OPENMATH [Bus+04].

3.2 $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ Archives

3.2.1 The Local MathHub-Directory

`\usemodule`, `\importmodule`, `\inputref` etc. allow for including content modularly without having to specify absolute paths, which would differ between users and machines. Instead, $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ uses *archives* that determine the global namespaces for symbols and statements and make it possible for $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ to find content referenced via such URIs.

All $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ archives need to exist in the local MathHub-directory. $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ knows where this folder is via one of four means:

1. If the $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ package is loaded with the option `mathhub=/path/to/mathhub`, then $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ will consider `/path/to/mathhub` as the local MathHub-directory.
2. If the `mathhub` package option is *not* set, but the macro `\mathhub` exists when the $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ -package is loaded, then this macro is assumed to point to the local MathHub-directory; i.e. `\def\mathhub{/path/to/mathhub}\usepackage{stex}` will set the MathHub-directory as `path/to/mathhub`.
3. Otherwise, $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ will attempt to retrieve the system variable `MATHHUB`, assuming it will point to the local MathHub-directory. Since this variant needs setting up only *once* and is machine-specific (rather than defined in tex code), it is compatible with collaborating and sharing tex content, and hence recommended.
4. Finally, if all else fails, $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ will look for a file `~/.stex/mathhub.path`. If this file exists, $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ will assume that it contains the path to the local MathHub-directory. This method is recommended on systems where it is difficult to set environment variables.

3.2.2 The Structure of $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ Archives

An $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ archive `group/name` is stored in the directory `/path/to/mathhub/group/name`; e.g. assuming your local MathHub-directory is set as `/user/foo/MathHub`, then in order for the `smglom/calculus`-archive to be found by the $\mathcal{S}\mathcal{T}\mathcal{E}\mathcal{X}$ system, it needs to be in `/user/foo/MathHub/smglom/calculus`.

Each such archive needs two subdirectories:

- `/source` – this is where all your tex files go.
- `/META-INF` – a directory containing a single file `MANIFEST.MF`, the content of which we will consider shortly

An additional `lib`-directory is optional, and is where $\text{\texttt{S\TeX}}$ will look for files included via `\libinput`.

Additionally a *group* of archives `group/name` may have an additional archive `group/meta-inf`. If this `meta-inf`-archive has a `/lib`-subdirectory, it too will be searched by `\libinput` from all tex files in any archive in the `group/*-group`.

We recommend the following additional directory structure in the `source`-folder of an $\text{\texttt{S\TeX}}$ archive:

- `/source/mod/` – individual $\text{\texttt{S\TeX}}$ modules, containing symbol declarations, notations, and `\begin{paragraph}``[type=symdoc,for=...]` environments for “encyclopaedic” symbol documentations
- `/source/def/` – definitions
- `/source/ex/` – examples
- `/source/thm/` – theorems, lemmata and proofs; preferably proofs in separate files to allow for multiple proofs for the same statement
- `/source/snip/` – individual text snippets such as remarks, explanations etc.
- `/source/frag/` – individual document fragments, ideally only `\inputrefing` snippets, definitions, examples etc. in some desirable order
- `/source/tikz/` – tikz images, as individual `.tex`-files
- `/source/pic/` – image files.³

3.2.3 MANIFEST.MF-Files

The `MANIFEST.MF` in the `META-INF`-directory consists of key-value-pairs, informing $\text{\texttt{S\TeX}}$ (and associated software) of various properties of an archive. For example, the `MANIFEST.MF` of the `smglom/calculus`-archive looks like this:

```
id: smglom/calculus
source-base: http://mathhub.info/smgglom/calculus
narration-base: http://mathhub.info/smgglom/calculus
dependencies: smglom/arithmetics,smglom/sets,smglom/topology,
              smglom/mv,smglom/linear-algebra,smglom/algebra
responsible: Michael.Kohlhase@FAU.de
title: Elementary Calculus
teaser: Terminology for the mathematical study of change.
description: desc.html
```

Many of these are in fact ignored by $\text{\texttt{S\TeX}}$, but some are important:

`id`: The name of the archive, including its group (e.g. `smglom/calculus`),

`source-base` or

`ns`: The namespace from which all symbol and module URIs in this repository are formed, see (TODO),

³EdNOTE: MK: bisher habe ich immer PIC subdirs, soll ich das ändern?

narration-base: The namespace from which all document URIs in this repository are formed, see (TODO),

url-base: The URL that is formed as a basis for *external references*, see (TODO),

dependencies: All archives that this archive depends on. $\text{\texttt{STeX}}$ ignores this field, but MMT can pick up on them to resolve dependencies, e.g. for `lmh install`.

3.2.4 Using Files in $\text{\texttt{STeX}}$ Archives Directly

Several macros provided by $\text{\texttt{STeX}}$ allow for directly including files in repositories. These are:

$\text{\texttt{\backslash mhinput}}$	$\text{\texttt{\backslash mhinput}}[\text{Some/Archive}]\{\text{some/file}\}$ directly inputs the file <code>some/file</code> in the <code>source-</code> folder of <code>Some/Archive</code> .
--------------------------------------	---

$\text{\texttt{\backslash inputref}}$	$\text{\texttt{\backslash inputref}}[\text{Some/Archive}]\{\text{some/file}\}$ behaves like $\text{\texttt{\backslash mhinput}}$, but wraps the input in a <code>\begingroup ... \endgroup</code> . When converting to <code>xhtml</code> , the file is not input at all, and instead an <code>html</code> -annotation is inserted that references the file, e.g. for lazy loading.
---------------------------------------	--

In the majority of practical cases $\text{\texttt{\backslash inputref}}$ is likely to be preferred over $\text{\texttt{\backslash mhinput}}$ because it leads to less duplication in the generated `xhtml`.

$\text{\texttt{\backslash ifinput}}$	Both $\text{\texttt{\backslash mhinput}}$ and $\text{\texttt{\backslash inputref}}$ set $\text{\texttt{\backslash ifinput}}$ to “true” during input. This allows for selectively including e.g. bibliographies only if the current file is not being currently included in a larger document.
--------------------------------------	---

$\text{\texttt{\backslash addmhbibresource}}$	$\text{\texttt{\backslash addmhbibresource}}[\text{Some/Archive}]\{\text{some/file}\}$ searches for a file like $\text{\texttt{\backslash mhinput}}$ does, but calls $\text{\texttt{\backslash addbibresource}}$ to the result and looks for the file in the archive root directory directly, rather than the <code>source</code> directory. Typical invocations are
---	--

- $\text{\texttt{\backslash addmhbibresource}}\{\text{lib/refs.bib}\}$, which specifies a bibliography in the `lib` folder in the local archive or
- $\text{\texttt{\backslash addmhbibresource}}[\text{HW/meta-inf}]\{\text{lib/refs.bib}\}$ in another.

$\text{\texttt{\backslash libinput}}$	$\text{\texttt{\backslash libinput}}\{\text{some/file}\}$ searches for a file <code>some/file</code> in
---------------------------------------	---

- the `lib`-directory of the current archive, and
- the `lib`-directory of a `meta-inf`-archive in (any of) the archive groups containing the current archive

and include all found files in reverse order; e.g. $\text{\texttt{\backslash libinput}}\{\text{preamble}\}$ in a `.tex`-file in `smglom/calculus` will *first* input `.../smglom/meta-inf/lib/preamble.tex` and then `../smglom/calculus/lib/preamble.tex`.

$\text{\texttt{\backslash libinput}}$ will throw an error if *no* candidate for `some/file` is found.

`\libusepackage` `\libusepackage`[package-options]{some/file} searches for a file `some/file.sty` in the same way that `\libinput` does, but will call `\usepackage`[package-options]{path/to/some/file} instead of `\input`.
`\libusepackage` throws an error if not *exactly one* candidate for `some/file` is found.

Remark 3.2.1:

A good practice is to have individual \TeX fragments follow basically this document frame:

```

1 \documentclass{stex}
2 \libinput{preamble}
3 \begin{document}
4   ...
5   \ifinputref \else \libinput{postamble} \fi
6 \end{document}

```

Then the `preamble.tex` files can take care of loading the generally required packages, setting presentation customizations etc. (per archive or archive group or both), and `postamble.tex` can e.g. print the bibliography, index etc.

`\libusepackage` is particularly useful in `preamble.tex` when we want to use custom packages that are not part of \TeX Live. In this case we commit the respective packages in one of the `lib` folders and use `\libusepackage` to load them.

3.3 Module, Symbol and Notation Declarations

3.3.1 The `smodule`-Environment

`smodule` A new module is declared using the basic syntax

```
\begin{smodule}[options]{ModuleName}...\end{smodule}.
```

A module is required to declare any new formal content such as symbols or notations (but not variables, which may be introduced anywhere).

The `smodule`-environment takes several keyword arguments, all of which are optional:

`title` (*(token list)*) to display in customizations.

`type` (*(string)**) for use in customizations.

`deprecate` (*(module)*) if set, will throw a warning when loaded, urging to use *(module)* instead.

`id` (*(string)*) for cross-referencing.

`ns` (*(URI)*) the namespace to use. *Should not be used, unless you know precisely what you're doing.* If not explicitly set, is computed using `\stex_modules_current_namespace:`.

`lang` (*(language)*) if not set, computed from the current file name (e.g. `foo.en.tex`).

`sig` (*(language)*) if the current file is a translation of a file with the same base name but a different language suffix, setting `sig=<lang>` will preload the module from that language file. This helps ensuring that the (formal) content of both modules is (almost) identical across languages and avoids duplication.

`creators` ($\langle string \rangle^*$) names of the creators.
`contributors` ($\langle string \rangle^*$) names of contributors.
`srccite` ($\langle string \rangle$) a source citation for the content of this module.

\hookrightarrow M \rightarrow An \LaTeX module corresponds to an MMT/OMDoc *theory*. As such it
 \hookrightarrow M \rightarrow gets assigned a module URI (*universal resource identifier*) of the form
 \hookrightarrow T \hookrightarrow $\langle namespace \rangle ? \langle module-name \rangle$.

By default, opening a module will produce no output whatsoever, e.g.:

Example 1

Input:

```
1 \begin{smodule}[title={This is Some Module}]{SomeModule}
2   Hello World
3 \end{smodule}
```

Output:

Hello World

\stexpatchmodule

We can customize this behavior either for all modules or only for modules with a specific type using the command `\stexpatchmodule[optional-type]{begin-code}{end-code}`. Some optional parameters are then available in `\smodule*`-macros, specifically `\smoduletitle`, `\smoduletype` and `\smoduleid`.

For example:

Example 2

Input:

```
1 \stexpatchmodule[display]
2   {\textbf{Module (\smoduletitle)}\par}
3   {\par\noindent\textbf{End of Module (\smoduletitle)}}
4
5 \begin{smodule}[type=display,title={Some New Module}]{SomeModule2}
6   Hello World
7 \end{smodule}
```

Output:

Module (Some New Module)
 Hello World
 End of Module (Some New Module)

3.3.2 Declaring New Symbols and Notations

Inside an `smodule` environment, we can declare new \TeX symbols.

`\symdecl`

The most basic command for doing so is using `\symdecl{symbolname}`. This introduces a new symbol with name `symbolname`, arity 0 and semantic macro `\symbolname`.

The starred variant `\symdecl*{symbolname}` will declare a symbol, but not introduce a semantic macro. If we don't want to supply a notation (for example to introduce concepts like “abelian”, which is not something that has a notation), the starred variant is likely to be what we want.

\hookrightarrow `\symdecl` introduces a new OMDoc/MMT constant in the current module (\Rightarrow OMDoc/MMT theory). Correspondingly, they get assigned the URI `<module-URI>?<constant-name>`.

Without a semantic macro or a notation, the only meaningful way to reference a symbol is via `\symref`, `\symname` etc.

Example 3

Input:

```
1 \symdecl*{foo}
2 Given a \symname{foo}, we can...
```

Output:

Given a `foo`, we can...

Obviously, most semantic macros should take actual *arguments*, implying that the symbol we introduce is an *operator* or *function*. We can let `\symdecl` know the *arity* (i.e. number of arguments) of a symbol like this:

Example 4

Input:

```
1 \symdecl{binarysymbol}[args=2]
2 \symref{binarysymbol}{this} is a symbol taking two arguments.
```

Output:

`this` is a symbol taking two arguments.

So far we have gained exactly ... nothing by adding the arity information: we cannot do anything with the arguments in the text.

We will now see what we can gain with more machinery.

`\notation`

We probably want to supply a notation as well, in which case we can finally actually use the semantic macro in math mode. We can do so using the `\notation` command, like this:




Example 5

Input:

```
1 \notation{binarysymbol}{\text{First: }#1\text{; Second: }#2}
2 $\binarysymbol{a}{b}$
```

Output:

First: a ; Second: b

-  `M` → Applications of semantic macros, such as `\binarysymbol{a}{b}` are translated to
-  `M` → MMT/OMDOC as OMA-terms with head `<OMS name="...?binarysymbol"/>`.
-  `T` → Semantic macros with no arguments correspond to OMS directly.

`\comp`

For many semantic services e.g. semantic highlighting or **wikification** (linking user-visible notation components to the definition of the respective symbol they come from), we need to specify the notation components. Unfortunately, there is currently no way the \LaTeX engine can infer this by itself, so we have to specify it manually in the notation specification. We can do so with the `\comp` command.

We can introduce a new notation `highlight` for `\binarysymbol` that fixes this flaw, which we can subsequently use with `\binarysymbol[highlight]`:

Example 6

Input:

```
1 \notation{binarysymbol}[highlight]
2 {\comp{\text{First: }}#1\comp{\text{; Second: }}#2}
3 $\binarysymbol[highlight]{a}{b}$
```

Output:

First: a ; Second: b



Ideally, `\comp` would not be necessary: Everything in a notation that is *not* an argument should be a notation component. Unfortunately, it is computationally expensive to determine where an argument begins and ends, and the argument markers `#n` may themselves be nested in other macro applications or \LaTeX groups, making it ultimately almost impossible to determine them automatically while also remaining compatible with arbitrary highlighting customizations (such as tooltips, hyperlinks, colors) that users might employ, and that are ultimately invoked by `\comp`.

Note that it is required that

1. the argument markers `#n` never occur inside a `\comp`, and
2. no semantic arguments may ever occur inside a notation.

Both criteria are not just required for technical reasons, but conceptionally meaningful:

The underlying principle is that the arguments to a semantic macro represent *arguments to the mathematical operation* represented by a symbol. For example, a semantic macro `\addition{a}{b}` taking two arguments would represent *the actual addition of (mathematical objects) a and b*. It should therefore be impossible for *a* or *b* to be part of a notation component of `\addition`.



Similarly, a semantic macro can not conceptually be part of the notation of `\addition`, since a semantic macro represents a *distinct mathematical concept* with *its own semantics*, whereas notations are syntactic representations of the very symbol to which the notation belongs.

If you want an argument to a semantic macro to be a purely syntactic parameter, then you are likely somewhat confused with respect to the distinction between the precise *syntax* and *semantics* of the symbol you are trying to declare (which happens quite often even to experienced \LaTeX users), and might want to give those another thought - quite likely, the macro you aim to implement does not actually represent a semantically meaningful mathematical concept, and you will want to use `\def` and similar native \LaTeX macro definitions rather than semantic macros.

`\symdef`

In the vast majority of cases where a symbol declaration should come with a semantic macro, we will want to supply a notation immediately. For that reason, the `\symdef` command combines the functionality of both `\symdecl` and `\notation` with the optional arguments of both:

Example 7

Input:

```
1 \symdef{newbinarysymbol}[h1,args=2]
2   {\comp{\text{1.: }}#1\comp{\text{; 2.: }}#2}
3 $\newbinarysymbol{a}{b}$
```

Output:

1.: *a*; 2.: *b*

We just declared a new symbol `newbinarysymbol` with `args=2` and immediately provided it with a notation with identifier `h1`. Since `h1` is the *first* (and so far, only) notation supplied for `newbinarysymbol`, using `\newbinarysymbol` without optional argument defaults to this notation.

But one man's meat is another man's poison: it is very subjective what the "default notation" of an operator should be. Different communities have different practices. For instance, the complex unit is written as *i* in Mathematics and as *j* in electrical engineering.

So to allow modular specification and facilitate re-use of document fragments \LaTeX allows to re-set notation defaults.

$\backslash\text{setnotation}$

The first notation provided will stay the default notation unless explicitly changed – this is enabled by the $\backslash\text{setnotation}$ command: $\backslash\text{setnotation}\{\text{symbolname}\}\{\text{notation-id}\}$ sets the default notation of $\backslash\text{symbolname}$ to notation-id , i.e. henceforth, $\backslash\text{symbolname}$ behaves like $\backslash\text{symbolname}[\text{notation-id}]$ from now on.

Often, a default notation is set right after the corresponding notation is introduced – the starred version $\backslash\text{notation}^*$ for that reason introduces a new notation and immediately sets it to be the new default notation. So expressed differently, the *first* $\backslash\text{notation}$ for a symbol behaves exactly like $\backslash\text{notation}^*$, and $\backslash\text{notation}^*\{\text{foo}\}[\text{bar}]\{\dots\}$ behaves exactly like $\backslash\text{notation}\{\text{foo}\}[\text{bar}]\{\dots\}\backslash\text{setnotation}\{\text{foo}\}[\text{bar}]$.

Operator Notations

Once we have a semantic macro with arguments, such as $\backslash\text{newbinarysymbol}$, the semantic macro represents the *application* of the symbol to a list of arguments. What if we want to refer to the operator *itself*, though?

We can do so by supplying the $\backslash\text{notation}$ (or $\backslash\text{symdef}$) with an *operator notation*, indicated with the optional argument op= . We can then invoke the operator notation using $\backslash\text{symbolname}![\text{notation-identifier}]$. Since operator notations never take arguments, we do not need to use $\backslash\text{comp}$ in it, the whole notation is wrapped in a $\backslash\text{comp}$ automatically:

Example 8

Input:

```
1 \notation{newbinarysymbol}[ab, op={\text{a:}\cdot\text{; b:}\cdot}]
2 {\comp{\text{a:}}#1\comp{\text{; b:}}#2} \symname{newbinarysymbol} is also
3 occasionally written $\newbinarysymbol![ab]$
```

Output:

newbinarysymbol is also occasionally written $\text{a:} \cdot \text{; b:} \cdot$

\hookrightarrow $\backslash\text{symbolname}!$ is translated to OMDoc/MMT as $\langle\text{OMS name}=\dots?\text{symbolname}\rangle/$
 \hookrightarrow directly.
 \hookrightarrow

3.3.3 Argument Modes

The notations so far used *simple* arguments which we call *mode-i* arguments. Declaring a new symbol with $\backslash\text{symdecl}\{\text{foo}\}[\text{args}=3]$ is equivalent to writing $\backslash\text{symdecl}\{\text{foo}\}[\text{args}=iii]$, indicating that the semantic macro takes three mode-i arguments. However, there are three more argument modes which we will investigate now, namely mode-b, mode-a and mode-B arguments.

Mode-b Arguments

A mode-b argument represents a *variable* that is *bound* by the symbol in its application, making the symbol a *binding operator*. Typical examples of binding operators are e.g. sums \sum , products \prod , integrals \int , quantifiers like \forall and \exists , that λ -operator, etc.

\hookrightarrow Mode-b arguments behave exactly like mode-i arguments within T_EX, but applications of binding operators, i.e. symbols with mode-b arguments, are translated to OMBIND-terms in OMDoc/MMT, rather than OMA.

For example, we can implement a summation operator binding an index variable and taking lower and upper index bounds and the expression to sum over like this:

Example 9

Input:

```

1 \symdef{summation}[args=biii]
2   {\mathop{\comp{sum}}_{\#1\comp{=}\#2}^{\#3\#4}}
3   $\summation{\svar{x}}{1}{\svar{n}}{\svar{x}}^2$
    
```

Output:

$$\sum_{x=1}^n x^2$$

where the variable x is now *bound* by the `\summation`-symbol in the expression.

Mode-a Arguments

Mode-a arguments represent a *flexary argument sequence*, i.e. a sequence of arguments of arbitrary length. Formally, operators that take arbitrarily many arguments don't "exist", but in informal mathematics, they are ubiquitous. Mode-a arguments allow us to write e.g. `\addition{a,b,c,d,e}` rather than having to write something like `\addition{a}{\addition{b}{\addition{c}{\addition{d}{e}}}}`!

`\notation` (and consequently `\symdef`, too) take one additional argument for each mode-a argument that indicates how to "accumulate" a comma-separated sequence of arguments. This is best demonstrated on an example.

Let's say we want an operator representing quantification over an ascending chain of elements in some set, i.e. `\ascendingchain{S}{a,b,c,d,e}{t}` should yield $\forall a <_S b <_S c <_S d <_S e. t$. The "base"-notation for this operator is simply `{\comp{forall} \#2\comp{.},\#3}`, where `\#2` represents the full notation fragment *accumulated* from `{a,b,c,d,e}`.

The *additional* argument to `\notation` (or `\symdef`) takes the same arguments as the base notation and two *additional* arguments `\#1` and `\#2` representing successive pairs in the mode-a argument, and accumulates them into `\#2`, i.e. to produce $a <_S b <_S c <_S d <_S e$, we do `{\#1 \comp{<}_{\#1} \#2}`:

Example 10

Input:

```

1 \symdef{ascendingchain}[args=iai]
2   {\comp{\forall} #2\comp{. \,} #3}
3   {##1 \comp{<}_{#1} ##2}
4
5 Tadaa: $\ascendingchain{S}{a,b,c,d,e}{t}$

```

Output:

Tadaa: $\forall a <_S b <_S c <_S d <_S e. t$

If this seems overkill, keep in mind that you will rarely need the single-hash arguments #1,#2 etc. in the a-notation-argument. For a much more representative and simpler example, we can introduce flexary addition via:

Example 11

Input:

```

1 \symdef{addition}[args=a]{#1}{##1 \comp{+} ##2}
2
3 Tadaa: $\addition{a,b,c,d,e}$

```

Output:

Tadaa: $a+b+c+d+e$

The assoc-key We mentioned earlier that “formally”, flexary arguments don’t really “exist”. Indeed, formally, addition is usually defined as a binary operation, quantifiers bind a single variable etc.

Consequently, we can tell \LaTeX (or, rather, MMT/OMDOC) how to “resolve” flexary arguments by providing `\symdecl` or `\symdef` with an optional `assoc`-argument, as in `\symdecl{addition}[args=a,assoc=bin]`. The possible values for the `assoc`-key are:

bin: A binary, associative argument, e.g. as in `\addition`

binl: A binary, left-associative argument, e.g. $a^{b^{c^d}}$, which stands for $((a^b)^c)^d$

binr: A binary, right-associative argument, e.g. as in $A \rightarrow B \rightarrow C \rightarrow D$, which stands for $A \rightarrow (B \rightarrow (C \rightarrow D))$

pre: Successively prefixed, e.g. as in $\forall x, y, z. P$, which stands for $\forall x. \forall y. \forall z. P$

conj: Conjunctive, e.g. as in $a = b = c = d$ or $a, b, c, d \in A$, which stand for $a = d \wedge b = d \wedge c = d$ and $a \in A \wedge b \in A \wedge c \in A \wedge d \in A$, respectively

pwconj: Pairwise conjunctive, e.g. as in $a \neq b \neq c \neq d$, which stands for $a \neq b \wedge a \neq c \wedge a \neq d \wedge b \neq c \wedge b \neq d \wedge c \neq d$

As before, at the PDF level, this annotation is invisible (and without effect), but at the level of the generated OMDoc/MMT this leads to more semantical expressions.

Mode-B Arguments

Finally, mode-B arguments simply combine the functionality of both `a` and `b` - i.e. they represent an arbitrarily long sequence of variables to be bound, e.g. for implementing quantifiers:

Example 12

Input:

```
1 \symdef{quantforall}[args=Bi]
2   {\comp{\forall}#1\comp{.}#2}
3   {##1\comp,##2}
4
5 \$\quantforall{\svar{x},\svar{y},\svar{z}}{P}$
```

Output:

$\forall x,y,z.P$

3.3.4 Type and Definiens Components

`\symdecl` and `\symdef` take two more optional arguments. \TeX largely ignores them (except for special situations we will talk about later), but MMT can pick up on them for additional services. These are the `type` and `def` keys, which expect expressions in math-mode (ideally using semantic macros, of course!)

The `type` and `def` keys correspond to the `type` and `definiens` components of

- \hookrightarrow OMDOC/MMT constants.
- \rightarrow Correspondingly, the name “type” should be taken with a grain of salt, since
- \rightarrow OMDOC/MMT – being foundation-independent – does not a priori implement a fixed typing system.

The `type`-key allows us to provide additional information (given the necessary \TeX symbols), e.g. for addition on natural numbers:

Example 13

Input:

```
1 \symdef{Nat}[type=\set]{\comp{\mathbb N}}
2 \symdef{addition}[
3   type=\funtype{\Nat,\Nat}{\Nat},
4   op=+,
5   args=a
6 ]{#1}{##1 \comp+ ##2}
7
8 \symname{addition} is an operation $\funtype{\Nat,\Nat}{\Nat}$
```

Output:

`addition` is an operation $\mathbb{N} \times \mathbb{N} \rightarrow \mathbb{N}$

The `def`-key allows for declaring symbols as abbreviations:

Example 14

Input:

```
1 \symdef{successor}[
2   type=\funtype{\Nat}{\Nat},
3   def=\fun{\svar{x}}{\addition{\svar{x},1}},
4   op=\mathtt{succ},
5   args=1
6 ]{\comp{\mathtt{succ}{}#1\comp{}}}
7
8 The \symname{successor} operation $\funtype{\Nat}{\Nat}$
9 is defined as $\fun{\svar{x}}{\addition{\svar{x},1}}$
```

Output:

The `successor` operation $\mathbb{N} \rightarrow \mathbb{N}$ is defined as $x \mapsto x+1$

3.3.5 Precedences and Automated Bracketing

Having done `\addition`, the obvious next thing to implement is `\multiplication`. This is straight-forward in theory:

Example 15

Input:

```
1 \symdef{multiplication}[
2   type=\funtype{\Nat,\Nat}{\Nat},
3   op=\cdot,
4   args=a
5 ]{\#1}{\#1 \comp\cdot \#2}
6
7 \symname{multiplication} is an operation $\funtype{\Nat,\Nat}{\Nat}$
```

Output:

`multiplication` is an operation $\mathbb{N} \times \mathbb{N} \rightarrow \mathbb{N}$

However, if we *combine* `\addition` and `\multiplication`, we notice a problem:

Example 16

Input:

```
1 $\addition{a,\multiplication{b,\addition{c,\multiplication{d,e}}}}$
```

Output:

$a+b \cdot c+d \cdot e$

We all know that \cdot binds stronger than $+$, so the output $a+b\cdot c+d\cdot e$ does not actually reflect the term we wrote. We can of course insert parentheses manually

Example 17

Input:

```
1 $\addition{a,\multiplication{b,(\addition{c,\multiplication{d,e}})}}$
```

Output:

$$a+b\cdot(c+d\cdot e)$$

but we can also do better by supplying *precedences* and have \TeX insert parentheses automatically.

For that purpose, `\notation` (and hence `\symdef`) take an optional argument `prec=<opprec>;<argprec1>x...x<argprec n>`.

We will investigate the precise meaning of `<opprec>` and the `<argprec>`s shortly – in the vast majority of cases, it is perfectly sufficient to think of `prec=` taking a single number and having that be *the* precedence of the notation, where lower precedences (somewhat counterintuitively) bind stronger than higher precedences. So fixing our notations for `\addition` and `\multiplication`, we get:

Example 18

Input:

```
1 \notation{multiplication}[
2   op=\cdot,
3   prec=50
4 ]{#1}{##1 \comp\cdot ##2}
5 \notation{addition}[
6   op=+,
7   prec=100
8 ]{#1}{##1 \comp+ ##2}
9
10 $\addition{a,\multiplication{b,\addition{c,\multiplication{d,e}}}}$
```

Output:

$$a+b\cdot(c+d\cdot e)$$

Note that the precise numbers used for precedences are pretty arbitrary – what matters is which precedences are higher than which other precedences when used in conjunction.

`\infprec`
`\neginfprec`

It is occasionally useful to have “infinitely” high or low precedences to enforce or forbid automated bracketing entirely – for those purposes, `\infprec` and `\neginfprec` exist (which are implemented as the maximal and minimal integer values accordingly).

More precisely, each notation takes

1. One *operator precedence* and
2. one *argument precedence* for each argument.

By default, all precedences are 0, unless the symbol takes no argument, in which case the operator precedence is `\neginfprec` (negative infinity). If we only provide a single number, this is taken as both the operator precedence and all argument precedences.

$\text{\S}\text{\TeX}$ decides whether to insert parentheses by comparing operator precedences to a *downward precedence* p_d with initial value `\infprec`. When encountering a semantic macro, $\text{\S}\text{\TeX}$ takes the operator precedence p_{op} of the notation used and checks whether $p_{op} > p_d$. If so, $\text{\S}\text{\TeX}$ insert parentheses.

When $\text{\S}\text{\TeX}$ steps into an argument of a semantic macro, it sets p_d to the respective argument precedence of the notation used.

In the example above:



1. $\text{\S}\text{\TeX}$ starts out with $p_d = \text{\code{\infprec}}$.
2. $\text{\S}\text{\TeX}$ encounters `\addition` with $p_{op} = 100$. Since $100 \not> \text{\code{\infprec}}$, it inserts no parentheses.
3. Next, $\text{\S}\text{\TeX}$ encounters the two arguments for `\addition`. Both have no specifically provided argument precedence, so $\text{\S}\text{\TeX}$ uses $p_d = p_{op} = 100$ for both and recurses.
4. Next, $\text{\S}\text{\TeX}$ encounters `\multiplication{b,...}`, whose notation has $p_{op} = 50$.
5. We compare to the current downward precedence p_d set by `\addition`, arriving at $p_{op} = 50 \not> 100 = p_d$, so $\text{\S}\text{\TeX}$ again inserts no parentheses.
6. Since the notation of `\multiplication` has no explicitly set argument precedences, $\text{\S}\text{\TeX}$ uses the operator precedence for all arguments of `\multiplication`, hence sets $p_d = p_{op} = 50$ and recurses.
7. Next, $\text{\S}\text{\TeX}$ encounters the inner `\addition{c,...}` whose notation has $p_{op} = 100$.
8. We compare to the current downward precedence p_d set by `\multiplication`, arriving at $p_{op} = 100 > 50 = p_d$ – which finally prompts $\text{\S}\text{\TeX}$ to insert parentheses, and we proceed as before.

3.3.6 Variables

All symbol and notation declarations require a module with which they are associated, hence the commands `\symdecl`, `\notation`, `\symdef` etc. are disabled outside of `smodule`-environments.

Variables are different – variables are allowed everywhere, are not exported when the current module (if one exists) is imported (via `\importmodule` or `\usemodule`) and (also unlike symbol declarations) “disappear” at the end of the current \TeX group.

`\svar`

So far, we have always used variables using `\svar{n}`, which marks-up n as a variable with name `n`. More generally, `\svar[foo]{<texcode>}` marks-up the arbitrary `<texcode>` as representing a variable with name `foo`.

Of course, this makes it difficult to reuse variables, or introduce “functional” variables with arities > 0 , or provide them with a type or definiens.

\vardef

For that, we can use the `\vardef` command. Its syntax is largely the same as that of `\symdef`, but unlike symbols, variables have only one notation (TODO: so far?), hence there is only `\vardef` and no `\vardecl`.

Example 19

Input:

```

1 \vardef{varf}[
2   name=f,
3   type=\funtype{\Nat}{\Nat},
4   op=f,
5   args=1,
6   prec=0;\neginfprec
7 ]{\comp{f}#1}
8 \vardef{varn}[name=n,type=\Nat]{\comp{n}}
9 \vardef{varx}[name=x,type=\Nat]{\comp{x}}
10
11 Given a function $\varf!:\funtype{\Nat}{\Nat}$,
12 by $\addition{\varf!,\varn}$ we mean the function
13 $\fun{\varx}{\varf{\addition{\varx,\varn}}}$

```

Output:

Given a function $f : \mathbb{N} \rightarrow \mathbb{N}$, by $f+n$ we mean the function $x \mapsto f(x+n)$

(of course, “lifting” addition in the way described in the previous example is an operation that deserves its own symbol rather than abusing `\addition`, but... well.)

TODO: bind=forall/exists

3.3.7 Variable Sequences

Variable *sequences* occur quite frequently in informal mathematics, hence they deserve special support. Variable sequences behave like variables in that they disappear at the end of the current \TeX group and are not exported from modules, but their declaration is quite different.

\varseq

A variable sequence is introduced via the command `\varseq`, which takes the usual optional arguments `name` and `type`. It then takes a starting index, an end index and a *notation* for the individual elements of the sequence parametric in an index. Note that both the starting as well as the ending index may be variables.

This is best shown by example:

Example 20

Input:


```

1 \vardef{varn}[name=n,type=\Nat]{\comp{n}}
2 \varseq{seqa}[name=a,type=\Nat]{1}{\varn}{\comp{a}_{#1}}
3
4 The  $i$ th index of  $\text{\seqa!}$  is  $\text{\seqa}{i}$ .

```

Output:

The i th index of a_1, \dots, a_n is a_i .

Note that the syntax `\seqa!` now automatically generates a presentation based on the starting and ending index.

TODO: more notations for invoking sequences.

Notably, variable sequences are nicely compatible with `a`-type arguments, so we can do the following:

Example 21

Input:

```
1  $\text{\addition}{\text{\seqa}}$ 
```

Output:

$a_1 + \dots + a_n$

Sequences can be *multidimensional* using the `args`-key, in which case the notation's arity increases and starting and ending indices have to be provided as a comma-separated list:

Example 22

Input:

```

1 \vardef{varm}[name=m,type=\Nat]{\comp{m}}
2 \varseq{seqa}[
3   name=a,
4   args=2,
5   type=\Nat,
6 ]{1,1}{\varn,\varm}{\comp{a}_{#1}^{\#2}}
7
8  $\text{\seqa!}$  and  $\text{\addition}{\text{\seqa}}$ 

```

Output:

a_1^1, \dots, a_n^m and $a_1^1 + \dots + a_n^m$

We can also explicitly provide a “middle” segment to be used, like such:

Example 23

Input:

```

1 \varseq{seqa}[
2   name=a,
3   type=\Nat,
4   args=2,
5   mid={\comp{a}_{\varn}^1,\comp{a}_1^2,\ellipses,\comp{a}_{1}^{\varn}}
6 ]{1,1}{\varn,\varm}{\comp{a}_{\#1}^{\#2}}
7
8 $\seqa!$ and $\addition{\seqa}$

```

Output:

$$a_1^1, \dots, a_n^1, a_1^2, \dots, a_1^m, \dots, a_n^m \text{ and } a_1^1 + \dots + a_n^1 + a_1^2 + \dots + a_1^m + \dots + a_n^m$$

3.4 Module Inheritance and Structures

The sTeX features for modular document management are inherited from the OM-Doc/MMT model that organizes knowledge into a graph, where the nodes are theories (called modules in sTeX) and the edges are truth-preserving mappings (called theory morphisms in MMT). We have already seen modules/theories above.

Before we get into theory morphisms in sTeX we will see a very simple application of modules: managing multilinguality modularly.

3.4.1 Multilinguality and Translations

If we load the sTeX document class or package with the option `lang=<lang>`, sTeX will load the appropriate `babel` language for you – e.g. `lang=de` will load the `babel` language `ngerman`. Additionally, it makes sTeX aware of the current document being set in (in this example) *german*. This matters for reasons other than mere `babel`-purposes, though:

Every *module* is assigned a language. If no sTeX package option is set that allows for inferring a language, sTeX will check whether the current file name ends in e.g. `.en.tex` (or `.de.tex` or `.fr.tex`, or...) and set the language accordingly. Alternatively, a language can be explicitly assigned via `\begin{smodule}[lang=<language>]{Foo}`.

Technically, each `smodule`-environment induces *two* OMDoc/MMT theories:
 \hookrightarrow `\begin{smodule}[lang=<lang>]{Foo}` generates a theory `some/namespace?Foo` that only contains the “formal” part of the module – i.e. exactly the content that is exported when using `\importmodule`.
 \rightsquigarrow Additionally, MMT generates a *language theory* `some/namespace/Foo?<lang>` that includes `some/namespace?Foo` and contains all the other document content – variable declarations, includes for each `\usemodule`, etc.

Notably, the language suffix in a filename is ignored for `\usemodule`, `\importmodule` and in generating/computing URIs for modules. This however allows for providing *translations* for modules between languages without needing to duplicate content:

If a module `Foo` exists in e.g. english in a file `Foo.en.tex`, we can provide a file `Foo.de.tex` right next to it, and write `\begin{smodule}[sig=en]{Foo}`. The `sig`-key

then signifies, that the “signature” of the module is contained in the *english* version of the module, which is immediately imported from there, just like `\importmodule` would.

Additionally to translating the informal content of a module file to different languages, it also allows for customizing notations between languages. For example, the *least common multiple* of two numbers is often denoted as $\text{lcm}(a, b)$ in english, but is called *kleinstes gemeinsames Vielfaches* in german and consequently denoted as $\text{kgV}(a, b)$ there.

We can therefore imagine a german version of an lcm-module looking something like this:

```
1 \begin{smodule}[sig=en]{lcm}
2   \notation*{lcm}[de]{\comp{\mathtt{kgV}}}{#1,#2}}
3
4   Das \symref{lcm}{kleinste gemeinsame Vielfache}
5   $\text{lcm}\{a,b\}$ von zwei Zahlen $a,b$ ist...
6 \end{smodule}
```

If we now do `\importmodule{lcm}` (or `\usemodule{lcm}`) within a *german* document, it will also load the content of the german translation, including the `de`-notation for `\lcm`.

3.4.2 Simple Inheritance and Namespaces

`\importmodule`
`\usemodule`

`\importmodule`[Some/Archive]{path?ModuleName} is only allowed within an `smodule`-environment and makes the symbols declared in ModuleName available therein. Additionally the symbols of ModuleName will be exported if the current module is imported somewhere else via `\importmodule`.

`\usemodule` behaves the same way, but without exporting the content of the used module.

It is worth going into some detail how exactly `\importmodule` and `\usemodule` resolve their arguments to find the desired module – which is closely related to the *namespace* generated for a module, that is used to generate its URI.



Ideally, \LaTeX would use arbitrary URIs for modules, with no forced relationships between the *logical* namespace of a module and the *physical* location of the file declaring the module – like MMT does things.

Unfortunately, \TeX only provides very restricted access to the file system, so we are forced to generate namespaces systematically in such a way that they reflect the physical location of the associated files, so that \LaTeX can resolve them accordingly. Largely, users need not concern themselves with namespaces at all, but for completeness sake, we describe how they are constructed:

- If `\begin{smodule}{Foo}` occurs in a file `/path/to/file/Foo[.<lang>].tex` which does not belong to an archive, the namespace is `file://path/to/file`.
- If the same statement occurs in a file `/path/to/file/bar[.<lang>].tex`, the namespace is `file://path/to/file/bar`.

In other words: outside of archives, the namespace corresponds to the file URI with the filename dropped iff it is equal to the module name, and ignoring the (optional) language suffix.



If the current file is in an archive, the procedure is the same except that the initial segment of the file path up to the archive's `source`-folder is replaced by the archive's namespace URI.



Conversely, here is how namespaces/URIs and file paths are computed in import statements, exemplary `\importmodule`:

- `\importmodule{Foo}` outside of an archive refers to module `Foo` in the current namespace. Consequently, `Foo` must have been declared earlier in the same document or, if not, in a file `Foo[.<lang>].tex` in the same directory.
- The same statement *within* an archive refers to either the module `Foo` declared earlier in the same document, or otherwise to the module `Foo` in the archive's top-level namespace. In the latter case, it has to be declared in a file `Foo[.<lang>].tex` directly in the archive's `source`-folder.
- Similarly, in `\importmodule{some/path?Foo}` the path `some/path` refers to either the sub-directory and relative namespace path of the current directory and namespace outside of an archive, or relative to the current archive's top-level namespace and `source`-folder, respectively.

The module `Foo` must either be declared in the file `<top-directory>/some/path/Foo[.<lang>].tex`, or in `<top-directory>/some/path[.<lang>].tex` (which are checked in that order).

- Similarly, `\importmodule[Some/Archive]{some/path?Foo}` is resolved like the previous cases, but relative to the archive `Some/Archive` in the mathhub-directory.
- Finally, `\importmodule{full://uri?Foo}` naturally refers to the module `Foo` in the namespace `full://uri`. Since the file this module is declared in can not be determined directly from the URI, the module must be in memory already, e.g. by being referenced earlier in the same document.

Since this is less compatible with a modular development, using full URIs directly is strongly discouraged, unless the module is declared in the current file directly.

`\STEXexport`

`\importmodule` and `\usemodule` import all symbols, notations, semantic macros and (recursively) `\importmodules`. If you want to additionally export e.g. convenience macros and other (S_TE_X) code from a module, you can use the command `\STEXexport{<code>}` in your module. Then `<code>` is executed (both immediately and) every time the current module is opened via `\importmodule` or `\usemodule`.



Note, that `\newcommand` defines macros *globally* and throws an error if the macro already exists, potentially leading to low-level L^AT_EX errors if we put a `\newcommand` in an `\STEXexport` and the `<code>` is executed more than once in a document – which can happen easily.

A safer alternative is to use macro definition principles, that are safe to use even if the macro being defined already exists, and ideally are local to the current T_EX



group, such as `\def` or `\let`.

3.4.3 The `mathstructure` Environment

A common occurrence in mathematics is bundling several interrelated “declarations” together into *structures*. For example:

- A *monoid* is a structure $\langle M, \circ, e \rangle$ with $\circ : M \times M \rightarrow M$ and $e \in M$ such that...
- A *topological space* is a structure $\langle X, \mathcal{T} \rangle$ where X is a set and \mathcal{T} is a topology on X
- A *partial order* is a structure $\langle S, \leq \rangle$ where \leq is a binary relation on S such that...

This phenomenon is important and common enough to warrant special support, in particular because it requires being able to *instantiate* such structures (or, rather, structure *signatures*) in order to talk about (concrete or variable) *particular* monoids, topological spaces, partial orders etc.

`mathstructure` The `mathstructure` environment allows us to do exactly that. It behaves exactly like the `smodule` environment, but is itself only allowed inside an `smodule` environment, and allows for instantiation later on.

How this works is again best demonstrated by example:

Example 24

Input:

```
1 \begin{mathstructure}{monoid}
2   \symdef{universe}[type=\set]{\comp{U}}
3   \symdef{op}[
4     args=2,
5     type=\funtype{\universe,\universe}{\universe},
6     op=\circ
7   ]{\#1 \comp{\circ} \#2}
8   \symdef{unit}[type=\universe]{\comp{e}}
9 \end{mathstructure}
10
11 A \symname{monoid} is...
```

Output:

A `monoid` is...

Note that the `\symname{monoid}` is appropriately highlighted and (depending on your pdf viewer) shows a URI on hovering – implying that the `mathstructure` environment has generated a *symbol* `monoid` for us. It has not generated a semantic macro though, since we can not use the `monoid`-symbol *directly*. Instead, we can instantiate it, for example for integers:

Example 25

Input:

```

1 \symdef{Int}[type=\set]{\comp{\mathbb Z}}
2 \symdef{addition}[
3   type=\funtype{\Int,\Int}{\Int},
4   args=2,
5   op=+
6 ]{##1 \comp{+} ##2}
7 \symdef{zero}[type=\Int]{\comp{0}}
8
9 $\mathstruct{\Int,\addition!,\zero}$ is a \symname{monoid}.

```

Output:

$\langle \mathbb{Z}, +, 0 \rangle$ is a monoid.

So far, we have not actually instantiated monoid, but now that we have all the symbols to do so, we can:

Example 26

Input:

```

1 \instantiate{intmonoid}{monoid}{\mathbb{Z}_{+,0}}[
2   universe = Int ,
3   op = addition ,
4   unit = zero
5 ]
6
7 $\intmonoid{universe}$, $\intmonoid{unit}$ and $\intmonoid{op}\{a\}\{b\}$.
8
9 Also: $\intmonoid!$

```

Output:

\mathbb{Z} , 0 and $a+b$.
Also: $\mathbb{Z}_{+,0}$

\instantiate

So summarizing: `\instantiate` takes four arguments: The (macro-)name of the instance, a key-value pair assigning declarations in the corresponding `mathstructure` to symbols currently in scope, the name of the `mathstructure` to instantiate, and lastly a notation for the instance itself.

It then generates a semantic macro that takes as argument the name of a declaration in the instantiated `mathstructure` and resolves it to the corresponding instance of that particular declaration.

`\instantiate` and `mathstructure` make use of the *Theories-as-Types* paradigm \hookrightarrow (see [MRK18]):
 \hookrightarrow `mathstructure{<name>}` simply creates a nested theory with name `<name>-structure`. The *constant* `<name>` is defined as `Mod(<name>-structure)` – a *dependent record type with manifest fields*, the fields of which are generated

$\hookrightarrow M$ from (and correspond to) the constants in `<name>-structure`.
 $\hookrightarrow M$ `\instantiate` generates a constant whose definiens is a record term of type `Mod(<name>-structure)`, with the fields assigned based on the respective key-value-list.
 $\rightsquigarrow T$

Notably, `\instantiate` throws an error if not *every* declaration in the instantiated `mathstructure` is being assigned.

You might consequently ask what the usefulness of `mathstructure` even is.

`\varinstantiate`

The answer is that we can also instantiate a `mathstructure` with a *variable*. The syntax of `\varinstantiate` is equivalent to that of `\instantiate`, but all of the key-value-pairs are optional, and if not explicitly assigned (to a symbol *or* a variable declared with `\vardef`) inherit their notation from the one in the `mathstructure` environment.

This allows us to do things like:

Example 27

Input:

```

1 \varinstantiate{varM}{monoid}{M}
2
3 A \symname{monoid} is a structure
4 $\varM! := \mathstruct{\varM{universe}, \varM{op}!, \varM{unit}}$
5 such that
6 $\varM{op}!: \funtype{\varM{universe}, \varM{universe}}{\varM{universe}}$ ...

```

Output:

A `monoid` is a structure $M := \langle U, \circ, e \rangle$ such that $\circ : U \times U \rightarrow U$...

.

and

Example 28

Input:

```

1 \varinstantiate{varMb}{monoid}{M_2}[universe = Int]
2
3 Let $\varMb! := \mathstruct{\varMb{universe}, \varMb{op}!, \varMb{unit}}$
4 be a \symname{monoid} on $\Int$ ...

```

Output:

Let $M_2 := \langle \mathbb{Z}, \circ, e \rangle$ be a `monoid` on \mathbb{Z} ...

.

We will return to these two example later, when we also know how to handle the *axioms* of a monoid.

3.4.4 The copymodule Environment

TODO: explain

Given modules:

Example 29

Input:

```

1 \begin{smodule}{magma}
2   \symdef{universe}{\comp{\mathcal U}}
3   \symdef{operation}[args=2,op=\circ]{#1 \comp\circ #2}
4 \end{smodule}
5 \begin{smodule}{monoid}
6   \importmodule{magma}
7   \symdef{unit}{\comp e}
8 \end{smodule}
9 \begin{smodule}{group}
10  \importmodule{monoid}
11  \symdef{inverse}[args=1]{#1~{\comp{-1}}}
12 \end{smodule}

```

Output:

.

We can form a module for *rings* by “cloning” an instance of *group* (for addition) and *monoid* (for multiplication), respectively, and “glueing them together” to ensure they share the same universe:

Example 30

Input:

```

1 \begin{smodule}{ring}
2   \begin{copymodule}{group}{addition}
3     \renamedecl[name=universe]{universe}{runiverse}
4     \renamedecl[name=plus]{operation}{rplus}
5     \renamedecl[name=zero]{unit}{rzero}
6     \renamedecl[name=uminus]{inverse}{ruminus}
7   \end{copymodule}
8   \notation*{rplus}[plus,op=+,prec=60]{#1 \comp+ #2}
9   \notation*{rzero}[zero]{\comp0}
10  \notation*{ruminus}[uminus,op=-]{\comp- #1}
11  \begin{copymodule}{monoid}{multiplication}
12    \assign{universe}{\runiverse}
13    \renamedecl[name=times]{operation}{rtimes}
14    \renamedecl[name=one]{unit}{rone}
15  \end{copymodule}
16  \notation*{rtimes}[cdot,op=\cdot,prec=50]{#1 \comp\cdot #2}
17  \notation*{rone}[one]{\comp1}
18  Test: $\rtimes a\{rplus c\{rtimes d\}}$
19 \end{smodule}

```

Output:

Test: $a \cdot (c + d \cdot e)$

TODO: explain donotclone

3.4.5 The `interpretmodule` Environment

TODO: explain

Example 31

Input:

```
1 \begin{smodule}{int}
2   \syndef{Integers}{\comp{\mathbb Z}}
3   \syndef{plus}[args=2,op=+]{#1 \comp+ #2}
4   \syndef{zero}{\comp0}
5   \syndef{uminus}[args=1,op=-]{\comp-#1}
6
7   \begin{interpretmodule}{group}{intisgroup}
8     \assign{universe}{\Integers}
9     \assign{operation}{\plus!}
10    \assign{unit}{\zero}
11    \assign{inverse}{\uminus!}
12  \end{interpretmodule}
13 \end{smodule}
```

Output:

3.5 Primitive Symbols (The `stex` Metatheory)

The `stex-metatheory` package contains `stex` symbols so ubiquitous, that it is virtually impossible to describe any flexiformal content without them, or that are required to annotate even the most primitive symbols with meaningful (foundation-independent) “type”-annotations, or required for basic structuring principles (theorems, definitions). As such, it serves as the default meta theory for any `stex` module.

We can also see the `stex-metatheory` as a foundation of mathematics in the sense of [Rab15], albeit an informal one (the ones discussed there are all formal foundations). The state of the `stex-metatheory` is necessarily incomplete, and will stay so for a long while: It arises as a collection of empirically useful symbols that are collected as more and more mathematics are encoded in `stex` and are classified as foundational.

Formal foundations should ideally instantiate these symbols with their formal counterparts, e.g. `isa` corresponds to a typing operation in typed setting, or the \in -operator in set-theoretic contexts; `bind` corresponds to a universal quantifier in (n th-order) logic, or a Π in dependent type theories.

We make this theory part of the `stex` collection rather than encoding it in `stex` itself⁴

⁴EdNOTE: MK: why? continue

Chapter 4

Using \TeX Symbols

Given a symbol declaration `\symdecl{symbolname}`, we obtain a semantic macro `\symbolname`. We can use this semantic macro in math mode to use its notation(s), and we can use `\symbolname!` in math mode to use its operator notation(s). What else can we do?

4.1 `\symref` and its variants

`\symref`
`\symname`

We have already seen `\symname` and `\symref`, the latter being the more general.

`\symref{<symbolname>}{<code>}` marks-up `<code>` as referencing `<symbolname>`. Since quite often, the `<code>` should be (a variant of) the name of the symbol anyway, we also have `\symname{<symbolname>}`.

Note that `\symname` uses the *name* of a symbol, not its macroname. More precisely, `\symname` will insert the name of the symbol with “-” replaced by spaces. If a symbol does not have an explicit `name=` given, the two are equal – but for `\symname` it often makes sense to make the two explicitly distinct. For example:

Example 32

Input:

```
1 \symdef{Nat}[
2   name=natural-number,
3   type=\set
4 ]{\comp{\mathbb{N}}}
5
6 A \symname{Nat} is...
```

Output:

A natural number is...

`\symname` takes two additional optional arguments, `pre=` and `post=` that get prepended or appended respectively to the symbol name.

`\Symname`

Additionally, `\Symname` behaves exactly like `\symname`, but will capitalize the first letter of the name:

Example 33

Input:

```
1 \Symname[post=s]{Nat} are...
```

Output:

```
Natural numbers are...
```



This is as good a place as any other to explain how \TeX resolves a string `symbolname` to an actual symbol.

If `\symbolname` is a semantic macro, then \TeX has no trouble resolving `symbolname` to the full URI of the symbol that is being invoked.

However, especially in `\symname` (or if a symbol was introduced using `\symdecl*` without generating a semantic macro), we might prefer to use the *name* of a symbol directly for readability – e.g. we would want to write `A \symname{natural-number} is...` rather than `A \symname{Nat} is...`. \TeX attempts to handle this case thusly:

If `string` does *not* correspond to a semantic macro `\string` and does *not* contain a `?`, then \TeX checks all symbols currently in scope until it finds one, whose name is `string`. If `string` is of the form `pre?name`, \TeX first looks through all modules currently in scope, whose full URI ends with `pre`, and then looks for a symbol with name `name` in those. This allows for disambiguating more precisely, e.g. by saying `\symname{Integers?addition}` or `\symname{RealNumbers?addition}` in the case where several `additions` are in scope.

4.2 Marking Up Text and On-the-Fly Notations

We can also use semantic macros outside of text mode though, which allows us to annotate arbitrary text fragments.

Let us assume again, that we have `\symdef{addition}[args=2]{#1 \comp+ #2}`. Then we can do

Example 34

Input:

```
1 \addition{\comp{The sum of} \arg{\$svar{n}}\$} \comp{ and } \arg{\$svar{m}}\$}  
2 is...
```

Output:

```
The sum of  $n$  and  $m$  is...
```

...which marks up the text fragment as representing an *application* of the `addition`-symbol to two argument n and m .

\hookrightarrow M \rightarrow As expected, the above example is translated to OMDoc/MMT as an
 \rightarrow M \rightarrow OMA with `<OMS name="...?addition"/>` as head and `<OMV name="n"/>` and
 \rightsquigarrow T \rightsquigarrow `<OMV name="m"/>` as arguments.



Note the difference in treating “arguments” between math mode and text mode. In math mode the (in this case two) tokens/groups following the `\addition` macro are treated as arguments to the addition function, whereas in text mode the group following `\addition` is taken to be the ad-hoc presentation. We drill in on this now.

\arg

In text mode, every semantic macro takes exactly one argument, namely the text-fragment to be annotated. The `\arg` command is only valid within the argument to a semantic macro and marks up the *individual arguments* for the symbol.

We can also use semantic macros in text mode to invoke an operator itself instead of its application, with the usual syntax using `!`:

Example 35

Input:

```
1 \addition!{Addition} is...
```

Output:

```
Addition is...
```

Indeed, `\symbolname!{<code>}` is exactly equivalent to `\symref{symbolname}{<code>}` (the latter is in fact implemented in terms of the former).

`\arg` also allows us to switch the order of arguments around and “hide” arguments: For example, `\arg[3]{<code>}` signifies that `<code>` represents the *third* argument to the current operator, and `\arg*[i]{<code>}` signifies that `<code>` represents the *i*th argument, but it should not produce any output (it is exported in the `xhtml` however, so that MMT and other systems can pick up on it).⁵

Example 36

Input:

```
1 \addition{\comp{adding}
2   \arg[2]{\svar{k}$}
3   \arg*{\svar{n}}{\svar{m}}}} yields...
```

Output:

⁵EdNOTE: MK: I do not understand why we have to/want to give the second `arg*`; I think this must be elaborated on.

adding k yields...

Note that since the second `\arg` has no explicit argument number, it automatically represents the first not-yet-given argument – i.e. in this case the first one.⁶

The same syntax can be used in math mod as well. This allows us to spontaneously introduce new notations on the fly. We can activate it using the starred variants of semantic macros:

Example 37

Input:

```
1 Given $\addition{\svar{n}}{\svar{m}}$, then
2 $\addition*{
3   \arg*{\addition{\svar{n}}{\svar{m}}}
4   \comp{+}
5   \arg{\svar{k}}
6 }$ yields...
```

Output:

Given $n+m$, then $+k$ yields...

4.3 Referencing Symbols and Statements

TODO: references documentation

⁶EdNOTE: MK: I do not understand this at all.

Chapter 5

sTEX Statements

5.1 Definitions, Theorems, Examples, Paragraphs

As mentioned earlier, we can semantically mark-up *statements* such as definitions, theorems, lemmata, examples, etc.

The corresponding environments for that are:

- `sdefinition` for definitions,
- `sassertion` for assertions, i.e. propositions that are declared to be *true*, such as theorems, lemmata, axioms,
- `sexample` for examples and counterexamples, and
- `sparagraph` for “other” semantic paragraphs, such as comments, remarks, conjectures, etc.

The *presentation* of these environments can be customized to use e.g. predefined theorem-environments, see [chapter 6](#) for details.

All of these environments take optional arguments in the form of `key=value`-pairs. Common to all of them are the keys `id=` (for cross-referencing, see [section 4.3](#)), `type=` for customization (see [chapter 6](#)) and additional information (e.g. definition principles, “difficulty” etc), as well as `title=` (for giving the paragraph a title), and finally `for=`.

The `for=` key expects a comma-separated list of existing symbols, allowing for e.g. things like

Example 38

Input:

```
1 \begin{sexample}[
2   id=additionandmultiplication.ex,
3   for={addition,multiplication},
4   type={trivial,boring},
5   title={An Example}
6 ]
7   $\addition{2,3}$ is $5$, $\multiplication{2,3}$ is $6$.
8 \end{sexample}
```

Output:

Example 5.1.1 (An Example). $2+3$ is 5, $2\cdot 3$ is 6.

`\definiendum`
`\definame`
`\Definame`

`sdefinition` (and `sparagraph` with `type=symdoc`) introduce three new macros: `definiendum` behaves like `symref` (and `definame/Definame` like `symname/Symname`, respectively), but highlights the referenced symbol as *being defined* in the current definition.

\hookrightarrow M \rightarrow The special `type=symdoc` for `sparagraph` is intended to be used for “informal definitions”, or encyclopedia-style descriptions for symbols.
 \rightarrow M \rightarrow The MMT system can use those (in lieu of an actual `sdefinition` in scope) to present to users, e.g. when hovering over symbols.
 \rightsquigarrow T \rightsquigarrow

`\definiens`

Additionally, `sdefinition` (and `sparagraph` with `type=symdoc`) introduces `\definiens`[<optional sym which marks up <code> as being the explicit *definiens* of <optional symbolname> (in case `for=` has multiple symbols).

All four statement environments – i.e. `sdefinition`, `sassertion`, `sexample`, and `sparagraph` – also take an optional parameter `name=` – if this one is given a value, the environment will generate a *symbol* by that name (but with no semantic macro). Not only does this allow for `\symref` et al, it allows us to resume our earlier example for monoids much more nicely:⁷

Example 39

Input:

⁷EdNOTE: MK: we should reference the example explicitly here.

```

1 \begin{mathstructure}{monoid}
2   \syndef{universe}[type=\set]{\comp{U}}
3   \syndef{op}[
4     args=2,
5     type=\funtype{\universe,\universe}{\universe},
6     op=\circ
7   ]{#1 \comp{\circ} #2}
8   \syndef{unit}[type=\universe]{\comp{e}}
9
10  \begin{sparagraph}[type=symdoc,for=monoid]
11    A \definame{monoid} is a structure
12    $\mathstruct{\universe,\op!,\unit}$
13    where $\op!:\funtype{\universe}{\universe}$ and
14    $\inset{\unit}{\universe}$ such that
15
16    \begin{sassertion}[name=associative,
17      type=axiom,
18      title=Associativity]
19      $\op!$ is associative
20    \end{sassertion}
21    \begin{sassertion}[name=isunit,
22      type=axiom,
23      title=Unit]
24      $\equal{\op{\svar{x}}{\unit}}{\svar{x}}$
25      for all $\inset{\svar{x}}{\universe}$
26    \end{sassertion}
27  \end{sparagraph}
28 \end{mathstructure}
29
30 An example for a \symname{monoid} is...

```

Output:

A **monoid** is a structure $\langle U, \circ, e \rangle$ where $\circ : U \rightarrow U$ and $e \in U$ such that

Axiom 5.1.2 (Associativity). \circ is associative

Axiom 5.1.3 (Unit). $x \circ e = x$ for all $x \in U$

An example for a **monoid** is...

The main difference to before⁸ is that the two **sassertions** now have **name=** attributes. Thus the **mathstructure monoid** now contains two additional symbols, namely the axioms for associativity and that e is a unit. Note that both symbols do not represent the mere *propositions* that e.g. \circ is associative, but *the assertion that it is actually true* that \circ is associative.

If we now want to instantiate **monoid** (unless with a variable, of course), we also need to assign **associative** and **neutral** to analogous assertions. So the earlier example

```

1 \instantiate{intmonoid}{monoid}{\mathbb{Z}_{+,0}}[
2   universe = Int ,
3   op = addition ,
4   unit = zero
5 ]

```

⁸EDNOTE: MK: reference

...will not work anymore. We now need to give assertions that addition is associative and that zero is a unit with respect to addition.²

The `stex-proof` package supplies macros and environment that allow to annotate the structure of mathematical proofs in \LaTeX document. This structure can be used by MKM systems for added-value services, either directly from the \LaTeX sources, or after translation.

We will go over the general intuition by way of a running example:

```

1 \begin{sproof}[id=simple-proof]
2   {We prove that  $\sum_{i=1}^n 2i-1 = n^2$  by induction over  $n$ }
3   \begin{spfcases}{For the induction we have to consider three cases:}
4     \begin{spfcase}{ $n=1$ }
5       \begin{spfstep}[type=inline] then we compute  $1=1^2$  \end{spfstep}
6     \end{spfcase}
7     \begin{spfcase}{ $n=2$ }
8       \begin{spfcomment}[type=inline]
9         This case is not really necessary, but we do it for the
10        fun of it (and to get more intuition).
11      \end{spfcomment}
12      \begin{spfstep}[type=inline] We compute  $1+3=2^2=4$ . \end{spfstep}
13    \end{spfcase}
14    \begin{spfcase}{ $n>1$ }
15      \begin{spfstep}[type=assumption,id=ind-hyp]
16        Now, we assume that the assertion is true for a certain  $k \geq 1$ ,
17        i.e.  $\sum_{i=1}^k (2i-1) = k^2$ .
18      \end{spfstep}
19      \begin{spfcomment}
20        We have to show that we can derive the assertion for  $n=k+1$  from
21        this assumption, i.e.  $\sum_{i=1}^{k+1} (2i-1) = (k+1)^2$ .
22      \end{spfcomment}
23      \begin{spfstep}
24        We obtain  $\sum_{i=1}^{k+1} (2i-1) = \sum_{i=1}^k (2i-1) + 2(k+1) - 1$ 
25        \spfjust[method=arith:split-sum]{by splitting the sum}.
26      \end{spfstep}
27      \begin{spfstep}
28        Thus we have  $\sum_{i=1}^{k+1} (2i-1) = k^2 + 2k + 1$ 
29        \spfjust[method=fertilize]{by inductive hypothesis}.
30      \end{spfstep}
31      \begin{spfstep}[type=conclusion]
32        We can \spfjust[method=simplify]{simplify} the right-hand side to
33         $(k+1)^2$ , which proves the assertion.
34      \end{spfstep}
35    \end{spfcase}
36    \begin{spfstep}[type=conclusion]
37      We have considered all the cases, so we have proven the assertion.
38    \end{spfstep}
39  \end{spfcases}
40 \end{sproof}

```

This yields the following result:

Proof: We prove that $\sum_{i=1}^n 2i - 1 = n^2$ by induction over n

²Of course, \LaTeX can not check that the assertions are the “correct” ones – but if the assertions (both in monoid as well as those for addition and zero) are properly marked up, MMT can. **TODO: should**

1. For the induction we have to consider the following cases:

1.1. $n = 1$: then we compute $1 = 1^2$ □

1.2. $n = 2$: This case is not really necessary, but we do it for the fun of it (and to get more intuition). We compute $1 + 3 = 2^2 = 4$ □

1.3. $n > 1$:

1.3.1. Now, we assume that the assertion is true for a certain $k \geq 1$, i.e. $\sum_{i=1}^k (2i - 1) = k^2$.

1.3.2. We have to show that we can derive the assertion for $n = k + 1$ from this assumption, i.e. $\sum_{i=1}^{k+1} (2i - 1) = (k + 1)^2$.

1.3.3. We obtain $\sum_{i=1}^{k+1} (2i - 1) = \sum_{i=1}^k (2i - 1) + 2(k + 1) - 1$ by splitting the sum.

1.3.4. Thus we have $\sum_{i=1}^{k+1} (2i - 1) = k^2 + 2k + 1$ by inductive hypothesis.

1.3.5. We can simplify the right-hand side to $(k + 1)^2$, which proves the assertion. □

1.4. We have considered all the cases, so we have proven the assertion. □

spproof The **spproof** environment is the main container for proofs. It takes an optional **KeyVal** argument that allows to specify the **id** (identifier) and **for** (for which assertion is this a proof) keys. The regular argument of the **proof** environment contains an introductory comment, that may be used to announce the proof style. The **proof** environment contains a sequence of **spfststep**, **spfstcomment**, and **spfstcases** environments that are used to markup the proof steps.

\spfstidea The **\spfstidea** macro allows to give a one-paragraph description of the proof idea.

\spfstsketch For one-line proof sketches, we use the **\spfstsketch** macro, which takes the same optional argument as **spproof** and another one: a natural language text that sketches the proof.

spfststep Regular proof steps are marked up with the **step** environment, which takes an optional **KeyVal** argument for annotations. A proof step usually contains a local assertion (the text of the step) together with some kind of evidence that this can be derived from already established assertions.

<hr/> <hr/> <code>\spfjust</code>	This evidence is marked up with the <code>\spfjust</code> macro in the <code>stex-proofs</code> package. This environment totally invisible to the formatted result; it wraps the text in the proof step that corresponds to the evidence. The environment takes an optional <code>KeyVal</code> argument, which can have the <code>method</code> key, whose value is the name of a proof method (this will only need to mean something to the application that consumes the semantic annotations). Furthermore, the justification can contain “premises” (specifications to assertions that were used justify the step) and “arguments” (other information taken into account by the proof method).
<hr/> <hr/> <code>\premise</code>	The <code>\premise</code> macro allows to mark up part of the text as reference to an assertion that is used in the argumentation. In the running example we have used the <code>\premise</code> macro to identify the inductive hypothesis.
<hr/> <hr/> <code>\justarg</code>	<p>The <code>\justarg</code> macro is very similar to <code>\premise</code> with the difference that it is used to mark up arguments to the proof method. Therefore the content of the first argument is interpreted as a mathematical object rather than as an identifier as in the case of <code>\premise</code>. In our example, we specified that the simplification should take place on the right hand side of the equation. Other examples include proof methods that instantiate. Here we would indicate the substituted object in a <code>\justarg</code> macro.</p> <p>Note that both <code>\premise</code> and <code>\justarg</code> can be used with an empty second argument to mark up premises and arguments that are not explicitly mentioned in the text.</p>
<code>subproof</code>	The <code>spfcases</code> environment is used to mark up a subproof. This environment takes an optional <code>KeyVal</code> argument for semantic annotations and a second argument that allows to specify an introductory comment (just like in the <code>proof</code> environment). The <code>method</code> key can be used to give the name of the proof method executed to make this subproof.
<code>spfcases</code>	The <code>spfcases</code> environment is used to mark up a proof by cases. Technically it is a variant of the <code>subproof</code> where the <code>method</code> is <code>by-cases</code> . Its contents are <code>spfcase</code> environments that mark up the cases one by one.
<code>spfcase</code>	The content of a <code>spfcases</code> environment are a sequence of case proofs marked up in the <code>spfcase</code> environment, which takes an optional <code>KeyVal</code> argument for semantic annotations. The second argument is used to specify the the description of the case under consideration. The content of a <code>spfcase</code> environment is the same as that of a <code>sproof</code> , i.e. <code>spfsteps</code> , <code>spfcomments</code> , and <code>spfcases</code> environments.
<hr/> <hr/> <code>\spfcasesketch</code>	<code>\spfcasesketch</code> is a variant of the <code>spfcase</code> environment that takes the same arguments, but instead of the <code>spfsteps</code> in the body uses a third argument for a proof sketch.
<code>spfcomment</code>	The <code>spfcomment</code> environment is much like a <code>step</code> , only that it does not have an object-level assertion of its own. Rather than asserting some fact that is relevant for the proof, it is used to explain where the proof is going, what we are attempting to to, or what we have achieved so far. As such, it cannot be the target of a <code>\premise</code> .

`\sproofend`

Traditionally, the end of a mathematical proof is marked with a little box at the end of the last line of the proof (if there is space and on the end of the next line if there isn't), like so:

The `stex-proofs` package provides the `\sproofend` macro for this.

`\sProofEndSymbol`

If a different symbol for the proof end is to be used (e.g. *q.e.d*), then this can be obtained by specifying it using the `\sProofEndSymbol` configuration macro (e.g. by specifying `\sProofEndSymbol{q.e.d}`).

Some of the proof structuring macros above will insert proof end symbols for sub-proofs, in most cases, this is desirable to make the proof structure explicit, but sometimes this wastes space (especially, if a proof ends in a case analysis which will supply its own proof end marker). To suppress it locally, just set `proofend={}` in them or use `\sProofEndSymbol{}`.

Chapter 6

Highlighting and Presentation Customizations

The environments starting with `s` (i.e. `smodule`, `sassertion`, `sexample`, `sdefinition`, `sparagraph` and `sproof`) by default produce no additional output whatsoever (except for the environment content of course). Instead, the document that uses them (whether directly or e.g. via `\inputref`) can decide how these environments are supposed to look like.

The `stexthm` package defines some default customizations that can be used, but of course many existing \LaTeX templates come with their own `definition`, `theorem` and similar environments that authors are supposed (or even required) to use. Their concrete syntax however is usually not compatible with all the additional arguments that \LaTeX allows for semantic information.

Therefore we introduced the separate environments `sdefinition` etc. instead of using `definition` directly. We allow authors to specify how these environments should be styled via the commands `stexpatch*`.

```
\stexpatchmodule
\stexpatchdefinition
\stexpatchassertion
\stexpatchexample
\stexpatchparagraph
\stexpatchproof
```

All of these commands take one optional and two proper arguments, i.e.

```
\stexpatch*{<type>}{<begin-code>}{<end-code>}.
```

After \LaTeX reads and processes the optional arguments for these environments, (some of) their values are stored in the macros `\s*<field>` (i.e. `sexampleid`, `\sassertionname`, etc.). It then checks for all the values `<type>` in the `type=`-list, whether an `\stexpatch*{<type>}` for the current environment has been called. If it finds one, it uses the patches `<begin-code>` and `<end-code>` to mark up the current environment. If no patch for (any of) the type(s) is found, it checks whether and `\stexpatch*` was called without optional argument.

For example, if we want to use a predefined `theorem` environment for `sassertions` with `type=theorem`, we can do

```
1 \stexpatchassertion[theorem]{\begin{theorem}}{\end{theorem}}
```

...or, rather, since e.g. `theorem`-like environments defined using `amsthm` take an optional title as argument, we can do:

```
1 \stexpatchassertion[theorem]
2   {\ifx\sassertiontitle\@empty
3     \begin{theorem}
```

```

4   \else
5     \begin{theorem}[\sassertiontitle]
6   \fi}
7 {\end{theorem}}

```

Or, if we want *all kinds of sdefinitions* to use a predefined definition-environment irrespective of their type=, then we can issue the following customization patch:

```

1 \stexpatchdefinition
2 {\ifx\sdefinitiontitle\@empty
3   \begin{definition}
4   \else
5     \begin{definition}[\sdefinitiontitle]
6   \fi}
7 {\end{definition}}

```

`\compemph`
`\varemp`
`\symrefemph`
`\defemph`

Apart from the environments, we can control how \TeX highlights variables, notation components, `\symrefs` and `\definiendums`, respectively.

To do so, we simply redefine these four macros. For example, to highlight notation components (i.e. everything in a `\comp`) in blue, as in this document, we can do `\def\compemph#1{\textcolor{blue}{#1}}`. By default, `\compemph` et al do nothing.

`\compemph@uri`
`\varemp@uri`
`\symrefemph@uri`
`\defemph@uri`

For each of the four macros, there exists an additional macro that takes the full URI of the relevant symbol currently being highlighted as a second argument. That allows us to e.g. use pdf tooltips and links. For example, this document uses⁹

```

1 \protected\def\symrefemph@uri#1#2{
2   \pdftooltip{
3     \srefsymuri{#2}{\symrefemph{#1}}
4   }{
5     URI:~\detokenize{#2}
6   }
7 }

```

By default, `\compemph@uri` is simply defined as `\compemph{#1}` (analogously for the other three commands).

Chapter 7

Additional Packages

7.1 Tikzinput: Treating TIKZ code as images

image

The behavior of the `ikzinput` package is determined by whether the `image` option is given. If it is not, then the `tikz` package is loaded, all other options are passed on to it and `\tikzinput{<file>}` inputs the TIKZ file `<file>.tex`; if not, only the `graphicx` package is loaded and `\tikzinput{<file>}` loads an image file `<file>.<ext>` generated from `<file>.tex`.

The selective input functionality of the `tikzinput` package assumes that the TIKZ pictures are externalized into a standalone picture file, such as the following one

```
1 \documentclass{standalone}
2 \usepackage{tikz}
3 \usetikzpackage{...}
4 \begin{document}
5   \begin{tikzpicture}
6     ...
7   \end{tikzpicture}
8 \end{document}
```

The `standalone` class is a minimal \LaTeX class that when loaded in a document that uses the `standalone` package: the preamble and the `document` environment are disregarded during loading, so they do not pose any problems. In effect, an `\input` of the file above only sees the `tikzpicture` environment, but the file itself is standalone in the sense that we can run \LaTeX over it separately, e.g. for generating an image file from it.

\tikzinput
\ctikzinput

This is exactly where the `tikzinput` package comes in: it supplies the `\tikzinput` macro, which – depending on the `image` option – either directly inputs the TIKZ picture (source) or tries to load an image file generated from it.

Concretely, if the `image` option is not set for the `tikzinput` package, then `\tikzinput[<opt>]{<file>}` disregards the optional argument `<opt>` and inputs `<file>.tex` via `\input` and resizes it to as specified in the `width` and `height` keys. If it is, `\tikzinput[<opt>]{<file>}` expands to `\includegraphics[<opt>]{<file>}`.

`\ctikzinput` is a version of `\tikzinput` that is centered.

`\mhtikzinput`
`\cmhtikzinput`

`\mhtizkinput` is a variant of `\tikzinput` that treats its file path argument as a relative path in a math archive in analogy to `\inputref`. To give the archive path, we use the `mhrepos=` key. Again, `\cmhtizkinput` is a version of `\mhtikzinput` that is centered.

`\libusetikzlibrary`

Sometimes, we want to supply archive-specific TIKZ libraries in the `lib` folder of the archive or the `meta-inf/lib` of the archive group. Then we need an analogon to `\libinput` for `\usetikzlibrary`. The `stex-tikzinput` package provides the `libusetikzlibrary` for this purpose.

7.2 Modular Document Structuring

The `document-structure` package supplies an infrastructure for writing OMDOC documents in \LaTeX . This includes a simple structure sharing mechanism for \TeX that allows to move from a copy-and-paste document development model to a copy-and-reference model, which conserves space and simplifies document management. The augmented structure can be used by MKM systems for added-value services, either directly from the \TeX sources, or after translation.

The `document-structure` package supplies macros and environments that allow to label document fragments and to reference them later in the same document or in other documents. In essence, this enhances the document-as-trees model to documents-as-directed-acyclic-graphs (DAG) model. This structure can be used by MKM systems for added-value services, either directly from the \TeX sources, or after translation. Currently, trans-document referencing provided by this package can only be used in the \TeX collection.

DAG models of documents allow to replace the “Copy and Paste” in the source document with a label-and-reference model where document are shared in the document source and the formatter does the copying during document formatting/presentation.

The `document-structure` package accepts the following options:

<code>class=<name></code>	load <code><name>.cls</code> instead of <code>article.cls</code>
<code>topsect=<sect></code>	The top-level sectioning level; the default for <code><sect></code> is <code>section</code>

sfragment The structure of the document is given by nested `sfragment` environments. In the \LaTeX route, the `sfragment` environment is flexibly mapped to sectioning commands, inducing the proper sectioning level from the nesting of `sfragment` environments. Correspondingly, the `sfragment` environment takes an optional key/value argument for metadata followed by a regular argument for the (section) title of the sfragment. The optional metadata argument has the keys `id` for an identifier, `creators` and `contributors` for the Dublin Core metadata [DCM03]. The option `short` allows to give a short title for the generated section. If the title contains semantic macros, they need to be protected by `\protect`¹⁰, and we need to give the `loadmodules` key it needs no value. For instance we would have

```

1 \begin{smodule}{foo}
2   \symdef{bar}{B^a_r}
3   ...
4   \begin{sfragment}[id=sec.barderiv,loadmodules]
5     {Introducing $\protect\bar$ Derivations}
```

¹⁰EdNOTE: MK: still?

\TeX automatically computes the sectioning level, from the nesting of `sfragment` environments.

But sometimes, we want to skip levels (e.g. to use a `\subsection*` as an introduction for a chapter).

blindfragment Therefore the `document-structure` package provides a variant `blindfragment` that does not produce markup, but increments the sectioning level and logically groups document parts that belong together, but where traditional document markup relies on convention rather than explicit markup. The `blindfragment` environment is useful e.g. for creating frontmatter at the correct level. The example below shows a typical setup for the outer document structure of a book with parts and chapters.

```

1 \begin{document}
2 \begin{blindfragment}
3 \begin{blindfragment}
4 \begin{frontmatter}
5 \maketitle\newpage
6 \begin{sfragment}{Preface}
7 ... <<preface>> ...
8 \end{sfragment}
9 \clearpage\setcounter{tocdepth}{4}\tableofcontents\clearpage
10 \end{frontmatter}
11 \end{blindfragment}
12 ... <<introductory remarks>> ...
13 \end{blindfragment}
14 \begin{sfragment}{Introduction}
15 ... <<intro>> ...
16 \end{sfragment}
17 ... <<more chapters>> ...
18 \bibliographystyle{alpha}\bibliography{kwarc}
19 \end{document}

```

Here we use two levels of `blindfragment`:

- The outer one groups the introductory parts of the book (which we assume to have a sectioning hierarchy topping at the part level). This `blindfragment` makes sure that the introductory remarks become a “chapter” instead of a “part”.
- The inner one groups the frontmatter³ and makes the preface of the book a section-level construct.¹¹

\skipfragment The `\skipfragment` “skips an `sfragment`”, i.e. it just steps the respective sectioning counter. This macro is useful, when we want to keep two documents in sync structurally, so that section numbers match up: Any section that is left out in one becomes a `\skipfragment`.

³We shied away from redefining the `frontmatter` to induce a `blindfragment`, but this may be the “right” way to go in the future.

¹¹EDNOTE: MK: We need a substitute for the “Note that here the `display=flow` on the `sfragment` environment prevents numbering as is traditional for prefaces.”

`\currentsectionlevel`
`\CurrentSectionLevel`

The `\currentsectionlevel` macro supplies the name of the current sectioning level, e.g. “chapter”, or “subsection”. `\CurrentSectionLevel` is the capitalized variant. They are useful to write something like “In this `\currentsectionlevel`, we will...” in an `sfragment` environment, where we do not know which sectioning level we will end up.

`\prematurestop`
`\afterprematurestop`

For prematurely stopping the formatting of a document, `STEX` provides the `\prematurestop` macro. It can be used everywhere in a document and ignores all input after that – backing out of the `sfragment` environment as needed. After that – and before the implicit `\end{document}` it calls the internal `\afterprematurestop`, which can be customized to do additional cleanup or e.g. print the bibliography.

`\prematurestop` is useful when one has a driver file, e.g. for a course taught multiple years and wants to generate course notes up to the current point in the lecture. Instead of commenting out the remaining parts, one can just move the `\prematurestop` macro. This is especially useful, if we need the rest of the file for processing, e.g. to generate a theory graph of the whole course with the already-covered parts marked up as an overview over the progress; see `import_graph.py` from the `lmhtools` utilities [LMH].

Text fragments and modules can be made more re-usable by the use of global variables. For instance, the admin section of a course can be made course-independent (and therefore re-usable) by using variables (actually token registers) `courseAcronym` and `courseTitle` instead of the text itself. The variables can then be set in the `STEX` preamble of the course notes file.

`\setSGvar`
`\useSGvar`

`\setSGvar{<vname>}{<text>}` to set the global variable `<vname>` to `<text>` and `\useSGvar{<vname>}` to reference it.

`\ifSGvar`

With `\ifSGvar` we can test for the contents of a global variable: the macro call `\ifSGvar{<vname>}{<val>}{<text>}` tests the content of the global variable `<vname>`, only if (after expansion) it is equal to `<val>`, the conditional text `<text>` is formatted.

7.3 Slides and Course Notes

The `notesslides` document class is derived from `beamer.cls` [Tana], it adds a “notes version” for course notes that is more suited to printing than the one supplied by `beamer.cls`.

The `notesslides` class takes the notion of a slide frame from Till Tantau’s excellent `beamer` class and adapts its notion of frames for use in the `STEX` and `OMDOC`. To support semantic course notes, it extends the notion of mixing frames and explanatory text, but rather than treating the frames as images (or integrating their contents into the flowing text), the `notesslides` package displays the slides as such in the course notes to give students a visual anchor into the slide presentation in the course (and to distinguish the different writing styles in slides and course notes).

In practice we want to generate two documents from the same source: the slides for presentation in the lecture and the course notes as a narrative document for home study. To achieve this, the `notesslides` class has two modes: *slides mode* and *notes mode* which are determined by the package option.

slides
notes
sectocframes
frameimages
fiboxed

The notesslides class takes a variety of class options:

- The options `slides` and `notes` switch between slides mode and notes mode (see Section ??).
- If the option `sectocframes` is given, then for the `sfragments`, special frames with the `sfragment` title (and number) are generated.
- If the option `frameimages` is set, then slide mode also shows the `\frameimage`-generated frames (see section ??). If also the `fiboxed` option is given, the slides are surrounded by a box.

`frame,note` Slides are represented with the `frame` environment just like in the `beamer` class, see [Tanb] for details. The `notesslides` class adds the `note` environment for encapsulating the course note fragments.⁴



Note that it is essential to start and end the `notes` environment at the start of the line – in particular, there may not be leading blanks – else L^AT_EX becomes confused and throws error messages that are difficult to decipher.

By interleaving the `frame` and `note` environments, we can build course notes as shown here:

```

1 \ifnotes\maketitle\else
2 \frame[noframenumbering]\maketitle\fi
3
4 \begin{note}
5   We start this course with ...
6 \end{note}
7
8 \begin{frame}
9   \frametitle{The first slide}
10  ...
11 \end{frame}
12 \begin{note}
13   ... and more explanatory text
14 \end{note}
15
16 \begin{frame}
17   \frametitle{The second slide}
18   ...
19 \end{frame}
20 ...

```

`\ifnotes`

Note the use of the `\ifnotes` conditional, which allows different treatment between `notes` and `slides` mode – manually setting `\notestru` or `\notesfalse` is strongly discouraged however.

⁴MK: it would be very nice, if we did not need this environment, and this should be possible in principle, but not without intensive L^AT_EX trickery. Hints to the author are welcome.



We need to give the title frame the `noframenumbering` option so that the frame numbering is kept in sync between the slides and the course notes.



The `beamer` class recommends not to use the `allowframebreaks` option on frames (even though it is very convenient). This holds even more in the `notesslides` case: At least in conjunction with `\newpage`, frame numbering behaves funnily (we have tried to fix this, but who knows).

`\inputref*`

If we want to transclude a the contents of a file as a note, we can use a new variant `\inputref*` of the `\inputref` macro: `\inputref*{foo}` is equivalent to `\begin{note}\inputref{foo}\end{note}`.

`nexample`, `nsproof`, `nassertion`

There are some environments that tend to occur at the top-level of `note` environments. We make convenience versions of these: e.g. the `nparagraph` environment is just an `sparagraph` inside a `note` environment (but looks nicer in the source, since it avoids one level of source indenting). Similarly, we have the `nfragment`, `ndefinition`, `nexample`, `nsproof`, and `nassertion` environments.

`\setslidelogo`

The default logo provided by the `notesslides` package is the `STEX` logo it can be customized using `\setslidelogo{<logo name>}`.

`\setsource`

The default footer line of the `notesslides` package mentions copyright and licensing. In the `beamer` class, `\source` stores the author's name as the copyright holder . By default it is *Michael Kohlhase* in the `notesslides` package since he is the main user and designer of this package. `\setsource{<name>}` can change the writer's name.

`\setlicensing`

For licensing, we use the Creative Commons Attribution-ShareAlike license by default to strengthen the public domain. If package `hyperref` is loaded, then we can attach a hyperlink to the license logo. `\setlicensing[<url>]{<logo name>}` is used for customization, where `<url>` is optional.

Sometimes, we want to integrate slides as images after all – e.g. because we already have a PowerPoint presentation, to which we want to add `STEX` notes.

`\frameimage`
`\mhframeimage`

In this case we can use `\frameimage[⟨opt⟩]{⟨path⟩}`, where `⟨opt⟩` are the options of `\includegraphics` from the `graphicx` package [CR99] and `⟨path⟩` is the file path (extension can be left off like in `\includegraphics`). We have added the `label` key that allows to give a frame label that can be referenced like a regular `beamer` frame.

The `\mhframeimage` macro is a variant of `\frameimage` with repository support. Instead of writing

```
1 \frameimage{\MathHub{fooMH/bar/source/baz/foobar}}
```

we can simply write (assuming that `\MathHub` is defined as above)

```
1 \mhframeimage[fooMH/bar]{baz/foobar}
```

Note that the `\mhframeimage` form is more semantic, which allows more advanced document management features in `MathHub`.

If `baz/foobar` is the “current module”, i.e. if we are on the `MathHub` path `...MathHub/fooMH/bar...`, then stating the repository in the first optional argument is redundant, so we can just use

```
1 \mhframeimage{baz/foobar}
```

`\textwarning`

The `\textwarning` macro generates a warning sign: 

In course notes, we sometimes want to point to an “excursion” – material that is either presupposed or tangential to the course at the moment – e.g. in an appendix. The typical setup is the following:

```
1 \excursion{founif}{../ex/founif}{We will cover first-order unification in}
2 ...
3 \begin{appendix}\printexcursions\end{appendix}
```

`\excursion`

The `\excursion{⟨ref⟩}{⟨path⟩}{⟨text⟩}` is syntactic sugar for

```
1 \begin{nparagraph}[title=Excursion]
2   \activateexcursion{founif}{../ex/founif}
3   We will cover first-order unification in \sref{founif}.
4 \end{nparagraph}
```

`\activateexcursion`
`\printexcursion`
`\excursionref`

Here `\activateexcursion{⟨path⟩}` augments the `\printexcursions` macro by a call `\inputref{⟨path⟩}`. In this way, the `\printexcursions` macro (usually in the appendix) will collect up all excursions that are specified in the main text.

Sometimes, we want to reference – in an excursion – part of another. We can use `\excursionref{⟨label⟩}` for that.

`\excursiongroup`

Finally, we usually want to put the excursions into an `sfragment` environment and add an introduction, therefore we provide the a variant of the `\printexcursions` macro: `\excursiongroup[id=<id>,intro=<path>]` is equivalent to

```
1 \begin{note}
2 \begin{sfragment}[id=<id>]{Excursions}
3   \inputref{<path>}
4   \printexcursions
5 \end{sfragment}
6 \end{note}
```



When option `book` which uses `\pagestyle{headings}` is given and semantic macros are given in the `sfragment` titles, then they sometimes are not defined by the time the heading is formatted. Need to look into how the headings are made. This is a problem of the underlying `document-structure` package.

7.4 Representing Problems and Solutions

The `problem` package supplies an infrastructure that allows specify problem. Problems are text fragments that come with auxiliary functions: hints, notes, and solutions⁵. Furthermore, we can specify how long the solution to a given problem is estimated to take and how many points will be awarded for a perfect solution.

Finally, the `problem` package facilitates the management of problems in small files, so that problems can be re-used in multiple environment.

`solutions`
`notes`
`hints`
`gnotes`
`pts`
`min`
`boxed`
`test`

The `problem` package takes the options `solutions` (should solutions be output?), `notes` (should the problem notes be presented?), `hints` (do we give the hints?), `gnotes` (do we show grading notes?), `pts` (do we display the points awarded for solving the problem?), `min` (do we display the estimated minutes for problem soling). If theses are specified, then the corresponding auxiliary parts of the problems are output, otherwise, they remain invisible.

The `boxed` option specifies that problems should be formatted in framed boxes so that they are more visible in the text. Finally, the `test` option signifies that we are in a test situation, so this option does not show the solutions (of course), but leaves space for the students to solve them.

`problem` The main environment provided by the `problempackage` is (surprise surprise) the `problem` environment. It is used to mark up problems and exercises. The environment takes an optional `KeyVal` argument with the keys `id` as an identifier that can be reference later, `pts` for the points to be gained from this exercise in homework or quiz situations, `min` for the estimated minutes needed to solve the problem, and finally `title` for an informative title of the problem.

⁵for the moment multiple choice problems are not supported, but may well be in a future version

Example 40

Input:

```

1 \documentclass{article}
2 \usepackage[solutions,hints,pts,min]{problem}
3 \begin{document}
4   \begin{sproblem}[id=elephants,pts=10,min=2,title=Fitting Elephants]
5     How many Elephants can you fit into a Volkswagen beetle?
6     \begin{hint}
7       Think positively, this is simple!
8     \end{hint}
9     \begin{exnote}
10      Justify your answer
11    \end{exnote}
12 \begin{solution}[for=elephants,height=3cm]
13   Four, two in the front seats, and two in the back.
14 \begin{gnote}
15   if they do not give the justification deduct 5 pts
16 \end{gnote}
17 \end{solution}
18 \end{sproblem}
19 \end{document}

```

Output:

Problem 7.4.1 (Fitting Elephants)
 How many Elephants can you fit into a Volkswagen beetle?

Hint: Think positively, this is simple!

Note: Justify your answer

Solution: Four, two in the front seats, and two in the back.

Grading: if they do not give the justification deduct 5 pts

solution The `solution` environment can be to specify a solution to a problem. If the package option `solutions` is set or `\solutionstrue` is set in the text, then the solution will be presented in the output. The `solution` environment takes an optional KeyVal argument with the keys `id` for an identifier that can be reference `for` to specify which problem this is a solution for, and `height` that allows to specify the amount of space to be left in test situations (i.e. if the `test` option is set in the `\usepackage` statement).

hint,exnote,gnote The `hint` and `exnote` environments can be used in a `problem` environment to give hints and to make notes that elaborate certain aspects of the problem. The `gnote` (grading notes) environment can be used to document situations that may arise in grading.

\startsolutions
\stopsolutions

Sometimes we would like to locally override the `solutions` option we have given to the package. To turn on solutions we use the `\startsolutions`, to turn them off, `\stopsolutions`. These two can be used at any point in the documents.

`\ifsolutions`

Also, sometimes, we want content (e.g. in an exam with master solutions) conditional on whether solutions are shown. This can be done with the `\ifsolutions` conditional.

`mcb` Multiple choice blocks can be formatted using the `mcb` environment, in which single choices are marked up with `\mcc` macro.

`\mcc`

`\mcc[⟨keyvals⟩]{⟨text⟩}` takes an optional key/value argument `⟨keyvals⟩` for choice meta-data and a required argument `⟨text⟩` for the proposed answer text. The following keys are supported

- `T` for true answers, `F` for false ones,
- `Ttext` the verdict for true answers, `Ftext` for false ones, and
- `feedback` for a short feedback text given to the student.

If we start the solutions, then we get

Example 41

Input:

```
1 \startsolutions
2 \begin{sproblem}[title=Functions,name=functions1]
3   What is the keyword to introduce a function definition in python?
4   \begin{mcb}
5     \mcc[T]{def}
6     \mcc[F,feedback=that is for C and C++] {function}
7     \mcc[F,feedback=that is for Standard ML] {fun}
8     \mcc[F,Ftext=Nooooooooo,feedback=that is for Java] {public static void}
9   \end{mcb}
10 \end{sproblem}
```

Output:

Problem 7.4.2 (Functions)

What is the keyword to introduce a function definition in python?

- ☐ `def`
(**true**)
- ☐ `function`
(**false**) (*that is for C and C++*)
- ☐ `fun`
(**false**) (*that is for Standard ML*)
- ☐ `public static void`
(**false**) (*that is for Java*)

¹²EdNOTE: MK: that did not work!

Example 42

Input:

```
1 \stopsolutions
2 \begin{sproblem}[title=Functions,name=functions1]
3   What is the keyword to introduce a function definition in python?
4   \begin{mcb}
5     \mcc[T]{def}
6     \mcc[F,feedback=that is for C and C++){function}
7     \mcc[F,feedback=that is for Standard ML]{fun}
8     \mcc[F,Ftext=Noooooooooooo,feedback=that is for Java]{public static void}
9   \end{mcb}
10 \end{sproblem}
```

Output:

Problem 7.4.3 (Functions)

What is the keyword to introduce a function definition in python?

- ☐ def
(true)
- ☐ function
(false) (that is for C and C++)
- ☐ fun
(false) (that is for Standard ML)
- ☐ public static void
(false) (that is for Java)

\includeproblem

The `\includeproblem` macro can be used to include a problem from another file. It takes an optional `KeyVal` argument and a second argument which is a path to the file containing the problem (the macro assumes that there is only one problem in the include file). The keys `title`, `min`, and `pts` specify the problem title, the estimated minutes for solving the problem and the points to be gained, and their values (if given) overwrite the ones specified in the `problem` environment in the included file.

The sum of the points and estimated minutes (that we specified in the `pts` and `min` keys to the `problem` environment or the `\includeproblem` macro) to the log file and the screen after each run. This is useful in preparing exams, where we want to make sure that the students can indeed solve the problems in an allotted time period.

The `\min` and `\pts` macros allow to specify (i.e. to print to the margin) the distribution of time and reward to parts of a problem, if the `pts` and `pts` options are set. This allows to give students hints about the estimated time and the points to be awarded.

7.5 Homeworks, Quizzes and Exams

The `hwexam` package and class supplies an infrastructure that allows to format nice-looking assignment sheets by simply including problems from problem files marked up

with the `roblem` package. It is designed to be compatible with `problems.sty`, and inherits some of the functionality.

<code>solutions</code>	The <code>wexam</code> package and class take the options <code>solutions</code> , <code>notes</code> , <code>hints</code> , <code>gnotes</code> , <code>pts</code> , <code>min</code> , and <code>boxed</code> that are just passed on to the <code>problems</code> package (cf. its documentation for a description of the intended behavior).
<code>notes</code>	
<code>hints</code>	
<code>gnotes</code>	
<code>pts</code>	
<code>min</code>	
<code>assignment</code>	This package supplies the <code>assignment</code> environment that groups problems into assignment sheets. It takes an optional <code>KeyVal</code> argument with the keys <code>number</code> (for the assignment number; if none is given, 1 is assumed as the default or — in multi-assignment documents — the ordinal of the <code>assignment</code> environment), <code>title</code> (for the assignment title; this is referenced in the title of the assignment sheet), <code>type</code> (for the assignment type; e.g. “quiz”, or “homework”), <code>given</code> (for the date the assignment was given), and <code>due</code> (for the date the assignment is due).
<code>number</code>	
<code>title</code>	
<code>type</code>	
<code>given</code>	
<code>due</code>	
<code>multiple</code>	Furthermore, the <code>hwexam</code> package takes the option <code>multiple</code> that allows to combine multiple assignment sheets into a compound document (the assignment sheets are treated as section, there is a table of contents, etc.).
<code>test</code>	Finally, there is the option <code>test</code> that modifies the behavior to facilitate formatting tests. Only in <code>test</code> mode, the macros <code>\testspace</code> , <code>\testnewpage</code> , and <code>\testemptypage</code> have an effect: they generate space for the students to solve the given problems. Thus they can be left in the \LaTeX source.
<code>\testspace</code>	<code>\testspace</code> takes an argument that expands to a dimension, and leaves vertical space accordingly. <code>\testnewpage</code> makes a new page in <code>test</code> mode, and <code>\testemptypage</code> generates an empty page with the cautionary message that this page was intentionally left empty.
<code>\testnewpage</code>	
<code>\testemptypage</code>	
<code>testheading</code>	Finally, the <code>\testheading</code> takes an optional keyword argument where the keys <code>duration</code> specifies a string that specifies the duration of the test, <code>min</code> specifies the equivalent in number of minutes, and <code>reqpts</code> the points that are required for a perfect grade.
<code>duration</code>	
<code>min</code>	
<code>reqpts</code>	
	<pre> 1 \title{320101 General Computer Science (Fall 2010)} 2 \begin{testheading}[duration=one hour,min=60,reqpts=27] 3 Good luck to all students! 4 \end{testheading} </pre>

Will result in

Name:

Matriculation Number:

320101 General Computer Science (Fall 2010)

2022-05-20

You have one hour (sharp) for the test;

Write the solutions to the sheet.

The estimated time for solving this exam is 60 minutes, leaving you 0 minutes for revising your exam.

You can reach 40 points if you solve all problems. You will only need 27 points for a perfect score, i.e. 13 points are bonus points.

You have ample time, so take it slow and avoid rushing to mistakes!

Different problems test different skills and knowledge, so do not get stuck on one problem.

	To be used for grading, do not write here											
prob.	7.4.1	7.4.2	7.4.3	1.1	2.1	2.2	2.3	3.1	3.2	3.3	Sum	grade
total	10			4	4	6	6	4	4	2	40	
reached												

good luck

EdN:13

13

`\inputassignment`

The `\inputassignment` macro can be used to input an assignment from another file. It takes an optional `KeyVal` argument and a second argument which is a path to the file containing the problem (the macro assumes that there is only one `assignment` environment in the included file). The keys `number`, `title`, `type`, `given`, and `due` are just as for the `assignment` environment and (if given) overwrite the ones specified in the `assignment` environment in the included file.

¹³EDNOTE: MK: The first three “problems” come from the stex examples above, how do we get rid of this?

Part II
Documentation

Chapter 8

sTeX-Basics

This sub package provides general set up code, auxiliary methods and abstractions for xhtml annotations.

8.1 Macros and Environments

<code>\sTeX</code>	Both print this sTeX logo.
<code>\stex</code>	

<code>\stex_debug:nn</code>	<code>\stex_debug:nn {<log-prefix>} {<message>}</code>
-----------------------------	--

Logs *<message>*, if the package option `debug` contains *<log-prefix>*.

8.1.1 HTML Annotations

<code>\if@latexml</code>	L ^A T _E X2e conditional for L ^A T _E XML
--------------------------	---

<code>\latexml_if_p: *</code>	L ^A T _E X3 conditionals for L ^A T _E XML.
<code>\latexml_if:TF *</code>	

<code>\stex_if_do_html_p: *</code>	Whether to currently produce any HTML annotations (can be false in some advanced structuring environments, for example)
<code>\stex_if_do_html:TF *</code>	

<code>\stex_suppress_html:n</code>	Temporarily disables HTML annotations in its argument code
------------------------------------	--

We have four macros for annotating generated HTML (via L^AT_EXML or R_US_TE_X) with attributes:

<code>\stex_annotate:nnn</code>	<code>\stex_annotate:nnn {⟨property⟩} {⟨resource⟩} {⟨content⟩}</code>
<code>\stex_annotate_invisible:nnn</code>	
<code>\stex_annotate_invisible:n</code>	

Annotates the HTML generated by `⟨content⟩` with

`property="stex:⟨property⟩", resource="⟨resource⟩".`

`\stex_annotate_invisible:n` adds the attributes

`stex:visible="false", style="display:none".`

`\stex_annotate_invisible:nnn` combines the functionality of both.

<code>stex_annotate_env</code>	<code>\begin{stex_annotate_env}{⟨property⟩}{⟨resource⟩}</code> <code>⟨content⟩</code> <code>\end{stex_annotate_env}</code> behaves like <code>\stex_annotate:nnn {⟨property⟩} {⟨resource⟩} {⟨content⟩}</code> .
--------------------------------	--

8.1.2 Babel Languages

<code>\c_stex_languages_prop</code>
<code>\c_stex_language_abbrevs_prop</code>

Map language abbreviations to their full babel names and vice versa. e.g. `\c_stex_languages_prop{en}` yields `english`, and `\c_stex_language_abbrevs_prop{english}` yields `en`.

8.1.3 Auxiliary Methods

<code>\stex_deactivate_macro:Nn</code>	<code>\stex_deactivate_macro:Nn⟨cs⟩{⟨environments⟩}</code>
<code>\stex_reactivate_macro:N</code>	

Makes the macro `⟨cs⟩` throw an error, indicating that it is only allowed in the context of `⟨environments⟩`.

`\stex_reactivate_macro:N⟨cs⟩` reactivates it again, i.e. this happens ideally in the `⟨begin⟩`-code of the associated environments.

<code>\ignorespacesandpars</code>	ignores white space characters and <code>\par</code> control sequences. Expands tokens in the process.
-----------------------------------	--

Chapter 9

STEX-MathHub

This sub package provides code for handling ST_EX archives, files, file paths and related methods.

9.1 Macros and Environments

<code>\stex_kpsewhich:n</code>	<code>\stex_kpsewhich:n</code> executes <code>kpsewhich</code> and stores the return in <code>\l_stex_kpsewhich_return_str</code> . This does not require shell escaping.
--------------------------------	---

9.1.1 Files, Paths, URIs

<code>\stex_path_from_string:Nn</code>	<code>\stex_path_from_string:Nn</code> $\langle path-variable \rangle$ $\{\langle string \rangle\}$ turns the $\langle string \rangle$ into a path by splitting it at <code>/</code> -characters and stores the result in $\langle path-variable \rangle$. Also applies <code>\stex_path_canonicalize:N</code> .
--	--

<code>\stex_path_to_string:NN</code> <code>\stex_path_to_string:N</code>	The inverse; turns a path into a string and stores it in the second argument variable, or leaves it in the input stream.
---	--

<code>\stex_path_canonicalize:N</code>	Canonicalizes the path provided; in particular, resolves <code>.</code> and <code>..</code> path segments.
--	--

<code>\stex_path_if_absolute_p:N</code> \star <code>\stex_path_if_absolute:N$\underline{T$</code> \star	Checks whether the path provided is <i>absolute</i> , i.e. starts with an empty segment
---	---

<code>\c_stex_pwd_seq</code> <code>\c_stex_pwd_str</code> <code>\c_stex_mainfile_seq</code> <code>\c_stex_mainfile_str</code>	Store the current working directory as path-sequence and string, respectively, and the (heuristically guessed) full path to the main file, based on the PWD and <code>\jobname</code> .
--	---

<code>\g_stex_currentfile_seq</code>	The file being currently processed (respecting <code>\input</code> etc.)
--------------------------------------	--

<code>\stex_filestack_push:n</code> <code>\stex_filestack_pop:</code>	Push and pop (repectively) a file path to the file stack, to keep track of the current file. Are called in hooks <code>file/before</code> and <code>file/after</code> , respectively.
--	---

9.1.2 MathHub Archives

<code>\mathhub</code> <code>\c_stex_mathhub_seq</code> <code>\c_stex_mathhub_str</code>	We determine the path to the local MathHub folder via one of four means, in order of precedence:
---	--

1. The `mathhub` package option, or
2. the `\mathhub-macro`, if it has been defined before the `\usepackage{stex}`-statement, or
3. the `MATHHUB` system variable, or
4. a path specified in `~/.stex/mathhub.path`.

In all four cases, `\c_stex_mathhub_seq` and `\c_stex_mathhub_str` are set accordingly.

<code>\l_stex_current_repository_prop</code>	
--	--

Always points to the *current* MathHub repository (if we currently are in one). Has the following fields corresponding to the entries in the `MANIFEST.MF`-file:

- `id`: The name of the archive, including its group (e.g. `smglom/calculus`),
- `ns`: The content namespace (for modules and symbols),
- `narr`: the narration namespace (for document references),
- `docurl`: The URL that is used as a basis for *external references*,
- `deps`: All archives that this archive depends on (currently not in use).

<code>\stex_set_current_repository:n</code>	
---	--

Sets the current repository to the one with the provided ID. calls `__stex_mathhub_do_manifest:n`, so works whether this repository's `MANIFEST.MF`-file has already been read or not.

<code>\stex_require_repository:n</code>	Calls <code>__stex_mathhub_do_manifest:n</code> iff the corresponding archive property list does not already exist, and adds a corresponding definition to the <code>.sms</code> -file.
---	--

<code>\stex_in_repository:nn</code>	<code>\stex_in_repository:nn{<repository-name>}{<code>}</code> Change the current repository to <code>{<repository-name>}</code> (or not, if <code>{<repository-name>}</code> is empty), and passes its ID on to <code>{<code>}</code> as <code>#1</code> . Switches back to the previous repository after executing <code>{<code>}</code> .
-------------------------------------	---

9.1.3 Using Content in Archives

<hr/> <hr/> <code>\mhpath *</code>	<code>\mhpath{<archive-ID>}{<filename>}</code> Expands to the full path of file <code><filename></code> in repository <code><archive-ID></code> . Does not check whether the file or the repository exist.
<hr/> <hr/> <code>\inputref</code> <code>\mhinput</code>	<code>\inputref[<archive-ID>]{<filename>}</code> Both <code>\input</code> the file <code><filename></code> in archive <code><archive-ID></code> (relative to the <code>source-</code> subdirectory). <code>\mhinput</code> does so directly. <code>\inputref</code> does so within an <code>\begingroup... \endgroup-</code> block, and skips it in <code>html-mode</code> , inserting a <i>reference</i> to the file instead. Both also set <code>\ifinputref</code> to true.
<hr/> <hr/> <code>\addmhbibresource</code>	<code>\inputref[<archive-ID>]{<filename>}</code> Adds a <code>.bib</code> -file <code><filename></code> in archive <code><archive-ID></code> (relative to the top-directory of the archive!).
<hr/> <hr/> <code>\libinput</code>	<code>\libinput{<filename>}</code> Inputs <code><filename>.tex</code> from the <code>lib</code> folders in the current archive and the <code>meta-inf-</code> archive of the current archive group(s) (if existent) in descending order. Throws an error if no file by that name exists in any of the relevant <code>lib</code> -folders.
<hr/> <hr/> <code>\libusepackage</code>	<code>\libusepackage[<args>]{<filename>}</code> Like <code>\libinput</code> , but looks for <code>.sty</code> -files and calls <code>\usepackage[<meta{args}>]{<Arg{filename}>}</code> instead of <code>\input</code> . Throws an error, if none or more than one suitable package file is found.
<hr/> <hr/> <code>\mhgraphics</code> <code>\cmhgraphics</code>	<i>If</i> the <code>graphicx</code> package is loaded, these macros are defined at <code>\begin{document}</code> . <code>\mhgraphics</code> takes the same arguments as <code>\includegraphics</code> , with the additional optional key <code>mhrepos</code> . It then resolves the file path in <code>\mhgraphics[mhrepos=Foo/Bar]{foo/bar.png}</code> relative to the <code>source-</code> folder of the <code>Foo/Bar</code> -archive. <code>\cmhgraphics</code> additional wraps the image in a <code>center</code> -environment.
<hr/> <hr/> <code>\lstinputmhlisting</code> <code>\clstinputmhlisting</code>	Like <code>\mhgraphics</code> , but only defined if the <code>listings</code> -package is loaded, and with <code>\lstinputlisting</code> instead of <code>\includegraphics</code> .

Chapter 10

STEX-References

This sub package contains code related to links and cross-references

10.1 Macros and Environments

\STEXreftitle**\STEXreftitle{<some title>}**

Sets the title of the current document to *<some title>*. A reference to the current document from *some other* document will then be displayed accordingly. e.g. if **\STEXreftitle{foo book}** is called, then referencing Definition 3.5 in this document in another document will display **Definition 3.5 in foo book**.

\stex_get_document_uri:

Computes the current document uri from the current archive's **narr**-field and its location relative to the archive's **source**-directory. Reference targets are computed from this URI and the reference-id.

\l_stex_current_docns_str

Stores its result in **\l_stex_current_docns_str**

\stex_get_document_url:

Computes the current URL from the current archive's **docurl**-field and its location relative to the archive's **source**-directory. Reference targets are computed from this URL and the reference-id, if this document is only included in SMS mode.

\l_stex_current_docurl_str

Stores its result in **\l_stex_current_docurl_str**

10.1.1 Setting Reference Targets

\stex_ref_new_doc_target:n**\stex_ref_new_doc_target:n{<id>}**

Sets a new reference target with id *<id>*.

\stex_ref_new_sym_target:n**\stex_ref_new_sym_target:n{<uri>}**

Sets a new reference target for the symbol *<uri>*.

10.1.2 Using References

`\sref` `\sref[<opt-args>]{<id>}`

References the label with if *<id>*. Optional arguments: **TODO**

`\srefsym` `\srefsym[<opt-args>]{<symbol>}`

Like `\sref`, but references the *canonical label* for the provided symbol. The canonical target is the last of the following occurring in the document:

- A `\definiendum` or `\definame` for *<symbol>*,
- The `sassertion`, `sexample` or `sparagraph` with `for=<symbol>` that generated *<symbol>* in the first place, or
- A `\sparagraph` with `type=symdoc` and `for=<symbol>`.

`\srefsymuri` `\srefsymuri{<URI>}{<text>}`

A convenient short-hand for `\srefsym[linktext={<text>}]<URI>`, but requires the first argument to be a full URI already. Intended to be used in e.g. `\compemph@uri`, `\defemph@uri`, etc.

Chapter 11

sTeX-Modules

This sub package contains code related to Modules

11.1 Macros and Environments

The content of a module with uri $\langle <URI> \rangle$ is stored in four macros. All modifications of these macros are global:

`\c_stex_module_<URI>_prop`

A property list with the following fields:

name The *name* of the module,

ns the *namespace* in field **ns**,

file the *file* containing the module, as a sequence of path fragments

lang the module's *language*,

sig the language of the signature module, if the current file is a translation from some other language,

deprecate if this module is deprecated, the module that replaces it,

meta the metatheory of the module.

`\c_stex_module_<URI>_code`

The code to execute when this module is activated (i.e. imported), e.g. to set all the semantic macros, notations, etc.

`\c_stex_module_<URI>_constants`

The names of all constants declared in the module

`\c_stex_module_<URI>_constants`

The full URIs of all modules imported in this module

<hr/> <hr/> <code>\l_stex_current_module_str</code>	<code>\l_stex_current_module_str</code> always contains the URI of the current module (if existent).
<hr/> <hr/> <code>\l_stex_all_modules_seq</code>	Stores full URIs for all modules currently in scope.
<hr/> <hr/> <code>\stex_if_in_module_p: *</code> <code>\stex_if_in_module:TF *</code>	Conditional for whether we are currently in a module
<hr/> <hr/> <code>\stex_if_module_exists_p:n *</code> <code>\stex_if_module_exists:nTF *</code>	Conditional for whether a module with the provided URI is already known.
<hr/> <hr/> <code>\stex_add_to_current_module:n</code> <code>\STEXexport</code>	Adds the provided tokens to the <code>_code</code> control sequence of the current module. <code>\stex_add_to_current_module:n</code> is used internally, <code>\STEXexport</code> is intended for users and additionally executes the provided code immediately.
<hr/> <hr/> <code>\stex_add_constant_to_current_module:n</code>	Adds the declaration with the provided name to the <code>_constants</code> control sequence of the current module.
<hr/> <hr/> <code>\stex_add_import_to_current_module:n</code>	Adds the module with the provided full URI to the <code>_imports</code> control sequence of the current module.
<hr/> <hr/> <code>\stex_collect_imports:n</code>	Iterates over all imports of the provided (full URI of a) module and stores them as a topologically sorted list – including the provided module as the last element – in <code>\l_stex_collect_imports_seq</code>
<hr/> <hr/> <code>\stex_do_up_to_module:n</code>	Code that is <i>exported</i> from module (such as symbol declarations) should be local <i>to the current module</i> . For that reason, ideally all symbol declarations and similar commands should be called directly in the module environment, however, that is not always feasible, e.g. in structural features or <code>sparapraphs</code> . <code>\stex_do_up_to_module</code> therefore executes the provided code repeatedly in an <code>\aftergroup</code> up until the group level is equal to that of the innermost smodule environment.

`\stex_modules_current_namespace:`

Computes the current namespace as follows:

If the current file is `.../source/sub/file.tex` in some archive with namespace `http://some.namespace/foo`, then the namespace of is `http://some.namespace/foo/sub/file`. Otherwise, the namespace is the absolute file path of the current file (i.e. starting with `file:///`).

The result is stored in `\l_stex_module_ns_str`. Additionally, the sub path relative to the current repository is stored in `\l_stex_module_subpath_str`.

11.1.1 The `smodule` environment

`module` `\begin{module}[\langle options \rangle]{\langle name \rangle}`

Opens a new module with name `\langle name \rangle`. Options are:

`title` (`\langle token list \rangle`) to display in customizations.

`type` (`\langle string \rangle*`) for use in customizations.

`deprecate` (`\langle module \rangle`) if set, will throw a warning when loaded, urging to use `\langle module \rangle` instead.

`id` (`\langle string \rangle`) for cross-referencing.

`ns` (`\langle URI \rangle`) the namespace to use. *Should not be used, unless you know precisely what you're doing.* If not explicitly set, is computed using `\stex_modules_current_namespace:`.

`lang` (`\langle language \rangle`) if not set, computed from the current file name (e.g. `foo.en.tex`).

`sig` (`\langle language \rangle`) if the current file is a translation of a file with the same base name but a different language suffix, setting `sig=<lang>` will preload the module from that language file. This helps ensuring that the (formal) content of both modules is (almost) identical across languages and avoids duplication.

`creators` (`\langle string \rangle*`) names of the creators.

`contributors` (`\langle string \rangle*`) names of contributors.

`srccite` (`\langle string \rangle`) a source citation for the content of this module.

`\stex_module_setup:nn` `\stex_module_setup:nn{\langle params \rangle}{\langle name \rangle}`

Sets up a new module with name `\langle name \rangle` and optional parameters `\langle params \rangle`. In particular, sets `\l_stex_current_module_str` appropriately.

`\stexpatchmodule` `\stexpatchmodule [\langle type \rangle] {\langle begincode \rangle} {\langle endcode \rangle}`

Customizes the presentation for those `smodule`-environments with `type=\langle type \rangle`, or all others if no `\langle type \rangle` is given.

`\STEXModule` `\STEXModule {\langle fragment \rangle}`

Attempts to find a module whose URI ends with `\langle fragment \rangle` in the current scope and passes the full URI on to `\stex_invoke_module:n`.

`\stex_invoke_module:n` Invoked by `\STEXModule`. Needs to be followed either by `!\macro` or `?{\langle symbolname \rangle}`. In the first case, it stores the full URI in `\macro`; in the second case, it invokes the symbol `\langle symbolname \rangle` in the selected module.

`\stex_activate_module:n`

Activate the module with the provided URI; i.e. executes all macro code of the module's `_code`-macro (does nothing if the module is already activated in the current context) and adds the module to `\l_stex_all_modules_seq`.

Chapter 12

STEX-Module Inheritance

Code related to Module Inheritance, in particular *sms mode*.

12.1 Macros and Environments

12.1.1 SMS Mode

“SMS Mode” is used when loading modules from external tex files. It deactivates any output and ignores all T_EX commands not explicitly allowed via the following lists – all of which either declare module content or are needed in order to declare module content:

`\g_stex_smsmode_allowedmacros_tl`

Macros that are executed as is; i.e. sms mode continues immediately after. These macros may not take any arguments or otherwise gobble tokens.

Initially: `\makeatletter`, `\makeatother`, `\ExplSyntaxOn`, `\ExplSyntaxOff`.

`\g_stex_smsmode_allowedmacros_escape_tl`

Macros that are executed and potentially gobble up further tokens. These macros need to make sure, that the very last token they ultimately expand to is `\stex_smsmode_do:`.

Initially: `\symdecl`, `\notation`, `\symdef`, `\importmodule`, `\STEXexport`, `\inlineass`, `\inlinedef`, `\inlineex`, `\endinput`, `\setnotation`, `\copynotation`.

`\g_stex_smsmode_allowedenvs_seq`

The names of environments that should be allowed in SMS mode. The corresponding `\begin`-statements are treated like the macros in `\g_stex_smsmode_allowedmacros_escape_tl`, so `\stex_smsmode_do:` needs to be the last token in the `\begin`-code. Since `\end`-statements take no arguments anyway, those are called directly and sms mode continues afterwards.

Initially: `smodule`, `copymodule`, `interpretmodule`, `sdefinition`, `sexample`, `sassertion`, `sparagraph`.

`\stex_if_smsmode_p: *`
`\stex_if_smsmode: TF *`

Tests whether SMS mode is currently active.

<hr/> <hr/> <code>\stex_file_in_smsmode:nn</code>	<code>\stex_in_smsmode:nn</code> $\{\langle filename \rangle\}$ $\{\langle code \rangle\}$
	Executes $\langle code \rangle$ in SMS mode, followed by the content of $\langle filename \rangle$. $\langle code \rangle$ can be used e.g. to set the current repository, and is executed within a new tex group, and the same group as the file content.

<hr/> <hr/> <code>\stex_smsmode_do:</code>	Starts gobbling tokens until one is encountered that is allowed in SMS mode.
--	--

12.1.2 Imports and Inheritance

<hr/> <hr/> <code>\importmodule</code>	<code>\importmodule</code> $[\langle archive-ID \rangle]$ $\{\langle module-path \rangle\}$
	Imports a module by reading it from a file and “activating” it. $\text{\texttt{S\TeX}}$ determines the module and its containing file by passing its arguments on to <code>\stex_import_module_path:nn</code> .

<hr/> <hr/> <code>\usemodule</code>	<code>\importmodule</code> $[\langle archive-ID \rangle]$ $\{\langle module-path \rangle\}$
	Like <code>\importmodule</code> , but does not export its contents; i.e. including the current module will not activate the used module

<hr/> <code>\stex_import_module_uri:nn</code> <hr/>	$\text{\stex_import_module_uri:nn } \{ \langle \textit{archive-ID} \rangle \} \{ \langle \textit{module-path} \rangle \}$ <p>Determines the URI of a module by splitting $\langle \textit{module-path} \rangle$ into $\langle \textit{path} \rangle ? \langle \textit{name} \rangle$. If $\langle \textit{module-path} \rangle$ does <i>not</i> contain a ?-character, we consider it to be the $\langle \textit{name} \rangle$, and $\langle \textit{path} \rangle$ to be empty.</p> <p>If $\langle \textit{archive-ID} \rangle$ is empty, it is automatically set to the ID of the current archive (if one exists).</p> <ol style="list-style-type: none"> 1. If $\langle \textit{archive-ID} \rangle$ is empty: <ol style="list-style-type: none"> (a) If $\langle \textit{path} \rangle$ is empty, then $\langle \textit{name} \rangle$ must have been declared earlier in the same file and retrievable from <code>\g_stex_modules_in_file_seq</code>, or a file with name $\langle \textit{name} \rangle . \langle \textit{lang} \rangle . \textit{tex}$ must exist in the same folder, containing a module $\langle \textit{name} \rangle$. That module should have the same namespace as the current one. (b) If $\langle \textit{path} \rangle$ is not empty, it must point to the relative path of the containing file as well as the namespace. 2. Otherwise: <ol style="list-style-type: none"> (a) If $\langle \textit{path} \rangle$ is empty, then $\langle \textit{name} \rangle$ must have been declared earlier in the same file and retrievable from <code>\g_stex_modules_in_file_seq</code>, or a file with name $\langle \textit{name} \rangle . \langle \textit{lang} \rangle . \textit{tex}$ must exist in the top <code>source</code> folder of the archive, containing a module $\langle \textit{name} \rangle$. That module should lie directly in the namespace of the archive. (b) If $\langle \textit{path} \rangle$ is not empty, it must point to the path of the containing file as well as the namespace, relative to the namespace of the archive. If a module by that namespace exists, it is returned. Otherwise, we call <code>\stex_require_module:nn</code> on the <code>source</code> directory of the archive to find the file.
---	---

<hr/> <code>\l_stex_import_name_str</code> <code>\l_stex_import_archive_str</code> <code>\l_stex_import_path_str</code> <code>\l_stex_import_ns_str</code> <hr/>	stores the result in these four variables.
---	--

 $\text{\stex_import_require_module:nnnn } \{ \langle \textit{ns} \rangle \} \{ \langle \textit{archive-ID} \rangle \} \{ \langle \textit{path} \rangle \} \{ \langle \textit{name} \rangle \}$

Checks whether a module with URI $\langle \textit{ns} \rangle ? \langle \textit{name} \rangle$ already exists. If not, it looks for a plausible file that declares a module with that URI.

Finally, activates that module by executing its `_code`-macro.

Chapter 13

STEX-Symbols

Code related to symbol declarations and notations

13.1 Macros and Environments

<code>\symdecl</code>	<code>\symdecl{<i>macroname</i>}[<i>args</i>]</code>
-----------------------	--

Declares a new symbol with semantic macro `\macroname`. Optional arguments are:

- **name**: An (OMDOC) name. By default equal to `<macroname>`.
- **type**: An (ideally semantic) term, representing a *type*. Not used by `STEX`, but passed on to MMT for semantic services.
- **def**: An (ideally semantic) term, representing a *definiens*. Not used by `STEX`, but passed on to MMT for semantic services.
- **local**: A boolean (by default false). If set, this declaration will not be added to the module content, i.e. importing the current module will not make this declaration available.
- **args**: Specifies the “signature” of the semantic macro. Can be either an integer $0 \leq n \leq 9$, or a (more precise) sequence of the following characters:
 - i** a “normal” argument, e.g. `\symdecl{plus}[args=ii]` allows for `\plus{2}{2}`.
 - a** an *associative* argument; i.e. a sequence of arbitrarily many arguments provided as a comma-separated list, e.g. `\symdecl{plus}[args=a]` allows for `\plus{2,2,2}`.
 - b** a *variable* argument. Is treated by `STEX` like an *i*-argument, but an application is turned into an `OMBind` in OMDOC, binding the provided variable in the subsequent arguments of the operator; e.g. `\symdecl{forall}[args=bi]` allows for `\forall{x \in \mathbb{N}}{x \geq 0}`.

<hr/> <hr/> <code>\stex_symdecl_do:n</code>	<p>Implements the core functionality of <code>\symdecl</code>, and is called by <code>\symdecl</code> and <code>\symdef</code>. Ultimately stores the symbol $\langle URI \rangle$ in the property list <code>\l_stex_symdecl_<URI>_prop</code> with fields:</p> <ul style="list-style-type: none"> • <code>name</code> (string), • <code>module</code> (string), • <code>notations</code> (sequence of strings; initially empty), • <code>local</code> (boolean), • <code>type</code> (token list), • <code>args</code> (string of <code>is</code>, <code>as</code> and <code>bs</code>), • <code>arity</code> (integer string), • <code>assocs</code> (integer string; number of associative arguments),
<hr/> <hr/> <code>\stex_all_symbols:n</code>	<p>Iterates over all currently available symbols. Requires two <code>\seq_map_break:</code> to break fully.</p>
<hr/> <hr/> <code>\stex_get_symbol:n</code>	<p>Computes the full URI of a symbol from a macro argument, e.g. the macro name, the macro itself, the full URI...</p>
<hr/> <hr/> <code>\notation</code>	<p><code>\notation[<args>]{<symbol>}{<notations⁺>}</code> Introduces a new notation for $\langle symbol \rangle$, see <code>\stex_notation_do:nn</code></p>
<hr/> <hr/> <code>\stex_notation_do:nn</code>	<p><code>\stex_notation_do:nn{<URI>}{<notations⁺>}</code> Implements the core functionality of <code>\notation</code>, and is called by <code>\notation</code> and <code>\symdef</code>. Ultimately stores the notation in the property list <code>\g_stex_notation_<URI>#<variant>#<lang>_prop</code> with fields:</p> <ul style="list-style-type: none"> • <code>symbol</code> (URI string), • <code>language</code> (string), • <code>variant</code> (string), • <code>opprec</code> (integer string), • <code>argprec</code> (sequence of integer strings)
<hr/> <hr/> <code>\symdef</code>	<p><code>\symdef[<args>]{<symbol>}{<notations⁺>}</code> Combines <code>\symdecl</code> and <code>\notation</code> by introducing a new symbol and assigning a new notation for it.</p>

Chapter 14

STEX-Terms

Code related to symbolic expressions, typesetting notations, notation components, etc.

14.1 Macros and Environments

<code>\STEXsymbol</code>	Uses <code>\stex_get_symbol:n</code> to find the symbol denoted by the first argument and passes the result on to <code>\stex_invoke_symbol:n</code>
--------------------------	--

<code>\symref</code>	<code>\symref{<symbol>}{<text>}</code> shortcut for <code>\STEXsymbol{<symbol>}! [<text>]</code>
----------------------	---

<code>\stex_invoke_symbol:n</code>	Executes a semantic macro. Outside of math mode or if followed by <code>*</code> , it continues to <code>\stex_term_custom:nn</code> . In math mode, it uses the default or optionally provided notation of the associated symbol.
------------------------------------	--

If followed by `!`, it will invoke the symbol *itself* rather than its application (and continue to `\stex_term_custom:nn`), i.e. it allows to refer to `\plus![addition]` as an operation, rather than `\plus[addition of]{some}{terms}`.

<code>\STEXInternalTermMathOMSiiii</code> <code>\STEXInternalTermMathOMAiiai</code> <code>\STEXInternalTermMathOMBiiii</code>	<code><URI><fragment><precedence><body></code>
---	--

Annotates `<body>` as an OMDOC-term (OMID, OMA or OMBIND, respectively) with head symbol `<URI>`, generated by the specific notation `<fragment>` with (upwards) operator precedence `<precedence>`. Inserts parentheses according to the current downwards precedence and operator precedence.

<code>\STEXInternalTermMathArgiii</code>	<code>\stex_term_arg:nnn<int><prec><body></code>
--	--

Annotates `<body>` as the `<int>`th argument of the current OMA or OMBIND, with (downwards) argument precedence `<prec>`.

<hr/> <hr/>	<code>\STEXInternalTermMathAssocArgiiii</code>	<code>\stex_term_arg:nnn⟨int⟩⟨prec⟩⟨notation⟩⟨body⟩</code>
		Annotates $\langle body \rangle$ as the $\langle int \rangle$ th (associative) <i>sequence</i> argument (as comma-separated list of terms) of the current OMA or OMBIND, with (downwards) argument precedence $\langle prec \rangle$ and associative notation $\langle notation \rangle$.
<hr/> <hr/>	<code>\infprec</code> <code>\neginfprec</code>	Maximal and minimal notation precedences.
<hr/> <hr/>	<code>\dobrackets</code>	<code>\dobrackets {⟨body⟩}</code> Puts $\langle body \rangle$ in parentheses; scaled if in display mode unscaled otherwise. Uses the current \TeX brackets (by default (and)), which can be changed temporarily using <code>\withbrackets</code> .
<hr/> <hr/>	<code>\withbrackets</code>	<code>\withbrackets ⟨left⟩ ⟨right⟩ {⟨body⟩}</code> Temporarily (i.e. within $\langle body \rangle$) sets the brackets used by \TeX for automated bracketing (by default (and)) to $\langle left \rangle$ and $\langle right \rangle$. Note that $\langle left \rangle$ and $\langle right \rangle$ need to be allowed after <code>\left</code> and <code>\right</code> in display-mode.
<hr/> <hr/>	<code>\stex_term_custom:nn</code>	<code>\stex_term_custom:nn{⟨URI⟩}{⟨args⟩}</code> Implements custom one-time notation. Invoked by <code>\stex_invoke_symbol:n</code> in text mode, or if followed by <code>*</code> in math mode, or whenever followed by <code>!</code> .
<hr/> <hr/>	<code>\comp</code> <code>\compemph</code> <code>\compemph@uri</code> <code>\defemph</code> <code>\defemph@uri</code> <code>\symrefemph</code> <code>\symrefemph@uri</code> <code>\varemp</code> <code>\varemp@uri</code>	<code>\comp{⟨args⟩}</code> Marks $\langle args \rangle$ as a notation component of the current symbol for highlighting, linking, etc. The precise behavior is governed by <code>\@comp</code> , which takes as additional argument the URI of the current symbol. By default, <code>\@comp</code> adds the URI as a PDF tooltip and colors the highlighted part in blue. <code>\@defemph</code> behaves like <code>\@comp</code> , and can be similarly redefined, but marks an expression as <i>definiendum</i> (used by <code>\definiendum</code>)
<hr/> <hr/>	<code>\STEXinvisible</code>	Exports its argument as OMDOC (invisible), but does not produce PDF output. Useful e.g. for semantic macros that take arguments that are not part of the symbolic notation.
<hr/> <hr/>	<code>\ellipses</code>	TODO

Chapter 15

TeX-Structural Features

Code related to structural features

15.1 Macros and Environments

15.1.1 Structures

`mathstructure` TODO

Chapter 16

sTeX-Statements

Code related to statements, e.g. definitions, theorems

16.1 Macros and Environments

`symboldoc` `\begin{<symboldoc>}{<symbols>}` `<text>` `\end{<symboldoc>}`
 Declares `<text>` to be a (natural language, encyclopaedic) description of `{<symbols>}`
 (a comma separated list of symbol identifiers).

Chapter 17

sTeX-Proofs: Structural Markup for Proofs

Chapter 18

sT_EX-Metatheory

18.1 Symbols

Part III
Extensions

Chapter 19

Tikzinput: Treating TIKZ code as images

19.1 Macros and Environments

LocalWords: bibfolder jobname.dtx tikzinput.dtx usetikzlibrary Gin@ewidth Gin@eheight
LocalWords: resizebox ctikzinput mhtikzinput Gin@mhrepos mhpath

Chapter 20

document-structure: Semantic Markup for Open Mathematical Documents in L^AT_EX

Chapter 21

NotesSlides – Slides and Course Notes

Chapter 22

`problem.sty`: An Infrastructure for formatting Problems

Chapter 23

**hwexam.sty/cls: An
Infrastructure for formatting
Assignments and Exams**

Part IV
Implementation

Chapter 24

\TeX -Basics Implementation

24.1 The \TeX Document Class

The `stex` document class is pretty straight-forward: It largely extends the `standalone` package and loads the `stex` package, passing all provided options on to the package.

```
1 <*cls>
2
3 %%%%%%%%% basics.dtx %%%%%%%%%
4
5 \RequirePackage{expl3,l3keys2e}
6 \ProvidesExplClass{stex}{2022/03/03}{3.1.0}{sTeX document class}
7
8 \DeclareOption*{\PassOptionsToPackage{\CurrentOption}{stex}}
9 \ProcessOptions
10
11 \bool_set_true:N \c_stex_document_class_bool
12
13 \RequirePackage{stex}
14
15 \stex_html_backend:TF {
16   \LoadClass{article}
17 }{
18   \LoadClass[border=1px,varwidth,crop=false]{standalone}
19   \setlength\textwidth{15cm}
20 }
21 \RequirePackage{standalone}
22
23
24 \clist_if_empty:NT \c_stex_languages_clist {
25   \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
26   \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
27   \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str % .tex
28   \exp_args:No \str_if_eq:nnF \l_tmpa_str {tex} {
29     \exp_args:No \str_if_eq:nnF \l_tmpa_str {dtx} {
30       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq \l_tmpa_str
```

```

31     }
32   }
33   \seq_pop_left:NN \l_tmpa_seq \l_tmpa_str % <filename>
34   \seq_if_empty:NF \l_tmpa_seq { %remaining element should be [<something>.]language
35     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
36     \prop_if_in:NoT \c_stex_languages_prop \l_tmpa_str {
37       \stex_debug:nn{language} {Language~\l_tmpa_str~
38         inferred~from~file~name}
39     }
40   }
41 }
42 }
43 </cls>

```

24.2 Preliminaries

```

44 <*package>
45
46 %%%%%%%%% basics.dtx %%%%%%%%%
47
48 \RequirePackage{expl3,l3keys2e,ltxcmds}
49 \ProvidesExplPackage{stex}{2022/03/03}{3.1.0}{sTeX package}
50
51 \bool_if_exist:NF \c_stex_document_class_bool {
52   \bool_set_false:N \c_stex_document_class_bool
53   \RequirePackage{standalone}
54 }
55
56 \message{^^J
57   *****^^J
58   *~This~is~sTeX~version~3.1.0*~^^J
59   *****^^J
60 ^^J}
61
62 %\RequirePackage{morewrites}
63 %\RequirePackage{amsmath}
64

```

Package options:

```

65 \keys_define:nn { stex } {
66   debug      .clist_set:N = \c_stex_debug_clist ,
67   lang       .clist_set:N = \c_stex_languages_clist ,
68   mathhub    .tl_set_x:N  = \mathhub ,
69   usesms     .bool_set:N  = \c_stex_persist_mode_bool ,
70   writesms   .bool_set:N  = \c_stex_persist_write_mode_bool ,
71   image      .bool_set:N  = \c_tikzinput_image_bool ,
72   unknown    .code:n      = {}
73 }
74 \ProcessKeysOptions { stex }

```

\stex The sTeX logo:

\sTeX

```

75 \RequirePackage{xspace}
76 \protected\def\stex{
77   \@ifundefined{texorpdfstring}{\let\texorpdfstring\@firstoftwo}{

```

```

78 \texorpdfstring{\raisebox{-.5ex}{S\kern-.5ex\TeX}}{sTeX}\xspace
79 }
80 \let\TeX\stex

```

(End definition for `\stex` and `\TeX`. These functions are documented on page 63.)

24.3 Messages and logging

```

81 <@@=stex_log>
    Warnings and error messages
82 \msg_new:nnn{stex}{error/unknownlanguage}{
83   Unknown~language:~#1
84 }
85 \msg_new:nnn{stex}{warning/nomathhub}{
86   MATHHUB~system~variable~not~found~and~no~
87   \detokenize{\mathhub}~value~set!
88 }
89 \msg_new:nnn{stex}{error/deactivated-macro}{
90   The~\detokenize{#1}~command~is~only~allowed~in~#2!
91 }

```

`\stex_debug:nn` A simple macro issuing package messages with subpath.

```

92 \cs_new_protected:Nn \stex_debug:nn {
93   \clist_if_in:NnTF \c_stex_debug_clist { all } {
94     \msg_set:nnn{stex}{debug / #1}{
95       \Debug~#1:~#2\
96     }
97     \msg_none:nn{stex}{debug / #1}
98   }{
99     \clist_if_in:NnT \c_stex_debug_clist { #1 } {
100       \msg_set:nnn{stex}{debug / #1}{
101         \Debug~#1:~#2\
102       }
103       \msg_none:nn{stex}{debug / #1}
104     }
105   }
106 }

```

(End definition for `\stex_debug:nn`. This function is documented on page 63.)

Redirecting messages:

```

107 \clist_if_in:NnTF \c_stex_debug_clist {all} {
108   \msg_redirect_module:nnn{ stex }{ none }{ term }
109 }{
110   \clist_map_inline:Nn \c_stex_debug_clist {
111     \msg_redirect_name:nnn{ stex }{ debug / ##1 }{ term }
112   }
113 }
114
115 \stex_debug:nn{log}{debug~mode~on}

```

24.4 HTML Annotations

116 `<@=stex_annotate>`

`\l_stex_html_arg_tl` Used by annotation macros to ensure that the HTML output to annotate is not empty.
`\c_stex_html_emptyarg_tl`

117 `\tl_new:N \l_stex_html_arg_tl`

(End definition for `\l_stex_html_arg_tl` and `\c_stex_html_emptyarg_tl`. These variables are documented on page ??.)

`_stex_html_checkempty:n`

```
118 \cs_new_protected:Nn \_stex_html_checkempty:n {
119   \tl_set:Nn \l_stex_html_arg_tl { #1 }
120   \tl_if_empty:NT \l_stex_html_arg_tl {
121     \tl_set_eq:NN \l_stex_html_arg_tl \c_stex_html_emptyarg_tl
122   }
123 }
```

(End definition for `_stex_html_checkempty:n`. This function is documented on page ??.)

`\stex_if_do_html_p:` Whether to (locally) produce HTML output

`\stex_if_do_html:TF`

```
124 \bool_new:N \_stex_html_do_output_bool
125 \bool_set_true:N \_stex_html_do_output_bool
126
127 \prg_new_conditional:Nnn \stex_if_do_html: {p,T,F,TF} {
128   \bool_if:nTF \_stex_html_do_output_bool
129     \prg_return_true: \prg_return_false:
130 }
```

(End definition for `\stex_if_do_html:TF`. This function is documented on page 63.)

`\stex_suppress_html:n` Whether to (locally) produce HTML output

```
131 \cs_new_protected:Nn \stex_suppress_html:n {
132   \exp_args:Nne \use:nn {
133     \bool_set_false:N \_stex_html_do_output_bool
134     #1
135   }{
136     \stex_if_do_html:T {
137       \bool_set_true:N \_stex_html_do_output_bool
138     }
139   }
140 }
```

(End definition for `\stex_suppress_html:n`. This function is documented on page 63.)

`\stex_annotate:bnx`

`\stex_annotate_invisible:n`

`\stex_annotate_invisible:nnn`

We define four macros for introducing attributes in the HTML output. The definitions depend on the “backend” used (L^AT_EX_{ML}, R_US_TE_X, p_DF_LA_TE_X).

The p_DF_LA_TE_X-macros largely do nothing; the R_US_TE_X-implementations are pretty clear in what they do, the L^AT_EX_{ML}-implementations resort to perl bindings.

```
141 \tl_if_exist:NF\stex@backend{
142   \ifcsname if@rustex\endcsname
143     \def\stex@backend{rustex}
144   \else
145     \ifcsname if@latexml\endcsname
```

```

146     \def\stex@backend{latexml}
147     \else
148     \def\stex@backend{pdflatex}
149     \fi
150     \fi
151 }
152 \input{stex-backend-\stex@backend.cfg}
153
154 \newif\ifstexhtml
155 \stex_html_backend:TF\stexhtmltrue\stexhtmlfalse
156

```

(End definition for `\stex_annotate:nnn`, `\stex_annotate_invisible:n`, and `\stex_annotate_invisible:nnn`. These functions are documented on page 64.)

24.5 Babel Languages

```

157 <@=stex_language>

```

`\c_stex_languages_prop`
`\c_stex_language_abbrevs_prop`

We store language abbreviations in two (mutually inverse) property lists:

```

158 \exp_args:NNx \prop_const_from_keyval:Nn \c_stex_languages_prop { \tl_to_str:n {
159     en = english ,
160     de = ngerman ,
161     ar = arabic ,
162     bg = bulgarian ,
163     ru = russian ,
164     fi = finnish ,
165     ro = romanian ,
166     tr = turkish ,
167     fr = french
168 }}
169
170 \exp_args:NNx \prop_const_from_keyval:Nn \c_stex_language_abbrevs_prop { \tl_to_str:n {
171     english   = en ,
172     ngerman   = de ,
173     arabic    = ar ,
174     bulgarian = bg ,
175     russian   = ru ,
176     finnish   = fi ,
177     romanian  = ro ,
178     turkish   = tr ,
179     french    = fr
180 }}
181 % todo: chinese simplified (zhs)
182 %       chinese traditional (zht)

```

(End definition for `\c_stex_languages_prop` and `\c_stex_language_abbrevs_prop`. These variables are documented on page 64.)

we use the `lang-package` option to load the corresponding babel languages:

```

183 \cs_new_protected:Nn \stex_set_language:Nn {
184     \str_set:Nx \l_tmpa_str {#2}
185     \prop_get:NoNT \c_stex_languages_prop \l_tmpa_str #1 {
186         \ifx\@onlypreamble\@notprerr
187         \ltx@ifpackageloaded{babel}{

```

```

188     \exp_args:No \selectlanguage #1
189   }{}
190   \else
191     \exp_args:No \str_if_eq:nnTF #1 {turkish} {
192       \RequirePackage[#1,shorthands=:!]{babel}
193     }{
194       \RequirePackage[#1]{babel}
195     }
196   \fi
197 }
198 }
199
200 \clist_if_empty:NF \c_stex_languages_clist {
201   \bool_set_false:N \l_tmpa_bool
202   \clist_clear:N \l_tmpa_clist
203   \clist_map_inline:Nn \c_stex_languages_clist {
204     \str_set:Nx \l_tmpa_str {#1}
205     \str_if_eq:nnT {#1}{tr}{
206       \bool_set_true:N \l_tmpa_bool
207     }
208     \prop_get:NoNTF \c_stex_languages_prop \l_tmpa_str \l_tmpa_str {
209       \clist_put_right:No \l_tmpa_clist \l_tmpa_str
210     } {
211       \msg_error:nnx{stex}{error/unknownlanguage}{\l_tmpa_str}
212     }
213   }
214   \stex_debug:nn{lang} {Languages:~\clist_use:Nn \l_tmpa_clist {,~} }
215   \bool_if:NTF \l_tmpa_bool {
216     \RequirePackage[\clist_use:Nn \l_tmpa_clist,,shorthands=:!]{babel}
217   }{
218     \RequirePackage[\clist_use:Nn \l_tmpa_clist,]{babel}
219   }
220 }
221
222 \AtBeginDocument{
223   \stex_html_backend:T {
224     \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
225     \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
226     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str % .tex
227     \seq_pop_left:NN \l_tmpa_seq \l_tmpa_str % <filename>
228     \seq_if_empty:NF \l_tmpa_seq { %remaining element should be language
229       \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
230       \stex_debug:nn{basics} {Language~\l_tmpa_str~
231         inferred~from~file~name}
232       \stex_annotate_invisible:nnn{language}{ \l_tmpa_str }{}
233     }
234   }
235 }

```

24.6 Persistence

```

236 <@@=stex_persist>
237 \bool_if:NTF \c_stex_persist_mode_bool {

```

```

238 \def \stex_persist:n #1 {}
239 \def \stex_persist:x #1 {}
240 }{
241 \bool_if:NTF \c_stex_persist_write_mode_bool {
242 \iow_new:N \c__stex_persist_iow
243 \iow_open:Nn \c__stex_persist_iow{\jobname.sms}
244 \AtEndDocument{
245 \iow_close:N \c__stex_persist_iow
246 }
247 \cs_new_protected:Nn \stex_persist:n {
248 \tl_set:Nn \l_tmpa_tl { #1 }
249 \regex_replace_all:nnN { \cP\# } { \cO\# } \l_tmpa_tl
250 \regex_replace_all:nnN { \ } { \~ } \l_tmpa_tl
251 \exp_args:NNo \iow_now:Nn \c__stex_persist_iow \l_tmpa_tl
252 }
253 \cs_generate_variant:Nn \stex_persist:n {x}
254 }{
255 \def \stex_persist:n #1 {}
256 \def \stex_persist:x #1 {}
257 }
258 }

```

24.7 Auxiliary Methods

\stex_deactivate_macro:Nn

```

259 \cs_new_protected:Nn \stex_deactivate_macro:Nn {
260 \exp_after:wN\let\csname \detokenize{#1} - orig\endcsname#1
261 \def#1{
262 \msg_error:nnnn{stex}{error/deactivated-macro}{\detokenize{#1}}{#2}
263 }
264 }

```

(End definition for \stex_deactivate_macro:Nn. This function is documented on page 64.)

\stex_reactivate_macro:N

```

265 \cs_new_protected:Nn \stex_reactivate_macro:N {
266 \exp_after:wN\let\exp_after:wN#1\csname \detokenize{#1} - orig\endcsname
267 }

```

(End definition for \stex_reactivate_macro:N. This function is documented on page 64.)

\ignorespacesandpars

```

268 \protected\def\ignorespacesandpars{
269 \begingroup\catcode13=10\relax
270 \@ifnextchar\par{
271 \endgroup\expandafter\ignorespacesandpars\@gobble
272 }{
273 \endgroup
274 }
275 }
276
277 \cs_new_protected:Nn \stex_copy_control_sequence:NNN {
278 \tl_set:Nx \_tmp_args_tl {\cs_argument_spec:N #2}
279 \exp_args:NNo \tl_remove_all:Nn \_tmp_args_tl \c_hash_str

```



```

280 \int_set:Nn \l_tmpa_int {\tl_count:N \_tmp_args_tl}
281
282 \tl_clear:N \_tmp_args_tl
283 \int_step_inline:nn \l_tmpa_int {
284   \tl_put_right:Nx \_tmp_args_tl {\exp_not:n{###}\exp_not:n{##1}}
285 }
286
287 \tl_set:Nn #3 {\cs_generate_from_arg_count:NNnn #1 \cs_set:Npn}
288 \tl_put_right:Nx #3 { {\int_use:N \l_tmpa_int}{
289   \exp_after:wN\exp_after:wN\exp_after:wN \exp_not:n
290   \exp_after:wN\exp_after:wN\exp_after:wN {
291     \exp_after:wN #2 \_tmp_args_tl
292   }
293 }}
294 }
295 \cs_generate_variant:Nn \stex_copy_control_sequence:NNN {cNN}
296 \cs_generate_variant:Nn \stex_copy_control_sequence:NNN {NcN}
297 \cs_generate_variant:Nn \stex_copy_control_sequence:NNN {ccN}
298
299 \cs_new_protected:Nn \stex_copy_control_sequence_ii:NNN {
300   \tl_set:Nx \_tmp_args_tl {\cs_argument_spec:N #2}
301   \exp_args:NNo \tl_remove_all:Nn \_tmp_args_tl \c_hash_str
302   \int_set:Nn \l_tmpa_int {\tl_count:N \_tmp_args_tl}
303
304   \tl_clear:N \_tmp_args_tl
305   \int_step_inline:nn \l_tmpa_int {
306     \tl_put_right:Nx \_tmp_args_tl {\exp_not:n{#####}\exp_not:n{##1}}
307   }
308
309   \edef \_tmp_args_tl {
310     \exp_after:wN\exp_after:wN\exp_after:wN \exp_not:n
311     \exp_after:wN\exp_after:wN\exp_after:wN {
312       \exp_after:wN #2 \_tmp_args_tl
313     }
314   }
315
316   \exp_after:wN \def \exp_after:wN \_tmp_args_tl
317   \exp_after:wN ##\exp_after:wN 1 \exp_after:wN ##\exp_after:wN 2
318   \exp_after:wN { \_tmp_args_tl }
319
320   \edef \_tmp_args_tl {
321     \exp_after:wN \exp_not:n \exp_after:wN {
322       \_tmp_args_tl {###1}{###2}
323     }
324   }
325
326   \tl_set:Nn #3 {\cs_generate_from_arg_count:NNnn #1 \cs_set:Npn}
327   \tl_put_right:Nx #3 { {\int_use:N \l_tmpa_int}{
328     \exp_after:wN\exp_not:n\exp_after:wN{\_tmp_args_tl}
329   }}
330 }
331
332 \cs_generate_variant:Nn \stex_copy_control_sequence_ii:NNN {cNN}
333 \cs_generate_variant:Nn \stex_copy_control_sequence_ii:NNN {NcN}

```

```
334 \cs_generate_variant:Nn \stex_copy_control_sequence_ii:NNN {ccN}
```

(End definition for \ignorespacesandpars. This function is documented on page 64.)

\MMTrule

```
335 \NewDocumentCommand \MMTrule {m m}{
336   \seq_set_split:Nnn \l_tmpa_seq , {#2}
337   \int_zero:N \l_tmpa_int
338   \stex_annotate_invisible:nnn{mmtrule}{scala://#1}{
339     \seq_if_empty:NF \l_tmpa_seq {
340       $\seq_map_inline:Nn \l_tmpa_seq {
341         \int_incr:N \l_tmpa_int
342         \stex_annotate:nnn{arg}{i\int_use:N \l_tmpa_int}{##1}
343       }$
344     }
345   }
346 }
347
348 \NewDocumentCommand \MMTinclude {m}{
349   \stex_annotate_invisible:nnn{import}{#1}{ }
350 }
351
352 \tl_new:N \g_stex_document_title
353 \cs_new_protected:Npn \STEXtitle #1 {
354   \tl_if_empty:NT \g_stex_document_title {
355     \tl_gset:Nn \g_stex_document_title { #1 }
356   }
357 }
358 \cs_new_protected:Nn \stex_document_title:n {
359   \tl_if_empty:NT \g_stex_document_title {
360     \tl_gset:Nn \g_stex_document_title { #1 }
361     \stex_annotate_invisible:n{\noindent
362       \stex_annotate:nnn{doctitle}{ }{ #1 }
363     \par}
364   }
365 }
366 \AtBeginDocument {
367   \let \STEXtitle \stex_document_title:n
368   \tl_if_empty:NF \g_stex_document_title {
369     \stex_annotate_invisible:n{\noindent
370       \stex_annotate:nnn{doctitle}{ }{ \g_stex_document_title }
371     \par}
372   }
373   \let \stex_maketitle \maketitle
374   \def \maketitle {
375     \tl_if_empty:NF \@title {
376       \exp_args:No \stex_document_title:n \@title
377     }
378     \stex_maketitle:
379   }
380 }
381
382 \cs_new_protected:Nn \stex_par: {
383   \mode_if_vertical:F{
```

```

384     \if@minipage\else\if@nobreak\else\par\fi\fi
385   }
386 }
387
388 \</package>

```

(End definition for \MMTrule. This function is documented on page ??.)

Chapter 25

STEX -MathHub Implementation

```
389 <*package>
390
391 %%%%%%%%%% mathhub.dtx %%%%%%%%%%
392
393 <@@=stex_path>
394
395 Warnings and error messages
396 \msg_new:nnn{stex}{error/norepository}{
397   No~archive~#1~found~in~#2
398 }
399 \msg_new:nnn{stex}{error/notinarchive}{
400   Not~currently~in~an~archive,~but~\detokenize{#1}~
401   needs~one!
402 }
403 \msg_new:nnn{stex}{error/nofile}{
404   \detokenize{#1}~could~not~find~file~#2
405 }
406 \msg_new:nnn{stex}{error/twofiles}{
407   \detokenize{#1}~found~two~candidates~for~#2
408 }
```

25.1 Generic Path Handling

We treat paths as L^AT_EX3-sequences (of the individual path segments, i.e. separated by a /-character) unix-style; i.e. a path is absolute if the sequence starts with an empty entry.

`\stex_path_from_string:Nn`

```
407 \cs_new_protected:Nn \stex_path_from_string:Nn {
408   \str_set:Nx \l_tmpa_str { #2 }
409   \str_if_empty:NTF \l_tmpa_str {
410     \seq_clear:N #1
411   }{
412     \exp_args:NNNo \seq_set_split:Nnn #1 / { \l_tmpa_str }
413     \sys_if_platform_windows:T{
414       \seq_clear:N \l_tmpa_tl
```

```

415     \seq_map_inline:Nn #1 {
416       \seq_set_split:Nnn \l_tmpb_tl \c_backslash_str { ##1 }
417       \seq_concat:NNN \l_tmpa_tl \l_tmpa_tl \l_tmpb_tl
418     }
419     \seq_set_eq:NN #1 \l_tmpa_tl
420   }
421   \stex_path_canonicalize:N #1
422 }
423 }
424

```

(End definition for `\stex_path_from_string:Nn`. This function is documented on page 65.)

`\stex_path_to_string:NN`
`\stex_path_to_string:N`

```

425 \cs_new_protected:Nn \stex_path_to_string:NN {
426   \exp_args:Nne \str_set:Nn #2 { \seq_use:Nn #1 / }
427 }
428
429 \cs_new:Nn \stex_path_to_string:N {
430   \seq_use:Nn #1 /
431 }

```

(End definition for `\stex_path_to_string:NN` and `\stex_path_to_string:N`. These functions are documented on page 65.)

`\c__stex_path_dot_str` . and .., respectively.
`\c__stex_path_up_str`

```

432 \str_const:Nn \c__stex_path_dot_str {.}
433 \str_const:Nn \c__stex_path_up_str {...}

```

(End definition for `\c__stex_path_dot_str` and `\c__stex_path_up_str`.)

`\stex_path_canonicalize:N` Canonicalizes the path provided; in particular, resolves . and .. path segments.

```

434 \cs_new_protected:Nn \stex_path_canonicalize:N {
435   \seq_if_empty:NF #1 {
436     \seq_clear:N \l_tmpa_seq
437     \seq_get_left:NN #1 \l_tmpa_tl
438     \str_if_empty:NT \l_tmpa_tl {
439       \seq_put_right:Nn \l_tmpa_seq {}
440     }
441     \seq_map_inline:Nn #1 {
442       \str_set:Nn \l_tmpa_tl { ##1 }
443       \str_if_eq:NNF \l_tmpa_tl \c__stex_path_dot_str {
444         \str_if_eq:NNTF \l_tmpa_tl \c__stex_path_up_str {
445           \seq_if_empty:NNTF \l_tmpa_seq {
446             \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
447               \c__stex_path_up_str
448             }
449           }{
450             \seq_get_right:NN \l_tmpa_seq \l_tmpa_tl
451             \str_if_eq:NNTF \l_tmpa_tl \c__stex_path_up_str {
452               \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
453                 \c__stex_path_up_str
454               }
455             }{

```

```

456         \seq_pop_right:NN \l_tmpa_seq \l_tmpb_tl
457     }
458 }
459 }{
460     \str_if_empty:NF \l_tmpa_tl {
461         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq { \l_tmpa_tl }
462     }
463 }
464 }
465 }
466 \seq_gset_eq:NN #1 \l_tmpa_seq
467 }
468 }

```

(End definition for `\stex_path_canonicalize:N`. This function is documented on page 65.)

`\stex_path_if_absolute_p:N`
`\stex_path_if_absolute:N \underline{TF}`

```

469 \prg_new_conditional:Nnn \stex_path_if_absolute:N {p, T, F, TF} {
470     \seq_if_empty:NTF #1 {
471         \prg_return_false:
472     }{
473         \seq_get_left:NN #1 \l_tmpa_tl
474         \sys_if_platform_windows:TF{
475             \str_if_in:NnTF \l_tmpa_tl {:}{
476                 \prg_return_true:
477             }{
478                 \prg_return_false:
479             }
480         }{
481             \str_if_empty:NTF \l_tmpa_tl {
482                 \prg_return_true:
483             }{
484                 \prg_return_false:
485             }
486         }
487     }
488 }

```

(End definition for `\stex_path_if_absolute:N \underline{TF}` . This function is documented on page 65.)

25.2 PWD and kpsewhich

`\stex_kpsewhich:n`

```

489 \str_new:N\l_stex_kpsewhich_return_str
490 \cs_new_protected:Nn \stex_kpsewhich:n {\begingroup
491     \catcode'\ =12
492     \sys_get_shell:nnN { kpsewhich ~ #1 } { } \l_tmpa_tl
493     \tl_gset_eq:NN \l_tmpa_tl \l_tmpa_tl
494     \endgroup
495     \exp_args:NNo\str_set:Nn\l_stex_kpsewhich_return_str{\l_tmpa_tl}
496     \tl_trim_spaces:N \l_stex_kpsewhich_return_str
497 }

```

(End definition for `\stex_kpsewhich:n`. This function is documented on page 65.)

We determine the PWD

`\c_stex_pwd_seq`
`\c_stex_pwd_str`

```

498 \sys_if_platform_windows:TF{
499   \begingroup\escapechar=-1\catcode'\=12
500   \exp_args:Nx\stex_kpsewhich:n{-expand-var~\c_percent_str CD\c_percent_str}
501   \exp_args:NNx\str_replace_all:Nnn\l_stex_kpsewhich_return_str{\c_backslash_str}/
502   \exp_args:Nnx\use:nn{\endgroup}{\str_set:Nn\exp_not:N\l_stex_kpsewhich_return_str{\l_stex_
503   }}{
504   \stex_kpsewhich:n{-var-value~PWD}
505   }
506
507 \stex_path_from_string:Nn\c_stex_pwd_seq\l_stex_kpsewhich_return_str
508 \stex_path_to_string:NN\c_stex_pwd_seq\c_stex_pwd_str
509 \stex_debug:nn {mathhub} {PWD:~\str_use:N\c_stex_pwd_str}

```

(End definition for `\c_stex_pwd_seq` and `\c_stex_pwd_str`. These variables are documented on page 65.)

25.3 File Hooks and Tracking

510 `<@@=stex_files>`

We introduce hooks for file inputs that keep track of the absolute paths of files used. This will be useful to keep track of modules, their archives, namespaces etc.

Note that the absolute paths are only accurate in `\input`-statements for paths relative to the PWD, so they shouldn't be relied upon in any other setting than for \TeX -purposes.

`\g_stex_files_stack` keeps track of file changes

511 `\seq_gclear_new:N\g_stex_files_stack`

(End definition for `\g_stex_files_stack`.)

`\c_stex_mainfile_seq`
`\c_stex_mainfile_str`

```

512 \str_set:Nx \c_stex_mainfile_str {\c_stex_pwd_str/\jobname.tex}
513 \stex_path_from_string:Nn \c_stex_mainfile_seq
514   \c_stex_mainfile_str

```

(End definition for `\c_stex_mainfile_seq` and `\c_stex_mainfile_str`. These variables are documented on page 65.)

`\g_stex_currentfile_seq`

515 `\seq_gclear_new:N\g_stex_currentfile_seq`

(End definition for `\g_stex_currentfile_seq`. This variable is documented on page 66.)

`\stex_filestack_push:n`

```

516 \cs_new_protected:Nn \stex_filestack_push:n {
517   \stex_path_from_string:Nn\g_stex_currentfile_seq{#1}
518   \stex_path_if_absolute:NF\g_stex_currentfile_seq{
519     \stex_path_from_string:Nn\g_stex_currentfile_seq{
520       \c_stex_pwd_str/#1
521     }

```

```

522 }
523 \seq_gset_eq:NN\g_stex_currentfile_seq\g_stex_currentfile_seq
524 \exp_args:NNo\seq_gpush:Nn\g__stex_files_stack\g_stex_currentfile_seq
525 }

```

(End definition for `\stex_filestack_push:n`. This function is documented on page 66.)

`\stex_filestack_pop:`

```

526 \cs_new_protected:Nn \stex_filestack_pop: {
527   \seq_if_empty:NF\g__stex_files_stack{
528     \seq_gpop:NN\g__stex_files_stack\l_tmpa_seq
529   }
530   \seq_if_empty:NTF\g__stex_files_stack{
531     \seq_gset_eq:NN\g_stex_currentfile_seq\c_stex_mainfile_seq
532   }{
533     \seq_get:NN\g__stex_files_stack\l_tmpa_seq
534     \seq_gset_eq:NN\g_stex_currentfile_seq\l_tmpa_seq
535   }
536 }

```

(End definition for `\stex_filestack_pop:`. This function is documented on page 66.)

Hooks for the current file:

```

537 \AddToHook{file/before}{
538   \stex_filestack_push:n{\CurrentFilePath/\CurrentFile}
539 }
540 \AddToHook{file/after}{
541   \stex_filestack_pop:
542 }

```

25.4 MathHub Repositories

```

543 <@=stex_mathhub>

```

`\mathhub`
`\c_stex_mathhub_seq`
`\c_stex_mathhub_str`

The path to the mathhub directory. If the `\mathhub`-macro is not set, we query `kpsewhich` for the MATHHUB system variable.

```

544 \str_if_empty:NTF\mathhub{
545   \sys_if_platform_windows:TF{
546     \begingroup\escapechar=-1\catcode'\=12
547     \exp_args:Nx\stex_kpsewhich:n{-expand-var~\c_percent_str MATHHUB\c_percent_str}
548     \exp_args:NNx\str_replace_all:Nnn\l_stex_kpsewhich_return_str{\c_backslash_str}/
549     \exp_args:Nnx\use:nn{\endgroup}{\str_set:Nn\exp_not:N\l_stex_kpsewhich_return_str{\l_stex_kpsewhich_return_str}}
550   }{
551     \stex_kpsewhich:n{-var-value-MATHHUB}
552   }
553   \str_set_eq:NN\c_stex_mathhub_str\l_stex_kpsewhich_return_str
554 }
555 \str_if_empty:NT \c_stex_mathhub_str {
556   \sys_if_platform_windows:TF{
557     \begingroup\escapechar=-1\catcode'\=12
558     \exp_args:Nx\stex_kpsewhich:n{-var-value-HOME}
559     \exp_args:NNx\str_replace_all:Nnn\l_stex_kpsewhich_return_str{\c_backslash_str}/
560     \exp_args:Nnx\use:nn{\endgroup}{\str_set:Nn\exp_not:N\l_stex_kpsewhich_return_str{\l_stex_kpsewhich_return_str}}
561   }{

```



```

562     \stex_kpsewhich:n{-var-value~HOME}
563   }
564   \ior_open:NnT \l_tmpa_ior{\l_stex_kpsewhich_return_str / .stex / mathhub.path}{
565     \begingroup\escapechar=-1\catcode'\=12
566     \ior_str_get:NN \l_tmpa_ior \l_tmpa_str
567     \sys_if_platform_windows:T{
568       \exp_args:NNx\str_replace_all:Nnn\l_tmpa_str{\c_backslash_str}/
569     }
570     \str_gset_eq:NN \c_stex_mathhub_str\l_tmpa_str
571     \endgroup
572     \ior_close:N \l_tmpa_ior
573   }
574 }
575 \str_if_empty:NTF\c_stex_mathhub_str{
576   \msg_warning:nn{stex}{warning/nomathhub}
577 }{
578   \stex_debug:nn{mathhub}{MathHub:~\str_use:N\c_stex_mathhub_str}
579   \exp_args:NNo \stex_path_from_string:Nn\c_stex_mathhub_seq\c_stex_mathhub_str
580 }
581 }{
582   \stex_path_from_string:Nn \c_stex_mathhub_seq \mathhub
583   \stex_path_if_absolute:NF \c_stex_mathhub_seq {
584     \exp_args:NNx \stex_path_from_string:Nn \c_stex_mathhub_seq {
585       \c_stex_pwd_str/\mathhub
586     }
587   }
588   \stex_path_to_string:NN\c_stex_mathhub_seq\c_stex_mathhub_str
589   \stex_debug:nn{mathhub}{MathHub:~\str_use:N\c_stex_mathhub_str}
590 }

```

(End definition for `\mathhub`, `\c_stex_mathhub_seq`, and `\c_stex_mathhub_str`. These variables are documented on page 66.)

`_stex_mathhub_do_manifest:n` Checks whether the manifest for archive #1 already exists, and if not, finds and parses the corresponding manifest file

```

591 \cs_new_protected:Nn \_stex_mathhub_do_manifest:n {
592   \prop_if_exist:cF {c_stex_mathhub_#1_manifest_prop} {
593     \str_set:Nx \l_tmpa_str { #1 }
594     \prop_new:c { c_stex_mathhub_#1_manifest_prop }
595     \seq_set_split:NnV \l_tmpa_seq / \l_tmpa_str
596     \seq_concat:NNN \l_tmpa_seq \c_stex_mathhub_seq \l_tmpa_seq
597     \_stex_mathhub_find_manifest:N \l_tmpa_seq
598     \seq_if_empty:NTF \l__stex_mathhub_manifest_file_seq {
599       \msg_error:nnxx{stex}{error/norepository}{#1}{
600         \stex_path_to_string:N \c_stex_mathhub_str
601       }
602       \input{Fatal-Error!}
603     } {
604       \exp_args:No \_stex_mathhub_parse_manifest:n { \l_tmpa_str }
605     }
606   }
607 }

```

(End definition for `_stex_mathhub_do_manifest:n`.)

\l_stex_mathhub_manifest_file_seq

608 \seq_new:N\l__stex_mathhub_manifest_file_seq

(End definition for \l_stex_mathhub_manifest_file_seq.)

__stex_mathhub_find_manifest:N

Attempts to find the MANIFEST.MF in some file path and stores its path in \l__stex_mathhub_manifest_file_seq:

```

609 \cs_new_protected:Nn \__stex_mathhub_find_manifest:N {
610   \seq_set_eq:NN\l_tmpa_seq #1
611   \bool_set_true:N\l_tmpa_bool
612   \bool_while_do:Nn \l_tmpa_bool {
613     \seq_if_empty:NTF \l_tmpa_seq {
614       \bool_set_false:N\l_tmpa_bool
615     }{
616       \file_if_exist:nTF{
617         \stex_path_to_string:N\l_tmpa_seq/MANIFEST.MF
618       }{
619         \seq_put_right:Nn\l_tmpa_seq{MANIFEST.MF}
620         \bool_set_false:N\l_tmpa_bool
621       }{
622         \file_if_exist:nTF{
623           \stex_path_to_string:N\l_tmpa_seq/META-INF/MANIFEST.MF
624         }{
625           \seq_put_right:Nn\l_tmpa_seq{META-INF}
626           \seq_put_right:Nn\l_tmpa_seq{MANIFEST.MF}
627           \bool_set_false:N\l_tmpa_bool
628         }{
629           \file_if_exist:nTF{
630             \stex_path_to_string:N\l_tmpa_seq/meta-inf/MANIFEST.MF
631           }{
632             \seq_put_right:Nn\l_tmpa_seq{meta-inf}
633             \seq_put_right:Nn\l_tmpa_seq{MANIFEST.MF}
634             \bool_set_false:N\l_tmpa_bool
635           }{
636             \seq_pop_right:NN\l_tmpa_seq\l_tmpa_tl
637           }
638         }
639       }
640     }
641   }
642   \seq_set_eq:NN\l__stex_mathhub_manifest_file_seq\l_tmpa_seq
643 }

```

(End definition for __stex_mathhub_find_manifest:N.)

\c_stex_mathhub_manifest_ior

File variable used for MANIFEST-files

644 \ior_new:N \c__stex_mathhub_manifest_ior

(End definition for \c_stex_mathhub_manifest_ior.)

__stex_mathhub_parse_manifest:n

Stores the entries in manifest file in the corresponding property list:

```

645 \cs_new_protected:Nn \__stex_mathhub_parse_manifest:n {
646   \seq_set_eq:NN \l_tmpa_seq \l__stex_mathhub_manifest_file_seq
647   \ior_open:Nn \c__stex_mathhub_manifest_ior {\stex_path_to_string:N \l_tmpa_seq}

```

```

648 \ior_map_inline:Nn \c__stex_mathhub_manifest_ior {
649   \str_set:Nn \l_tmpa_str {##1}
650   \exp_args:NNoo \seq_set_split:Nnn
651     \l_tmpb_seq \c_colon_str \l_tmpa_str
652   \seq_pop_left:NNTF \l_tmpb_seq \l_tmpa_tl {
653     \exp_args:NNe \str_set:Nn \l_tmpb_tl {
654       \exp_args:NNo \seq_use:Nn \l_tmpb_seq \c_colon_str
655     }
656     \exp_args:No \str_case:nnTF \l_tmpa_tl {
657       {id} {
658         \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
659           { id } \l_tmpb_tl
660       }
661       {narration-base} {
662         \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
663           { narr } \l_tmpb_tl
664       }
665       {url-base} {
666         \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
667           { docurl } \l_tmpb_tl
668       }
669       {source-base} {
670         \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
671           { ns } \l_tmpb_tl
672       }
673       {ns} {
674         \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
675           { ns } \l_tmpb_tl
676       }
677       {dependencies} {
678         \prop_gput:cno { c_stex_mathhub_#1_manifest_prop }
679           { deps } \l_tmpb_tl
680       }
681     }{}{}
682   }{}
683 }
684 \ior_close:N \c__stex_mathhub_manifest_ior
685 \stex_persist:x {
686   \prop_set_from_keyval:cn{ c_stex_mathhub_#1_manifest_prop }{
687     \exp_after:wN \prop_to_keyval:N \csname c_stex_mathhub_#1_manifest_prop\endcsname
688   }
689 }
690 }

```

(End definition for `_stex_mathhub_parse_manifest:n`.)

`\stex_set_current_repository:n`

```

691 \cs_new_protected:Nn \stex_set_current_repository:n {
692   \stex_require_repository:n { #1 }
693   \prop_set_eq:Nc \l_stex_current_repository_prop {
694     c_stex_mathhub_#1_manifest_prop
695   }
696 }

```

(End definition for `\stex_set_current_repository:n`. This function is documented on page 66.)

`\stex_require_repository:n`

```

697 \cs_new_protected:Nn \stex_require_repository:n {
698   \prop_if_exist:cF { c_stex_mathhub_#1_manifest_prop } {
699     \stex_debug:nn{mathhub}{Opening~archive:~#1}
700     \__stex_mathhub_do_manifest:n { #1 }
701   }
702 }

```

(End definition for `\stex_require_repository:n`. This function is documented on page 66.)

`\l_stex_current_repository_prop`

Current MathHub repository

```

703 %\prop_new:N \l_stex_current_repository_prop
704 \bool_if:NF \c_stex_persist_mode_bool {
705   \__stex_mathhub_find_manifest:N \c_stex_pwd_seq
706   \seq_if_empty:NTF \l__stex_mathhub_manifest_file_seq {
707     \stex_debug:nn{mathhub}{Not~currently~in~a~MathHub~repository}
708   } {
709     \__stex_mathhub_parse_manifest:n { main }
710     \prop_get:NnN \c_stex_mathhub_main_manifest_prop {id}
711     \l_tmpa_str
712     \prop_set_eq:cN { c_stex_mathhub_ \l_tmpa_str _manifest_prop }
713     \c_stex_mathhub_main_manifest_prop
714     \exp_args:Nx \stex_set_current_repository:n { \l_tmpa_str }
715     \stex_debug:nn{mathhub}{Current~repository:~
716     \prop_item:Nn \l_stex_current_repository_prop {id}
717   }
718 }
719 }

```

(End definition for `\l_stex_current_repository_prop`. This variable is documented on page 66.)

`\stex_in_repository:nn`

Executes the code in the second argument in the context of the repository whose ID is provided as the first argument.

```

720 \cs_new_protected:Nn \stex_in_repository:nn {
721   \str_set:Nx \l_tmpa_str { #1 }
722   \cs_set:Npn \l_tmpa_cs ##1 { #2 }
723   \str_if_empty:NTF \l_tmpa_str {
724     \prop_if_exist:NTF \l_stex_current_repository_prop {
725       \stex_debug:nn{mathhub}{do~in~current~repository:~\prop_item:Nn \l_stex_current_reposi
726       \exp_args:Ne \l_tmpa_cs{
727         \prop_item:Nn \l_stex_current_repository_prop { id }
728       }
729     }{
730       \l_tmpa_cs{}
731     }
732   }{
733     \stex_debug:nn{mathhub}{in~repository:~\l_tmpa_str}
734     \stex_require_repository:n \l_tmpa_str
735     \str_set:Nx \l_tmpa_str { #1 }
736     \exp_args:Nne \use:nn {
737       \stex_set_current_repository:n \l_tmpa_str
738       \exp_args:Nx \l_tmpa_cs{\l_tmpa_str}
739     }{
740       \stex_debug:nn{mathhub}{switching~back~to:~

```

```

741     \prop_if_exist:NTF \l_stex_current_repository_prop {
742       \prop_item:Nn \l_stex_current_repository_prop { id } :~
743       \meaning\l_stex_current_repository_prop
744     }{
745       no~repository
746     }
747   }
748   \prop_if_exist:NTF \l_stex_current_repository_prop {
749     \stex_set_current_repository:n {
750       \prop_item:Nn \l_stex_current_repository_prop { id }
751     }
752   }{
753     \let\exp_not:N\l_stex_current_repository_prop\exp_not:N\undefined
754   }
755 }
756 }
757 }

```

(End definition for `\stex_in_repository:nn`. This function is documented on page 66.)

25.5 Using Content in Archives

`\mhpath`

```

758 \def \mhpath #1 #2 {
759   \exp_args:Ne \tl_if_empty:nTF{#1}{
760     \c_stex_mathhub_str /
761     \prop_item:Nn \l_stex_current_repository_prop { id }
762     / source / #2
763   }{
764     \c_stex_mathhub_str / #1 / source / #2
765   }
766 }

```

(End definition for `\mhpath`. This function is documented on page 67.)

`\inputref`

`\mhinput`

```

767 \newif \ifinputref \inputreffalse
768
769 \cs_new_protected:Nn \__stex_mathhub_mhinput:nn {
770   \stex_in_repository:nn {#1} {
771     \ifinputref
772       \input{ \c_stex_mathhub_str / ##1 / source / #2 }
773     \else
774       \inputreftrue
775       \input{ \c_stex_mathhub_str / ##1 / source / #2 }
776       \inputreffalse
777     \fi
778   }
779 }
780 \NewDocumentCommand \mhinput { 0{} m }{
781   \__stex_mathhub_mhinput:nn{ #1 }{ #2 }
782 }
783

```

```

784 \cs_new_protected:Nn \__stex_mathhub_inputref:nn {
785   \stex_in_repository:nn {#1} {
786     \stex_html_backend:TF {
787       \str_clear:N \l_tmpa_str
788       \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
789         \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
790       }
791
792       \tl_if_empty:nTF{ ##1 }{
793         \IfFileExists{#2}{
794           \stex_annotate_invisible:nnn{inputref}{
795             \l_tmpa_str / #2
796           }{}
797         }{
798           \input{#2}
799         }
800       }{
801         \IfFileExists{ \c_stex_mathhub_str / ##1 / source / #2 }{
802           \stex_annotate_invisible:nnn{inputref}{
803             \l_tmpa_str / #2
804           }{}
805         }{
806           \input{ \c_stex_mathhub_str / ##1 / source / #2 }
807         }
808       }
809
810     }{
811       \begingroup
812       \inputreftrue
813       \tl_if_empty:nTF{ ##1 }{
814         \input{#2}
815       }{
816         \input{ \c_stex_mathhub_str / ##1 / source / #2 }
817       }
818       \endgroup
819     }
820   }
821 }
822 \NewDocumentCommand \inputref { 0{} m}{
823   \__stex_mathhub_inputref:nn{ #1 }{ #2 }
824 }

```

(End definition for `\inputref` and `\mhinput`. These functions are documented on page 67.)

`\addmhbibresource`

```

825 \cs_new_protected:Nn \__stex_mathhub_mhbibresource:nn {
826   \stex_in_repository:nn {#1} {
827     \addbibresource{ \c_stex_mathhub_str / ##1 / #2 }
828   }
829 }
830 \newcommand\addmhbibresource[2][]{
831   \__stex_mathhub_mhbibresource:nn{ #1 }{ #2 }
832 }

```

(End definition for `\addmhbibresource`. This function is documented on page 67.)

`\libinput`

```
833 \cs_new_protected:Npn \libinput #1 {
834   \prop_if_exist:NF \l_stex_current_repository_prop {
835     \msg_error:nnn{stex}{error/notinarchive}\libinput
836   }
837   \prop_get:NnNF \l_stex_current_repository_prop {id} \l_tmpa_str {
838     \msg_error:nnn{stex}{error/notinarchive}\libinput
839   }
840   \seq_clear:N \l__stex_mathhub_libinput_files_seq
841   \seq_set_eq:NN \l_tmpa_seq \c_stex_mathhub_seq
842   \seq_set_split:NnV \l_tmpb_seq / \l_tmpa_str
843
844   \bool_while_do:nn { ! \seq_if_empty_p:N \l_tmpb_seq }{
845     \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / meta-inf / lib / #1.tex}
846     \IfFileExists{ \l_tmpa_str }{
847       \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
848     }{}
849     \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str
850     \seq_put_right:No \l_tmpa_seq \l_tmpa_str
851   }
852
853   \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / lib / #1.tex}
854   \IfFileExists{ \l_tmpa_str }{
855     \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
856   }{}
857
858   \seq_if_empty:NTF \l__stex_mathhub_libinput_files_seq {
859     \msg_error:nnxx{stex}{error/nofile}{\exp_not:N\libinput}{#1.tex}
860   }{
861     \seq_map_inline:Nn \l__stex_mathhub_libinput_files_seq {
862       \input{ ##1 }
863     }
864   }
865 }
```

(End definition for `\libinput`. This function is documented on page 67.)

`\libusepackage`

```
866 \NewDocumentCommand \libusepackage {0{ } m} {
867   \prop_if_exist:NF \l_stex_current_repository_prop {
868     \msg_error:nnn{stex}{error/notinarchive}\libusepackage
869   }
870   \prop_get:NnNF \l_stex_current_repository_prop {id} \l_tmpa_str {
871     \msg_error:nnn{stex}{error/notinarchive}\libusepackage
872   }
873   \seq_clear:N \l__stex_mathhub_libinput_files_seq
874   \seq_set_eq:NN \l_tmpa_seq \c_stex_mathhub_seq
875   \seq_set_split:NnV \l_tmpb_seq / \l_tmpa_str
876
877   \bool_while_do:nn { ! \seq_if_empty_p:N \l_tmpb_seq }{
878     \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / meta-inf / lib / #2}
879     \IfFileExists{ \l_tmpa_str.sty }{
880       \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
881     }{}
882   }
```

```

882 \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str
883 \seq_put_right:No \l_tmpa_seq \l_tmpa_str
884 }
885
886 \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / lib / #2}
887 \IfFileExists{ \l_tmpa_str.sty }{
888 \seq_put_right:No \l__stex_mathhub_libinput_files_seq \l_tmpa_str
889 }{}
890
891 \seq_if_empty:NTF \l__stex_mathhub_libinput_files_seq {
892 \msg_error:nnxx{stex}{error/nofile}{\exp_not:N\libusepackage}{#2.sty}
893 }{
894 \int_compare:nNnTF {\seq_count:N \l__stex_mathhub_libinput_files_seq} = 1 {
895 \seq_map_inline:Nn \l__stex_mathhub_libinput_files_seq {
896 \usepackage[#1]{ #1 }
897 }
898 }{
899 \msg_error:nnxx{stex}{error/twofiles}{\exp_not:N\libusepackage}{#2.sty}
900 }
901 }
902 }

```

(End definition for `\libusepackage`. This function is documented on page 67.)

`\mhgraphics`
`\cmhgraphics`

```

903
904 \AddToHook{begindocument}{
905 \ltx@ifpackageloaded{graphicx}{
906 \define@key{Gin}{mhrepos}{\def\Gin@mhrepos{#1}}
907 \newcommand\mhgraphics[2][]{\%
908 \def\Gin@mhrepos{}\setkeys{Gin}{#1}%
909 \includegraphics[#1]{\mhp\Gin@mhrepos{#2}}}
910 \newcommand\cmhgraphics[2][]{\begin{center}\mhgraphics[#1]{#2}\end{center}}
911 }{}

```

(End definition for `\mhgraphics` and `\cmhgraphics`. These functions are documented on page 67.)

`\lstinputmhlisting`
`\clstinputmhlisting`

```

912 \ltx@ifpackageloaded{listings}{
913 \define@key{lst}{mhrepos}{\def\lst@mhrepos{#1}}
914 \newcommand\lstinputmhlisting[2][]{\%
915 \def\lst@mhrepos{}\setkeys{lst}{#1}%
916 \lstinputlisting[#1]{\mhp\lst@mhrepos{#2}}}
917 \newcommand\clstinputmhlisting[2][]{\begin{center}\lstinputmhlisting[#1]{#2}\end{center}}
918 }{}
919 }
920
921 </package>

```

(End definition for `\lstinputmhlisting` and `\clstinputmhlisting`. These functions are documented on page 67.)

Chapter 26

STEX -References Implementation

```
922 <*package>
923
924 %%%%%%%%%% references.dtx %%%%%%%%%%
925
926 <@@=stex_refs>
927
928 Warnings and error messages
```

References are stored in the file `\jobname.sref`, to enable cross-referencing external documents.

```
928 %\iow_new:N \c__stex_refs_refs_iow
929 \AtBeginDocument{
930 % \iow_open:Nn \c__stex_refs_refs_iow {\jobname.sref}
931 }
932 \AtEndDocument{
933 % \iow_close:N \c__stex_refs_refs_iow
934 }
```

`\STEXreftitle`

```
935 \str_set:Nn \g__stex_refs_title_tl {Unnamed~Document}
936
937 \NewDocumentCommand \STEXreftitle { m } {
938   \tl_gset:Nx \g__stex_refs_title_tl { #1 }
939 }
```

(End definition for `\STEXreftitle`. This function is documented on page 68.)

26.1 Document URIs and URLs

`\l_stex_current_docns_str`

```
940 \str_new:N \l_stex_current_docns_str
```

(End definition for `\l_stex_current_docns_str`. This variable is documented on page 68.)

`\stex_get_document_uri:`

```
941 \cs_new_protected:Nn \stex_get_document_uri: {
942   \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
943   \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str
944   \exp_args:NNno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
945   \seq_get_left:NN \l_tmpb_seq \l_tmpb_str
946   \seq_put_right:No \l_tmpa_seq \l_tmpb_str
947
948   \str_clear:N \l_tmpa_str
949   \prop_if_exist:NT \l_stex_current_repository_prop {
950     \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
951       \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
952     }
953   }
954
955   \str_if_empty:NTF \l_tmpa_str {
956     \str_set:Nx \l_stex_current_docns_str {
957       file:/\stex_path_to_string:N \l_tmpa_seq
958     }
959   }{
960     \bool_set_true:N \l_tmpa_bool
961     \bool_while_do:Nn \l_tmpa_bool {
962       \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
963       \exp_args:No \str_case:nnTF { \l_tmpb_str } {
964         {source} { \bool_set_false:N \l_tmpa_bool }
965       }{}{
966         \seq_if_empty:NT \l_tmpa_seq {
967           \bool_set_false:N \l_tmpa_bool
968         }
969       }
970     }
971
972     \seq_if_empty:NTF \l_tmpa_seq {
973       \str_set_eq:NN \l_stex_current_docns_str \l_tmpa_str
974     }{
975       \str_set:Nx \l_stex_current_docns_str {
976         \l_tmpa_str/\stex_path_to_string:N \l_tmpa_seq
977       }
978     }
979   }
980 }
```

(End definition for `\stex_get_document_uri:`. This function is documented on page 68.)

`\l_stex_current_docurl_str`

```
981 \str_new:N \l_stex_current_docurl_str
```

(End definition for `\l_stex_current_docurl_str`. This variable is documented on page 68.)

`\stex_get_document_url:`

```
982 \cs_new_protected:Nn \stex_get_document_url: {
983   \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
984   \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str
985   \exp_args:NNno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
```

```

986 \seq_get_left:NN \l_tmpb_seq \l_tmpb_str
987 \seq_put_right:No \l_tmpa_seq \l_tmpb_str
988
989 \str_clear:N \l_tmpa_str
990 \prop_if_exist:NT \l_stex_current_repository_prop {
991   \prop_get:NnNF \l_stex_current_repository_prop { docurl } \l_tmpa_str {
992     \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
993       \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
994     }
995   }
996 }
997
998 \str_if_empty:NTF \l_tmpa_str {
999   \str_set:Nx \l_stex_current_docurl_str {
1000     file:/\stex_path_to_string:N \l_tmpa_seq
1001   }
1002 }{
1003   \bool_set_true:N \l_tmpa_bool
1004   \bool_while_do:Nn \l_tmpa_bool {
1005     \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1006     \exp_args:No \str_case:nnTF { \l_tmpb_str } {
1007       {source} { \bool_set_false:N \l_tmpa_bool }
1008     }{}{
1009       \seq_if_empty:NT \l_tmpa_seq {
1010         \bool_set_false:N \l_tmpa_bool
1011       }
1012     }
1013   }
1014 }
1015 \seq_if_empty:NTF \l_tmpa_seq {
1016   \str_set_eq:NN \l_stex_current_docurl_str \l_tmpa_str
1017 }{
1018   \str_set:Nx \l_stex_current_docurl_str {
1019     \l_tmpa_str/\stex_path_to_string:N \l_tmpa_seq
1020   }
1021 }
1022 }
1023 }

```

(End definition for `\stex_get_document_url`:. This function is documented on page 68.)

26.2 Setting Reference Targets

```

1024 \str_const:Nn \c__stex_refs_url_str{URL}
1025 \str_const:Nn \c__stex_refs_ref_str{REF}
1026 \str_new:N \l__stex_refs_curr_label_str
1027 % @currentlabel -> number
1028 % @currentlabelname -> title
1029 % @currentHref -> name.number <- id of some kind
1030 % \theH# -> \arabic{section}
1031 % \the# -> number
1032 % \hyper@makecurrent{#}
1033 \int_new:N \l__stex_refs_unnamed_counter_int

```

`\stex_ref_new_doc_target:n`

```

1034 \cs_new_protected:Nn \stex_ref_new_doc_target:n {
1035   \stex_get_document_uri:
1036   \str_clear:N \l__stex_refs_curr_label_str
1037   \str_set:Nx \l_tmpa_str { #1 }
1038   \str_if_empty:NT \l_tmpa_str {
1039     \int_incr:N \l__stex_refs_unnamed_counter_int
1040     \str_set:Nx \l_tmpa_str {REF\int_use:N \l__stex_refs_unnamed_counter_int}
1041   }
1042   \str_set:Nx \l__stex_refs_curr_label_str {
1043     \l_stex_current_docns_str?\l_tmpa_str
1044   }
1045   \seq_if_exist:cF{g__stex_refs_labels_\l_tmpa_str_seq}{
1046     \seq_new:c {g__stex_refs_labels_\l_tmpa_str_seq}
1047   }
1048   \seq_if_in:coF{g__stex_refs_labels_\l_tmpa_str_seq}\l__stex_refs_curr_label_str {
1049     \seq_gput_right:co{g__stex_refs_labels_\l_tmpa_str_seq}\l__stex_refs_curr_label_str
1050   }
1051   \stex_if_smsmode:TF {
1052     \stex_get_document_url:
1053     \str_gset_eq:cN {sref_url_\l__stex_refs_curr_label_str_str}\l_stex_current_docurl_str
1054     \str_gset_eq:cN {sref_\l__stex_refs_curr_label_str_type}\c__stex_refs_url_str
1055   }{
1056     %\iow_now:Nx \c__stex_refs_refs_iow { \l_tmpa_str~=\expandafter\unexpanded\expandafter{
1057     \exp_args:Nx\label{sref_\l__stex_refs_curr_label_str}
1058     \immediate\write\@auxout{\stexauxadddocref{\l_stex_current_docns_str}{\l_tmpa_str}}
1059     \str_gset:cx {sref_\l__stex_refs_curr_label_str_type}\c__stex_refs_ref_str
1060   }
1061 }

```

(End definition for `\stex_ref_new_doc_target:n`. This function is documented on page 68.)

The following is used to set the necessary macros in the .aux-file.

```

1062 \cs_new_protected:Npn \stexauxadddocref #1 #2 {
1063   \str_set:Nn \l_tmpa_str {#1?#2}
1064   \str_gset_eq:cN{sref_#1?#2_type}\c__stex_refs_ref_str
1065   \seq_if_exist:cF{g__stex_refs_labels_#2_seq}{
1066     \seq_new:c {g__stex_refs_labels_#2_seq}
1067   }
1068   \seq_if_in:coF{g__stex_refs_labels_#2_seq}\l_tmpa_str {
1069     \seq_gput_right:co{g__stex_refs_labels_#2_seq}\l_tmpa_str
1070   }
1071 }

```

To avoid resetting the same macros when the .aux-file is read at the end of the document:

```

1072 \AtEndDocument{
1073   \def\stexauxadddocref#1 #2 {}{}
1074 }

```

`\stex_ref_new_sym_target:n`

```

1075 \cs_new_protected:Nn \stex_ref_new_sym_target:n {
1076   \stex_if_smsmode:TF {
1077     \str_if_exist:cF{sref_sym_#1_type}{
1078       \stex_get_document_url:
1079       \str_gset_eq:cN {sref_sym_url_#1_str}\l_stex_current_docurl_str

```

```

1080     \str_gset_eq:cN {sref_sym_#1_type}\c__stex_refs_url_str
1081   }
1082   ){
1083     \str_if_empty:NF \l__stex_refs_curr_label_str {
1084       \str_gset_eq:cN {sref_sym_#1_label_str}\l__stex_refs_curr_label_str
1085       \immediate\write\@auxout{
1086         \exp_not:N\expandafter\def\exp_not:N\csname \exp_not:N\detokenize{sref_sym_#1_label_
1087           \l__stex_refs_curr_label_str
1088         }
1089       }
1090     }
1091   }
1092 }

```

(End definition for `\stex_ref_new_sym_target:n`. This function is documented on page 68.)

26.3 Using References

```

1093 \str_new:N \l__stex_refs_indocument_str

```

\sref Optional arguments:

```

1094
1095 \keys_define:nn { stex / sref } {
1096   linktext      .tl_set:N = \l__stex_refs_linktext_tl ,
1097   fallback      .tl_set:N = \l__stex_refs_fallback_tl ,
1098   pre           .tl_set:N = \l__stex_refs_pre_tl ,
1099   post          .tl_set:N = \l__stex_refs_post_tl ,
1100 }
1101 \cs_new_protected:Nn \__stex_refs_args:n {
1102   \tl_clear:N \l__stex_refs_linktext_tl
1103   \tl_clear:N \l__stex_refs_fallback_tl
1104   \tl_clear:N \l__stex_refs_pre_tl
1105   \tl_clear:N \l__stex_refs_post_tl
1106   \str_clear:N \l__stex_refs_repo_str
1107   \keys_set:nn { stex / sref } { #1 }
1108 }

```

The actual macro:

```

1109 \NewDocumentCommand \sref { 0{} m}{
1110   \__stex_refs_args:n { #1 }
1111   \str_if_empty:NTF \l__stex_refs_indocument_str {
1112     \str_set:Nx \l_tmpa_str { #2 }
1113     \exp_args:NNno \seq_set_split:Nnn \l_tmpa_seq ? \l_tmpa_str
1114     \int_compare:nNnTF {\seq_count:N \l_tmpa_seq} = 1 {
1115       \seq_if_exist:cTF{g__stex_refs_labels_\l_tmpa_str _seq}{
1116         \seq_get_left:cNF {g__stex_refs_labels_\l_tmpa_str _seq} \l_tmpa_str {
1117           \str_clear:N \l_tmpa_str
1118         }
1119       }{
1120         \str_clear:N \l_tmpa_str
1121       }
1122     }{
1123       \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1124       \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str

```

```

1125 \int_set:Nn \l_tmpa_int { \exp_args:Ne \str_count:n {\l_tmpb_str?\l_tmpa_str} }
1126 \seq_if_exist:cTF{g__stex_refs_labels_\l_tmpa_str_seq}{
1127   \str_set_eq:NN \l_tmpc_str \l_tmpa_str
1128   \str_clear:N \l_tmpa_str
1129   \seq_map_inline:cn {g__stex_refs_labels_\l_tmpc_str_seq} {
1130     \str_if_eq:eeT { \l_tmpb_str?\l_tmpc_str }{
1131       \str_range:nnn { ##1 }{-\l_tmpa_int}{ -1 }
1132     }{
1133       \seq_map_break:n {
1134         \str_set:Nn \l_tmpa_str { ##1 }
1135       }
1136     }
1137   }
1138 }{
1139   \str_clear:N \l_tmpa_str
1140 }
1141 }
1142 \str_if_empty:NTF \l_tmpa_str {
1143   \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs_lin
1144 }{
1145   \str_if_eq:cNTF {sref_\l_tmpa_str_type} \c__stex_refs_ref_str {
1146     \tl_if_empty:NTF \l__stex_refs_linktext_tl {
1147       \cs_if_exist:cTF{autoref}{
1148         \l__stex_refs_pre_tl\exp_args:Nx\autoref{sref_\l_tmpa_str}\l__stex_refs_post_tl
1149       }{
1150         \l__stex_refs_pre_tl\exp_args:Nx\ref{sref_\l_tmpa_str}\l__stex_refs_post_tl
1151       }
1152     }{
1153       \ltx@ifpackageloaded{hyperref}{
1154         \hyperref[sref_\l_tmpa_str]\l__stex_refs_linktext_tl
1155       }{
1156         \l__stex_refs_linktext_tl
1157       }
1158     }
1159   }{
1160     \ltx@ifpackageloaded{hyperref}{
1161       \href{\use:c{sref_url_\l_tmpa_str_str}}{\tl_if_empty:NTF \l__stex_refs_linktext_t
1162     }{
1163       \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs
1164     }
1165   }
1166 }
1167 }{
1168   % TODO
1169 }
1170 }

```

(End definition for `\sref`. This function is documented on page 69.)

`\srefsym`

```

1171 \NewDocumentCommand \srefsym { 0{} m}{
1172   \stex_get_symbol:n { #2 }
1173   \__stex_refs_sym_aux:nn{##1}{\l_stex_get_symbol_uri_str}
1174 }

```

```

1175
1176 \cs_new_protected:Nn \__stex_refs_sym_aux:nn {
1177   \str_if_exist:cTF {sref_sym_#2 _label_str }{
1178     \sref[#1]{\use:c{sref_sym_#2 _label_str}}
1179   }{
1180     \__stex_refs_args:n { #1 }
1181     \str_if_empty:NTF \l__stex_refs_indocument_str {
1182       \tl_if_exist:cTF{sref_sym_#2 _type}{
1183         % doc uri in \l_tmpb_str
1184         \str_set:Nx \l_tmpa_str {\use:c{sref_sym_#2 _type}}
1185         \str_if_eq:NNTF \l_tmpa_str \c__stex_refs_ref_str {
1186           % reference
1187           \tl_if_empty:NTF \l__stex_refs_linktext_tl {
1188             \cs_if_exist:cTF{autoref}{
1189               \l__stex_refs_pre_tl\autoref{sref_sym_#2}\l__stex_refs_post_tl
1190             }{
1191               \l__stex_refs_pre_tl\ref{sref_sym_#2}\l__stex_refs_post_tl
1192             }
1193           }{
1194             \ltx@ifpackageloaded{hyperref}{
1195               \hyperref[sref_sym_#2]\l__stex_refs_linktext_tl
1196             }{
1197               \l__stex_refs_linktext_tl
1198             }
1199           }
1200         }{
1201           % URL
1202           \ltx@ifpackageloaded{hyperref}{
1203             \href{\use:c{sref_sym_url_#2 _str}}{\tl_if_empty:NTF \l__stex_refs_linktext_tl \
1204           }{
1205             \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_re
1206           }
1207         }
1208       }{
1209         \tl_if_empty:NTF \l__stex_refs_linktext_tl \l__stex_refs_fallback_tl \l__stex_refs_l
1210       }
1211     }{
1212       % TODO
1213     }
1214   }
1215 }

```

(End definition for \srefsym. This function is documented on page 69.)

\srefsymuri

```

1216 \cs_new_protected:Npn \srefsymuri #1 #2 {
1217   \__stex_refs_sym_aux:nn{linktext={#2}}{#1}
1218 }

```

(End definition for \srefsymuri. This function is documented on page 69.)

```

1219 </package>

```

Chapter 27

STEX -Modules Implementation

```
1220 <*package>
1221
1222 %%%%%%%%%%% modules.dtx %%%%%%%%%%%
1223
1224 <@@=stex_modules>
1225
1226   Warnings and error messages
1227   \msg_new:nnn{stex}{error/unknownmodule}{
1228     No~module~#1~found
1229   }
1230   \msg_new:nnn{stex}{error/syntax}{
1231     Syntax~error:~#1
1232   }
1233   \msg_new:nnn{stex}{error/siglanguage}{
1234     Module~#1~declares~signature~#2,~but~does~not~
1235     declare~its~language
1236   }
1237   \msg_new:nnn{stex}{warning/deprecated}{
1238     #1~is~deprecated;~please~use~#2~instead!
1239   }
1240   \msg_new:nnn{stex}{error/conflictingmodules}{
1241     Conflicting~imports~for~module~#1
1242   }
```

```
\l_stex_current_module_str The current module:
1242 \str_new:N \l_stex_current_module_str
(End definition for \l_stex_current_module_str. This variable is documented on page 71.)
```

```
\l_stex_all_modules_seq Stores all available modules
1243 \seq_new:N \l_stex_all_modules_seq
(End definition for \l_stex_all_modules_seq. This variable is documented on page 71.)
```



```

\stex_if_in_module_p:
\stex_if_in_module:TF
1244 \prg_new_conditional:Nnn \stex_if_in_module: {p, T, F, TF} {
1245   \str_if_empty:NTF \l_stex_current_module_str
1246   \prg_return_false: \prg_return_true:
1247 }

(End definition for \stex_if_in_module:TF. This function is documented on page 71.)

```

```

\stex_if_module_exists_p:n
\stex_if_module_exists:nTF
1248 \prg_new_conditional:Nnn \stex_if_module_exists:n {p, T, F, TF} {
1249   \prop_if_exist:cTF { c_stex_module_#1_prop }
1250   \prg_return_true: \prg_return_false:
1251 }

(End definition for \stex_if_module_exists:nTF. This function is documented on page 71.)

```

```

\stex_add_to_current_module:n
\STEXexport
Only allowed within modules:
1252 \cs_new_protected:Nn \stex_execute_in_module:n { \stex_if_in_module:T {
1253   \stex_add_to_current_module:n { #1 }
1254   \stex_do_up_to_module:n { #1 }
1255 }}
1256 \cs_generate_variant:Nn \stex_execute_in_module:n {x}
1257
1258 \cs_new_protected:Nn \stex_add_to_current_module:n {
1259   \tl_gput_right:cn {c_stex_module_\l_stex_current_module_str_code} { #1 }
1260 }
1261 \cs_generate_variant:Nn \stex_add_to_current_module:n {x}
1262 \cs_new_protected:Npn \STEXexport {
1263   \ExplSyntaxOn
1264   \__stex_modules_export:n
1265 }
1266 \cs_new_protected:Nn \__stex_modules_export:n {
1267   #1\ExplSyntaxOff
1268   \stex_add_to_current_module:n { #1}
1269   \stex_smsmode_do:
1270 }
1271 \let \stex_module_export_helper:n \use:n
1272 \stex_deactivate_macro:Nn \STEXexport {module~environments}

(End definition for \stex_add_to_current_module:n and \STEXexport. These functions are documented
on page 71.)

```

```

\stex_add_constant_to_current_module:n
1273 \cs_new_protected:Nn \stex_add_constant_to_current_module:n {
1274   \str_set:Nx \l_tmpa_str { #1 }
1275   \seq_gput_right:co {c_stex_module_\l_stex_current_module_str_constants} { \l_tmpa_str }
1276 }

(End definition for \stex_add_constant_to_current_module:n. This function is documented on page
71.)

```

```

\stex_add_import_to_current_module:n
1277 \cs_new_protected:Nn \stex_add_import_to_current_module:n {
1278   \str_set:Nx \l_tmpa_str { #1 }
1279   \exp_args:Nno

```

```

1280 \seq_if_in:cnF{c_stex_module_\l_stex_current_module_str _imports}\l_tmpa_str{
1281 \seq_gput_right:co{c_stex_module_\l_stex_current_module_str _imports}\l_tmpa_str
1282 }
1283 }

```

(End definition for `\stex_add_import_to_current_module:n`. This function is documented on page 71.)

`\stex_collect_imports:n`

```

1284 \cs_new_protected:Nn \stex_collect_imports:n {
1285 \seq_clear:N \l_stex_collect_imports_seq
1286 \__stex_modules_collect_imports:n {#1}
1287 }
1288 \cs_new_protected:Nn \__stex_modules_collect_imports:n {
1289 \seq_map_inline:cn {c_stex_module_#1_imports} {
1290 \seq_if_in:NnF \l_stex_collect_imports_seq { ##1 } {
1291 \__stex_modules_collect_imports:n { ##1 }
1292 }
1293 }
1294 \seq_if_in:NnF \l_stex_collect_imports_seq { #1 } {
1295 \seq_put_right:Nx \l_stex_collect_imports_seq { #1 }
1296 }
1297 }

```

(End definition for `\stex_collect_imports:n`. This function is documented on page 71.)

`\stex_do_up_to_module:n`

```

1298 \int_new:N \l__stex_modules_group_depth_int
1299 \cs_new_protected:Nn \stex_do_up_to_module:n {
1300 \int_compare:nNnTF \l__stex_modules_group_depth_int = \currentgrouplevel {
1301 #1
1302 }{
1303 #1
1304 \expandafter \tl_gset:Nn
1305 \csname l__stex_modules_aftergroup_\l_stex_current_module_str _tl
1306 \expandafter\expandafter\expandafter\endcsname
1307 \expandafter\expandafter\expandafter { \csname
1308 l__stex_modules_aftergroup_\l_stex_current_module_str _tl\endcsname #1 }
1309 \aftergroup\__stex_modules_aftergroup_do:
1310 }
1311 }
1312 \cs_generate_variant:Nn \stex_do_up_to_module:n {x}
1313 \cs_new_protected:Nn \__stex_modules_aftergroup_do: {
1314 \stex_debug:nn{aftergroup}{\cs_meaning:c{
1315 l__stex_modules_aftergroup_\l_stex_current_module_str _tl
1316 }}}
1317 \int_compare:nNnTF \l__stex_modules_group_depth_int = \currentgrouplevel {
1318 \use:c{l__stex_modules_aftergroup_\l_stex_current_module_str _tl}
1319 \tl_gclear:c{l__stex_modules_aftergroup_\l_stex_current_module_str _tl}
1320 }{
1321 \use:c{l__stex_modules_aftergroup_\l_stex_current_module_str _tl}
1322 \aftergroup\__stex_modules_aftergroup_do:
1323 }
1324 }
1325 \cs_new_protected:Nn \stex_reset_up_to_module:n {
1326 \expandafter\let\csname l__stex_modules_aftergroup_#1_tl\endcsname\undefined

```

1327 }

(End definition for \stex_do_up_to_module:n. This function is documented on page 71.)

\stex_modules_compute_namespace:nN Computes the appropriate namespace from the top-level namespace of a repository (#1) and a file path (#2).

1328

(End definition for \stex_modules_compute_namespace:nN. This function is documented on page ??.)

\stex_modules_current_namespace: Computes the current namespace based on the current MathHub repository (if existent) and the current file.

```
1329 \str_new:N \l_stex_module_ns_str
1330 \str_new:N \l_stex_module_subpath_str
1331 \cs_new_protected:Nn \__stex_modules_compute_namespace:nN {
1332   \seq_set_eq:NN \l_tmpa_seq #2
1333   % split off file extension
1334   \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str % <- filename
1335   \exp_args:Nnno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
1336   \seq_get_left:NN \l_tmpb_seq \l_tmpb_str % <- filename without suffixes
1337   \seq_put_right:No \l_tmpa_seq \l_tmpb_str % <- file path including name without suffixes
1338
1339   \bool_set_true:N \l_tmpa_bool
1340   \bool_while_do:Nn \l_tmpa_bool {
1341     \seq_pop_left:NN \l_tmpa_seq \l_tmpb_str
1342     \exp_args:No \str_case:nnTF { \l_tmpb_str } {
1343       {source} { \bool_set_false:N \l_tmpa_bool }
1344     }{}{
1345       \seq_if_empty:NT \l_tmpa_seq {
1346         \bool_set_false:N \l_tmpa_bool
1347       }
1348     }
1349   }
1350
1351   \stex_path_to_string:NN \l_tmpa_seq \l_stex_module_subpath_str
1352   % \l_tmpa_seq <- sub-path relative to archive
1353   \str_if_empty:NTF \l_stex_module_subpath_str {
1354     \str_set:Nx \l_stex_module_ns_str {#1}
1355   }{
1356     \str_set:Nx \l_stex_module_ns_str {
1357       #1/\l_stex_module_subpath_str
1358     }
1359   }
1360 }
1361
1362 \cs_new_protected:Nn \stex_modules_current_namespace: {
1363   \str_clear:N \l_stex_module_subpath_str
1364   \prop_if_exist:NTF \l_stex_current_repository_prop {
1365     \prop_get:NnN \l_stex_current_repository_prop { ns } \l_tmpa_str
1366     \__stex_modules_compute_namespace:nN \l_tmpa_str \g_stex_currentfile_seq
1367   }{
1368     % split off file extension
1369     \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1370     \seq_pop_right:NN \l_tmpa_seq \l_tmpb_str
```

```

1371 \exp_args:NNno \seq_set_split:Nnn \l_tmpb_seq . \l_tmpb_str
1372 \seq_get_left:NN \l_tmpb_seq \l_tmpb_str
1373 \seq_put_right:No \l_tmpa_seq \l_tmpb_str
1374 \str_set:Nx \l_stex_module_ns_str {
1375   file:/\stex_path_to_string:N \l_tmpa_seq
1376 }
1377 }
1378 }

```

(End definition for `\stex_modules_current_namespace:.` This function is documented on page 72.)

27.1 The smodule environment

smodule arguments:

```

1379 \keys_define:nn { stex / module } {
1380   title      .tl_set:N      = \smodulename ,
1381   type       .str_set_x:N   = \smodulename ,
1382   id         .str_set_x:N   = \smoduleid ,
1383   deprecate  .str_set_x:N   = \l_stex_module_deprecate_str ,
1384   ns         .str_set_x:N   = \l_stex_module_ns_str ,
1385   lang       .str_set_x:N   = \l_stex_module_lang_str ,
1386   sig        .str_set_x:N   = \l_stex_module_sig_str ,
1387   creators   .str_set_x:N   = \l_stex_module_creators_str ,
1388   contributors .str_set_x:N = \l_stex_module_contributors_str ,
1389   meta       .str_set_x:N   = \l_stex_module_meta_str ,
1390   srccite    .str_set_x:N   = \l_stex_module_srccite_str
1391 }
1392
1393 \cs_new_protected:Nn \__stex_modules_args:n {
1394   \str_clear:N \smodulename
1395   \str_clear:N \smodulename
1396   \str_clear:N \smoduleid
1397   \str_clear:N \l_stex_module_ns_str
1398   \str_clear:N \l_stex_module_deprecate_str
1399   \str_clear:N \l_stex_module_lang_str
1400   \str_clear:N \l_stex_module_sig_str
1401   \str_clear:N \l_stex_module_creators_str
1402   \str_clear:N \l_stex_module_contributors_str
1403   \str_clear:N \l_stex_module_meta_str
1404   \str_clear:N \l_stex_module_srccite_str
1405   \keys_set:nn { stex / module } { #1 }
1406 }
1407
1408 % module parameters here? In the body?
1409

```

`\stex_module_setup:nn` Sets up a new module property list:

```

1410 \cs_new_protected:Nn \stex_module_setup:nn {
1411   \int_set:Nn \l__stex_modules_group_depth_int {\currentgrouplevel}
1412   \str_set:Nx \l_stex_module_name_str { #2 }
1413   \__stex_modules_args:n { #1 }

```

First, we set up the name and namespace of the module.

Are we in a nested module?

```

1414 \stex_if_in_module:TF {
1415   % Nested module
1416   \prop_get:cnN {c_stex_module_\l_stex_current_module_str _prop}
1417   { ns } \l_stex_module_ns_str
1418   \str_set:Nx \l_stex_module_name_str {
1419     \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
1420     { name } / \l_stex_module_name_str
1421   }
1422   \str_if_empty:NT \l_stex_module_lang_str {
1423     \str_set:Nx \l_stex_module_lang_str {
1424       \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
1425       { lang }
1426     }
1427   }
1428 }{
1429   % not nested:
1430   \str_if_empty:NT \l_stex_module_ns_str {
1431     \stex_modules_current_namespace:
1432     \exp_args:NNNo \seq_set_split:Nnn \l_tmpa_seq
1433       / {\l_stex_module_ns_str}
1434     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
1435     \str_if_eq:NNT \l_tmpa_str \l_stex_module_name_str {
1436       \str_set:Nx \l_stex_module_ns_str {
1437         \stex_path_to_string:N \l_tmpa_seq
1438       }
1439     }
1440   }
1441 }

```

Next, we determine the language of the module:

```

1442 \str_if_empty:NT \l_stex_module_lang_str {
1443   \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
1444   \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
1445   \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str % .tex
1446   \exp_args:No \str_if_eq:nnF \l_tmpa_str {tex} {
1447     \exp_args:No \str_if_eq:nnF \l_tmpa_str {dtx} {
1448       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq \l_tmpa_str
1449     }
1450   }
1451   \seq_pop_left:NN \l_tmpa_seq \l_tmpa_str % <filename>
1452   \seq_if_empty:NF \l_tmpa_seq { %remaining element should be [<something>.]language
1453     \seq_pop_right:NN \l_tmpa_seq \l_stex_module_lang_str
1454     \stex_debug:nn{modules} {Language~\l_stex_module_lang_str~
1455       inferred~from~file~name}
1456   }
1457 }
1458
1459 \stex_if_smsmode:F { \str_if_empty:NF \l_stex_module_lang_str {
1460   \exp_args:NNo \stex_set_language:Nn \l_tmpa_str \l_stex_module_lang_str
1461 }}

```

We check if we need to extend a signature module, and set `\l_stex_current_module_prop` accordingly:

```

1462 \str_if_empty:NTF \l_stex_module_sig_str {
1463   \exp_args:Nnx \prop_gset_from_keyval:cn {
1464     c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _prop
1465   } {
1466     name      = \l_stex_module_name_str ,
1467     ns        = \l_stex_module_ns_str ,
1468     file      = \exp_not:o { \g_stex_currentfile_seq } ,
1469     lang      = \l_stex_module_lang_str ,
1470     sig       = \l_stex_module_sig_str ,
1471     deprecate = \l_stex_module_deprecate_str ,
1472     meta      = \l_stex_module_meta_str
1473   }
1474   \seq_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _imports}
1475   \seq_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _constants}
1476   \seq_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _copymodules}
1477   \tl_clear:c {c_stex_module_\l_stex_module_ns_str?\l_stex_module_name_str _code}
1478   \str_set:Nx\l_stex_current_module_str{\l_stex_module_ns_str?\l_stex_module_name_str}

```

We load the metatheory:

```

1479 \str_if_empty:NT \l_stex_module_meta_str {
1480   \str_set:Nx \l_stex_module_meta_str {
1481     \c_stex_metatheory_ns_str ? Metatheory
1482   }
1483 }
1484 \str_if_eq:VnF \l_stex_module_meta_str {NONE} {
1485   \bool_set_true:N \l_stex_in_meta_bool
1486   \exp_args:Nx \stex_add_to_current_module:n {
1487     \bool_set_true:N \l_stex_in_meta_bool
1488     \stex_activate_module:n {\l_stex_module_meta_str}
1489     \bool_set_false:N \l_stex_in_meta_bool
1490   }
1491   \stex_activate_module:n {\l_stex_module_meta_str}
1492   \bool_set_false:N \l_stex_in_meta_bool
1493 }
1494 }{
1495   \str_if_empty:NT \l_stex_module_lang_str {
1496     \msg_error:nnxx{stex}{error/siglanguage}{
1497       \l_stex_module_ns_str?\l_stex_module_name_str
1498     }{\l_stex_module_sig_str}
1499   }
1500   \stex_debug:nn{modules}{Signature~\l_stex_module_sig_str~for~\l_stex_module_ns_str?\l_st
1501   \stex_if_module_exists:nTF{\l_stex_module_ns_str?\l_stex_module_name_str}{
1502     \stex_debug:nn{modules}{(already exists)}
1503   }{
1504     \stex_debug:nn{modules}{(needs loading)}
1505     \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1506     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
1507     \seq_set_split:NnV \l_tmpb_seq . \l_tmpa_str
1508     \seq_pop_right:NN \l_tmpb_seq \l_tmpa_str % .tex
1509     \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str % <filename>
1510     \str_set:Nx \l_tmpa_str {
1511       \stex_path_to_string:N \l_tmpa_seq /

```

```

1512     \l_tmpa_str . \l_stex_module_sig_str .tex
1513 }
1514 \IfFileExists \l_tmpa_str {
1515     \exp_args:No \stex_file_in_smsmode:nn { \l_tmpa_str } {
1516         \str_clear:N \l_stex_current_module_str
1517         \seq_clear:N \l_stex_all_modules_seq
1518         \stex_debug:nn{modules}{Loading~signature}
1519     }
1520 }{
1521     \msg_error:nnx{stex}{error/unknownmodule}{for~signature~\l_tmpa_str}
1522 }
1523 }
1524 \stex_if_smsmode:F {
1525     \stex_activate_module:n {
1526         \l_stex_module_ns_str ? \l_stex_module_name_str
1527     }
1528 }
1529 \str_set:Nx\l_stex_current_module_str{\l_stex_module_ns_str?\l_stex_module_name_str}
1530 }
1531 \str_if_empty:NF \l_stex_module_deprecate_str {
1532     \msg_warning:nnxx{stex}{warning/deprecated}{
1533         Module~\l_stex_current_module_str
1534     }{
1535         \l_stex_module_deprecate_str
1536     }
1537 }
1538 \seq_put_right:Nx \l_stex_all_modules_seq {
1539     \l_stex_module_ns_str ? \l_stex_module_name_str
1540 }
1541 \tl_clear:c{l__stex_modules_aftergroup_\l_stex_module_ns_str ? \l_stex_module_name_str _tl}
1542 }

```

(End definition for `\stex_module_setup:nn`. This function is documented on page 72.)

smodule The module environment.

```

\__stex_modules_begin_module: implements \begin{smodule}
1543 \cs_new_protected:Nn \__stex_modules_begin_module: {
1544     \stex_reactivate_macro:N \STEXexport
1545     \stex_reactivate_macro:N \importmodule
1546     \stex_reactivate_macro:N \symdecl
1547     \stex_reactivate_macro:N \notation
1548     \stex_reactivate_macro:N \symdef
1549
1550     \stex_debug:nn{modules}{
1551         New~module:\\
1552         Namespace:~\l_stex_module_ns_str\\
1553         Name:~\l_stex_module_name_str\\
1554         Language:~\l_stex_module_lang_str\\
1555         Signature:~\l_stex_module_sig_str\\
1556         Metatheory:~\l_stex_module_meta_str\\
1557         File:~\stex_path_to_string:N \g_stex_currentfile_seq
1558     }
1559

```

```

1560 \stex_if_do_html:T{
1561   \begin{stex_annotate_env} {theory} {
1562     \l_stex_module_ns_str ? \l_stex_module_name_str
1563   }
1564
1565   \stex_annotate_invisible:nnn{header}{} {
1566     \stex_annotate:nnn{language}{ \l_stex_module_lang_str }{}
1567     \stex_annotate:nnn{signature}{ \l_stex_module_sig_str }{}
1568     \str_if_eq:VnF \l_stex_module_meta_str {NONE} {
1569       \stex_annotate:nnn{metatheory}{ \l_stex_module_meta_str }{}
1570     }
1571     \str_if_empty:NF \smoduletype {
1572       \stex_annotate:nnn{type}{\smoduletype}{}
1573     }
1574   }
1575 }
1576 % TODO: Inherit metatheory for nested modules?
1577 }
1578 \iffalse \end{stex_annotate_env} \fi %^^A make syntax highlighting work again

```

(End definition for `_stex_modules_begin_module:.`)

`_stex_modules_end_module:` implements `\end{module}`

```

1579 \cs_new_protected:Nn \_stex_modules_end_module: {
1580   \stex_debug:nn{modules}{Closing module~\prop_item:cn {c_stex_module_\l_stex_current_module}
1581   \stex_reset_up_to_module:n \l_stex_current_module_str
1582   \stex_if_smsmode:T {
1583     \stex_persist:x {
1584       \prop_set_from_keyval:cn{c_stex_module_\l_stex_current_module_str _prop}{
1585         \exp_after:wN \prop_to_keyval:N \csname c_stex_module_\l_stex_current_module_str _pr
1586       }
1587       \seq_set_from_clist:cn{c_stex_module_\l_stex_current_module_str _constants}{
1588         \seq_use:cn{c_stex_module_\l_stex_current_module_str _constants},
1589       }
1590       \seq_set_from_clist:cn{c_stex_module_\l_stex_current_module_str _imports}{
1591         \seq_use:cn{c_stex_module_\l_stex_current_module_str _imports},
1592       }
1593       \tl_set:cn {c_stex_module_\l_stex_current_module_str _code}
1594     }
1595     \exp_after:wN \let \exp_after:wN \l_tmpa_tl \csname c_stex_module_\l_stex_current_module
1596     \exp_after:wN \stex_persist:n \exp_after:wN { \exp_after:wN { \l_tmpa_tl } }
1597   }
1598 }

```

(End definition for `_stex_modules_end_module:.`)

The core environment

```

1599 \iffalse \begin{stex_annotate_env} \fi %^^A make syntax highlighting work again
1600 \NewDocumentEnvironment { smodule } { 0 } { m } {
1601   \stex_module_setup:nn{#1}{#2}
1602   %\par
1603   \stex_if_smsmode:F{
1604     \tl_if_empty:NF \smoduletitle {
1605       \exp_args:No \stex_document_title:n \smoduletitle
1606     }

```



```

1607 \tl_clear:N \l_tmpa_tl
1608 \clist_map_inline:Nn \smodulotype {
1609   \tl_if_exist:cT {__stex_modules_smodule_##1_start:}{
1610     \tl_set:Nn \l_tmpa_tl {\use:c{__stex_modules_smodule_##1_start:}}
1611   }
1612 }
1613 \tl_if_empty:NTF \l_tmpa_tl {
1614   \__stex_modules_smodule_start:
1615 }{
1616   \l_tmpa_tl
1617 }
1618 }
1619 \__stex_modules_begin_module:
1620 \str_if_empty:NF \smoduleid {
1621   \stex_ref_new_doc_target:n \smoduleid
1622 }
1623 \stex_smsmode_do:
1624 } {
1625   \__stex_modules_end_module:
1626   \stex_if_smsmode:F {
1627     \end{stex_annotate_env}
1628     \clist_set:Nn \l_tmpa_clist \smodulotype
1629     \tl_clear:N \l_tmpa_tl
1630     \clist_map_inline:Nn \l_tmpa_clist {
1631       \tl_if_exist:cT {__stex_modules_smodule_##1_end:}{
1632         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_modules_smodule_##1_end:}}
1633       }
1634     }
1635     \tl_if_empty:NTF \l_tmpa_tl {
1636       \__stex_modules_smodule_end:
1637     }{
1638       \l_tmpa_tl
1639     }
1640   }
1641 }

```

\stexpatchmodule

```

1642 \cs_new_protected:Nn \__stex_modules_smodule_start: {}
1643 \cs_new_protected:Nn \__stex_modules_smodule_end: {}
1644
1645 \newcommand\stexpatchmodule[3] [] {
1646   \str_set:Nx \l_tmpa_str{ #1 }
1647   \str_if_empty:NTF \l_tmpa_str {
1648     \tl_set:Nn \__stex_modules_smodule_start: { #2 }
1649     \tl_set:Nn \__stex_modules_smodule_end: { #3 }
1650   }{
1651     \exp_after:wN \tl_set:Nn \csname __stex_modules_smodule_#1_start:\endcsname{ #2 }
1652     \exp_after:wN \tl_set:Nn \csname __stex_modules_smodule_#1_end:\endcsname{ #3 }
1653   }
1654 }

```

(End definition for \stexpatchmodule. This function is documented on page [72](#).)

27.2 Invoking modules

```

\STEXModule
\stex_invoke_module:n 1655 \NewDocumentCommand \STEXModule { m } {
1656   \exp_args:NNx \str_set:Nn \l_tmpa_str { #1 }
1657   \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
1658   \tl_set:Nn \l_tmpa_tl {
1659     \msg_error:nnx{stex}{error/unknownmodule}{#1}
1660   }
1661   \seq_map_inline:Nn \l_stex_all_modules_seq {
1662     \str_set:Nn \l_tmpb_str { ##1 }
1663     \str_if_eq:eeT { \l_tmpa_str } {
1664       \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
1665     } {
1666       \seq_map_break:n {
1667         \tl_set:Nn \l_tmpa_tl {
1668           \stex_invoke_module:n { ##1 }
1669         }
1670       }
1671     }
1672   }
1673   \l_tmpa_tl
1674 }
1675
1676 \cs_new_protected:Nn \stex_invoke_module:n {
1677   \stex_debug:nn{modules}{Invoking~module~#1}
1678   \peek_charcode_remove:NTF ! {
1679     \__stex_modules_invoke_uri:nN { #1 }
1680   } {
1681     \peek_charcode_remove:NTF ? {
1682       \__stex_modules_invoke_symbol:nn { #1 }
1683     } {
1684       \msg_error:nnx{stex}{error/syntax}{
1685         ?~or~!~expected~after~
1686         \c_backslash_str STEXModule{#1}
1687       }
1688     }
1689   }
1690 }
1691
1692 \cs_new_protected:Nn \__stex_modules_invoke_uri:nN {
1693   \str_set:Nn #2 { #1 }
1694 }
1695
1696 \cs_new_protected:Nn \__stex_modules_invoke_symbol:nn {
1697   \stex_invoke_symbol:n{#1?#2}
1698 }

```

(End definition for `\STEXModule` and `\stex_invoke_module:n`. These functions are documented on page 72.)

```

\stex_activate_module:n
1699 \bool_new:N \l_stex_in_meta_bool
1700 \bool_set_false:N \l_stex_in_meta_bool

```

```

1701 \cs_new_protected:Nn \stex_activate_module:n {
1702   \stex_debug:nn{modules}{Activating~module~#1}
1703   \exp_args:NNx \seq_if_in:NnF \l_stex_all_modules_seq { #1 } {
1704     \seq_put_right:Nx \l_stex_all_modules_seq { #1 }
1705     \use:c{ c_stex_module_#1_code }
1706   }
1707 }

```

(End definition for \stex_activate_module:n. This function is documented on page 73.)

```

1708 \endpackage

```

Chapter 28

STEX -Module Inheritance Implementation

```
1709 <*package>
1710
1711 %%%%%%%%%% inheritance.dtx %%%%%%%%%%
1712
```

28.1 SMS Mode

```
1713 <@@=stex_smsmode>

\g_stex_smsmode_allowedmacros_tl
\g_stex_smsmode_allowedmacros_escape_tl
\g_stex_smsmode_allowedenvs_seq

1714 \tl_new:N \g_stex_smsmode_allowedmacros_tl
1715 \tl_new:N \g_stex_smsmode_allowedmacros_escape_tl
1716 \seq_new:N \g_stex_smsmode_allowedenvs_seq
1717
1718 \tl_set:Nn \g_stex_smsmode_allowedmacros_tl {
1719   \makeatletter
1720   \makeatother
1721   \ExplSyntaxOn
1722   \ExplSyntaxOff
1723   \rustexBREAK
1724 }
1725
1726 \tl_set:Nn \g_stex_smsmode_allowedmacros_escape_tl {
1727   \symdef
1728   \importmodule
1729   \notation
1730   \symdecl
1731   \STEXexport
1732   \inlineass
1733   \inlinedef
1734   \inlineex
1735   \endinput
1736   \setnotation
```

```

1737 \copynotation
1738 \assign
1739 \renamedekl
1740 \donotcopy
1741 \instantiate
1742 \textsymdecl
1743 }
1744
1745 \exp_args:NNx \seq_set_from_clist:Nn \g_stex_smsmode_allowedenvs_seq {
1746   \tl_to_str:n {
1747     smodule,
1748     copymodule,
1749     interpretmodule,
1750     realization,
1751     sdefinition,
1752     sexample,
1753     sassertion,
1754     sparagraph,
1755     mathstructure
1756   }
1757 }

```

(End definition for `\g_stex_smsmode_allowedmacros_tl`, `\g_stex_smsmode_allowedmacros_escape_tl`, and `\g_stex_smsmode_allowedenvs_seq`. These variables are documented on page 74.)

`\stex_if_smsmode_p:`

`\stex_if_smsmode:TF`

```

1758 \bool_new:N \g__stex_smsmode_bool
1759 \bool_set_false:N \g__stex_smsmode_bool
1760 \prg_new_conditional:Nnn \stex_if_smsmode: { p, T, F, TF } {
1761   \bool_if:NTF \g__stex_smsmode_bool \prg_return_true: \prg_return_false:
1762 }

```

(End definition for `\stex_if_smsmode:TF`. This function is documented on page 74.)

`_stex_smsmode_in_smsmode:nn`

```

1763 \cs_new_protected:Nn \_stex_smsmode_in_smsmode:nn { \stex_suppress_html:n {
1764   \vbox_set:Nn \l_tmpa_box {
1765     \bool_set_eq:cN { l__stex_smsmode_#1_bool } \g__stex_smsmode_bool
1766     \bool_gset_true:N \g__stex_smsmode_bool
1767     #2
1768     \bool_gset_eq:Nc \g__stex_smsmode_bool { l__stex_smsmode_#1_bool }
1769   }
1770   \box_clear:N \l_tmpa_box
1771 } }

```

(End definition for `_stex_smsmode_in_smsmode:nn`.)

`\stex_file_in_smsmode:nn`

```

1772 \quark_new:N \q__stex_smsmode_break
1773
1774 \NewDocumentCommand \_stex_smsmode_importmodule: { 0{} m } {
1775   \seq_gput_right:Nn \l__stex_smsmode_importmodules_seq {{#1}{#2}}
1776   \stex_smsmode_do:
1777 }
1778

```

```

1779 \cs_new_protected:Nn \__stex_smsmode_module:nn {
1780   \__stex_modules_args:n{#1}
1781   \stex_if_in_module:F {
1782     \str_if_empty:NF \l_stex_module_sig_str {
1783       \stex_modules_current_namespace:
1784       \str_set:Nx \l_stex_module_name_str { #2 }
1785       \stex_if_module_exists:nF{\l_stex_module_ns_str?\l_stex_module_name_str}{
1786         \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1787         \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
1788         \seq_set_split:NnV \l_tmpb_seq . \l_tmpa_str
1789         \seq_pop_right:NN \l_tmpb_seq \l_tmpa_str % .tex
1790         \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str % <filename>
1791         \str_set:Nx \l_tmpa_str {
1792           \stex_path_to_string:N \l_tmpa_seq /
1793           \l_tmpa_str . \l_stex_module_sig_str .tex
1794         }
1795         \IfFileExists \l_tmpa_str {
1796           \exp_args:NNx \seq_gput_right:Nn \l__stex_smsmode_sigmodules_seq \l_tmpa_str
1797         }{
1798           \msg_error:nnx{stex}{error/unknownmodule}{for~signature~\l_tmpa_str}
1799         }
1800       }
1801     }
1802   }
1803 }
1804
1805 \prg_new_conditional:Nnn \__stex_smsmode_check_import_pair:nn {T,F,TF} {
1806   %\stex_debug:nn{import-pair}{\detokenize{#1}~{#2}}{
1807   \tl_if_empty:nTF{#1}{
1808     \prop_if_exist:NTF \l_stex_current_repository_prop
1809     {
1810       %\stex_debug:nn{import-pair}{in repository \prop_item:Nn \l_stex_current_repository_
1811       \prg_return_true:
1812     } {
1813       \seq_set_split:Nnn \l_tmpa_seq ? {#2}
1814       \seq_get_left:NN \l_tmpa_seq \l_tmpa_tl
1815       \tl_if_empty:NT \l_tmpa_tl {
1816         \seq_pop_left:NN \l_tmpa_seq \l_tmpa_tl
1817       }
1818       %\stex_debug:nn{import-pair}{\seq_use:Nn \l_tmpa_seq,~of~length~\seq_count:N \l_tmpa
1819       \int_compare:nNnTF {\seq_count:N \l_tmpa_seq} > 1
1820       \prg_return_true: \prg_return_false:
1821     }
1822   }\prg_return_true:
1823 }
1824
1825 \cs_new_protected:Nn \stex_file_in_smsmode:nn {
1826   \stex_filestack_push:n{#1}
1827   \seq_gclear:N \l__stex_smsmode_importmodules_seq
1828   \seq_gclear:N \l__stex_smsmode_sigmodules_seq
1829   % ----- new -----
1830   \__stex_smsmode_in_smsmode:nn{#1}{
1831     \let\importmodule\__stex_smsmode_importmodule:
1832     \let\stex_module_setup:nn\__stex_smsmode_module:nn

```

```

1833 \let\__stex_modules_begin_module:\relax
1834 \let\__stex_modules_end_module:\relax
1835 \seq_clear:N \g_stex_smsmode_allowedenvs_seq
1836 \exp_args:NNx \seq_put_right:Nn \g_stex_smsmode_allowedenvs_seq {\tl_to_str:n{smodule}}
1837 \tl_clear:N \g_stex_smsmode_allowedmacros_tl
1838 \tl_clear:N \g_stex_smsmode_allowedmacros_escape_tl
1839 \tl_put_right:Nn \g_stex_smsmode_allowedmacros_escape_tl {\importmodule}
1840 \everyeof{\q__stex_smsmode_break\noexpand}
1841 \expandafter\expandafter\expandafter
1842 \stex_smsmode_do:
1843 \csname @ @ input\endcsname "#1"\relax
1844
1845 \seq_map_inline:Nn \l__stex_smsmode_sigmodules_seq {
1846   \stex_filestack_push:n{##1}
1847   \expandafter\expandafter\expandafter
1848   \stex_smsmode_do:
1849   \csname @ @ input\endcsname "##1"\relax
1850   \stex_filestack_pop:
1851 }
1852 }
1853 % ----- new -----
1854 \__stex_smsmode_in_smsmode:nn{#1} {
1855   #2
1856   % ----- new -----
1857   \begingroup
1858   %\stex_debug:nn{smsmode}{Here:~\seq_use:Nn\l__stex_smsmode_importmodules_seq, }
1859   \seq_map_inline:Nn \l__stex_smsmode_importmodules_seq {
1860     \__stex_smsmode_check_import_pair:nnT ##1 { \begingroup
1861       \stex_import_module_uri:nn ##1
1862       \stex_import_require_module:nnnn
1863       \l_stex_import_ns_str
1864       \l_stex_import_archive_str
1865       \l_stex_import_path_str
1866       \l_stex_import_name_str \endgroup
1867     }
1868   }
1869   \endgroup
1870   \stex_debug:nn{smsmode}{Actually~loading~file~#1}
1871   % ----- new -----
1872   \everyeof{\q__stex_smsmode_break\noexpand}
1873   \expandafter\expandafter\expandafter
1874   \stex_smsmode_do:
1875   \csname @ @ input\endcsname "#1"\relax
1876 }
1877 \stex_filestack_pop:
1878 }

```

(End definition for `\stex_file_in_smsmode:nn`. This function is documented on page 75.)

`\stex_smsmode_do:` is executed on encountering `\` in smsmode. It checks whether the corresponding command is allowed and executes or ignores it accordingly:

```

1879 \cs_new_protected:Npn \stex_smsmode_do: {
1880   \stex_if_smsmode:T {
1881     \__stex_smsmode_do:w

```

```

1882 }
1883 }
1884 \cs_new_protected:Npn \__stex_smsmode_do:w #1 {
1885   \exp_args:Nx \tl_if_empty:nTF { \tl_tail:n{ #1 } }{
1886     \expandafter\if\expandafter\relax\noexpand#1
1887     \expandafter\__stex_smsmode_do_aux:N\expandafter#1
1888   \else\expandafter\__stex_smsmode_do:w\fi
1889 }{
1890   \__stex_smsmode_do:w % #1
1891 }
1892 }
1893 \cs_new_protected:Nn \__stex_smsmode_do_aux:N {
1894   \cs_if_eq:NNTF #1 \q__stex_smsmode_break {
1895     \tl_if_in:NnTF \g_stex_smsmode_allowedmacros_tl {#1} {
1896       #1\__stex_smsmode_do:w
1897     }{
1898       \tl_if_in:NnTF \g_stex_smsmode_allowedmacros_escape_tl {#1} {
1899         #1
1900       }{
1901         \cs_if_eq:NNTF \begin #1 {
1902           \__stex_smsmode_check_begin:n
1903         }{
1904           \cs_if_eq:NNTF \end #1 {
1905             \__stex_smsmode_check_end:n
1906           }{
1907             \__stex_smsmode_do:w
1908           }
1909         }
1910       }
1911     }
1912   }
1913 }
1914
1915 \cs_new_protected:Nn \__stex_smsmode_check_begin:n {
1916   \seq_if_in:NxTF \g_stex_smsmode_allowedenvs_seq { \detokenize{#1} }{
1917     \begin{#1}
1918   }{
1919     \__stex_smsmode_do:w
1920   }
1921 }
1922 \cs_new_protected:Nn \__stex_smsmode_check_end:n {
1923   \seq_if_in:NxTF \g_stex_smsmode_allowedenvs_seq { \detokenize{#1} }{
1924     \end{#1}\__stex_smsmode_do:w
1925   }{
1926     \str_if_eq:nnTF{#1}{document}{\endinput}{\__stex_smsmode_do:w}
1927   }
1928 }

```

(End definition for `\stex_smsmode_do:.` This function is documented on page [75](#).)

28.2 Inheritance

```

1929 <@@=stex_importmodule>

```


`\stex_import_module_uri:nn`

```

1930 \cs_new_protected:Nn \stex_import_module_uri:nn {
1931   \str_set:Nx \l_stex_import_archive_str { #1 }
1932   \str_set:Nn \l_stex_import_path_str { #2 }
1933
1934   \exp_args:NNNo \seq_set_split:Nnn \l_tmpb_seq ? { \l_stex_import_path_str }
1935   \seq_pop_right:NN \l_tmpb_seq \l_stex_import_name_str
1936   \str_set:Nx \l_stex_import_path_str { \seq_use:Nn \l_tmpb_seq ? }
1937
1938   \stex_modules_current_namespace:
1939   \bool_lazy_all:nTF {
1940     {\str_if_empty_p:N \l_stex_import_archive_str}
1941     {\str_if_empty_p:N \l_stex_import_path_str}
1942     {\stex_if_module_exists_p:n { \l_stex_module_ns_str ? \l_stex_import_name_str } }
1943   }{
1944     \str_set_eq:NN \l_stex_import_path_str \l_stex_module_subpath_str
1945     \str_set_eq:NN \l_stex_import_ns_str \l_stex_module_ns_str
1946   }{
1947     \str_if_empty:NT \l_stex_import_archive_str {
1948       \prop_if_exist:NT \l_stex_current_repository_prop {
1949         \prop_get:NnN \l_stex_current_repository_prop { id } \l_stex_import_archive_str
1950       }
1951     }
1952     \str_if_empty:NTF \l_stex_import_archive_str {
1953       \str_if_empty:NF \l_stex_import_path_str {
1954         \stex_path_from_string:Nn \l_tmpb_seq {
1955           \l_stex_module_ns_str / .. / \l_stex_import_path_str
1956         }
1957         \str_set:Nx \l_stex_import_ns_str {\stex_path_to_string:N \l_tmpb_seq}
1958         \str_replace_once:Nnn \l_stex_import_ns_str {file://} {file:///}
1959       }
1960     }{
1961       \stex_require_repository:n \l_stex_import_archive_str
1962       \prop_get:cnN { c_stex_mathhub_\l_stex_import_archive_str_manifest_prop } { ns }
1963       \l_stex_import_ns_str
1964       \str_if_empty:NF \l_stex_import_path_str {
1965         \str_set:Nx \l_stex_import_ns_str {
1966           \l_stex_import_ns_str / \l_stex_import_path_str
1967         }
1968       }
1969     }
1970   }
1971 }

```

(End definition for `\stex_import_module_uri:nn`. This function is documented on page 76.)

`\l_stex_import_name_str`
`\l_stex_import_archive_str`
`\l_stex_import_path_str`
`\l_stex_import_ns_str`

Store the return values of `\stex_import_module_uri:nn`.

```

1972 \str_new:N \l_stex_import_name_str
1973 \str_new:N \l_stex_import_archive_str
1974 \str_new:N \l_stex_import_path_str
1975 \str_new:N \l_stex_import_ns_str

```

(End definition for `\l_stex_import_name_str` and others. These variables are documented on page 76.)

```

\stex_import_require_module:nnnnn {\langle ns \rangle} {\langle archive-ID \rangle} {\langle path \rangle} {\langle name \rangle}
1976 \cs_new_protected:Nn \stex_import_require_module:nnnnn {
1977   \exp_args:Nx \stex_if_module_exists:nF { #1 ? #4 } {
1978
1979     \stex_debug:nn{requiremodule}{Here:\~1:\~2:\~3:\~4}
1980
1981     \exp_args:NNxx \seq_set_split:Nnn \l_tmpa_seq {\tl_to_str:n{/}} {#4}
1982     \seq_get_left:NN \l_tmpa_seq \l_tmpc_str
1983
1984     %\stex_debug:nn{requiremodule}{Top~module:\l_tmpc_str}
1985
1986     % archive
1987     \str_set:Nx \l_tmpa_str { #2 }
1988     \str_if_empty:NTF \l_tmpa_str {
1989       \seq_set_eq:NN \l_tmpa_seq \g_stex_currentfile_seq
1990       \seq_put_right:Nn \l_tmpa_seq {...}
1991     } {
1992       \stex_path_from_string:Nn \l_tmpb_seq { \l_tmpa_str }
1993       \seq_concat:NNN \l_tmpa_seq \c_stex_mathhub_seq \l_tmpb_seq
1994       \seq_put_right:Nn \l_tmpa_seq { source }
1995     }
1996
1997     % path
1998     \str_set:Nx \l_tmpb_str { #3 }
1999     \str_if_empty:NTF \l_tmpb_str {
2000       \str_set:Nx \l_tmpa_str { \stex_path_to_string:N \l_tmpa_seq / \l_tmpc_str }
2001
2002       \ltx@ifpackageloaded{babel} {
2003         \exp_args:NNx \prop_get:NnNF \c_stex_language_abbrevs_prop
2004           { \language } \l_tmpb_str {
2005           \msg_error:nnx{stex}{error/unknownlanguage}{\language}
2006         }
2007       } {
2008         \str_clear:N \l_tmpb_str
2009       }
2010
2011       \stex_debug:nn{modules}{Checking~a1~\l_tmpa_str.\l_tmpb_str.tex}
2012       \IfFileExists{ \l_tmpa_str.\l_tmpb_str.tex }{
2013         \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.\l_tmpb_str.tex }
2014       }{
2015         \stex_debug:nn{modules}{Checking~a2~\l_tmpa_str.tex}
2016         \IfFileExists{ \l_tmpa_str.tex }{
2017           \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.tex }
2018         }{
2019           % try english as default
2020           \stex_debug:nn{modules}{Checking~a3~\l_tmpa_str.en.tex}
2021           \IfFileExists{ \l_tmpa_str.en.tex }{
2022             \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.en.tex }
2023           }{
2024             \msg_error:nnx{stex}{error/unknownmodule}{#1?#4}
2025           }
2026         }
2027       }
2028

```

```

2029 } {
2030   \seq_set_split:NnV \l_tmpb_seq / \l_tmpb_str
2031   \seq_concat:NNN \l_tmpb_seq \l_tmpa_seq \l_tmpb_seq
2032
2033   \ltx@ifpackageloaded{babel} {
2034     \exp_args:NnX \prop_get:NnNF \c_stex_language_abbrevs_prop
2035       { \language } \l_tmpb_str {
2036       \msg_error:nnx{stex}{error/unknownlanguage}{\language}
2037     }
2038   } {
2039     \str_clear:N \l_tmpb_str
2040   }
2041
2042   \stex_path_canonicalize:N \l_tmpb_seq
2043   \stex_path_to_string:NN \l_tmpb_seq \l_tmpa_str
2044
2045   \stex_debug:nn{modules}{Checking~b1~\l_tmpa_str/\l_tmpc_str.\l_tmpb_str.tex}
2046   \IfFileExists{ \l_tmpa_str/\l_tmpc_str.\l_tmpb_str.tex }{
2047     \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str/\l_tmpc_str.\l_tmpb_str.tex }
2048   }{
2049     \stex_debug:nn{modules}{Checking~b2~\l_tmpa_str/\l_tmpc_str.tex}
2050     \IfFileExists{ \l_tmpa_str/\l_tmpc_str.tex }{
2051       \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str/\l_tmpc_str.tex }
2052     }{
2053       % try english as default
2054       \stex_debug:nn{modules}{Checking~b3~\l_tmpa_str/\l_tmpc_str.en.tex}
2055       \IfFileExists{ \l_tmpa_str/\l_tmpc_str.en.tex }{
2056         \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str/\l_tmpc_str.en.tex }
2057       }{
2058         \stex_debug:nn{modules}{Checking~b4~\l_tmpa_str.\l_tmpb_str.tex}
2059         \IfFileExists{ \l_tmpa_str.\l_tmpb_str.tex }{
2060           \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.\l_tmpb_str.tex }
2061         }{
2062           \stex_debug:nn{modules}{Checking~b4~\l_tmpa_str.tex}
2063           \IfFileExists{ \l_tmpa_str.tex }{
2064             \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.tex }
2065           }{
2066             % try english as default
2067             \stex_debug:nn{modules}{Checking~b5~\l_tmpa_str.en.tex}
2068             \IfFileExists{ \l_tmpa_str.en.tex }{
2069               \str_gset:Nx \g__stex_importmodule_file_str { \l_tmpa_str.en.tex }
2070             }{
2071               \msg_error:nnx{stex}{error/unknownmodule}{#1?#4}
2072             }
2073           }
2074         }
2075       }
2076     }
2077   }
2078 }
2079
2080 \str_if_eq:eeF{\g__stex_importmodule_file_str}{\seq_use:Nn \g_stex_currentfile_seq /}{
2081   \exp_args:No \stex_file_in_smsmode:nn { \g__stex_importmodule_file_str } {
2082     \seq_clear:N \l_stex_all_modules_seq

```

```

2083     \str_clear:N \l_stex_current_module_str
2084     \str_set:Nx \l_tmpb_str { #2 }
2085     \str_if_empty:NF \l_tmpb_str {
2086       \stex_set_current_repository:n { #2 }
2087     }
2088     \stex_debug:nn{modules}{Loading~\g__stex_importmodule_file_str}
2089   }
2090
2091   \stex_if_module_exists:nF { #1 ? #4 } {
2092     \msg_error:nnx{stex}{error/unknownmodule}{
2093       #1?#4~(in~file~\g__stex_importmodule_file_str)
2094     }
2095   }
2096 }
2097
2098 }
2099 \stex_activate_module:n { #1 ? #4 }
2100 }

```

(End definition for `\stex_import_require_module:nnnn`. This function is documented on page 76.)

`\importmodule`

```

2101 \NewDocumentCommand \importmodule { 0{} m } {
2102   \stex_import_module_uri:nn { #1 } { #2 }
2103   \stex_debug:nn{modules}{Importing~module:~
2104     \l_stex_import_ns_str ? \l_stex_import_name_str
2105   }
2106   \stex_import_require_module:nnnn
2107   { \l_stex_import_ns_str } { \l_stex_import_archive_str }
2108   { \l_stex_import_path_str } { \l_stex_import_name_str }
2109   \stex_if_smsmode:F {
2110     \stex_annotate_invisible:nnn
2111     {import} { \l_stex_import_ns_str ? \l_stex_import_name_str } {}
2112   }
2113   \exp_args:Nx \stex_add_to_current_module:n {
2114     \stex_import_require_module:nnnn
2115     { \l_stex_import_ns_str } { \l_stex_import_archive_str }
2116     { \l_stex_import_path_str } { \l_stex_import_name_str }
2117   }
2118   \exp_args:Nx \stex_add_import_to_current_module:n {
2119     \l_stex_import_ns_str ? \l_stex_import_name_str
2120   }
2121   \stex_smsmode_do:
2122   \ignorespacesandpars
2123 }
2124 \stex_deactivate_macro:Nn \importmodule {module~environments}

```

(End definition for `\importmodule`. This function is documented on page 75.)

`\usemodule`

```

2125 \NewDocumentCommand \usemodule { 0{} m } {
2126   \stex_if_smsmode:F {
2127     \stex_import_module_uri:nn { #1 } { #2 }
2128     \stex_import_require_module:nnnn
2129     { \l_stex_import_ns_str } { \l_stex_import_archive_str }

```

```

2130 { \l_stex_import_path_str } { \l_stex_import_name_str }
2131 \stex_annotate_invisible:nnn
2132 {usemodule} {\l_stex_import_ns_str ? \l_stex_import_name_str} {}
2133 }
2134 \stex_smsmode_do:
2135 \ignorespacesandpars
2136 }

```

(End definition for \usemodule. This function is documented on page 75.)

```

2137 \cs_new_protected:Nn \stex_csl_to_imports:Nn {
2138   \tl_if_empty:nF{#2}{
2139     \clist_set:Nn \l_tmpa_clist {#2}
2140     \clist_map_inline:Nn \l_tmpa_clist {
2141       \tl_if_head_eq_charcode:nNTF {##1} [{
2142         #1 ##1
2143       }{
2144         #1{##1}
2145       }
2146     }
2147   }
2148 }
2149 \cs_generate_variant:Nn \stex_csl_to_imports:Nn {No}
2150
2151
2152 \endpackage

```

Chapter 29

STEX -Symbols Implementation

```
2153 <*package>
2154
2155 %%%%%%%%%% symbols.dtx %%%%%%%%%%
2156
    Warnings and error messages
2157 \msg_new:nnn{stex}{error/wrongargs}{
2158   args~value~in~symbol~declaration~for~#1~
2159   needs~to~be~i,~a,~b~or~B,~but~#2~given
2160 }
2161 \msg_new:nnn{stex}{error/unknownsymbol}{
2162   No~symbol~#1~found!
2163 }
2164 \msg_new:nnn{stex}{error/seqlength}{
2165   Expected~#1~arguments;~got~#2!
2166 }
2167 \msg_new:nnn{stex}{error/unknownnotation}{
2168   Unknown~notation~#1~for~#2!
2169 }
```

29.1 Symbol Declarations

```
2170 <@@=stex_symdecl>
\stex_all_symbols:n Map over all available symbols
2171 \cs_new_protected:Nn \stex_all_symbols:n {
2172   \def \__stex_symdecl_all_symbols_cs ##1 {#1}
2173   \seq_map_inline:Nn \l_stex_all_modules_seq {
2174     \seq_map_inline:cn{c_stex_module_##1_constants}{
2175       \__stex_symdecl_all_symbols_cs{##1?####1}
2176     }
2177   }
2178 }
```

(End definition for `\stex_all_symbols:n`. This function is documented on page 78.)

`\STEXsymbol`

```
2179 \NewDocumentCommand \STEXsymbol { m } {
2180   \stex_get_symbol:n { #1 }
2181   \exp_args:No
2182   \stex_invoke_symbol:n { \l_stex_get_symbol_uri_str }
2183 }
```

(End definition for `\STEXsymbol`. This function is documented on page 79.)

`symdecl` arguments:

```
2184 \keys_define:nn { stex / symdecl } {
2185   name      .str_set:x:N = \l_stex_symdecl_name_str ,
2186   local     .bool_set:N = \l_stex_symdecl_local_bool ,
2187   args      .str_set:x:N = \l_stex_symdecl_args_str ,
2188   type      .tl_set:N = \l_stex_symdecl_type_tl ,
2189   deprecate .str_set:x:N = \l_stex_symdecl_deprecate_str ,
2190   align     .str_set:N = \l_stex_symdecl_align_str , % TODO(?)
2191   gfc       .str_set:N = \l_stex_symdecl_gfc_str , % TODO(?)
2192   specializes .str_set:N = \l_stex_symdecl_specializes_str , % TODO(?)
2193   def       .tl_set:N = \l_stex_symdecl_definiens_tl ,
2194   reorder   .str_set:x:N = \l_stex_symdecl_reorder_str ,
2195   assoc     .choices:nn =
2196     {bin,binl,binr,pre,conj,pwconj}
2197     {\str_set:Nx \l_stex_symdecl_assoctype_str {\l_keys_choice_tl}}
2198 }
2199
2200 \bool_new:N \l_stex_symdecl_make_macro_bool
2201
2202 \cs_new_protected:Nn \__stex_symdecl_args:n {
2203   \str_clear:N \l_stex_symdecl_name_str
2204   \str_clear:N \l_stex_symdecl_args_str
2205   \str_clear:N \l_stex_symdecl_deprecate_str
2206   \str_clear:N \l_stex_symdecl_reorder_str
2207   \str_clear:N \l_stex_symdecl_assoctype_str
2208   \bool_set_false:N \l_stex_symdecl_local_bool
2209   \tl_clear:N \l_stex_symdecl_type_tl
2210   \tl_clear:N \l_stex_symdecl_definiens_tl
2211
2212   \keys_set:nn { stex / symdecl } { #1 }
2213 }
```

`\symdecl` Parses the optional arguments and passes them on to `\stex_symdecl_do:` (so that `\symdef` can do the same)

```
2214
2215 \NewDocumentCommand \symdecl { s m O{} } {
2216   \__stex_symdecl_args:n { #3 }
2217   \IfBooleanTF #1 {
2218     \bool_set_false:N \l_stex_symdecl_make_macro_bool
2219   } {
2220     \bool_set_true:N \l_stex_symdecl_make_macro_bool
2221   }
2222   \stex_symdecl_do:n { #2 }
2223   \stex_smsmode_do:
2224 }
```

```

2225
2226 \cs_new_protected:Nn \stex_symdecl_do:nn {
2227   \__stex_symdecl_args:n{#1}
2228   \bool_set_false:N \l_stex_symdecl_make_macro_bool
2229   \stex_symdecl_do:n{#2}
2230 }
2231
2232 \stex_deactivate_macro:Nn \symdecl {module-environments}

```

(End definition for \symdecl. This function is documented on page 77.)

\stex_symdecl_do:n

```

2233 \cs_new_protected:Nn \stex_symdecl_do:n {
2234   \stex_if_in_module:F {
2235     % TODO throw error? some default namespace?
2236   }
2237
2238   \str_if_empty:NT \l_stex_symdecl_name_str {
2239     \str_set:Nx \l_stex_symdecl_name_str { #1 }
2240   }
2241
2242   \prop_if_exist:cT { l_stex_symdecl_
2243     \l_stex_current_module_str ?
2244     \l_stex_symdecl_name_str
2245     _prop
2246   }{
2247     % TODO throw error (beware of circular dependencies)
2248   }
2249
2250   \prop_clear:N \l_tmpa_prop
2251   \prop_put:Nnx \l_tmpa_prop { module } { \l_stex_current_module_str }
2252   \seq_clear:N \l_tmpa_seq
2253   \prop_put:Nno \l_tmpa_prop { name } \l_stex_symdecl_name_str
2254   \prop_put:Nno \l_tmpa_prop { type } \l_stex_symdecl_type_tl
2255
2256   \str_if_empty:NT \l_stex_symdecl_deprecate_str {
2257     \str_if_empty:NF \l_stex_module_deprecate_str {
2258       \str_set_eq:NN \l_stex_symdecl_deprecate_str \l_stex_module_deprecate_str
2259     }
2260   }
2261   \prop_put:Nno \l_tmpa_prop { deprecate } \l_stex_symdecl_deprecate_str
2262
2263   \exp_args:No \stex_add_constant_to_current_module:n {
2264     \l_stex_symdecl_name_str
2265   }
2266
2267   % arity/args
2268   \int_zero:N \l_tmpb_int
2269
2270   \bool_set_true:N \l_tmpa_bool
2271   \str_map_inline:Nn \l_stex_symdecl_args_str {
2272     \token_case_meaning:NnF ##1 {
2273       0 {} 1 {} 2 {} 3 {} 4 {} 5 {} 6 {} 7 {} 8 {} 9 {}
2274       {\tl_to_str:n i} { \bool_set_false:N \l_tmpa_bool }

```



```

2275     {\tl_to_str:n b} { \bool_set_false:N \l_tmpa_bool }
2276     {\tl_to_str:n a} {
2277         \bool_set_false:N \l_tmpa_bool
2278         \int_incr:N \l_tmpb_int
2279     }
2280     {\tl_to_str:n B} {
2281         \bool_set_false:N \l_tmpa_bool
2282         \int_incr:N \l_tmpb_int
2283     }
2284 }{
2285     \msg_error:nnxx{stex}{error/wrongargs}{
2286         \l_stex_current_module_str ?
2287         \l_stex_symdecl_name_str
2288     }{##1}
2289 }
2290 }
2291 \bool_if:NTF \l_tmpa_bool {
2292     % possibly numeric
2293     \str_if_empty:NTF \l_stex_symdecl_args_str {
2294         \prop_put:Nnn \l_tmpa_prop { args } {}
2295         \prop_put:Nnn \l_tmpa_prop { arity } { 0 }
2296     }{
2297         \int_set:Nn \l_tmpa_int { \l_stex_symdecl_args_str }
2298         \prop_put:Nnx \l_tmpa_prop { arity } { \int_use:N \l_tmpa_int }
2299         \str_clear:N \l_tmpa_str
2300         \int_step_inline:nn \l_tmpa_int {
2301             \str_put_right:Nn \l_tmpa_str i
2302         }
2303         \prop_put:Nnx \l_tmpa_prop { args } { \l_tmpa_str }
2304     }
2305 } {
2306     \prop_put:Nnx \l_tmpa_prop { args } { \l_stex_symdecl_args_str }
2307     \prop_put:Nnx \l_tmpa_prop { arity }
2308     { \str_count:N \l_stex_symdecl_args_str }
2309 }
2310 \prop_put:Nnx \l_tmpa_prop { assocs } { \int_use:N \l_tmpb_int }
2311
2312 \tl_if_empty:NTF \l_stex_symdecl_definiens_tl {
2313     \prop_put:Nnx \l_tmpa_prop { defined }{ false }
2314 }{
2315     \prop_put:Nnx \l_tmpa_prop { defined }{ true }
2316 }
2317
2318 % semantic macro
2319
2320 \bool_if:NT \l_stex_symdecl_make_macro_bool {
2321     \exp_args:Nx \stex_do_up_to_module:n {
2322         \tl_set:cn { #1 } { \stex_invoke_symbol:n {
2323             \l_stex_current_module_str ? \l_stex_symdecl_name_str
2324         }}
2325     }
2326 }
2327
2328 \stex_debug:nn{symbols}{New~symbol:~

```

```

2329 \l_stex_current_module_str ? \l_stex_symdecl_name_str^^J
2330 Type:~\exp_not:o { \l_stex_symdecl_type_tl }^^J
2331 Args:~\prop_item:Nn \l_tmpa_prop { args }^^J
2332 Definiens:~\exp_not:o {\l_stex_symdecl_definiens_tl}
2333 }
2334
2335 % circular dependencies require this:
2336 \stex_if_do_html:T {
2337   \stex_annotate_invisible:nnn {symdecl} {
2338     \l_stex_current_module_str ? \l_stex_symdecl_name_str
2339   } {
2340     \tl_if_empty:NF \l_stex_symdecl_type_tl {
2341       \stex_annotate_invisible:nnn{type}{\l_stex_symdecl_type_tl$}
2342     }
2343     \stex_annotate_invisible:nnn{args}{\prop_item:Nn \l_tmpa_prop { args }}{ }
2344     \stex_annotate_invisible:nnn{macroname}{#1}{ }
2345     \tl_if_empty:NF \l_stex_symdecl_definiens_tl {
2346       \stex_annotate_invisible:nnn{definiens}{ }
2347       {\l_stex_symdecl_definiens_tl$}
2348     }
2349     \str_if_empty:NF \l_stex_symdecl_assoc_type_str {
2350       \stex_annotate_invisible:nnn{assoc_type}{\l_stex_symdecl_assoc_type_str}{ }
2351     }
2352     \str_if_empty:NF \l_stex_symdecl_reorder_str {
2353       \stex_annotate_invisible:nnn{reorderargs}{\l_stex_symdecl_reorder_str}{ }
2354     }
2355   }
2356 }
2357 \prop_if_exist:cF {
2358   \l_stex_symdecl_
2359   \l_stex_current_module_str ? \l_stex_symdecl_name_str
2360   _prop
2361 } {
2362   \bool_if:NTF \l_stex_symdecl_local_bool \stex_do_up_to_module:x \stex_execute_in_module:
2363   \__stex_symdecl_restore_symbol:nnnnnnn
2364   {\l_stex_symdecl_name_str}
2365   { \prop_item:Nn \l_tmpa_prop {args} }
2366   { \prop_item:Nn \l_tmpa_prop {arity} }
2367   { \prop_item:Nn \l_tmpa_prop {assocs} }
2368   { \prop_item:Nn \l_tmpa_prop {defined} }
2369   {\bool_if:NT \l_stex_symdecl_make_macro_bool {#1} }
2370   {\l_stex_current_module_str}
2371 }
2372 }
2373 }
2374 \cs_new_protected:Nn \__stex_symdecl_restore_symbol:nnnnnnn {
2375   \prop_clear:N \l_tmpa_prop
2376   \prop_put:Nnn \l_tmpa_prop { module } { #7 }
2377   \prop_put:Nnn \l_tmpa_prop { name } { #1 }
2378   \prop_put:Nnn \l_tmpa_prop { args } { #2 }
2379   \prop_put:Nnn \l_tmpa_prop { arity } { #3 }
2380   \prop_put:Nnn \l_tmpa_prop { assocs } { #4 }
2381   \prop_put:Nnn \l_tmpa_prop { defined } { #5 }
2382   \tl_if_empty:nF{#6}{

```

```

2383   \tl_set:cx{#6}{\stex_invoke_symbol:n{\detokenize{#7 ? #1}}}
2384 }
2385 \prop_set_eq:cN{l_stex_symdecl_ \detokenize{#7 ? #1} _prop}\l_tmpa_prop
2386 \seq_clear:c{l_stex_symdecl_ \detokenize{#7 ? #1} _notations}
2387 }

```

(End definition for \stex_symdecl_do:n. This function is documented on page 78.)

\textsymdecl

```

2388
2389 \keys_define:nn { stex / textsymdecl } {
2390   name      .str_set_x:N = \l__stex_symdecl_name_str ,
2391   type      .tl_set:N    = \l__stex_symdecl_type_tl
2392 }
2393
2394 \cs_new_protected:Nn \_stex_textsymdecl_args:n {
2395   \str_clear:N \l__stex_symdecl_name_str
2396   \tl_clear:N \l__stex_symdecl_type_tl
2397   \keys_set:nn { stex / textsymdecl } { #1 }
2398 }
2399
2400 \NewDocumentCommand \textsymdecl {m O{} m} {
2401   \_stex_textsymdecl_args:n { #2 }
2402   \str_if_empty:NTF \l__stex_symdecl_name_str {
2403     \__stex_symdecl_args:n{name=#1,#2}
2404   }{
2405     \__stex_symdecl_args:n{#2}
2406   }
2407   \bool_set_true:N \l_stex_symdecl_make_macro_bool
2408   \stex_symdecl_do:n{#1-sym}
2409   \stex_execute_in_module:n{
2410     \cs_set_nopar:cpn{#1name}{
2411       \ifvmode\hbox_unpack:N\c_empty_box\fi
2412       \hbox{#3}\xspace
2413     }
2414     \cs_set_nopar:cpn{#1}{
2415       \ifmmode\csname#1-sym\expandafter\endcsname\else
2416       \ifvmode\hbox_unpack:N\c_empty_box\fi
2417       \symref{#1-sym}{\hbox{#3}}\expandafter\xspace
2418       \fi
2419     }
2420   }
2421   \stex_execute_in_module:x{
2422     \__stex_notation_restore_notation:nnnnn
2423     {\l_stex_current_module_str?\tl_if_empty:NTF\l__stex_symdecl_name_str{#1}\l__stex_symdecl
2424     }{0}
2425     {\exp_not:n{\STEXInternalTermMathOMSiiii{\STEXInternalCurrentSymbolStr}{}}{\neginfprec}{
2426       \comp{\hbox{#3}}\STEXInternalSymbolAfterInvokationTL
2427     }}}}
2428   {}
2429 }
2430 \stex_smsmode_do:
2431 }

```

(End definition for \textsymdecl. This function is documented on page ??.)

`\stex_get_symbol:n`

```
2432 \str_new:N \l_stex_get_symbol_uri_str
2433
2434 \cs_new_protected:Nn \stex_get_symbol:n {
2435   \tl_if_head_eq_catcode:nNTF { #1 } \relax {
2436     \tl_set:Nn \l_tmpa_tl { #1 }
2437     \__stex_symdecl_get_symbol_from_cs:
2438   }{
2439     % argument is a string
2440     % is it a command name?
2441     \cs_if_exist:cTF { #1 }{
2442       \cs_set_eq:Nc \l_tmpa_tl { #1 }
2443       \str_set:Nx \l_tmpa_str { \cs_argument_spec:N \l_tmpa_tl }
2444       \str_if_empty:NTF \l_tmpa_str {
2445         \exp_args:Nx \cs_if_eq:NNTF {
2446           \tl_head:N \l_tmpa_tl
2447         } \stex_invoke_symbol:n {
2448           \__stex_symdecl_get_symbol_from_cs:
2449         }{
2450           \__stex_symdecl_get_symbol_from_string:n { #1 }
2451         }
2452       } {
2453         \__stex_symdecl_get_symbol_from_string:n { #1 }
2454       }
2455     }{
2456       % argument is not a command name
2457       \__stex_symdecl_get_symbol_from_string:n { #1 }
2458       % \l_stex_all_symbols_seq
2459     }
2460   }
2461   \str_if_eq:eeF {
2462     \prop_item:cn {
2463       l_stex_symdecl\l_stex_get_symbol_uri_str _prop
2464     }{ deprecate }
2465   }{}{
2466     \msg_warning:nxxx{stex}{warning/deprecated}{
2467       Symbol~\l_stex_get_symbol_uri_str
2468     }{
2469       \prop_item:cn {l_stex_symdecl\l_stex_get_symbol_uri_str _prop}{ deprecate }
2470     }
2471   }
2472 }
2473
2474 \cs_new_protected:Nn \__stex_symdecl_get_symbol_from_string:n {
2475   \tl_set:Nn \l_tmpa_tl {
2476     \msg_error:nnn{stex}{error/unknownsymbol}{#1}
2477   }
2478   \str_set:Nn \l_tmpa_str { #1 }
2479
2480   %\int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
2481
2482   \str_if_in:NnTF \l_tmpa_str ? {
2483     \exp_args:NNno \seq_set_split:Nnn \l_tmpa_seq ? \l_tmpa_str
2484     \seq_pop_right:NN \l_tmpa_seq \l_tmpa_str
```

```

2485 \str_set:Nx \l_tmpb_str {\seq_use:Nn \l_tmpa_seq ?}
2486 }{
2487 \str_clear:N \l_tmpb_str
2488 }
2489 \str_if_empty:NTF \l_tmpb_str {
2490 \seq_map_inline:Nn \l_stex_all_modules_seq {
2491 \seq_map_inline:cn{c_stex_module_###1_constants}{
2492 \exp_args:Nno \str_if_eq:nnT{####1} \l_tmpa_str {
2493 \seq_map_break:n{\seq_map_break:n{
2494 \tl_set:Nn \l_tmpa_tl {
2495 \str_set:Nn \l_stex_get_symbol_uri_str { ##1 ? ####1 }
2496 }
2497 }}
2498 }
2499 }
2500 }
2501 }{
2502 \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpb_str }
2503 \seq_map_inline:Nn \l_stex_all_modules_seq {
2504 \str_if_eq:eeT{ \l_tmpb_str }{ \str_range:nnn {##1}{-\l_tmpa_int}{-1}}{
2505 \seq_map_inline:cn{c_stex_module_###1_constants}{
2506 \exp_args:Nno \str_if_eq:nnT{####1} \l_tmpa_str {
2507 \seq_map_break:n{\seq_map_break:n{
2508 \tl_set:Nn \l_tmpa_tl {
2509 \str_set:Nn \l_stex_get_symbol_uri_str { ##1 ? ####1 }
2510 }
2511 }}
2512 }
2513 }
2514 }
2515 }
2516 }
2517
2518 \l_tmpa_tl
2519 }
2520
2521 \cs_new_protected:Nn \_stex_symdecl_get_symbol_from_cs: {
2522 \exp_args:NNx \tl_set:Nn \l_tmpa_tl
2523 { \tl_tail:N \l_tmpa_tl }
2524 \tl_if_single:NTF \l_tmpa_tl {
2525 \exp_args:No \tl_if_head_is_group:nTF \l_tmpa_tl {
2526 \exp_after:wN \str_set:Nn \exp_after:wN
2527 \l_stex_get_symbol_uri_str \l_tmpa_tl
2528 }{
2529 % TODO
2530 % tail is not a single group
2531 }
2532 }{
2533 % TODO
2534 % tail is not a single group
2535 }
2536 }

```

(End definition for `\stex_get_symbol:n`. This function is documented on page 78.)

29.2 Notations

```

2537 <@@=stex_notation>

      notation arguments:
2538 \keys_define:nn { stex / notation } {
2539 % lang .tl_set_x:N = \l__stex_notation_lang_str ,
2540 variant .tl_set_x:N = \l__stex_notation_variant_str ,
2541 prec .str_set_x:N = \l__stex_notation_prec_str ,
2542 op .tl_set:N = \l__stex_notation_op_tl ,
2543 primary .bool_set:N = \l__stex_notation_primary_bool ,
2544 primary .default:n = {true} ,
2545 unknown .code:n = \str_set:Nx
2546     \l__stex_notation_variant_str \l_keys_key_str
2547 }
2548
2549 \cs_new_protected:Nn \stex_notation_args:n {
2550 % \str_clear:N \l__stex_notation_lang_str
2551 \str_clear:N \l__stex_notation_variant_str
2552 \str_clear:N \l__stex_notation_prec_str
2553 \tl_clear:N \l__stex_notation_op_tl
2554 \bool_set_false:N \l__stex_notation_primary_bool
2555
2556 \keys_set:nn { stex / notation } { #1 }
2557 }

\notation

2558 \NewDocumentCommand \notation { s m O{} } {
2559     \stex_notation_args:n { #3 }
2560     \tl_clear:N \l_stex_symdecl_definiens_tl
2561     \stex_get_symbol:n { #2 }
2562     \tl_set:Nn \l_stex_notation_after_do_tl {
2563         \__stex_notation_final:
2564         \IfBooleanTF#1{
2565             \stex_setnotation:n {\l_stex_get_symbol_uri_str}
2566         }{}
2567         \stex_smsmode_do:\ignorespacesandpars
2568     }
2569     \stex_notation_do:nnnnn
2570     { \prop_item:cn {l_stex_symdecl\l_stex_get_symbol_uri_str_prop} { args } }
2571     { \prop_item:cn { l_stex_symdecl\l_stex_get_symbol_uri_str_prop } { arity } }
2572     { \l__stex_notation_variant_str }
2573     { \l__stex_notation_prec_str }
2574 }
2575 \stex_deactivate_macro:Nn \notation {module-environments}

(End definition for \notation. This function is documented on page 78.)

\stex_notation_do:nnnnn

2576 \seq_new:N \l__stex_notation_precedences_seq
2577 \tl_new:N \l__stex_notation_opprec_tl
2578 \int_new:N \l__stex_notation_currarg_int
2579 \tl_new:N \STEXInternalSymbolAfterInvokationTL
2580
2581 \cs_new_protected:Nn \stex_notation_do:nnnnn {

```

```

2582 \let\STEXInternalCurrentSymbolStr\relax
2583 \seq_clear:N \l__stex_notation_precedences_seq
2584 \tl_clear:N \l__stex_notation_opprec_tl
2585 \str_set:Nx \l__stex_notation_args_str { #1 }
2586 \str_set:Nx \l__stex_notation_arity_str { #2 }
2587 \str_set:Nx \l__stex_notation_suffix_str { #3 }
2588 \str_set:Nx \l__stex_notation_prec_str { #4 }
2589
2590 % precedences
2591 \str_if_empty:NTF \l__stex_notation_prec_str {
2592   \int_compare:nNnTF \l__stex_notation_arity_str = 0 {
2593     \tl_set:No \l__stex_notation_opprec_tl { \neginfprec }
2594   }{
2595     \tl_set:Nn \l__stex_notation_opprec_tl { 0 }
2596   }
2597 } {
2598   \str_if_eq:onTF \l__stex_notation_prec_str {nobrackets}{
2599     \tl_set:No \l__stex_notation_opprec_tl { \neginfprec }
2600     \int_step_inline:nn { \l__stex_notation_arity_str } {
2601       \exp_args:NNo
2602       \seq_put_right:Nn \l__stex_notation_precedences_seq { \infprec }
2603     }
2604   }{
2605     \seq_set_split:NnV \l_tmpa_seq ; \l__stex_notation_prec_str
2606     \seq_pop_left:NNTF \l_tmpa_seq \l_tmpa_str {
2607       \tl_set:No \l__stex_notation_opprec_tl { \l_tmpa_str }
2608       \seq_pop_left:NNT \l_tmpa_seq \l_tmpa_str {
2609         \exp_args:NNNo \exp_args:NNno \seq_set_split:Nnn
2610           \l_tmpa_seq {\tl_to_str:n{x}} { \l_tmpa_str }
2611         \seq_map_inline:Nn \l_tmpa_seq {
2612           \seq_put_right:Nn \l_tmpb_seq { ##1 }
2613         }
2614       }
2615     }{
2616       \int_compare:nNnTF \l__stex_notation_arity_str = 0 {
2617         \tl_set:No \l__stex_notation_opprec_tl { \infprec }
2618       }{
2619         \tl_set:No \l__stex_notation_opprec_tl { 0 }
2620       }
2621     }
2622   }
2623 }
2624
2625 \seq_set_eq:NN \l_tmpa_seq \l__stex_notation_precedences_seq
2626 \int_step_inline:nn { \l__stex_notation_arity_str } {
2627   \seq_pop_left:NNTF \l_tmpa_seq \l_tmpb_str {
2628     \exp_args:NNo
2629     \seq_put_right:No \l__stex_notation_precedences_seq {
2630       \l__stex_notation_opprec_tl
2631     }
2632   }
2633 }
2634 \tl_clear:N \l__stex_notation_dummyargs_tl
2635

```

```

2636 \int_compare:nNnTF \l__stex_notation_arity_str = 0 {
2637   \exp_args:NNe
2638   \cs_set:Npn \l_stex_notation_macrocode_cs {
2639     \STEXInternalTermMathOMSiiii { \STEXInternalCurrentSymbolStr }
2640     { \l__stex_notation_suffix_str }
2641     { \l__stex_notation_opprec_tl }
2642     { \exp_not:n { #5 } }
2643   }
2644   \l_stex_notation_after_do_tl
2645 }{
2646   \str_if_in:NnTF \l__stex_notation_args_str b {
2647     \exp_args:Nne \use:nn
2648     {
2649       \cs_generate_from_arg_count:NNnn \l_stex_notation_macrocode_cs
2650       \cs_set:Npn \l__stex_notation_arity_str } { {
2651         \STEXInternalTermMathOMBiiii { \STEXInternalCurrentSymbolStr }
2652         { \l__stex_notation_suffix_str }
2653         { \l__stex_notation_opprec_tl }
2654         { \exp_not:n { #5 } }
2655       }}
2656   }{
2657     \str_if_in:NnTF \l__stex_notation_args_str B {
2658       \exp_args:Nne \use:nn
2659       {
2660         \cs_generate_from_arg_count:NNnn \l_stex_notation_macrocode_cs
2661         \cs_set:Npn \l__stex_notation_arity_str } { {
2662           \STEXInternalTermMathOMBiiii { \STEXInternalCurrentSymbolStr }
2663           { \l__stex_notation_suffix_str }
2664           { \l__stex_notation_opprec_tl }
2665           { \exp_not:n { #5 } }
2666         } }
2667     }{
2668       \exp_args:Nne \use:nn
2669       {
2670         \cs_generate_from_arg_count:NNnn \l_stex_notation_macrocode_cs
2671         \cs_set:Npn \l__stex_notation_arity_str } { {
2672           \STEXInternalTermMathOMAiiii { \STEXInternalCurrentSymbolStr }
2673           { \l__stex_notation_suffix_str }
2674           { \l__stex_notation_opprec_tl }
2675           { \exp_not:n { #5 } }
2676         } }
2677     }
2678   }
2679
2680   \str_set_eq:NN \l__stex_notation_remaining_args_str \l__stex_notation_args_str
2681   \int_zero:N \l__stex_notation_currarg_int
2682   \seq_set_eq:NN \l__stex_notation_remaining_precs_seq \l__stex_notation_precedences_seq
2683   \__stex_notation_arguments:
2684 }
2685 }

```

(End definition for \stex_notation_do:nnnnn. This function is documented on page ??.)

`__stex_notation_arguments:` Takes care of annotating the arguments in a notation macro


```

2686 \cs_new_protected:Nn \__stex_notation_arguments: {
2687   \int_incr:N \l__stex_notation_currarg_int
2688   \str_if_empty:NTF \l__stex_notation_remaining_args_str {
2689     \l_stex_notation_after_do_tl
2690   }{
2691     \str_set:Nx \l_tmpa_str { \str_head:N \l__stex_notation_remaining_args_str }
2692     \str_set:Nx \l__stex_notation_remaining_args_str { \str_tail:N \l__stex_notation_remaini
2693     \str_if_eq:VnTF \l_tmpa_str a {
2694       \__stex_notation_argument_assoc:nn{a}
2695     }{
2696       \str_if_eq:VnTF \l_tmpa_str B {
2697         \__stex_notation_argument_assoc:nn{B}
2698       }{
2699         \seq_pop_left:NN \l__stex_notation_remaining_precs_seq \l_tmpb_str
2700         \tl_put_right:Nx \l_stex_notation_dummyargs_tl {
2701           { \STEXInternalTermMathArgiii
2702             { \l_tmpa_str\int_use:N \l__stex_notation_currarg_int }
2703             { \l_tmpb_str }
2704             { ####\int_use:N \l__stex_notation_currarg_int }
2705           }
2706         }
2707         \__stex_notation_arguments:
2708       }
2709     }
2710   }
2711 }

```

(End definition for __stex_notation_arguments:.)

__stex_notation_argument_assoc:nn

```

2712 \cs_new_protected:Nn \__stex_notation_argument_assoc:nn {
2713
2714   \cs_generate_from_arg_count:NNnn \l_tmpa_cs \cs_set:Npn
2715     {\l__stex_notation_arity_str}{
2716       #2
2717     }
2718   \int_zero:N \l_tmpa_int
2719   \tl_clear:N \l_tmpa_tl
2720   \str_map_inline:Nn \l__stex_notation_args_str {
2721     \int_incr:N \l_tmpa_int
2722     \tl_put_right:Nx \l_tmpa_tl {
2723       \str_if_eq:nnTF {##1}{a}{ {} }{
2724         \str_if_eq:nnTF {##1}{B}{ {} }{
2725           {\_stex_term_arg:nn{##1}\int_use:N \l_tmpa_int}{##### \int_use:N \l_tmpa
2726         }
2727       }
2728     }
2729   }
2730   \exp_after:wN\exp_after:wN\exp_after:wN \def
2731   \exp_after:wN\exp_after:wN\exp_after:wN \l_tmpa_cs
2732   \exp_after:wN\exp_after:wN\exp_after:wN ##
2733   \exp_after:wN\exp_after:wN\exp_after:wN 1
2734   \exp_after:wN\exp_after:wN\exp_after:wN ##
2735   \exp_after:wN\exp_after:wN\exp_after:wN 2

```

```

2736 \exp_after:wN\exp_after:wN\exp_after:wN {
2737   \exp_after:wN \exp_after:wN \exp_after:wN
2738   \exp_not:n \exp_after:wN \exp_after:wN \exp_after:wN {
2739     \exp_after:wN \l_tmpa_cs \l_tmpa_tl
2740   }
2741 }
2742
2743 \seq_pop_left:NN \l__stex_notation_remaining_precs_seq \l_tmpa_str
2744 \tl_put_right:Nx \l_stex_notation_dummyargs_tl { {
2745   \STEXInternalTermMathAssocArgiiii
2746   { #1\int_use:N \l__stex_notation_currarg_int }
2747   { \l_tmpa_str }
2748   { ####\int_use:N \l__stex_notation_currarg_int }
2749   { \l_tmpa_cs {####1} {####2} }
2750 } }
2751 \__stex_notation_arguments:
2752 }

```

(End definition for __stex_notation_argument_assoc:nn.)

__stex_notation_final: Called after processing all notation arguments

```

2753 \cs_new_protected:Nn \__stex_notation_restore_notation:nnnnn {
2754   \cs_generate_from_arg_count:cNnn{stex_notation_\detokenize{#1} \c_hash_str \detokenize{#2}}
2755   \cs_set_nopar:Npn {#3}{#4}
2756   \tl_if_empty:nF {#5}{
2757     \tl_set:cn{stex_op_notation_\detokenize{#1} \c_hash_str \detokenize{#2}_cs}{\comp{ #5 }
2758   }
2759   \seq_if_exist:cT { l_stex_symdecl_\detokenize{#1} _notations }{
2760     \seq_put_right:cx { l_stex_symdecl_\detokenize{#1} _notations } { \detokenize{#2} }
2761   }
2762 }
2763
2764 \cs_new_protected:Nn \__stex_notation_final: {
2765
2766   \stex_execute_in_module:x {
2767     \__stex_notation_restore_notation:nnnnn
2768     {\l_stex_get_symbol_uri_str}
2769     {\l__stex_notation_suffix_str}
2770     {\l__stex_notation_arity_str}
2771     {
2772       \exp_after:wN \exp_after:wN \exp_after:wN
2773       \exp_not:n \exp_after:wN \exp_after:wN \exp_after:wN
2774       { \exp_after:wN \l_stex_notation_macrocode_cs \l_stex_notation_dummyargs_tl \STEXInt
2775     }
2776     {\exp_args:No \exp_not:n \l__stex_notation_op_tl }
2777   }
2778
2779   \stex_debug:nn{symbols}{
2780     Notation~\l__stex_notation_suffix_str
2781     ~for~\l_stex_get_symbol_uri_str^^J
2782     Operator~precedence:~\l__stex_notation_opprec_tl^^J
2783     Argument~precedences:~
2784     \seq_use:Nn \l__stex_notation_precedences_seq {,~}^^J
2785     Notation: \cs_meaning:c {

```

```

2786     stex_notation_ \l_stex_get_symbol_uri_str \c_hash_str
2787     \l__stex_notation_suffix_str
2788     _cs
2789 }
2790 }
2791 % HTML annotations
2792 \stex_if_do_html:T {
2793   \stex_annotate_invisible:nnn { notation }
2794   { \l_stex_get_symbol_uri_str } {
2795     \stex_annotate_invisible:nnn { notationfragment }
2796     { \l__stex_notation_suffix_str }{}
2797     \stex_annotate_invisible:nnn { precedence }
2798     { \l__stex_notation_prec_str }{}
2799
2800     \int_zero:N \l_tmpa_int
2801     \str_set_eq:NN \l__stex_notation_remaining_args_str \l__stex_notation_args_str
2802     \tl_clear:N \l_tmpa_tl
2803     \int_step_inline:nn { \l__stex_notation_arity_str }{
2804       \int_incr:N \l_tmpa_int
2805       \str_set:Nx \l_tmpb_str { \str_head:N \l__stex_notation_remaining_args_str }
2806       \str_set:Nx \l__stex_notation_remaining_args_str { \str_tail:N \l__stex_notation_rema
2807       \str_if_eq:VnTF \l_tmpb_str a {
2808         \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
2809           \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
2810           \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
2811         } }
2812       }{
2813         \str_if_eq:VnTF \l_tmpb_str B {
2814           \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
2815             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
2816             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
2817           } }
2818         }{
2819           \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
2820             \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int}{}
2821           } }
2822         }
2823       }
2824     }
2825     \stex_annotate_invisible:nnn { notationcomp }{}{
2826       \str_set:Nx \STEXInternalCurrentSymbolStr {\l_stex_get_symbol_uri_str }
2827       $ \exp_args:Nno \use:nn { \use:c {
2828         stex_notation_ \STEXInternalCurrentSymbolStr
2829         \c_hash_str \l__stex_notation_suffix_str _cs
2830       } } { \l_tmpa_tl } $
2831     }
2832     \tl_if_empty:NF \l__stex_notation_op_tl {
2833       \stex_annotate_invisible:nnn { notationopcomp }{}{
2834         $\l__stex_notation_op_tl$
2835       }
2836     }
2837   }
2838 }
2839 }

```

(End definition for `_stex_notation_final:`)

`\setnotation`

```

2840 \keys_define:nn { stex / setnotation } {
2841   % lang      .tl_set_x:N = \l__stex_notation_lang_str ,
2842   variant .tl_set_x:N = \l__stex_notation_variant_str ,
2843   unknown .code:n      = \str_set:Nx
2844     \l__stex_notation_variant_str \l_keys_key_str
2845 }
2846
2847 \cs_new_protected:Nn \stex_setnotation_args:n {
2848   % \str_clear:N \l__stex_notation_lang_str
2849   \str_clear:N \l__stex_notation_variant_str
2850   \keys_set:nn { stex / setnotation } { #1 }
2851 }
2852
2853 \cs_new_protected:Nn \__stex_notation_setnotation:nn {
2854   \seq_if_exist:cT{l_stex_symdecl_#1_notations}{
2855     \seq_remove_all:cn { l_stex_symdecl_#1_notations }{ #2 }
2856     \seq_put_left:cn { l_stex_symdecl_#1_notations }{ #2 }
2857   }
2858 }
2859
2860 \cs_new_protected:Nn \stex_setnotation:n {
2861   \exp_args:Nnx \seq_if_in:cnTF { l_stex_symdecl_#1_notations }
2862     { \l__stex_notation_variant_str }{
2863     \stex_execute_in_module:x{ \__stex_notation_setnotation:nn {#1}{\l__stex_notation_vari
2864     \stex_debug:nn {notations}{
2865       Setting~default~notation~
2866       {\l__stex_notation_variant_str }~for~
2867       #1 \\
2868       \expandafter\meaning\csname
2869       l_stex_symdecl_#1_notations\endcsname
2870     }
2871   }{
2872     \msg_error:nxxx{stex}{unknownnotation}{\l__stex_notation_variant_str}{#1}
2873   }
2874 }
2875
2876 \NewDocumentCommand \setnotation {m m} {
2877   \stex_get_symbol:n { #1 }
2878   \stex_setnotation_args:n { #2 }
2879   \stex_setnotation:n{\l_stex_get_symbol_uri_str}
2880   \stex_smsmode_do:\ignorespacesandpars
2881 }
2882
2883 \cs_new_protected:Nn \stex_copy_notations:nn {
2884   \stex_debug:nn {notations}{
2885     Copying~notations~from~#2~to~#1\\
2886     \seq_use:cn{l_stex_symdecl_#2_notations}{,~}
2887   }
2888   \tl_clear:N \l_tmpa_tl
2889   \int_step_inline:nn { \prop_item:cn {l_stex_symdecl_#2_prop}{ arity } } {
2890     \tl_put_right:Nn \l_tmpa_tl { {##### #1} }

```

```

2891 }
2892 \seq_map_inline:cn {l_stex_symdecl_#2_notations}{\begingroup
2893   \stex_debug:nn{Here}{Here:~##1}
2894   \cs_set_eq:Nc \l_tmpa_cs { stex_notation_ #2 \c_hash_str ##1 _cs }
2895   \edef \l_tmpa_tl {
2896     \exp_after:wN\exp_after:wN\exp_after:wN \exp_not:n
2897     \exp_after:wN\exp_after:wN\exp_after:wN {
2898       \exp_after:wN \l_tmpa_cs \l_tmpa_tl
2899     }
2900   }
2901
2902   \exp_after:wN \def \exp_after:wN \l_tmpa_tl
2903   \exp_after:wN #####\exp_after:wN 1 \exp_after:wN #####\exp_after:wN 2
2904   \exp_after:wN { \l_tmpa_tl }
2905
2906   \edef \l_tmpa_tl {
2907     \exp_after:wN \exp_not:n \exp_after:wN {
2908       \l_tmpa_tl {##### 1}{##### 2}
2909     }
2910   }
2911
2912   \stex_debug:nn{Here}{Here:~\expandafter\detokenize\expandafter{\l_tmpa_tl}}
2913
2914   \stex_execute_in_module:x {
2915     \__stex_notation_restore_notation:nnnnn
2916     {#1}{##1}
2917     { \prop_item:cn {l_stex_symdecl_#2_prop}{ arity } }
2918     { \exp_after:wN\exp_not:n\exp_after:wN{\l_tmpa_tl} }
2919     {
2920       \cs_if_exist:cT{stex_op_notation_ #2\c_hash_str ##1 _cs}{
2921         \exp_args:NNo\exp_args:No\exp_not:n{\csname stex_op_notation_ #2\c_hash_str ##1
2922       }
2923     }
2924   }\endgroup
2925 }
2926 }
2927
2928 \NewDocumentCommand \copynotation {m m} {
2929   \stex_get_symbol:n { #1 }
2930   \str_set_eq:NN \l_tmpa_str \l_stex_get_symbol_uri_str
2931   \stex_get_symbol:n { #2 }
2932   \exp_args:Noo
2933   \stex_copy_notations:nn \l_tmpa_str \l_stex_get_symbol_uri_str
2934   \stex_smsmode_do:\ignorespacesandpars
2935 }
2936

```

(End definition for \setnotation. This function is documented on page 19.)

\symdef

```

2937 \keys_define:nn { stex / symdef } {
2938   name      .str_set_x:N = \l_stex_symdecl_name_str ,
2939   local     .bool_set:N = \l_stex_symdecl_local_bool ,
2940   args      .str_set_x:N = \l_stex_symdecl_args_str ,

```

```

2941 type .tl_set:N = \l_stex_symdecl_type_tl ,
2942 def .tl_set:N = \l_stex_symdecl_definiens_tl ,
2943 reorder .str_set_x:N = \l_stex_symdecl_reorder_str ,
2944 op .tl_set:N = \l__stex_notation_op_tl ,
2945 % lang .str_set_x:N = \l__stex_notation_lang_str ,
2946 variant .str_set_x:N = \l__stex_notation_variant_str ,
2947 prec .str_set_x:N = \l__stex_notation_prec_str ,
2948 assoc .choices:nn =
2949 {bin,binl,binr,pre,conj,pwconj}
2950 {\str_set:Nx \l_stex_symdecl_assoctype_str {\l_keys_choice_tl}},
2951 unknown .code:n = \str_set:Nx
2952 \l__stex_notation_variant_str \l_keys_key_str
2953 }
2954
2955 \cs_new_protected:Nn \__stex_notation_symdef_args:n {
2956 \str_clear:N \l_stex_symdecl_name_str
2957 \str_clear:N \l_stex_symdecl_args_str
2958 \str_clear:N \l_stex_symdecl_assoctype_str
2959 \str_clear:N \l_stex_symdecl_reorder_str
2960 \bool_set_false:N \l_stex_symdecl_local_bool
2961 \tl_clear:N \l_stex_symdecl_type_tl
2962 \tl_clear:N \l_stex_symdecl_definiens_tl
2963 % \str_clear:N \l__stex_notation_lang_str
2964 \str_clear:N \l__stex_notation_variant_str
2965 \str_clear:N \l__stex_notation_prec_str
2966 \tl_clear:N \l__stex_notation_op_tl
2967
2968 \keys_set:nn { stex / symdef } { #1 }
2969 }
2970
2971 \NewDocumentCommand \symdef { m O{} } {
2972 \__stex_notation_symdef_args:n { #2 }
2973 \bool_set_true:N \l_stex_symdecl_make_macro_bool
2974 \stex_symdecl_do:n { #1 }
2975 \tl_set:Nn \l_stex_notation_after_do_tl {
2976 \__stex_notation_final:
2977 \stex_smsmode_do:\ignorespacesandpars
2978 }
2979 \str_set:Nx \l_stex_get_symbol_uri_str {
2980 \l_stex_current_module_str ? \l_stex_symdecl_name_str
2981 }
2982 \exp_args:Nx \stex_notation_do:nnnnn
2983 { \prop_item:cn {l_stex_symdecl_\l_stex_get_symbol_uri_str _prop } { args } }
2984 { \prop_item:cn { l_stex_symdecl_\l_stex_get_symbol_uri_str _prop } { arity } }
2985 { \l__stex_notation_variant_str }
2986 { \l__stex_notation_prec_str }
2987 }
2988 \stex_deactivate_macro:Nn \symdef {module~environments}

```

(End definition for `\symdef`. This function is documented on page 78.)

29.3 Variables

```

2989 <@@=stex_variables>

```

```

2990
2991 \keys_define:nn { stex / vardef } {
2992   name      .str_set_x:N = \l__stex_variables_name_str ,
2993   args      .str_set_x:N = \l__stex_variables_args_str ,
2994   type      .tl_set:N    = \l__stex_variables_type_tl ,
2995   def       .tl_set:N    = \l__stex_variables_def_tl ,
2996   op        .tl_set:N    = \l__stex_variables_op_tl ,
2997   prec      .str_set_x:N = \l__stex_variables_prec_str ,
2998   reorder   .str_set_x:N = \l__stex_variables_reorder_str ,
2999   assoc     .choices:nn  =
3000     {bin,binl,binr,pre,conj,pwconj}
3001     {\str_set:Nx \l__stex_variables_assoctype_str {\l_keys_choice_tl}},
3002   bind      .choices:nn  =
3003     {forall,exists}
3004     {\str_set:Nx \l__stex_variables_bind_str {\l_keys_choice_tl}}
3005 }
3006
3007 \cs_new_protected:Nn \__stex_variables_args:n {
3008   \str_clear:N \l__stex_variables_name_str
3009   \str_clear:N \l__stex_variables_args_str
3010   \str_clear:N \l__stex_variables_prec_str
3011   \str_clear:N \l__stex_variables_assoctype_str
3012   \str_clear:N \l__stex_variables_reorder_str
3013   \str_clear:N \l__stex_variables_bind_str
3014   \tl_clear:N \l__stex_variables_type_tl
3015   \tl_clear:N \l__stex_variables_def_tl
3016   \tl_clear:N \l__stex_variables_op_tl
3017
3018   \keys_set:nn { stex / vardef } { #1 }
3019 }
3020
3021 \NewDocumentCommand \__stex_variables_do_simple:nnn { m O{}} {
3022   \__stex_variables_args:n {#2}
3023   \str_if_empty:NT \l__stex_variables_name_str {
3024     \str_set:Nx \l__stex_variables_name_str { #1 }
3025   }
3026   \prop_clear:N \l_tmpa_prop
3027   \prop_put:Nno \l_tmpa_prop { name } \l__stex_variables_name_str
3028
3029   \int_zero:N \l_tmpb_int
3030   \bool_set_true:N \l_tmpa_bool
3031   \str_map_inline:Nn \l__stex_variables_args_str {
3032     \token_case_meaning:NnF ##1 {
3033       0 {} 1 {} 2 {} 3 {} 4 {} 5 {} 6 {} 7 {} 8 {} 9 {}
3034       {\tl_to_str:n i} { \bool_set_false:N \l_tmpa_bool }
3035       {\tl_to_str:n b} { \bool_set_false:N \l_tmpa_bool }
3036       {\tl_to_str:n a} {
3037         \bool_set_false:N \l_tmpa_bool
3038         \int_incr:N \l_tmpb_int
3039       }
3040       {\tl_to_str:n B} {
3041         \bool_set_false:N \l_tmpa_bool
3042         \int_incr:N \l_tmpb_int
3043       }

```

```

3044     }{
3045         \msg_error:nnxx{stex}{error/wrongargs}{
3046             variable~\l__stex_variables_name_str
3047         }{##1}
3048     }
3049 }
3050 \bool_if:NTF \l_tmpa_bool {
3051     % possibly numeric
3052     \str_if_empty:NTF \l__stex_variables_args_str {
3053         \prop_put:Nnn \l_tmpa_prop { args } {}
3054         \prop_put:Nnn \l_tmpa_prop { arity } { 0 }
3055     }{
3056         \int_set:Nn \l_tmpa_int { \l__stex_variables_args_str }
3057         \prop_put:Nnx \l_tmpa_prop { arity } { \int_use:N \l_tmpa_int }
3058         \str_clear:N \l_tmpa_str
3059         \int_step_inline:nn \l_tmpa_int {
3060             \str_put_right:Nn \l_tmpa_str i
3061         }
3062         \str_set_eq:NN \l__stex_variables_args_str \l_tmpa_str
3063         \prop_put:Nnx \l_tmpa_prop { args } { \l__stex_variables_args_str }
3064     }
3065 } {
3066     \prop_put:Nnx \l_tmpa_prop { args } { \l__stex_variables_args_str }
3067     \prop_put:Nnx \l_tmpa_prop { arity }
3068     { \str_count:N \l__stex_variables_args_str }
3069 }
3070 \prop_put:Nnx \l_tmpa_prop { assoc } { \int_use:N \l_tmpb_int }
3071 \tl_set:cx { #1 }{ \stex_invoke_variable:n { \l__stex_variables_name_str } }
3072
3073 \prop_set_eq:cN { l_stex_variable_\l__stex_variables_name_str _prop } \l_tmpa_prop
3074
3075 \tl_if_empty:NF \l__stex_variables_op_tl {
3076     \cs_set:cpx {
3077         stex_var_op_notation_\l__stex_variables_name_str _cs
3078     } { \exp_not:N\comp{ \exp_args:No \exp_not:n { \l__stex_variables_op_tl } } }
3079 }
3080
3081 \tl_set:Nn \l_stex_notation_after_do_tl {
3082     \exp_args:Nne \use:nn {
3083         \cs_generate_from_arg_count:cNnn { stex_var_notation_\l__stex_variables_name_str _cs }
3084         \cs_set:Npn { \prop_item:Nn \l_tmpa_prop { arity } }
3085     } {{
3086         \exp_after:wN \exp_after:wN \exp_after:wN
3087         \exp_not:n \exp_after:wN \exp_after:wN \exp_after:wN
3088         { \exp_after:wN \l_stex_notation_macrocode_cs \l_stex_notation_dummyargs_tl \STEXInter
3089     }}
3090 \stex_if_do_html:T {
3091     \stex_annotate_invisible:nnn {vardecl}{\l__stex_variables_name_str}{
3092         \stex_annotate_invisible:nnn { precedence }
3093         { \l__stex_variables_prec_str }{}
3094         \tl_if_empty:NF \l__stex_variables_type_tl {\stex_annotate_invisible:nnn{type}{}}{ $\l
3095         \stex_annotate_invisible:nnn{args}{ \l__stex_variables_args_str }{}
3096         \stex_annotate_invisible:nnn{macroname}{#1}{}
3097         \tl_if_empty:NF \l__stex_variables_def_tl {

```



```

3098     \stex_annotate_invisible:nnn{definiens}{}
3099     {${\l__stex_variables_def_tl$}
3100   }
3101   \str_if_empty:NF \l__stex_variables_assoctype_str {
3102     \stex_annotate_invisible:nnn{assoctype}{\l__stex_variables_assoctype_str}{}
3103   }
3104   \str_if_empty:NF \l__stex_variables_reorder_str {
3105     \stex_annotate_invisible:nnn{reorderargs}{\l__stex_variables_reorder_str}{}
3106   }
3107   \int_zero:N \l_tmpa_int
3108   \str_set_eq:NN \l__stex_variables_remaining_args_str \l__stex_variables_args_str
3109   \tl_clear:N \l_tmpa_tl
3110   \int_step_inline:nn { \prop_item:Nn \l_tmpa_prop { arity } }{
3111     \int_incr:N \l_tmpa_int
3112     \str_set:Nx \l_tmpb_str { \str_head:N \l__stex_variables_remaining_args_str }
3113     \str_set:Nx \l__stex_variables_remaining_args_str { \str_tail:N \l__stex_variables
3114     \str_if_eq:VnTF \l_tmpb_str a {
3115       \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3116         \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
3117         \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
3118       } }
3119     }{
3120       \str_if_eq:VnTF \l_tmpb_str B {
3121         \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3122           \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int a}{} ,
3123           \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int b}{}
3124         } }
3125       }{
3126         \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3127           \stex_annotate:nnn{argmarker}{\int_use:N \l_tmpa_int}{}
3128         } }
3129       }
3130     }
3131   }
3132   \stex_annotate_invisible:nnn { notationcomp }{}{
3133     \str_set:Nx \STEXInternalCurrentSymbolStr {var://\l__stex_variables_name_str }
3134     $ \exp_args:Nno \use:nn { \use:c {
3135       stex_var_notation_\l__stex_variables_name_str_cs
3136     } } { \l_tmpa_tl } $
3137   }
3138   \tl_if_empty:NF \l__stex_variables_op_tl {
3139     \stex_annotate_invisible:nnn { notationopcomp }{}{
3140       ${\l__stex_variables_op_tl$}
3141     }
3142   }
3143   }
3144   \str_if_empty:NF \l__stex_variables_bind_str {
3145     \stex_annotate_invisible:nnn {bindtype}{\l__stex_variables_bind_str,\l__stex_variab
3146   }
3147   }\ignorespacesandpars
3148 }
3149
3150 \stex_notation_do:nnnnn { \l__stex_variables_args_str } { \prop_item:Nn \l_tmpa_prop { ari
3151 }

```

```

3152
3153 \cs_new:Nn \_stex_reset:N {
3154   \tl_if_exist:NTF #1 {
3155     \def \exp_not:N #1 { \exp_args:No \exp_not:n #1 }
3156   }{
3157     \let \exp_not:N #1 \exp_not:N \undefined
3158   }
3159 }
3160
3161 \NewDocumentCommand \__stex_variables_do_complex:nn { m m }{
3162   \clist_set:Nx \l__stex_variables_names { \tl_to_str:n {#1} }
3163   \exp_args:Nnx \use:nn {
3164     % TODO
3165     \stex_annotate_invisible:nnn {vardecl}{\clist_use:Nn\l__stex_variables_names,}{
3166       #2
3167     }
3168   }{
3169     \_stex_reset:N \varnot
3170     \_stex_reset:N \vartype
3171     \_stex_reset:N \vardefi
3172   }
3173 }
3174
3175 \NewDocumentCommand \vardef { s } {
3176   \IfBooleanTF#1 {
3177     \__stex_variables_do_complex:nn
3178   }{
3179     \__stex_variables_do_simple:nnn
3180   }
3181 }
3182
3183 \NewDocumentCommand \svar { 0{} m }{
3184   \tl_if_empty:nTF {#1}{
3185     \str_set:Nn \l_tmpa_str { #2 }
3186   }{
3187     \str_set:Nn \l_tmpa_str { #1 }
3188   }
3189   \_stex_term_omv:nn {
3190     var://\l_tmpa_str
3191   }{
3192     \exp_args:Nnx \use:nn {
3193       \def\comp{\_varcomp}
3194       \str_set:Nx \STEXInternalCurrentSymbolStr { var://\l_tmpa_str }
3195       \comp{ #2 }
3196     }{
3197       \_stex_reset:N \comp
3198       \_stex_reset:N \STEXInternalCurrentSymbolStr
3199     }
3200   }
3201 }
3202
3203
3204
3205 \keys_define:nn { stex / varseq } {

```

```

3206 name      .str_set_x:N = \l__stex_variables_name_str ,
3207 args      .int_set:N = \l__stex_variables_args_int ,
3208 type      .tl_set:N = \l__stex_variables_type_tl ,
3209 mid       .tl_set:N = \l__stex_variables_mid_tl ,
3210 bind      .choices:nn =
3211           {forall,exists}
3212           {\str_set:Nx \l__stex_variables_bind_str {\l_keys_choice_tl}}
3213 }
3214
3215 \cs_new_protected:Nn \__stex_variables_seq_args:n {
3216   \str_clear:N \l__stex_variables_name_str
3217   \int_set:Nn \l__stex_variables_args_int 1
3218   \tl_clear:N \l__stex_variables_type_tl
3219   \str_clear:N \l__stex_variables_bind_str
3220
3221   \keys_set:nn { stex / varseq } { #1 }
3222 }
3223
3224 \NewDocumentCommand \varseq {m O{} m m m}{
3225   \__stex_variables_seq_args:n { #2 }
3226   \str_if_empty:NT \l__stex_variables_name_str {
3227     \str_set:Nx \l__stex_variables_name_str { #1 }
3228   }
3229   \prop_clear:N \l_tmpa_prop
3230   \prop_put:Nnx \l_tmpa_prop { arity }{\int_use:N \l__stex_variables_args_int}
3231
3232   \seq_set_from_clist:Nn \l_tmpa_seq {#3}
3233   \int_compare:nNnF {\seq_count:N \l_tmpa_seq} = \l__stex_variables_args_int {
3234     \msg_error:nnxx{stex}{error/seqlength}
3235     {\int_use:N \l__stex_variables_args_int}
3236     {\seq_count:N \l_tmpa_seq}
3237   }
3238   \seq_set_from_clist:Nn \l_tmpb_seq {#4}
3239   \int_compare:nNnF {\seq_count:N \l_tmpb_seq} = \l__stex_variables_args_int {
3240     \msg_error:nnxx{stex}{error/seqlength}
3241     {\int_use:N \l__stex_variables_args_int}
3242     {\seq_count:N \l_tmpb_seq}
3243   }
3244   \prop_put:Nnn \l_tmpa_prop {starts} {#3}
3245   \prop_put:Nnn \l_tmpa_prop {ends} {#4}
3246
3247   \cs_generate_from_arg_count:cNnn {stex_varseq_\l__stex_variables_name_str _cs}
3248   \cs_set:Npn {\int_use:N \l__stex_variables_args_int} { #5 }
3249
3250   \exp_args:NNo \tl_set:No \l_tmpa_tl {\use:c{stex_varseq_\l__stex_variables_name_str _cs}}
3251   \int_step_inline:nn \l__stex_variables_args_int {
3252     \tl_put_right:Nx \l_tmpa_tl { {\seq_item:Nn \l_tmpa_seq {##1}} }
3253   }
3254   \tl_set:Nx \l_tmpa_tl {\exp_args:NNo \exp_args:No \exp_not:n{\l_tmpa_tl}}
3255   \tl_put_right:Nn \l_tmpa_tl {\,\ellipses,}
3256   \tl_if_empty:NF \l__stex_variables_mid_tl {
3257     \tl_put_right:No \l_tmpa_tl \l__stex_variables_mid_tl
3258     \tl_put_right:Nn \l_tmpa_tl {\,\ellipses,}
3259   }

```

```

3260 \exp_args:NNo \tl_set:No \l_tmpb_tl {\use:c{stex_varseq_\l__stex_variables_name_str _cs}}
3261 \int_step_inline:nn \l__stex_variables_args_int {
3262   \tl_put_right:Nx \l_tmpb_tl { {\seq_item:Nn \l_tmpb_seq {##1}} }
3263 }
3264 \tl_set:Nx \l_tmpb_tl {\exp_args:NNo \exp_args:No \exp_not:n{\l_tmpb_tl}}
3265 \tl_put_right:No \l_tmpa_tl \l_tmpb_tl
3266
3267
3268 \prop_put:Nno \l_tmpa_prop { notation }\l_tmpa_tl
3269
3270 \tl_set:cx {#1} {\stex_invoke_sequence:n {\l__stex_variables_name_str}}
3271
3272 \exp_args:NNo \tl_set:No \l_tmpa_tl {\use:c{stex_varseq_\l__stex_variables_name_str _cs}}
3273
3274 \int_step_inline:nn \l__stex_variables_args_int {
3275   \tl_set:Nx \l_tmpa_tl {\exp_args:No \exp_not:n \l_tmpa_tl {
3276     \STEXInternalTermMathArgiii{i##1}{0}{\exp_not:n{####}##1}
3277   }}
3278 }
3279
3280 \tl_set:Nx \l_tmpa_tl {
3281   \STEXInternalTermMathOMaiiii { varseq://\l__stex_variables_name_str}{0}{
3282     \exp_args:NNo \exp_args:No \exp_not:n {\l_tmpa_tl}
3283   }
3284 }
3285
3286 \tl_set:No \l_tmpa_tl { \exp_after:wN { \l_tmpa_tl \STEXInternalSymbolAfterInvokationTL} }
3287
3288 \exp_args:Nno \use:nn {
3289   \cs_generate_from_arg_count:cNnn {stex_varseq_\l__stex_variables_name_str _cs}
3290   \cs_set:Npn {\int_use:N \l__stex_variables_args_int}{\l_tmpa_tl}
3291
3292   \stex_debug:nn{sequences}{New~Sequence:~
3293     \expandafter\meaning\csname stex_varseq_\l__stex_variables_name_str _cs\endcsname\\~\\
3294     \prop_to_keyval:N \l_tmpa_prop
3295   }
3296   \stex_if_do_html:T{\stex_annotate_invisible:nnn{varseq}{\l__stex_variables_name_str}{
3297     \tl_if_empty:NF \l__stex_variables_type_tl {
3298       \stex_annotate:nnn {type}{\l__stex_variables_type_tl$}
3299     }
3300     \stex_annotate:nnn {args}{\int_use:N \l__stex_variables_args_int}{}
3301     \str_if_empty:NF \l__stex_variables_bind_str {
3302       \stex_annotate:nnn {bindtype}{\l__stex_variables_bind_str}{}
3303     }
3304     \stex_annotate:nnn{startindex}{\l__stex_variables_startindex}{\l__stex_variables_endindex}
3305     \stex_annotate:nnn{endindex}{\l__stex_variables_endindex}{\l__stex_variables_startindex}
3306
3307     \tl_clear:N \l_tmpa_tl
3308     \int_step_inline:nn \l__stex_variables_args_int {
3309       \tl_set:Nx \l_tmpa_tl { \l_tmpa_tl {
3310         \stex_annotate:nnn{argmarker}{##1}{}
3311       } }
3312     }
3313     \stex_annotate_invisible:nnn { notationcomp }{}{

```

```

3314     \str_set:Nx \STEXInternalCurrentSymbolStr {varseq://\l__stex_variables_name_str }
3315     $ \exp_args:Nno \use:nn { \use:c {
3316         stex_varseq_\l__stex_variables_name_str _cs
3317     } } { \l_tmpa_tl } $
3318 }
3319
3320 }}
3321
3322 \prop_set_eq:cN {stex_varseq_\l__stex_variables_name_str _prop}\l_tmpa_prop
3323 \ignorespacesandpars
3324 }
3325
3326 </package>

```

Chapter 30

STEX -Terms Implementation

```
3327 <*package>
3328
3329 %%%%%%%%%%% terms.dtx %%%%%%%%%%%
3330
3331 <@@=stex_terms>
3332
3333   Warnings and error messages
3334   \msg_new:nnn{stex}{error/nonotation}{
3335     Symbol~#1~invoked,~but~has~no~notation#2!
3336   }
3337   \msg_new:nnn{stex}{error/notationarg}{
3338     Error~in~parsing~notation~#1
3339   }
3340   \msg_new:nnn{stex}{error/noop}{
3341     Symbol~#1~has~no~operator~notation~for~notation~#2
3342   }
3343   \msg_new:nnn{stex}{error/notallowed}{
3344     Symbol~invocation~#1~not~allowed~in~notation~component~of~#2
3345   }
3346   \msg_new:nnn{stex}{error/doubleargument}{
3347     Argument~#1~of~symbol~#2~already~assigned
3348   }
3349   \msg_new:nnn{stex}{error/overarity}{
3350     Argument~#1~invalid~for~symbol~#2~with~arity~#3
3351   }
```

30.1 Symbol Invocations

`\stex_invoke_symbol:n` Invokes a semantic macro

```
3351
3352
3353 \bool_new:N \l_stex_allow_semantic_bool
3354 \bool_set_true:N \l_stex_allow_semantic_bool
3355
```

```

3356 \cs_new_protected:Nn \stex_invoke_symbol:n {
3357   \ifvmode\indent\fi
3358   \bool_if:NTF \l_stex_allow_semantic_bool {
3359     \str_if_eq:eeF {
3360       \prop_item:cn {
3361         l_stex_symdecl_#1_prop
3362       }{ deprecate }
3363     }{}{
3364       \msg_warning:nxxx{stex}{warning/deprecated}{
3365         Symbol~#1
3366       }{
3367         \prop_item:cn {l_stex_symdecl_#1_prop}{ deprecate }
3368       }
3369     }
3370     \if_mode_math:
3371       \exp_after:wN \__stex_terms_invoke_math:n
3372     \else:
3373       \exp_after:wN \__stex_terms_invoke_text:n
3374     \fi: { #1 }
3375   }{
3376     \msg_error:nxxx{stex}{error/notallowed}{#1}{\STEXInternalCurrentSymbolStr}
3377   }
3378 }
3379
3380 \cs_new_protected:Nn \__stex_terms_invoke_text:n {
3381   \peek_charcode_remove:NTF ! {
3382     \__stex_terms_invoke_op_custom:nn {#1}
3383   }{
3384     \__stex_terms_invoke_custom:nn {#1}
3385   }
3386 }
3387
3388 \cs_new_protected:Nn \__stex_terms_invoke_math:n {
3389   \peek_charcode_remove:NTF ! {
3390     % operator
3391     \peek_charcode_remove:NTF * {
3392       % custom op
3393       \__stex_terms_invoke_op_custom:nn {#1}
3394     }{
3395       % op notation
3396       \peek_charcode:NTF [ {
3397         \__stex_terms_invoke_op_notation:nw {#1}
3398       }{
3399         \__stex_terms_invoke_op_notation:nw {#1}[]
3400       }
3401     }
3402   }{
3403     \peek_charcode_remove:NTF * {
3404       \__stex_terms_invoke_custom:nn {#1}
3405       % custom
3406     }{
3407       % normal
3408       \peek_charcode:NTF [ {
3409         \__stex_terms_invoke_notation:nw {#1}

```

```

3410     }{
3411         \__stex_terms_invoke_notation:nw {#1}[]
3412     }
3413 }
3414 }
3415 }
3416
3417
3418 \cs_new_protected:Nn \__stex_terms_invoke_op_custom:nn {
3419     \exp_args:Nnx \use:nn {
3420         \def\comp{\_comp}
3421         \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3422         \bool_set_false:N \l_stex_allow_semantic_bool
3423         \stex_term_oms:nnn {#1}{#1 \c_hash_str CUSTOM-}{
3424             \comp{ #2 }
3425         }
3426     }{
3427         \stex_reset:N \comp
3428         \stex_reset:N \STEXInternalCurrentSymbolStr
3429         \bool_set_true:N \l_stex_allow_semantic_bool
3430     }
3431 }
3432
3433 \keys_define:nn { stex / terms } {
3434     % lang .tl_set_x:N = \l_stex_notation_lang_str ,
3435     variant .tl_set_x:N = \l_stex_notation_variant_str ,
3436     unknown .code:n      = \str_set:Nx
3437         \l_stex_notation_variant_str \l_keys_key_str
3438 }
3439
3440 \cs_new_protected:Nn \__stex_terms_args:n {
3441     % \str_clear:N \l_stex_notation_lang_str
3442     \str_clear:N \l_stex_notation_variant_str
3443
3444     \keys_set:nn { stex / terms } { #1 }
3445 }
3446
3447 \cs_new_protected:Nn \stex_find_notation:nn {
3448     \__stex_terms_args:n { #2 }
3449     \seq_if_empty:cTF {
3450         l_stex_symdecl_ #1 _notations
3451     } {
3452         \msg_error:nnxx{stex}{error/nonotation}{#1}{s}
3453     } {
3454         \str_if_empty:NTF \l_stex_notation_variant_str {
3455             \seq_get_left:cN {l_stex_symdecl_#1_notations}\l_stex_notation_variant_str
3456         }{
3457             \seq_if_in:cxTF {l_stex_symdecl_#1_notations}{
3458                 \l_stex_notation_variant_str
3459             }{
3460                 % \str_set:Nx \l_stex_notation_variant_str { \l_stex_notation_variant_str \c_hash_str
3461             }{
3462                 \msg_error:nnxx{stex}{error/nonotation}{#1}{
3463                     ~\l_stex_notation_variant_str

```



```

3464     }
3465   }
3466 }
3467 }
3468 }
3469
3470 \cs_new_protected:Npn \__stex_terms_invoke_op_notation:nw #1 [#2] {
3471   \exp_args:Nnx \use:nn {
3472     \def\comp{\_comp}
3473     \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3474     \stex_find_notation:nn { #1 }{ #2 }
3475     \bool_set_false:N \l_stex_allow_semantic_bool
3476     \cs_if_exist:cTF {
3477       stex_op_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs
3478     }{
3479       \_stex_term_oms:nnn { #1 }{
3480         #1 \c_hash_str \l_stex_notation_variant_str
3481       }{
3482         \use:c{stex_op_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs}
3483       }
3484     }{
3485       \int_compare:nNnTF {\prop_item:cn {\l_stex_symdecl_#1_prop}{arity}} = 0{
3486         \cs_if_exist:cTF {
3487           stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs
3488         }{
3489           \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
3490             \_stex_reset:N \comp
3491             \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
3492             \_stex_reset:N \STEXInternalCurrentSymbolStr
3493             \bool_set_true:N \l_stex_allow_semantic_bool
3494           }
3495           \def\comp{\_comp}
3496           \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3497           \bool_set_false:N \l_stex_allow_semantic_bool
3498           \use:c{stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs}
3499         }{
3500           \msg_error:nnxx{stex}{error/nonotation}{#1}{
3501             ~\l_stex_notation_variant_str
3502           }
3503         }
3504       }{
3505         \msg_error:nnxx{stex}{error/noop}{#1}{\l_stex_notation_variant_str}
3506       }
3507     }
3508   }{
3509     \_stex_reset:N \comp
3510     \_stex_reset:N \STEXInternalCurrentSymbolStr
3511     \bool_set_true:N \l_stex_allow_semantic_bool
3512   }
3513 }
3514
3515 \cs_new_protected:Npn \__stex_terms_invoke_notation:nw #1 [#2] {
3516   \stex_find_notation:nn { #1 }{ #2 }
3517   \cs_if_exist:cTF {

```

```

3518     stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs
3519   }{
3520     \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
3521       \_stex_reset:N \comp
3522       \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
3523       \_stex_reset:N \STEXInternalCurrentSymbolStr
3524       \bool_set_true:N \l_stex_allow_semantic_bool
3525     }
3526     \def\comp{\_comp}
3527     \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3528     \bool_set_false:N \l_stex_allow_semantic_bool
3529     \use:c{stex_notation_ #1 \c_hash_str \l_stex_notation_variant_str _cs}
3530   }{
3531     \msg_error:nnxx{stex}{error/nonotation}{#1}{
3532       ~\l_stex_notation_variant_str
3533     }
3534   }
3535 }
3536
3537 \prop_new:N \l__stex_terms_custom_args_prop
3538
3539 \cs_new_protected:Nn \__stex_terms_custom_comp:n { \bool_set_false:N \l_stex_allow_semantic_bool }
3540
3541 \cs_new_protected:Nn \__stex_terms_invoke_custom:nn {
3542   \exp_args:Nnx \use:nn {
3543     \def\comp{\_stex_terms_custom_comp:n}
3544     \str_set:Nn \STEXInternalCurrentSymbolStr { #1 }
3545     \prop_clear:N \l__stex_terms_custom_args_prop
3546     \prop_put:Nnn \l__stex_terms_custom_args_prop {currnum} {1}
3547     \prop_get:cnN {
3548       l_stex_symdecl_#1 _prop
3549     } { args } \l_tmpa_str
3550     \prop_put:Nno \l__stex_terms_custom_args_prop {args} \l_tmpa_str
3551     \tl_set:Nn \arg { \_stex_terms_arg: }
3552     \str_if_empty:NTF \l_tmpa_str {
3553       \_stex_term oms:nnn {#1}{#1\c_hash_str CUSTOM-}{\ignorespaces#2}
3554     }{
3555       \str_if_in:NnTF \l_tmpa_str b {
3556         \_stex_term ombind:nnn {#1}{#1\c_hash_str CUSTOM-\l_tmpa_str}{\ignorespaces#2}
3557       }{
3558         \str_if_in:NnTF \l_tmpa_str B {
3559           \_stex_term ombind:nnn {#1}{#1\c_hash_str CUSTOM-\l_tmpa_str}{\ignorespaces#2}
3560         }{
3561           \_stex_term oma:nnn {#1}{#1\c_hash_str CUSTOM-\l_tmpa_str}{\ignorespaces#2}
3562         }
3563       }
3564     }
3565     % TODO check that all arguments exist
3566   }{
3567     \_stex_reset:N \STEXInternalCurrentSymbolStr
3568     \_stex_reset:N \arg
3569     \_stex_reset:N \comp
3570     \_stex_reset:N \l__stex_terms_custom_args_prop
3571     %\bool_set_true:N \l_stex_allow_semantic_bool

```

```

3572 }
3573 }
3574
3575 \NewDocumentCommand \__stex_terms_arg: { s O{} m}{
3576   \tl_if_empty:nTF {#2}{
3577     \int_set:Nn \l_tmpa_int {\prop_item:Nn \l__stex_terms_custom_args_prop {currnum}}
3578     \bool_set_true:N \l_tmpa_bool
3579     \bool_do_while:Nn \l_tmpa_bool {
3580       \exp_args:NNx \prop_if_in:NnTF \l__stex_terms_custom_args_prop {\int_use:N \l_tmpa_int
3581         \int_incr:N \l_tmpa_int
3582       }{
3583         \bool_set_false:N \l_tmpa_bool
3584       }
3585     }{
3586     }{
3587       \int_set:Nn \l_tmpa_int { #2 }
3588     }
3589     \str_set:Nx \l_tmpa_str {\prop_item:Nn \l__stex_terms_custom_args_prop {args} }
3590     \int_compare:nNnT \l_tmpa_int > {\str_count:N \l_tmpa_str} {
3591       \msg_error:nnxxx{stex}{error/overarity}
3592       {\int_use:N \l_tmpa_int}
3593       {\STEXInternalCurrentSymbolStr}
3594       {\str_count:N \l_tmpa_str}
3595     }
3596     \str_set:Nx \l_tmpa_str {\str_item:Nn \l_tmpa_str \l_tmpa_int}
3597     \exp_args:NNx \prop_if_in:NnT \l__stex_terms_custom_args_prop {\int_use:N \l_tmpa_int} {
3598       \bool_lazy_any:nF {
3599         {\str_if_eq_p:Vn \l_tmpa_str {a}}
3600         {\str_if_eq_p:Vn \l_tmpa_str {B}}
3601       }{
3602         \msg_error:nnxx{stex}{error/doubleargument}
3603         {\int_use:N \l_tmpa_int}
3604         {\STEXInternalCurrentSymbolStr}
3605       }
3606     }
3607     \exp_args:NNx \prop_put:Nnn \l__stex_terms_custom_args_prop {\int_use:N \l_tmpa_int} {\ign
3608     \bool_set_true:N \l_stex_allow_semantic_bool
3609     \IfBooleanTF#1{
3610       \stex_annotate_invisible:n { %TODO
3611         \exp_args:No \_stex_term_arg:nn {\l_tmpa_str\int_use:N \l_tmpa_int}{\ignorespaces#3}
3612       }
3613     }{ %TODO
3614       \exp_args:No \_stex_term_arg:nn {\l_tmpa_str\int_use:N \l_tmpa_int}{\ignorespaces#3}
3615     }
3616     \bool_set_false:N \l_stex_allow_semantic_bool
3617   }
3618
3619
3620   \cs_new_protected:Nn \_stex_term_arg:nn {
3621     \bool_set_true:N \l_stex_allow_semantic_bool
3622     \stex_annotate:nnn{ arg }{ #1 }{ #2 }
3623     \bool_set_false:N \l_stex_allow_semantic_bool
3624   }
3625

```

```

3626 \cs_new_protected:Npn \STEXInternalTermMathArgiii #1#2#3 {
3627   \exp_args:Nnx \use:nn
3628     { \int_set:Nn \l__stex_terms_downprec { #2 }
3629       \stex_term_arg:nn { #1 }{ #3 }
3630     }
3631   { \int_set:Nn \exp_not:N \l__stex_terms_downprec { \int_use:N \l__stex_terms_downprec }
3632 }

```

(End definition for `\stex_invoke_symbol:n`. This function is documented on page 79.)

`\STEXInternalTermMathAssocArgiii`

```

3633 \cs_new_protected:Npn \STEXInternalTermMathAssocArgiii #1#2#3#4 {
3634   \cs_set:Npn \l_tmpa_cs ##1 ##2 { #4 }
3635   \tl_set:Nn \l_tmpb_tl {\STEXInternalTermMathArgiii{#1}{#2}}
3636   \tl_if_empty:nTF { #3 }{
3637     \STEXInternalTermMathArgiii{#1}{#2}{}
3638   }{
3639     \exp_args:Nx \tl_if_empty:nTF { \tl_tail:n{ #3 } }{
3640       \expandafter\if\expandafter\relax\noexpand#3
3641         \tl_set:Nn \l_tmpa_tl {\__stex_terms_math_assoc_arg_maybe_sequence:Nn#3{#1}}
3642       \else
3643         \tl_set:Nn \l_tmpa_tl {\__stex_terms_math_assoc_arg_simple:nn{#1}{#3}}
3644       \fi
3645       \l_tmpa_tl
3646     }{
3647       \__stex_terms_math_assoc_arg_simple:nn{#1}{#3}
3648     }
3649   }
3650 }
3651
3652 \cs_new_protected:Nn \__stex_terms_math_assoc_arg_maybe_sequence:Nn {
3653   \str_set:Nx \l_tmpa_str { \cs_argument_spec:N #1 }
3654   \str_if_empty:NTF \l_tmpa_str {
3655     \exp_args:Nx \cs_if_eq:NNTF {
3656       \tl_head:N #1
3657     } \stex_invoke_sequence:n {
3658       \tl_set:Nx \l_tmpa_tl {\tl_tail:N #1}
3659       \str_set:Nx \l_tmpa_str {\exp_after:wN \use:n \l_tmpa_tl}
3660       \tl_set:Nx \l_tmpa_tl {\prop_item:cn {stex_varseq_\l_tmpa_str _prop}{notation}}
3661       \exp_args:NNo \seq_set_from_clist:Nn \l_tmpa_seq \l_tmpa_tl
3662       \tl_set:Nx \l_tmpa_tl {\exp_not:N \exp_not:n{
3663         \exp_not:n{\exp_args:Nnx \use:nn} {
3664           \exp_not:n {
3665             \def\comp{\_varcomp}
3666             \str_set:Nn \STEXInternalCurrentSymbolStr
3667               { \varseq://\l_tmpa_str }
3668             \exp_not:n{ ##1 }
3669           }{
3670             \exp_not:n {
3671               \_stex_reset:N \comp
3672               \_stex_reset:N \STEXInternalCurrentSymbolStr
3673             }
3674           }
3675         }}}

```

```

3676 \exp_args:Nno \use:nn {\seq_set_map:NNn \l_tmpa_seq \l_tmpa_seq} \l_tmpa_tl
3677 \seq_reverse:N \l_tmpa_seq
3678 \seq_pop:NN \l_tmpa_seq \l_tmpa_tl
3679 \seq_map_inline:Nn \l_tmpa_seq {
3680 \exp_args:NNNo \exp_args:NNo \tl_set:No \l_tmpa_tl {
3681 \exp_args:Nno
3682 \l_tmpa_cs { ##1 } \l_tmpa_tl
3683 }
3684 }
3685 \tl_set:Nx \l_tmpa_tl {
3686 \stex_term_omv:nn {varseq://\l_tmpa_str}{
3687 \exp_args:No \exp_not:n \l_tmpa_tl
3688 }
3689 }
3690 \exp_args:No\l_tmpb_tl\l_tmpa_tl
3691 }{
3692 \stex_terms_math_assoc_arg_simple:nn{#2} { #1 }
3693 }
3694 } {
3695 \stex_terms_math_assoc_arg_simple:nn{#2} { #1 }
3696 }
3697 }
3698 }
3699
3700 \cs_new_protected:Nn \stex_terms_math_assoc_arg_simple:nn {
3701 \clist_set:Nn \l_tmpa_clist{ #2 }
3702 \int_compare:nNnTF { \clist_count:N \l_tmpa_clist } < 2 {
3703 \tl_set:Nn \l_tmpa_tl { \stex_term_arg:nn{A#1}{ #2 } }
3704 }{
3705 \clist_reverse:N \l_tmpa_clist
3706 \clist_pop:NN \l_tmpa_clist \l_tmpa_tl
3707 \tl_set:Nx \l_tmpa_tl { \stex_term_arg:nn{A#1}{
3708 \exp_args:No \exp_not:n \l_tmpa_tl
3709 }}
3710 \clist_map_inline:Nn \l_tmpa_clist {
3711 \exp_args:NNNo \exp_args:NNo \tl_set:No \l_tmpa_tl {
3712 \exp_args:Nno
3713 \l_tmpa_cs { \stex_term_arg:nn{A#1}{##1} } \l_tmpa_tl
3714 }
3715 }
3716 }
3717 \exp_args:No\l_tmpb_tl\l_tmpa_tl
3718 }

```

(End definition for `\STEXInternalTermMathAssocArgiiii`. This function is documented on page 80.)

30.2 Terms

Precedences:

```

\infprec
\neginfprec
\l__stex_terms_downprec
3719 \tl_const:Nx \infprec {\int_use:N \c_max_int}
3720 \tl_const:Nx \neginfprec {-\int_use:N \c_max_int}

```

```

3721 \int_new:N \l__stex_terms_downprec
3722 \int_set_eq:NN \l__stex_terms_downprec \infp

```

(End definition for `\infp`, `\neginfp`, and `\l__stex_terms_downprec`. These variables are documented on page 80.)

Bracketing:

```

\l__stex_terms_left_bracket_str
\l__stex_terms_right_bracket_str

```

```

3723 \tl_set:Nn \l__stex_terms_left_bracket_str (
3724 \tl_set:Nn \l__stex_terms_right_bracket_str )

```

(End definition for `\l__stex_terms_left_bracket_str` and `\l__stex_terms_right_bracket_str`.)

```

\l__stex_terms_maybe_brackets:nn

```

Compares precedences and insert brackets accordingly

```

3725 \cs_new_protected:Nn \l__stex_terms_maybe_brackets:nn {
3726   \bool_if:NTF \l__stex_terms_brackets_done_bool {
3727     \bool_set_false:N \l__stex_terms_brackets_done_bool
3728     #2
3729   } {
3730     \int_compare:nNnTF { #1 } > \l__stex_terms_downprec {
3731       \bool_if:NTF \l__stex_inarray_bool { #2 } {
3732         \stex_debug:nn{dobrackets}{\number#1 > \number\l__stex_terms_downprec; \detokenize{#
3733         \dobrackets { #2 }
3734       }
3735     }{ #2 }
3736   }
3737 }

```

(End definition for `\l__stex_terms_maybe_brackets:nn`.)

\dobrackets

```

3738 \bool_new:N \l__stex_terms_brackets_done_bool
3739 %\RequirePackage{scalerel}
3740 \cs_new_protected:Npn \dobrackets #1 {
3741   %\ThisStyle{\if D\m@switch
3742   %   \exp_args:Nnx \use:nn
3743   %   { \exp_after:wN \left\l__stex_terms_left_bracket_str #1 }
3744   %   { \exp_not:N\right\l__stex_terms_right_bracket_str }
3745   %   \else
3746   %   \exp_args:Nnx \use:nn
3747   %   {
3748     \bool_set_true:N \l__stex_terms_brackets_done_bool
3749     \int_set:Nn \l__stex_terms_downprec \infp
3750     \l__stex_terms_left_bracket_str
3751     #1
3752   }
3753   {
3754     \bool_set_false:N \l__stex_terms_brackets_done_bool
3755     \l__stex_terms_right_bracket_str
3756     \int_set:Nn \l__stex_terms_downprec { \int_use:N \l__stex_terms_downprec }
3757   }
3758   %\fi}
3759 }

```

(End definition for `\dobrackets`. This function is documented on page 80.)

\withbrackets

```
3760 \cs_new_protected:Npn \withbrackets #1 #2 #3 {
3761   \exp_args:Nnx \use:nn
3762   {
3763     \tl_set:Nx \l__stex_terms_left_bracket_str { #1 }
3764     \tl_set:Nx \l__stex_terms_right_bracket_str { #2 }
3765     #3
3766   }
3767   {
3768     \tl_set:Nn \exp_not:N \l__stex_terms_left_bracket_str
3769     {\l__stex_terms_left_bracket_str}
3770     \tl_set:Nn \exp_not:N \l__stex_terms_right_bracket_str
3771     {\l__stex_terms_right_bracket_str}
3772   }
3773 }
```

(End definition for \withbrackets. This function is documented on page 80.)

\STEXinvisible

```
3774 \cs_new_protected:Npn \STEXinvisible #1 {
3775   \stex_annotate_invisible:n { #1 }
3776 }
```

(End definition for \STEXinvisible. This function is documented on page 80.)

OMDoc terms:

\STEXInternalTermMathOMSiiii

```
3777 \cs_new_protected:Nn \_stex_term_oms:nnn {
3778   \stex_annotate:nnn{ OMID }{ #2 }{
3779     #3
3780   }
3781 }
3782
3783 \cs_new_protected:Npn \STEXInternalTermMathOMSiiii #1#2#3#4 {
3784   \_stex_terms_maybe_brackets:nn { #3 }{
3785     \_stex_term_oms:nnn { #1 } { #1\c_hash_str#2 } { #4 }
3786   }
3787 }
```

(End definition for \STEXInternalTermMathOMSiiii. This function is documented on page 79.)

_stex_term_math_omv:nn

```
3788 \cs_new_protected:Nn \_stex_term_omv:nn {
3789   \stex_annotate:nnn{ OMV }{ #1 }{
3790     #2
3791   }
3792 }
```

(End definition for _stex_term_math_omv:nn. This function is documented on page ??.)

\STEXInternalTermMathOMAiiai

```
3793 \cs_new_protected:Nn \_stex_term_oma:nnn {
3794   \stex_annotate:nnn{ OMA }{ #2 }{
3795     #3
3796   }
```

```

3797 }
3798
3799 \cs_new_protected:Npn \STEXInternalTermMathOMAiiai #1#2#3#4 {
3800   \__stex_terms_maybe_brackets:nn { #3 }{
3801     \stex_term_oma:nnn { #1 } { #1\c_hash_str#2 } { #4 }
3802   }
3803 }

```

(End definition for \STEXInternalTermMathOMAiiai. This function is documented on page 79.)

\STEXInternalTermMathOMBiaiai

```

3804 \cs_new_protected:Nn \stex_term_ombind:nnn {
3805   \stex_annotate:nnn{ OMBIND }{ #2 }{
3806     #3
3807   }
3808 }
3809
3810 \cs_new_protected:Npn \STEXInternalTermMathOMBiaiai #1#2#3#4 {
3811   \__stex_terms_maybe_brackets:nn { #3 }{
3812     \stex_term_ombind:nnn { #1 } { #1\c_hash_str#2 } { #4 }
3813   }
3814 }

```

(End definition for \STEXInternalTermMathOMBiaiai. This function is documented on page 79.)

\symref
\symname

```

3815 \cs_new:Nn \stex_capitalize:n { \uppercase{#1} }
3816
3817 \keys_define:nn { stex / symname } {
3818   pre      .tl_set_x:N      = \l__stex_terms_pre_tl ,
3819   post     .tl_set_x:N      = \l__stex_terms_post_tl ,
3820   root     .tl_set_x:N      = \l__stex_terms_root_tl
3821 }
3822
3823 \cs_new_protected:Nn \stex_symname_args:n {
3824   \tl_clear:N \l__stex_terms_post_tl
3825   \tl_clear:N \l__stex_terms_pre_tl
3826   \tl_clear:N \l__stex_terms_root_str
3827   \keys_set:nn { stex / symname } { #1 }
3828 }
3829
3830 \NewDocumentCommand \symref { m m }{
3831   \let\compemph_uri_prev:\compemph@uri
3832   \let\compemph@uri\symrefemph@uri
3833   \STEXsymbol{#1}!\{ #2 }
3834   \let\compemph@uri\compemph_uri_prev:
3835 }
3836
3837 \NewDocumentCommand \synonym { O{} m m }{
3838   \stex_symname_args:n { #1 }
3839   \let\compemph_uri_prev:\compemph@uri
3840   \let\compemph@uri\symrefemph@uri
3841   % TODO
3842   \STEXsymbol{#2}!\{\l__stex_terms_pre_tl #3 \l__stex_terms_post_tl}
3843   \let\compemph@uri\compemph_uri_prev:

```



```

3844 }
3845
3846 \NewDocumentCommand \symname { 0{} m }{
3847   \stex_symname_args:n { #1 }
3848   \stex_get_symbol:n { #2 }
3849   \str_set:Nx \l_tmpa_str {
3850     \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
3851   }
3852   \exp_args:NNno \str_replace_all:Nnn \l_tmpa_str {-} {~}
3853
3854   \let\compemph_uri_prev:\compemph@uri
3855   \let\compemph@uri\symrefemph@uri
3856   \exp_args:NNx \use:nn
3857   \stex_invoke_symbol:n { { \l_stex_get_symbol_uri_str }!\ifmode*\fi{
3858     \l__stex_terms_pre_tl \l_tmpa_str \l__stex_terms_post_tl
3859   } }
3860   \let\compemph@uri\compemph_uri_prev:
3861 }
3862
3863 \NewDocumentCommand \Symname { 0{} m }{
3864   \stex_symname_args:n { #1 }
3865   \stex_get_symbol:n { #2 }
3866   \str_set:Nx \l_tmpa_str {
3867     \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
3868   }
3869   \exp_args:NNno \str_replace_all:Nnn \l_tmpa_str {-} {~}
3870   \let\compemph_uri_prev:\compemph@uri
3871   \let\compemph@uri\symrefemph@uri
3872   \exp_args:NNx \use:nn
3873   \stex_invoke_symbol:n { { \l_stex_get_symbol_uri_str }!\ifmode*\fi{
3874     \exp_after:wN \stex_capitalize:n \l_tmpa_str
3875     \l__stex_terms_post_tl
3876   } }
3877   \let\compemph@uri\compemph_uri_prev:
3878 }

```

(End definition for `\symref` and `\symname`. These functions are documented on page 79.)

30.3 Notation Components

```

3879 <@@=stex_notationcomps>

\comp
\compemph@uri 3880 \cs_new_protected:Npn \_comp #1 {
\compemph 3881   \str_if_empty:NF \STEXInternalCurrentSymbolStr {
\defemph 3882     \stex_html_backend:TF {
\defemph@uri 3883       \stex_annotate:nnn { comp }{ \STEXInternalCurrentSymbolStr }{ #1 }
\symrefemph 3884     }{
\symrefemph@uri 3885       \exp_args:Nnx \compemph@uri { #1 } { \STEXInternalCurrentSymbolStr }
\varemp 3886     }
\varemp@uri 3887   }
3888 }
3889
3890 \cs_new_protected:Npn \_varcomp #1 {

```

```

3891 \str_if_empty:NF \STEXInternalCurrentSymbolStr {
3892   \stex_html_backend:TF {
3893     \stex_annotate:nnn { varcomp }{ \STEXInternalCurrentSymbolStr }{ #1 }
3894   }{
3895     \exp_args:Nnx \varemp@uri { #1 } { \STEXInternalCurrentSymbolStr }
3896   }
3897 }
3898 }
3899
3900 \def\comp{\_comp}
3901
3902 \cs_new_protected:Npn \compemph@uri #1 #2 {
3903   \compemph{ #1 }
3904 }
3905
3906
3907 \cs_new_protected:Npn \compemph #1 {
3908   #1
3909 }
3910
3911 \cs_new_protected:Npn \defemph@uri #1 #2 {
3912   \defemph{#1}
3913 }
3914
3915 \cs_new_protected:Npn \defemph #1 {
3916   \textbf{#1}
3917 }
3918
3919 \cs_new_protected:Npn \symrefemph@uri #1 #2 {
3920   \symrefemph{#1}
3921 }
3922
3923 \cs_new_protected:Npn \symrefemph #1 {
3924   \emph{#1}
3925 }
3926
3927 \cs_new_protected:Npn \varemp@uri #1 #2 {
3928   \varemp{#1}
3929 }
3930
3931 \cs_new_protected:Npn \varemp #1 {
3932   #1
3933 }

```

(End definition for `\comp` and others. These functions are documented on page 80.)

\ellipses

```

3934 \NewDocumentCommand \ellipses {} { \ldots }

```

(End definition for `\ellipses`. This function is documented on page 80.)

```

\parray
\prmatrix 3935 \bool_new:N \l_stex_inparray_bool
\parrayline 3936 \bool_set_false:N \l_stex_inparray_bool
\parraylineh 3937 \NewDocumentCommand \parray { m m } {
\parraycell

```

```

3938 \begingroup
3939 \bool_set_true:N \l_stex_inarray_bool
3940 \begin{array}{#1}
3941 #2
3942 \end{array}
3943 \endgroup
3944 }
3945
3946 \NewDocumentCommand \prmatrix { m } {
3947 \begingroup
3948 \bool_set_true:N \l_stex_inarray_bool
3949 \begin{matrix}
3950 #1
3951 \end{matrix}
3952 \endgroup
3953 }
3954
3955 \def \maybepline {
3956 \bool_if:NT \l_stex_inarray_bool {\hline}
3957 }
3958
3959 \def \parrayline #1 #2 {
3960 #1 #2 \bool_if:NT \l_stex_inarray_bool {\}
3961 }
3962
3963 \def \pmrow #1 { \parrayline{}{ #1 } }
3964
3965 \def \parraylineh #1 #2 {
3966 #1 #2 \bool_if:NT \l_stex_inarray_bool {\hline}
3967 }
3968
3969 \def \parraycell #1 {
3970 #1 \bool_if:NT \l_stex_inarray_bool {&}
3971 }

```

(End definition for `\parray` and others. These functions are documented on page ??.)

30.4 Variables

```

3972 <@@=stex_variables>

```

`\stex_invoke_variable:n` Invokes a variable

```

3973 \cs_new_protected:Nn \stex_invoke_variable:n {
3974 \if_mode_math:
3975 \exp_after:wN \__stex_variables_invoke_math:n
3976 \else:
3977 \exp_after:wN \__stex_variables_invoke_text:n
3978 \fi: {#1}
3979 }
3980
3981 \cs_new_protected:Nn \__stex_variables_invoke_text:n {
3982 \peek_charcode_remove:NTF ! {
3983 \__stex_variables_invoke_op_custom:nn {#1}
3984 }{

```

```

3985     \__stex_variables_invoke_custom:nn {#1}
3986   }
3987 }
3988
3989
3990 \cs_new_protected:Nn \__stex_variables_invoke_math:n {
3991   \peek_charcode_remove:NTF ! {
3992     \peek_charcode_remove:NTF ! {
3993       \peek_charcode:NTF [ {
3994         % TODO throw error
3995       }{
3996         \__stex_variables_invoke_op_custom:nn
3997       }
3998     }{
3999       \__stex_variables_invoke_op:n { #1 }
4000     }
4001   }{
4002     \peek_charcode_remove:NTF * {
4003       \__stex_variables_invoke_custom:nn { #1 }
4004     }{
4005       \__stex_variables_invoke_math_ii:n { #1 }
4006     }
4007   }
4008 }
4009
4010 \cs_new_protected:Nn \__stex_variables_invoke_op_custom:nn {
4011   \exp_args:Nnx \use:nn {
4012     \def\comp{\_varcomp}
4013     \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4014     \bool_set_false:N \l_stex_allow_semantic_bool
4015     \stex_term_omv:nn {var://#1}{
4016       \comp{ #2 }
4017     }
4018   }{
4019     \stex_reset:N \comp
4020     \stex_reset:N \STEXInternalCurrentSymbolStr
4021     \bool_set_true:N \l_stex_allow_semantic_bool
4022   }
4023 }
4024
4025 \cs_new_protected:Nn \__stex_variables_invoke_op:n {
4026   \cs_if_exist:cTF {
4027     stex_var_op_notation_ #1 _cs
4028   }{
4029     \exp_args:Nnx \use:nn {
4030       \def\comp{\_varcomp}
4031       \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4032       \stex_term_omv:nn { var://#1 }{
4033         \use:c{stex_var_op_notation_ #1 _cs }
4034       }
4035     }{
4036       \stex_reset:N \comp
4037       \stex_reset:N \STEXInternalCurrentSymbolStr
4038     }

```

```

4039 }{
4040   \int_compare:nNnTF {\prop_item:cn {\l_stex_variable_#1_prop}{arity}} = 0{
4041     \__stex_variables_invoke_math_ii:n {#1}
4042   }{
4043     \msg_error:nnxx{stex}{error/noop}{variable~#1}{}
4044   }
4045 }
4046 }
4047
4048 \cs_new_protected:Npn \__stex_variables_invoke_math_ii:n #1 {
4049   \cs_if_exist:cTF {
4050     stex_var_notation_#1_cs
4051   }{
4052     \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
4053       \_stex_reset:N \comp
4054       \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
4055       \_stex_reset:N \STEXInternalCurrentSymbolStr
4056       \bool_set_true:N \l_stex_allow_semantic_bool
4057     }
4058     \def\comp{\_varcomp}
4059     \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4060     \bool_set_false:N \l_stex_allow_semantic_bool
4061     \use:c{stex_var_notation_#1_cs}
4062   }{
4063     \msg_error:nnxx{stex}{error/nonotation}{variable~#1}{s}
4064   }
4065 }
4066
4067 \cs_new_protected:Nn \__stex_variables_invoke_custom:nn {
4068   \exp_args:Nnx \use:nn {
4069     \def\comp{\_varcomp}
4070     \str_set:Nn \STEXInternalCurrentSymbolStr { var://#1 }
4071     \prop_clear:N \l__stex_terms_custom_args_prop
4072     \prop_put:Nnn \l__stex_terms_custom_args_prop {currnum} {1}
4073     \prop_get:cnN {
4074       l_stex_variable_#1_prop
4075     }{ args } \l_tmpa_str
4076     \prop_put:Nno \l__stex_terms_custom_args_prop {args} \l_tmpa_str
4077     \tl_set:Nn \arg { \__stex_terms_arg: }
4078     \str_if_empty:NTF \l_tmpa_str {
4079       \_stex_term_omv:nn {var://#1}{\ignorespaces#2}
4080     }{
4081       \str_if_in:NnTF \l_tmpa_str b {
4082         \_stex_term_ombind:nnn {var://#1}{\ignorespaces#2}
4083       }{
4084         \str_if_in:NnTF \l_tmpa_str B {
4085           \_stex_term_ombind:nnn {var://#1}{\ignorespaces#2}
4086         }{
4087           \_stex_term_oma:nnn {var://#1}{\ignorespaces#2}
4088         }
4089       }
4090     }
4091     % TODO check that all arguments exist
4092   }{

```

```

4093 \_stex_reset:N \STEXInternalCurrentSymbolStr
4094 \_stex_reset:N \arg
4095 \_stex_reset:N \comp
4096 \_stex_reset:N \l__stex_terms_custom_args_prop
4097 %\bool_set_true:N \l_stex_allow_semantic_bool
4098 }
4099 }

```

(End definition for `\stex_invoke_variable:n`. This function is documented on page ??.)

30.5 Sequences

```

4100 <@@=stex_sequences>
4101
4102 \cs_new_protected:Nn \stex_invoke_sequence:n {
4103 \peek_charcode_remove:NTF ! {
4104 \_stex_term_omv:nn {varseq://#1}{
4105 \exp_args:Nnx \use:nn {
4106 \def\comp{\_varcomp}
4107 \str_set:Nn \STEXInternalCurrentSymbolStr {varseq://#1}
4108 \prop_item:cn{stex_varseq_#1_prop}{notation}
4109 }{
4110 \_stex_reset:N \comp
4111 \_stex_reset:N \STEXInternalCurrentSymbolStr
4112 }
4113 }
4114 }{
4115 \bool_set_false:N \l_stex_allow_semantic_bool
4116 \def\comp{\_varcomp}
4117 \str_set:Nn \STEXInternalCurrentSymbolStr {varseq://#1}
4118 \tl_set:Nx \STEXInternalSymbolAfterInvokationTL {
4119 \_stex_reset:N \comp
4120 \_stex_reset:N \STEXInternalSymbolAfterInvokationTL
4121 \_stex_reset:N \STEXInternalCurrentSymbolStr
4122 \bool_set_true:N \l_stex_allow_semantic_bool
4123 }
4124 \use:c { stex_varseq_#1_cs }
4125 }
4126 }
4127 </package>

```

Chapter 31

STEX -Structural Features Implementation

```
4128 ⟨*package⟩
4129
4130 %%%%%%%%%%% features.dtx %%%%%%%%%%%
4131
4132 Warnings and error messages
4133 \msg_new:nnn{stex}{error/copymodule/notallowed}{
4134   Symbol~#1~can~not~be~assigned~in~copymodule~#2
4135 }
4136 \msg_new:nnn{stex}{error/interpretmodule/nodfiniens}{
4137   Symbol~#1~not~assigned~in~interpretmodule~#2
4138 }
4139 \msg_new:nnn{stex}{error/unknownstructure}{
4140   No~structure~#1~found!
4141 }
4142
4143 \msg_new:nnn{stex}{error/unknownfield}{
4144   No~field~#1~in~instance~#2~found!\#3
4145 }
4146
4147 \msg_new:nnn{stex}{error/keyval}{
4148   Invalid~key=value~pair~#1
4149 }
4150 \msg_new:nnn{stex}{error/instantiate/missing}{
4151   Assignments~missing~in~instantiate:~#1
4152 }
4153 \msg_new:nnn{stex}{error/incompatible}{
4154   Incompatible~signature:~#1~(#2)~and~#3~(#4)
4155 }
4156
```

31.1 Imports with modification

```

4157 <@@=stex_copymodule>
4158 \cs_new_protected:Nn \stex_get_symbol_in_seq:nn {
4159   \tl_if_head_eq_catcode:nNTF { #1 } \relax {
4160     \tl_set:Nn \l_tmpa_tl { #1 }
4161     \__stex_copymodule_get_symbol_from_cs:
4162   }{
4163     % argument is a string
4164     % is it a command name?
4165     \cs_if_exist:cTF { #1 }{
4166       \cs_set_eq:Nc \l_tmpa_tl { #1 }
4167       \str_set:Nx \l_tmpa_str { \cs_argument_spec:N \l_tmpa_tl }
4168       \str_if_empty:NTF \l_tmpa_str {
4169         \exp_args:Nx \cs_if_eq:NNTF {
4170           \tl_head:N \l_tmpa_tl
4171         } \stex_invoke_symbol:n {
4172           \__stex_copymodule_get_symbol_from_cs:n{ #2 }
4173         }{
4174           \__stex_copymodule_get_symbol_from_string:nn { #1 }{ #2 }
4175         }
4176       } {
4177         \__stex_copymodule_get_symbol_from_string:nn { #1 }{ #2 }
4178       }
4179     }{
4180       % argument is not a command name
4181       \__stex_copymodule_get_symbol_from_string:nn { #1 }{ #2 }
4182       % \l_stex_all_symbols_seq
4183     }
4184   }
4185 }
4186
4187 \cs_new_protected:Nn \__stex_copymodule_get_symbol_from_string:nn {
4188   \str_set:Nn \l_tmpa_str { #1 }
4189   \bool_set_false:N \l_tmpa_bool
4190   \bool_if:NF \l_tmpa_bool {
4191     \tl_set:Nn \l_tmpa_tl {
4192       \msg_error:nnn{stex}{error/unknownsymbol}{#1}
4193     }
4194     \str_set:Nn \l_tmpa_str { #1 }
4195     \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
4196     \seq_map_inline:Nn #2 {
4197       \str_set:Nn \l_tmpb_str { ##1 }
4198       \str_if_eq:eeT { \l_tmpa_str } {
4199         \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
4200       } {
4201         \seq_map_break:n {
4202           \tl_set:Nn \l_tmpa_tl {
4203             \str_set:Nn \l_stex_get_symbol_uri_str {
4204               ##1
4205             }
4206           }
4207         }
4208       }

```



```

4209     }
4210     \l_tmpa_tl
4211   }
4212 }
4213
4214 \cs_new_protected:Nn \__stex_copymodule_get_symbol_from_cs:n {
4215   \exp_args:NNx \tl_set:Nn \l_tmpa_tl
4216     { \tl_tail:N \l_tmpa_tl }
4217   \tl_if_single:NTF \l_tmpa_tl {
4218     \exp_args:No \tl_if_head_is_group:nTF \l_tmpa_tl {
4219       \exp_after:wN \str_set:Nn \exp_after:wN
4220         \l_stex_get_symbol_uri_str \l_tmpa_tl
4221       \__stex_copymodule_get_symbol_check:n { #1 }
4222     }{
4223       % TODO
4224       % tail is not a single group
4225     }
4226   }{
4227     % TODO
4228     % tail is not a single group
4229   }
4230 }
4231
4232 \cs_new_protected:Nn \__stex_copymodule_get_symbol_check:n {
4233   \exp_args:NNx \seq_if_in:NnF #1 \l_stex_get_symbol_uri_str {
4234     \msg_error:nnxx{stex}{error/copymodule/notallowed}{\l_stex_get_symbol_uri_str}{
4235       :~\seq_use:Nn #1 {,~}
4236     }
4237   }
4238 }
4239
4240 \cs_new_protected:Nn \stex_copymodule_start:nnnn {
4241   % import module
4242   \stex_import_module_uri:nn { #1 } { #2 }
4243   \str_set:Nx \l_stex_current_copymodule_name_str {#3}
4244   \stex_import_require_module:nnnn
4245     { \l_stex_import_ns_str } { \l_stex_import_archive_str }
4246     { \l_stex_import_path_str } { \l_stex_import_name_str }
4247
4248   \stex_collect_imports:n {\l_stex_import_ns_str ?\l_stex_import_name_str }
4249   \seq_set_eq:NN \l__stex_copymodule_copymodule_modules_seq \l_stex_collect_imports_seq
4250
4251   % fields
4252   \seq_clear:N \l__stex_copymodule_copymodule_fields_seq
4253   \seq_map_inline:Nn \l__stex_copymodule_copymodule_modules_seq {
4254     \seq_map_inline:cn {c_stex_module_##1_constants}{
4255       \exp_args:NNx \seq_put_right:Nn \l__stex_copymodule_copymodule_fields_seq {
4256         ##1 ? ####1
4257       }
4258     }
4259   }
4260
4261   % setup prop
4262   \seq_clear:N \l_tmpa_seq

```

```

4263 \exp_args:Nn \prop_set_from_keyval:Nn \l_stex_current_copymodule_prop {
4264   name      = \l_stex_current_copymodule_name_str ,
4265   module    = \l_stex_current_module_str ,
4266   from      = \l_stex_import_ns_str ?\l_stex_import_name_str ,
4267   includes  = \l_tmpa_seq %,
4268 % fields    = \l_tmpa_seq
4269 }
4270 \stex_debug:nn{copymodule}{#4~for~module~{\l_stex_import_ns_str ?\l_stex_import_name_str}
4271   as~\l_stex_current_module_str?\l_stex_current_copymodule_name_str}
4272 \stex_debug:nn{copymodule}{modules:\seq_use:Nn \l__stex_copymodule_copymodule_modules_seq {
4273 \stex_debug:nn{copymodule}{fields:\seq_use:Nn \l__stex_copymodule_copymodule_fields_seq {,
4274
4275 \stex_if_do_html:T {
4276   \begin{stex_annotate_env} {#4} {
4277     \l_stex_current_module_str?\l_stex_current_copymodule_name_str
4278   }
4279   \stex_annotate_invisible:nnn{domain}{\l_stex_import_ns_str ?\l_stex_import_name_str}{}
4280 }
4281 }
4282
4283 \cs_new_protected:Nn \stex_copymodule_end:n {
4284   % apply to every field
4285   \def \l_tmpa_cs ##1 ##2 {#1}
4286
4287   \tl_clear:N \__stex_copymodule_module_tl
4288   \tl_clear:N \__stex_copymodule_exec_tl
4289
4290   %\prop_get:NnN \l_stex_current_copymodule_prop {fields} \l_tmpa_seq
4291   \seq_clear:N \__stex_copymodule_fields_seq
4292
4293   \seq_map_inline:Nn \l__stex_copymodule_copymodule_modules_seq {
4294     \seq_map_inline:cn {c_stex_module_##1_constants}{
4295
4296       \tl_clear:N \__stex_copymodule_curr_symbol_tl % <- wrap in current symbol html
4297       \l_tmpa_cs{##1}{####1}
4298
4299       \str_if_exist:cTF {l__stex_copymodule_copymodule_##1?####1_name_str} {
4300         \str_set_eq:Nc \__stex_copymodule_curr_name_str {l__stex_copymodule_copymodule_##1?####1_name_str}
4301         \stex_if_do_html:T {
4302           \tl_put_right:Nx \__stex_copymodule_curr_symbol_tl {
4303             \stex_annotate_invisible:nnn{alias}{\use:c{l__stex_copymodule_copymodule_##1?####1_name_str}}
4304           }
4305         }
4306       }{
4307         \str_set:Nx \__stex_copymodule_curr_name_str { \l_stex_current_copymodule_name_str /
4308       }
4309
4310       \prop_set_eq:Nc \l_tmpa_prop {l_stex_symdecl_ ##1?####1 _prop}
4311       \prop_put:Nnx \l_tmpa_prop { name } \__stex_copymodule_curr_name_str
4312       \prop_put:Nnx \l_tmpa_prop { module } \l_stex_current_module_str
4313
4314       \tl_if_exist:cT {l__stex_copymodule_copymodule_##1?####1_def_tl}{
4315         \stex_if_do_html:T {
4316           \tl_put_right:Nx \__stex_copymodule_curr_symbol_tl {

```

```

4317         $\stex_annotate_invisible:nnn{definiens}{\}{\exp_after:wN \exp_not:N\csname l__st
4318     }
4319 }
4320 \prop_put:Nnn \l_tmpa_prop { defined } { true }
4321 }
4322
4323 \stex_add_constant_to_current_module:n \__stex_copymodule_curr_name_str
4324 \tl_put_right:Nx \__stex_copymodule_module_tl {
4325     \seq_clear:c {l_stex_symdecl_ \l_stex_current_module_str ? \__stex_copymodule_curr_n
4326     \prop_set_from_keyval:cn {
4327         l_stex_symdecl_ \l_stex_current_module_str ? \__stex_copymodule_curr_name_str _prop
4328     }{
4329         \prop_to_keyval:N \l_tmpa_prop
4330     }
4331 }
4332
4333 \str_if_exist:cT {l__stex_copymodule_copymodule_##1?####1_macroname_str} {
4334     \stex_if_do_html:T {
4335         \tl_put_right:Nx \__stex_copymodule_curr_symbol_tl {
4336             \stex_annotate_invisible:nnn{macroname}{\use:c{l__stex_copymodule_copymodule_##1
4337         }
4338     }
4339     \tl_put_right:Nx \__stex_copymodule_module_tl {
4340         \tl_set:cx {\use:c{l__stex_copymodule_copymodule_##1?####1_macroname_str}}{
4341             \stex_invoke_symbol:n {
4342                 \l_stex_current_module_str ? \__stex_copymodule_curr_name_str
4343             }
4344         }
4345     }
4346 }
4347
4348 \seq_put_right:Nx \__stex_copymodule_fields_seq {\l_stex_current_module_str ? \__stex_
4349
4350 \tl_put_right:Nx \__stex_copymodule_exec_tl {
4351     \stex_copy_notations:nn {\l_stex_current_module_str ? \__stex_copymodule_curr_name_s
4352 }
4353
4354 \tl_put_right:Nx \__stex_copymodule_exec_tl {
4355     \stex_if_do_html:TF{
4356         \stex_annotate_invisible:nnn{assignment} {##1?####1} { \exp_after:wN \exp_not:n \e
4357     }{
4358         \exp_after:wN \exp_not:n \exp_after:wN {\__stex_copymodule_curr_symbol_tl}
4359     }
4360 }
4361 }
4362 }
4363
4364
4365 \prop_put:Nno \l_stex_current_copymodule_prop {fields} \__stex_copymodule_fields_seq
4366 \tl_put_left:Nx \__stex_copymodule_module_tl {
4367     \prop_set_from_keyval:cn {
4368         l_stex_copymodule_ \l_stex_current_module_str? \l_stex_current_copymodule_name_str _pro
4369     }{
4370         \prop_to_keyval:N \l_stex_current_copymodule_prop

```

```

4371   }
4372 }
4373
4374 \seq_gput_right:cx{c_stex_module_\l_stex_current_module_str _copymodules}{
4375   \l_stex_current_module_str?\l_stex_current_copymodule_name_str
4376 }
4377
4378 \exp_args:No \stex_execute_in_module:n \__stex_copymodule_module_tl
4379 \stex_debug:nn{copymodule}{result:\meaning \__stex_copymodule_module_tl}
4380 \stex_debug:nn{copymodule}{output:\meaning \__stex_copymodule_exec_tl}
4381
4382 \__stex_copymodule_exec_tl
4383 \stex_if_do_html:T {
4384   \end{stex_annotate_env}
4385 }
4386 }
4387
4388 \NewDocumentEnvironment {copymodule} { 0{} m m}{
4389   \stex_copymodule_start:nnnn { #1 }{ #2 }{ #3 }{ copymodule }
4390   \stex_deactivate_macro:Nn \symdecl {module~environments}
4391   \stex_deactivate_macro:Nn \symdef {module~environments}
4392   \stex_deactivate_macro:Nn \notation {module~environments}
4393   \stex_reactivate_macro:N \assign
4394   \stex_reactivate_macro:N \renamedekl
4395   \stex_reactivate_macro:N \donotcopy
4396   \stex_smsmode_do:
4397 }{
4398   \stex_copymodule_end:n {}
4399 }
4400
4401 \NewDocumentEnvironment {interpretmodule} { 0{} m m}{
4402   \stex_copymodule_start:nnnn { #1 }{ #2 }{ #3 }{ interpretmodule }
4403   \stex_deactivate_macro:Nn \symdecl {module~environments}
4404   \stex_deactivate_macro:Nn \symdef {module~environments}
4405   \stex_deactivate_macro:Nn \notation {module~environments}
4406   \stex_reactivate_macro:N \assign
4407   \stex_reactivate_macro:N \renamedekl
4408   \stex_reactivate_macro:N \donotcopy
4409   \stex_smsmode_do:
4410 }{
4411   \stex_copymodule_end:n {
4412     \tl_if_exist:cF {
4413       l__stex_copymodule_copymodule_##1?##2_def_tl
4414     }{
4415       \str_if_eq:eeF {
4416         \prop_item:cn{
4417           l_stex_symdecl_ ##1 ? ##2 _prop }{ defined }
4418         }{ true }{
4419           \msg_error:nxxx{stex}{error/interpretmodule/nodéfiniens}{
4420             ##1?##2
4421           }{\l_stex_current_copymodule_name_str}
4422         }
4423       }
4424     }

```

```

4425 }
4426
4427 \iffalse \begin{stex_annotate_env} \fi
4428 \NewDocumentEnvironment {realization} { 0 } { m } {
4429   \stex_copymodule_start:nnnn { #1 } { #2 } { #2 } { realize }
4430   \stex_deactivate_macro:Nn \symdecl {module~environments}
4431   \stex_deactivate_macro:Nn \symdef {module~environments}
4432   \stex_deactivate_macro:Nn \notation {module~environments}
4433   \stex_reactivate_macro:N \donotcopy
4434   \stex_reactivate_macro:N \assign
4435   \stex_smsmode_do:
4436 } {
4437   \stex_import_module_uri:nn { #1 } { #2 }
4438   \tl_clear:N \__stex_copymodule_exec_tl
4439   \tl_set:Nx \__stex_copymodule_module_tl {
4440     \stex_import_require_module:nnnn
4441     { \l_stex_import_ns_str } { \l_stex_import_archive_str }
4442     { \l_stex_import_path_str } { \l_stex_import_name_str }
4443   }
4444
4445   \seq_map_inline:Nn \l__stex_copymodule_copymodule_modules_seq {
4446     \seq_map_inline:cn {c_stex_module_##1_constants}{
4447       \str_set:Nx \__stex_copymodule_curr_name_str { \l_stex_current_copymodule_name_str / #1 }
4448       \tl_if_exist:cT {l__stex_copymodule_copymodule_##1?###1_def_tl}{
4449         \stex_if_do_html:T {
4450           \tl_put_right:Nx \__stex_copymodule_exec_tl {
4451             \stex_annotate_invisible:nnn{assignment} {##1?###1} {
4452               $\stex_annotate_invisible:nnn{definien}{}{\exp_after:wN \exp_not:N\csname l__
4453             }
4454           }
4455         }
4456         \tl_put_right:Nx \__stex_copymodule_module_tl {
4457           \prop_put:cnn {l_stex_symdecl_##1?###1_prop}{ defined }{ true }
4458         }
4459       }
4460     }
4461
4462     \exp_args:No \stex_execute_in_module:n \__stex_copymodule_module_tl
4463
4464     \__stex_copymodule_exec_tl
4465     \stex_if_do_html:T {\end{stex_annotate_env}}
4466   }
4467
4468   \NewDocumentCommand \donotcopy { m } {
4469     \str_clear:N \l_stex_import_name_str
4470     \str_set:Nn \l_tmpa_str { #1 }
4471     \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
4472     \seq_map_inline:Nn \l_stex_all_modules_seq {
4473       \str_set:Nn \l_tmpb_str { ##1 }
4474       \str_if_eq:eeT { \l_tmpa_str } {
4475         \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
4476       } {
4477         \seq_map_break:n {
4478           \stex_if_do_html:T {

```

```

4479         \stex_if_smsmode:F {
4480             \stex_annotate_invisible:nnn{donotcopy}{##1}{
4481                 \stex_annotate:nnn{domain}{##1}{}}
4482             }
4483         }
4484     }
4485     \str_set_eq:NN \l_stex_import_name_str \l_tmpb_str
4486 }
4487 }
4488 \seq_map_inline:cn {c_stex_module_###1_copymodules}{
4489     \str_set:Nn \l_tmpb_str { ####1 }
4490     \str_if_eq:eeT { \l_tmpa_str } {
4491         \str_range:Nnn \l_tmpb_str { -\l_tmpa_int } { -1 }
4492     } {
4493         \seq_map_break:n {\seq_map_break:n {
4494             \stex_if_do_html:T {
4495                 \stex_if_smsmode:F {
4496                     \stex_annotate_invisible:nnn{donotcopy}{####1}{
4497                         \stex_annotate:nnn{domain}{
4498                             \prop_item:cn {l_stex_copymodule_ ####1 _prop}{module}
4499                         }{}
4500                     }
4501                 }
4502             }
4503             \str_set:Nx \l_stex_import_name_str {
4504                 \prop_item:cn {l_stex_copymodule_ ####1 _prop}{module}
4505             }
4506         }}
4507     }
4508 }
4509 }
4510 \str_if_empty:NTF \l_stex_import_name_str {
4511     % TODO throw error
4512 }{
4513     \stex_collect_imports:n {\l_stex_import_name_str }
4514     \seq_map_inline:Nn \l_stex_collect_imports_seq {
4515         \seq_remove_all:Nn \l__stex_copymodule_copymodule_modules_seq { ##1 }
4516         \seq_map_inline:cn {c_stex_module_###1_constants}{
4517             \seq_remove_all:Nn \l__stex_copymodule_copymodule_fields_seq { ##1 ? ####1 }
4518             \bool_lazy_any:nT {
4519                 { \cs_if_exist_p:c {l__stex_copymodule_copymodule_##1?####1_name_str}}
4520                 { \cs_if_exist_p:c {l__stex_copymodule_copymodule_##1?####1_macroname_str}}
4521                 { \cs_if_exist_p:c {l__stex_copymodule_copymodule_##1?####1_def_tl}}
4522             }{
4523                 % TODO throw error
4524             }
4525         }
4526     }
4527     \prop_get:NnN \l_stex_current_copymodule_prop { includes } \l_tmpa_seq
4528     \seq_put_right:Nx \l_tmpa_seq {\l_stex_import_name_str }
4529     \prop_put:Nno \l_stex_current_copymodule_prop {includes} \l_tmpa_seq
4530 }
4531 \stex_smsmode_do:
4532 }

```

```

4533
4534 \NewDocumentCommand \assign { m m }{
4535   \stex_get_symbol_in_seq:nn {#1} \l__stex_copymodule_copymodule_fields_seq
4536   \stex_debug:nn{assign}{defining~{\l_stex_get_symbol_uri_str}~as~\detokenize{#2}}
4537   \tl_set:cn {l__stex_copymodule_copymodule_\l_stex_get_symbol_uri_str_def_tl}{#2}
4538   \stex_smsmode_do:
4539 }
4540
4541 \keys_define:nn { stex / renamedecl } {
4542   name          .str_set_x:N = \l_stex_renamedecl_name_str
4543 }
4544 \cs_new_protected:Nn \__stex_copymodule_renamedecl_args:n {
4545   \str_clear:N \l_stex_renamedecl_name_str
4546   \keys_set:nn { stex / renamedecl } { #1 }
4547 }
4548
4549 \NewDocumentCommand \renamedecl { O{} m m }{
4550   \__stex_copymodule_renamedecl_args:n { #1 }
4551   \stex_get_symbol_in_seq:nn {#2} \l__stex_copymodule_copymodule_fields_seq
4552   \stex_debug:nn{renamedecl}{renaming~{\l_stex_get_symbol_uri_str}~to~#3}
4553   \str_set:cx {l__stex_copymodule_copymodule_\l_stex_get_symbol_uri_str_macroname_str}{#3}
4554   \str_if_empty:NTF \l_stex_renamedecl_name_str {
4555     \tl_set:cx { #3 }{ \stex_invoke_symbol:n {
4556       \l_stex_get_symbol_uri_str
4557     } }
4558   } {
4559     \str_set:cx {l__stex_copymodule_copymodule_\l_stex_get_symbol_uri_str_name_str}{\l_stex
4560       \stex_debug:nn{renamedecl}{@~\l_stex_current_module_str ? \l_stex_renamedecl_name_str}
4561       \prop_set_eq:cc {l_stex_symdecl_
4562         \l_stex_current_module_str ? \l_stex_renamedecl_name_str
4563         _prop
4564       }{l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}
4565       \seq_set_eq:cc {l_stex_symdecl_
4566         \l_stex_current_module_str ? \l_stex_renamedecl_name_str
4567         _notations
4568       }{l_stex_symdecl_ \l_stex_get_symbol_uri_str _notations}
4569       \prop_put:cnx {l_stex_symdecl_
4570         \l_stex_current_module_str ? \l_stex_renamedecl_name_str
4571         _prop
4572       }{ name }{ \l_stex_renamedecl_name_str }
4573       \prop_put:cnx {l_stex_symdecl_
4574         \l_stex_current_module_str ? \l_stex_renamedecl_name_str
4575         _prop
4576       }{ module }{ \l_stex_current_module_str }
4577       \exp_args:NNx \seq_put_left:Nn \l__stex_copymodule_copymodule_fields_seq {
4578         \l_stex_current_module_str ? \l_stex_renamedecl_name_str
4579       }
4580       \tl_set:cx { #3 }{ \stex_invoke_symbol:n {
4581         \l_stex_current_module_str ? \l_stex_renamedecl_name_str
4582       } }
4583     }
4584   \stex_smsmode_do:
4585 }
4586

```

```

4587 \stex_deactivate_macro:Nn \assign {copymodules}
4588 \stex_deactivate_macro:Nn \renamedekl {copymodules}
4589 \stex_deactivate_macro:Nn \donotcopy {copymodules}
4590
4591

```

31.2 The feature environment

structural@feature

```

4592 <@@=stex_features>
4593
4594 \NewDocumentEnvironment{structural_feature_module}{m m m}{
4595   \stex_if_in_module:F {
4596     \msg_set:nnn{stex}{error/nomodule}{
4597       Structural~Feature~has~to~occur~in~a~module:\\
4598       Feature~#2~of~type~#1\\
4599       In~File:~\stex_path_to_string:N \g_stex_currentfile_seq
4600     }
4601     \msg_error:nn{stex}{error/nomodule}
4602   }
4603
4604   \str_set_eq:NN \l_stex_feature_parent_str \l_stex_current_module_str
4605
4606   \stex_module_setup:nn{meta=NONE}{#2 - #1}
4607
4608   \stex_if_do_html:T {
4609     \begin{stex_annotate_env}{feature:#1 }{\l_stex_feature_parent_str ? #2 - #1}
4610     \stex_annotate_invisible:nnn{header}{}{ #3 }
4611   }
4612 }{
4613   \str_gset_eq:NN \l_stex_last_feature_str \l_stex_current_module_str
4614   \prop_gput:cnn {c_stex_module_ \l_stex_current_module_str _prop}{feature}{#1}
4615   \stex_debug:nn{features}{
4616     Feature: \l_stex_last_feature_str
4617   }
4618   \stex_if_do_html:T {
4619     \end{stex_annotate_env}
4620   }
4621 }

```

31.3 Structure

structure

```

4622 <@@=stex_structures>
4623 \cs_new_protected:Nn \stex_add_structure_to_current_module:nn {
4624   \prop_if_exist:cF {c_stex_module_ \l_stex_current_module_str _structures}{
4625     \prop_new:c {c_stex_module_ \l_stex_current_module_str _structures}
4626   }
4627   \prop_gput:cxn{c_stex_module_ \l_stex_current_module_str _structures}
4628   {#1}{#2}
4629 }
4630

```



```

4631 \keys_define:nn { stex / features / structure } {
4632   name          .str_set_x:N = \l__stex_structures_name_str ,
4633 }
4634
4635 \cs_new_protected:Nn \__stex_structures_structure_args:n {
4636   \str_clear:N \l__stex_structures_name_str
4637   \keys_set:nn { stex / features / structure } { #1 }
4638 }
4639
4640 \NewDocumentEnvironment{mathstructure}{m O{}}{
4641   \__stex_structures_structure_args:n { #2 }
4642   \str_if_empty:NT \l__stex_structures_name_str {
4643     \str_set:Nx \l__stex_structures_name_str { #1 }
4644   }
4645   \stex_suppress_html:n {
4646     \bool_set_true:N \l_stex_symdecl_make_macro_bool
4647     \exp_args:Nx \stex_symdecl_do:nn {
4648       name = \l__stex_structures_name_str ,
4649       def = {\STEXsymbol{module-type}}{
4650         \STEXInternalTermMathOMSiiii {
4651           \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
4652             { ns } ?
4653           \prop_item:cn {c_stex_module_\l_stex_current_module_str _prop}
4654             { name } / \l__stex_structures_name_str - structure
4655         }{}{0}{}
4656       }}
4657     }{ #1 }
4658   }
4659   \exp_args:Nnnx
4660   \begin{structural_feature_module}{ structure }
4661     { \l__stex_structures_name_str }{}
4662   \stex_smsmode_do:
4663 }{
4664   \end{structural_feature_module}
4665   \_stex_reset_up_to_module:n \l_stex_last_feature_str
4666   \exp_args:No \stex_collect_imports:n \l_stex_last_feature_str
4667   \seq_clear:N \l_tmpa_seq
4668   \seq_map_inline:Nn \l_stex_collect_imports_seq {
4669     \seq_map_inline:cn{c_stex_module_##1_constants}{
4670       \seq_put_right:Nn \l_tmpa_seq { ##1 ? ####1 }
4671     }
4672   }
4673   \exp_args:Nnno
4674   \prop_gput:cnn {c_stex_module_ \l_stex_last_feature_str _prop}{fields}\l_tmpa_seq
4675   \stex_debug:nn{structure}{Fields:~\seq_use:Nn \l_tmpa_seq ,}
4676   \stex_add_structure_to_current_module:nn
4677     \l__stex_structures_name_str
4678     \l_stex_last_feature_str
4679
4680   \stex_execute_in_module:x {
4681     \tl_set:cn { #1 }{
4682       \exp_not:N \stex_invoke_structure:nn {\l_stex_current_module_str }{ \l__stex_structures
4683     }
4684   }

```

```

4685 }
4686
4687 \cs_new:Nn \stex_invoke_structure:nn {
4688   \stex_invoke_symbol:n { #1?#2 }
4689 }
4690
4691 \cs_new_protected:Nn \stex_get_structure:n {
4692   \tl_if_head_eq_catcode:nNTF { #1 } \relax {
4693     \tl_set:Nn \l_tmpa_tl { #1 }
4694     \__stex_structures_get_from_cs:
4695   }{
4696     \cs_if_exist:cTF { #1 }{
4697       \cs_set_eq:Nc \l_tmpa_cs { #1 }
4698       \str_set:Nx \l_tmpa_str {\cs_argument_spec:N \l_tmpa_cs }
4699       \str_if_empty:NNTF \l_tmpa_str {
4700         \cs_if_eq:NNTF { \tl_head:N \l_tmpa_cs } \stex_invoke_structure:nn {
4701           \__stex_structures_get_from_cs:
4702         }{
4703           \__stex_structures_get_from_string:n { #1 }
4704         }
4705       }{
4706         \__stex_structures_get_from_string:n { #1 }
4707       }
4708     }{
4709       \__stex_structures_get_from_string:n { #1 }
4710     }
4711   }
4712 }
4713
4714 \cs_new_protected:Nn \__stex_structures_get_from_cs: {
4715   \exp_args:NNx \tl_set:Nn \l_tmpa_tl
4716     { \tl_tail:N \l_tmpa_tl }
4717   \str_set:Nx \l_tmpa_str {
4718     \exp_after:wN \use_i:nn \l_tmpa_tl
4719   }
4720   \str_set:Nx \l_tmpb_str {
4721     \exp_after:wN \use_ii:nn \l_tmpa_tl
4722   }
4723   \str_set:Nx \l_stex_get_structure_str {
4724     \l_tmpa_str ? \l_tmpb_str
4725   }
4726   \str_set:Nx \l_stex_get_structure_module_str {
4727     \exp_args:Nno \prop_item:cn {c_stex_module_\l_tmpa_str _structures}{\l_tmpb_str}
4728   }
4729 }
4730
4731 \cs_new_protected:Nn \__stex_structures_get_from_string:n {
4732   \tl_set:Nn \l_tmpa_tl {
4733     \msg_error:nnn{stex}{error/unknownstructure}{#1}
4734   }
4735   \str_set:Nn \l_tmpa_str { #1 }
4736   \int_set:Nn \l_tmpa_int { \str_count:N \l_tmpa_str }
4737
4738   \seq_map_inline:Nn \l_stex_all_modules_seq {

```

```

4739 \prop_if_exist:cT {c_stex_module_##1_structures} {
4740 \prop_map_inline:cn {c_stex_module_##1_structures} {
4741 \str_if_eq:eeT { \l_tmpa_str }{ \str_range:nnn {##1?####1}{-\l_tmpa_int}{-1}}{
4742 \prop_map_break:n{\seq_map_break:n{
4743 \tl_set:Nn \l_tmpa_tl {
4744 \str_set:Nn \l_stex_get_structure_str {##1?####1}
4745 \str_set:Nn \l_stex_get_structure_module_str {####2}
4746 }
4747 }}
4748 }
4749 }
4750 }
4751 }
4752 \l_tmpa_tl
4753 }

```

\instantiate

```

4754
4755 \keys_define:nn { stex / instantiate } {
4756 name .str_set_x:N = \l__stex_structures_name_str
4757 }
4758 \cs_new_protected:Nn \__stex_structures_instantiate_args:n {
4759 \str_clear:N \l__stex_structures_name_str
4760 \keys_set:nn { stex / instantiate } { #1 }
4761 }
4762
4763 \NewDocumentCommand \instantiate {m O{} m m O{}}{
4764 \beginingroup
4765 \stex_get_structure:n {#3}
4766 \__stex_structures_instantiate_args:n { #2 }
4767 \str_if_empty:NT \l__stex_structures_name_str {
4768 \str_set:Nn \l__stex_structures_name_str { #1 }
4769 }
4770 \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
4771 \seq_clear:N \l__stex_structures_fields_seq
4772 \exp_args:Nx \stex_collect_imports:n \l_stex_get_structure_module_str
4773 \seq_map_inline:Nn \l_stex_collect_imports_seq {
4774 \seq_map_inline:cn {c_stex_module_##1_constants}{
4775 \seq_put_right:Nx \l__stex_structures_fields_seq { ##1 ? ####1 }
4776 }
4777 }
4778
4779 \tl_if_empty:nF{#5}{
4780 \seq_set_split:Nnn \l_tmpa_seq , {#5}
4781 \prop_clear:N \l_tmpa_prop
4782 \seq_map_inline:Nn \l_tmpa_seq {
4783 \seq_set_split:Nnn \l_tmpb_seq = { ##1 }
4784 \int_compare:nNnF { \seq_count:N \l_tmpb_seq } = 2 {
4785 \msg_error:nnn{stex}{error/keyval}{##1}
4786 }
4787 \exp_args:Nx \stex_get_symbol_in_seq:nn {\seq_item:Nn \l_tmpb_seq 1} \l__stex_struct
4788 \str_set_eq:NN \l__stex_structures_dom_str \l_stex_get_symbol_uri_str
4789 \exp_args:NNx \seq_remove_all:Nn \l__stex_structures_fields_seq \l_stex_get_symbol_u
4790 \exp_args:Nx \stex_get_symbol:n {\seq_item:Nn \l_tmpb_seq 2}

```

```

4791     \exp_args:Nxx \str_if_eq:nnF
4792     {\prop_item:cn{l_stex_symdecl\l__stex_structures_dom_str _prop}{args}}
4793     {\prop_item:cn{l_stex_symdecl\l_stex_get_symbol_uri_str _prop}{args}}{
4794     \msg_error:nnxxxx{stex}{error/incompatible}
4795     {l__stex_structures_dom_str}
4796     {\prop_item:cn{l_stex_symdecl\l__stex_structures_dom_str _prop}{args}}
4797     {\l_stex_get_symbol_uri_str}
4798     {\prop_item:cn{l_stex_symdecl\l_stex_get_symbol_uri_str _prop}{args}}
4799     }
4800     \prop_put:Nxx \l_tmpa_prop {\seq_item:Nn \l_tmpb_seq 1} \l_stex_get_symbol_uri_str
4801   }
4802 }
4803
4804 \seq_map_inline:Nn \l__stex_structures_fields_seq {
4805   \str_set:Nx \l_tmpa_str {field:\l__stex_structures_name_str . \prop_item:cn {l_stex_sy
4806   \stex_debug:nn{instantiate}{Field~\l_tmpa_str :~##1}
4807
4808   \stex_add_constant_to_current_module:n {\l_tmpa_str}
4809   \stex_execute_in_module:x {
4810     \prop_set_from_keyval:cn { l_stex_symdecl_ \l_stex_current_module_str?\l_tmpa_str _p
4811     name   = \l_tmpa_str ,
4812     args   = \prop_item:cn {l_stex_symdecl_##1_prop}{args} ,
4813     arity  = \prop_item:cn {l_stex_symdecl_##1_prop}{arity} ,
4814     assocs = \prop_item:cn {l_stex_symdecl_##1_prop}{assocs}
4815   }
4816   \seq_clear:c {l_stex_symdecl\l_stex_current_module_str?\l_tmpa_str _notations}
4817 }
4818
4819 \seq_if_empty:cF{l_stex_symdecl_##1_notations}{
4820   \stex_find_notation:nn{##1}{}
4821   \stex_execute_in_module:x {
4822     \seq_put_right:cn {l_stex_symdecl\l_stex_current_module_str?\l_tmpa_str _notation
4823   }
4824
4825   \stex_copy_control_sequence_ii:ccN
4826   {stex_notation_\l_stex_current_module_str?\l_tmpa_str\c_hash_str \l_stex_notation_
4827   {stex_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}
4828   \l_tmpa_tl
4829   \exp_args:No \stex_execute_in_module:n \l_tmpa_tl
4830
4831
4832   \cs_if_exist:cT{stex_op_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}{
4833     \tl_set_eq:Nc \l_tmpa_cs {stex_op_notation_##1\c_hash_str \l_stex_notation_variant
4834     \stex_execute_in_module:x {
4835       \tl_set:cn
4836       {stex_op_notation_\l_stex_current_module_str?\l_tmpa_str\c_hash_str \l_stex_not
4837       { \exp_args:No \exp_not:n \l_tmpa_cs}
4838     }
4839   }
4840
4841 }
4842
4843 \prop_put:Nxx \l_tmpa_prop {\prop_item:cn {l_stex_symdecl_##1_prop}{name}}{\l_stex_cur
4844 }

```

```

4845
4846 \stex_execute_in_module:x {
4847   \prop_set_from_keyval:cn {l_stex_instance\_l_stex_current_module_str?l__stex_structur
4848     domain = \l_stex_get_structure_module_str ,
4849     \prop_to_keyval:N \l_tmpa_prop
4850   }
4851   \tl_set:cn{ #1 }{\stex_invoke_instance:n{ \l_stex_current_module_str?l__stex_structur
4852 }
4853 \stex_debug:nn{instantiate}{
4854   Instance~\l_stex_current_module_str?l__stex_structures_name_str \
4855   \prop_to_keyval:N \l_tmpa_prop
4856 }
4857 \exp_args:Nxx \stex_symdecl_do:nn {
4858   type={\STEXsymbol{module-type}}{
4859     \STEXInternalTermMathOMSiiii {
4860       \l_stex_get_structure_module_str
4861     }{}{0}{}
4862   }}
4863 }{\l__stex_structures_name_str}
4864 % {
4865   \str_set:Nx \l_stex_get_symbol_uri_str {\l_stex_current_module_str?l__stex_structures
4866   \tl_set:Nn \l_stex_notation_after_do_tl {\__stex_notation_final:}
4867   \stex_notation_do:nnnnn{}{}{}{}{\comp{#4}}
4868 % }
4869 %\exp_args:Nx \notation{\l__stex_structures_name_str}{\comp{#5}}
4870 \endgroup
4871 \stex_smsmode_do:\ignorespacesandpars
4872 }
4873
4874 \cs_new_protected:Nn \stex_symbol_or_var:n {
4875   \cs_if_exist:cTF{#1}{
4876     \cs_set_eq:Nc \l_tmpa_tl { #1 }
4877     \str_set:Nx \l_tmpa_str { \cs_argument_spec:N \l_tmpa_tl }
4878     \str_if_empty:NTF \l_tmpa_str {
4879       \exp_args:Nx \cs_if_eq:NNTF { \tl_head:N \l_tmpa_tl }
4880       \stex_invoke_variable:n {
4881         \bool_set_true:N \l_stex_symbol_or_var_bool
4882         \tl_set:Nx \l_tmpa_tl {\tl_tail:N \l_tmpa_tl}
4883         \tl_set:Nx \l_tmpa_tl {\exp_after:wN \use:n \l_tmpa_tl}
4884         \str_set:Nx \l_stex_get_symbol_uri_str {
4885           \exp_after:wN \use:n \l_tmpa_tl
4886         }
4887       }{
4888         \bool_set_false:N \l_stex_symbol_or_var_bool
4889         \stex_get_symbol:n{#1}
4890       }
4891     }{
4892       \__stex_structures_symbolorvar_from_string:n{ #1 }
4893     }
4894   }{
4895     \__stex_structures_symbolorvar_from_string:n{ #1 }
4896   }
4897 }
4898

```

```

4899 \cs_new_protected:Nn \__stex_structures_symbol_or_var_from_string:n {
4900   \prop_if_exist:cTF {l_stex_variable_#1 _prop}{
4901     \bool_set_true:N \l_stex_symbol_or_var_bool
4902     \str_set:Nn \l_stex_get_symbol_uri_str { #1 }
4903   }{
4904     \bool_set_false:N \l_stex_symbol_or_var_bool
4905     \stex_get_symbol:n{#1}
4906   }
4907 }
4908
4909 \keys_define:nn { stex / varinstantiate } {
4910   name          .str_set_x:N = \l__stex_structures_name_str,
4911   bind          .choices:nn =
4912     {forall,exists}
4913     {\str_set:Nx \l__stex_structures_bind_str {\l_keys_choice_tl}}
4914
4915 }
4916 \cs_new_protected:Nn \__stex_structures_varinstantiate_args:n {
4917   \str_clear:N \l__stex_structures_name_str
4918   \str_clear:N \l__stex_structures_bind_str
4919   \keys_set:nn { stex / varinstantiate } { #1 }
4920 }
4921
4922 \NewDocumentCommand \varinstantiate {m O{} m m O{}}{
4923   \begingroup
4924     \stex_get_structure:n {#3}
4925     \__stex_structures_varinstantiate_args:n { #2 }
4926     \str_if_empty:NT \l__stex_structures_name_str {
4927       \str_set:Nn \l__stex_structures_name_str { #1 }
4928     }
4929     \stex_if_do_html:TF{
4930       \stex_annotate:nnn{varinstance}{\l__stex_structures_name_str}
4931     }{\use:n}
4932     {
4933       \stex_if_do_html:T{
4934         \stex_annotate_invisible:nnn{domain}{\l_stex_get_structure_module_str}{ }
4935       }
4936       \seq_clear:N \l__stex_structures_fields_seq
4937       \exp_args:Nx \stex_collect_imports:n \l_stex_get_structure_module_str
4938       \seq_map_inline:Nn \l_stex_collect_imports_seq {
4939         \seq_map_inline:cn {c_stex_module_##1_constants}{
4940           \seq_put_right:Nx \l__stex_structures_fields_seq { ##1 ? ####1 }
4941         }
4942       }
4943       \exp_args:No \stex_activate_module:n \l_stex_get_structure_module_str
4944       \prop_clear:N \l_tmpa_prop
4945       \tl_if_empty:nF {#5} {
4946         \seq_set_split:Nnn \l_tmpa_seq , {#5}
4947         \seq_map_inline:Nn \l_tmpa_seq {
4948           \seq_set_split:Nnn \l_tmpb_seq = { ##1 }
4949           \int_compare:nNnF { \seq_count:N \l_tmpb_seq } = 2 {
4950             \msg_error:nnn{stex}{error/keyval}{##1}
4951           }
4952           \exp_args:Nx \stex_get_symbol_in_seq:nn {\seq_item:Nn \l_tmpb_seq 1} \l__stex_stru

```

```

4953 \str_set_eq:NN \l__stex_structures_dom_str \l_stex_get_symbol_uri_str
4954 \exp_args:NNx \seq_remove_all:Nn \l__stex_structures_fields_seq \l_stex_get_symbol
4955 \exp_args:Nx \stex_symbol_or_var:n {\seq_item:Nn \l_tmpb_seq 2}
4956 \stex_if_do_html:T{
4957   \stex_annotate:nnn{assign}{\l__stex_structures_dom_str,
4958     \bool_if:NTF\l_stex_symbol_or_var_bool{var://}{}\l_stex_get_symbol_uri_str}{}}
4959 }
4960 \bool_if:NTF \l_stex_symbol_or_var_bool {
4961   \exp_args:Nxx \str_if_eq:nnF
4962     {\prop_item:cn{l_stex_symdecl\l__stex_structures_dom_str _prop}{args}}
4963     {\prop_item:cn{l_stex_variable\l_stex_get_symbol_uri_str _prop}{args}}{
4964     \msg_error:nnxxx{stex}{error/incompatible}
4965     {\l__stex_structures_dom_str
4966     {\prop_item:cn{l_stex_symdecl\l__stex_structures_dom_str _prop}{args}}
4967     {\l_stex_get_symbol_uri_str
4968     {\prop_item:cn{l_stex_variable\l_stex_get_symbol_uri_str _prop}{args}}
4969     }
4970   \prop_put:Nxx \l_tmpa_prop {\seq_item:Nn \l_tmpb_seq 1} {\stex_invoke_variable:n
4971 }{
4972   \exp_args:Nxx \str_if_eq:nnF
4973     {\prop_item:cn{l_stex_symdecl\l__stex_structures_dom_str _prop}{args}}
4974     {\prop_item:cn{l_stex_symdecl\l_stex_get_symbol_uri_str _prop}{args}}{
4975     \msg_error:nnxxx{stex}{error/incompatible}
4976     {\l__stex_structures_dom_str
4977     {\prop_item:cn{l_stex_symdecl\l__stex_structures_dom_str _prop}{args}}
4978     {\l_stex_get_symbol_uri_str
4979     {\prop_item:cn{l_stex_symdecl\l_stex_get_symbol_uri_str _prop}{args}}
4980     }
4981   \prop_put:Nxx \l_tmpa_prop {\seq_item:Nn \l_tmpb_seq 1} {\stex_invoke_symbol:n
4982 }
4983 }
4984 }
4985 \tl_gclear:N \g__stex_structures_aftergroup_tl
4986 \seq_map_inline:Nn \l__stex_structures_fields_seq {
4987   \str_set:Nx \l_tmpa_str {\l__stex_structures_name_str . \prop_item:cn {l_stex_symdecl
4988   \stex_debug:nn{varinstantiate}{Field~\l_tmpa_str :~##1}
4989   \seq_if_empty:cF{l_stex_symdecl_##1_notations}{
4990     \stex_find_notation:nn{##1}{}
4991     \cs_gset_eq:cc{g__stex_structures_tmpa_\l_tmpa_str _cs}
4992       {stex_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}
4993     \stex_debug:nn{varinstantiate}{Notation:~\cs_meaning:c{g__stex_structures_tmpa_\l
4994     \cs_if_exist:cT{stex_op_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}{
4995     \cs_gset_eq:cc {g__stex_structures_tmpa_op_\l_tmpa_str _cs}
4996       {stex_op_notation_##1\c_hash_str \l_stex_notation_variant_str _cs}
4997     \stex_debug:nn{varinstantiate}{Operator~Notation:~\cs_meaning:c{g__stex_struct
4998   }
4999 }
5000 }
5001 \exp_args:NNx \tl_gput_right:Nn \g__stex_structures_aftergroup_tl {
5002   \prop_set_from_keyval:cn { l_stex_variable_ \l_tmpa_str _prop}{
5003     name   = \l_tmpa_str ,
5004     args   = \prop_item:cn {l_stex_symdecl_##1_prop}{args} ,
5005     arity  = \prop_item:cn {l_stex_symdecl_##1_prop}{arity} ,
5006     assocs = \prop_item:cn {l_stex_symdecl_##1_prop}{assocs}

```

```

5007     }
5008     \cs_set_eq:cc {stex_var_notation_\l_tmpa_str_cs}
5009     {g__stex_structures_tmpa_\l_tmpa_str_cs}
5010     \cs_set_eq:cc {stex_var_op_notation_\l_tmpa_str_cs}
5011     {g__stex_structures_tmpa_op_\l_tmpa_str_cs}
5012   }
5013   \prop_put:Nxx \l_tmpa_prop {\prop_item:cn {l_stex_symdecl_##1_prop}{name}}{\stex_inv
5014 }
5015   \exp_args:NNx \tl_gput_right:Nn \g__stex_structures_aftergroup_tl {
5016     \prop_set_from_keyval:cn {l_stex_varinstance_\l__stex_structures_name_str_prop }{
5017       domain = \l_stex_get_structure_module_str ,
5018       \prop_to_keyval:N \l_tmpa_prop
5019     }
5020     \tl_set:cn { #1 }{\stex_invoke_varinstance:n {\l__stex_structures_name_str}}
5021     \tl_set:cn {l_stex_varinstance_\l__stex_structures_name_str_op_tl}{
5022       \exp_args:Nnx \exp_not:N \use:nn {
5023         \str_set:Nn \exp_not:N \STEXInternalCurrentSymbolStr {var://\l__stex_structures_
5024         \_stex_term_omv:nn {var://\l__stex_structures_name_str}{
5025           \exp_not:n{
5026             \_varcomp{#4}
5027           }
5028         }
5029       }{
5030         \exp_not:n{\_stex_reset:N \STEXInternalCurrentSymbolStr}
5031       }
5032     }
5033   }
5034 }
5035 \stex_debug:nn{varinstantiate}{\expandafter\detokenize\expandafter{\g__stex_structures_a
5036 \aftergroup\g__stex_structures_aftergroup_tl
5037 \endgroup
5038 \stex_smsmode_do:\ignorespacesandpars
5039 }
5040
5041 \cs_new_protected:Nn \stex_invoke_instance:n {
5042   \peek_charcode_remove:NTF ! {
5043     \stex_invoke_symbol:n{#1}
5044   }{
5045     \_stex_invoke_instance:nn {#1}
5046   }
5047 }
5048
5049
5050 \cs_new_protected:Nn \stex_invoke_varinstance:n {
5051   \peek_charcode_remove:NTF ! {
5052     \exp_args:Nnx \use:nn {
5053       \def\comp{\_varcomp}
5054       \use:c{l_stex_varinstance_#1_op_tl}
5055     }{
5056       \_stex_reset:N \comp
5057     }
5058   }{
5059     \_stex_invoke_varinstance:nn {#1}
5060   }

```



```

5061 }
5062
5063 \cs_new_protected:Nn \stex_invoke_instance:nn {
5064   \prop_if_in:cnTF {l_stex_instance_ #1 _prop}{#2}{
5065     \exp_args:Nx \stex_invoke_symbol:n {\prop_item:cn{l_stex_instance_ #1 _prop}{#2}}
5066   }{
5067     \prop_set_eq:Nc \l_tmpa_prop{l_stex_instance_ #1 _prop}
5068     \msg_error:nnxxx{stex}{error/unknownfield}{#2}{#1}{
5069       \prop_to_keyval:N \l_tmpa_prop
5070     }
5071   }
5072 }
5073
5074 \cs_new_protected:Nn \stex_invoke_varinstance:nn {
5075   \prop_if_in:cnTF {l_stex_varinstance_ #1 _prop}{#2}{
5076     \prop_get:cnN{l_stex_varinstance_ #1 _prop}{#2}\l_tmpa_tl
5077     \l_tmpa_tl
5078   }{
5079     \msg_error:nnnnn{stex}{error/unknownfield}{#2}{#1}{
5080     }
5081   }

```

(End definition for \instantiate. This function is documented on page 32.)

\stex_invoke_structure:nnn

```

5082 % #1: URI of the instance
5083 % #2: URI of the instantiated module
5084 \cs_new_protected:Nn \stex_invoke_structure:nnn {
5085   \tl_if_empty:nTF{ #3 }{
5086     \prop_set_eq:Nc \l__stex_structures_structure_prop {
5087       c_stex_feature_ #2 _prop
5088     }
5089     \tl_clear:N \l_tmpa_tl
5090     \prop_get:NnN \l__stex_structures_structure_prop { fields } \l_tmpa_seq
5091     \seq_map_inline:Nn \l_tmpa_seq {
5092       \seq_set_split:Nnn \l_tmpb_seq ? { ##1 }
5093       \seq_get_right:NN \l_tmpb_seq \l_tmpa_str
5094       \cs_if_exist:cT {
5095         stex_notation_ #1/\l_tmpa_str \c_hash_str\c_hash_str _cs
5096       }{
5097         \tl_if_empty:NF \l_tmpa_tl {
5098           \tl_put_right:Nn \l_tmpa_tl {,}
5099         }
5100         \tl_put_right:Nx \l_tmpa_tl {
5101           \stex_invoke_symbol:n {#1/\l_tmpa_str}!
5102         }
5103       }
5104     }
5105     \exp_args:No \mathstruct \l_tmpa_tl
5106   }{
5107     \stex_invoke_symbol:n{#1/#3}
5108   }
5109 }

```

(End definition for \stex_invoke_structure:nmn. This function is documented on page ??.)

5110 `\endpackage`

Chapter 32

STEX -Statements Implementation

```
5111 <*package>
5112
5113 %%%%%%%%%%% features.dtx %%%%%%%%%%%
5114
5115 <@@=stex_statements>
    Warnings and error messages
5116

\titleemph
5117 \def\titleemph#1{\textbf{#1}}

(End definition for \titleemph. This function is documented on page ??.)
```

32.1 Definitions

definiendum

```
5118 \keys_define:nn {stex / definiendum }{
5119   pre      .tl_set:N      = \l__stex_statements_definiendum_pre_tl,
5120   post     .tl_set:N      = \l__stex_statements_definiendum_post_tl,
5121   root     .str_set_x:N    = \l__stex_statements_definiendum_root_str,
5122   gfa      .str_set_x:N    = \l__stex_statements_definiendum_gfa_str
5123 }
5124 \cs_new_protected:Nn \__stex_statements_definiendum_args:n {
5125   \str_clear:N \l__stex_statements_definiendum_root_str
5126   \tl_clear:N \l__stex_statements_definiendum_post_tl
5127   \str_clear:N \l__stex_statements_definiendum_gfa_str
5128   \keys_set:nn { stex / definiendum }{ #1 }
5129 }
5130 \NewDocumentCommand \definiendum { O{} m m } {
5131   \__stex_statements_definiendum_args:n { #1 }
5132   \stex_get_symbol:n { #2 }
5133   \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5134   \str_if_empty:NTF \l__stex_statements_definiendum_root_str {
5135     \tl_if_empty:NTF \l__stex_statements_definiendum_post_tl {
```

```

5136     \tl_set:Nn \l_tmpa_tl { #3 }
5137   } {
5138     \str_set:Nx \l__stex_statements_definiendum_root_str { #3 }
5139     \tl_set:Nn \l_tmpa_tl {
5140       \l__stex_statements_definiendum_pre_tl\l__stex_statements_definiendum_root_str\l__st
5141     }
5142   }
5143 } {
5144   \tl_set:Nn \l_tmpa_tl { #3 }
5145 }
5146
5147 % TODO root
5148 \stex_html_backend:TF {
5149   \stex_annotate:nnn { definiendum } { \l_stex_get_symbol_uri_str } { \l_tmpa_tl }
5150 } {
5151   \exp_args:Nnx \defemph@uri { \l_tmpa_tl } { \l_stex_get_symbol_uri_str }
5152 }
5153 }
5154 \stex_deactivate_macro:Nn \definiendum {definition~environments}

```

(End definition for definiendum. This function is documented on page 41.)

definame

```

5155
5156 \NewDocumentCommand \definame { 0{ } m } {
5157   \__stex_statements_definiendum_args:n { #1 }
5158   % TODO: root
5159   \stex_get_symbol:n { #2 }
5160   \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5161   \str_set:Nx \l_tmpa_str {
5162     \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
5163   }
5164   \str_replace_all:Nnn \l_tmpa_str {-} {~}
5165   \stex_html_backend:TF {
5166     \stex_if_do_html:T {
5167       \stex_annotate:nnn { definiendum } { \l_stex_get_symbol_uri_str } {
5168         \l_tmpa_str\l__stex_statements_definiendum_post_tl
5169       }
5170     }
5171   } {
5172     \exp_args:Nnx \defemph@uri {
5173       \l_tmpa_str\l__stex_statements_definiendum_post_tl
5174     } { \l_stex_get_symbol_uri_str }
5175   }
5176 }
5177 \stex_deactivate_macro:Nn \definame {definition~environments}
5178
5179 \NewDocumentCommand \Definame { 0{ } m } {
5180   \__stex_statements_definiendum_args:n { #1 }
5181   \stex_get_symbol:n { #2 }
5182   \str_set:Nx \l_tmpa_str {
5183     \prop_item:cn { l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop } { name }
5184   }
5185   \exp_args:NNno \str_replace_all:Nnn \l_tmpa_str {-} {~}

```

```

5186 \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5187 \stex_html_backend:TF {
5188   \stex_if_do_html:T {
5189     \stex_annotate:nnn { definiendum } { \l_stex_get_symbol_uri_str } {
5190       \exp_after:wN \stex_capitalize:n \l_tmpa_str\l__stex_statements_definiendum_post_tl
5191     }
5192   }
5193 } {
5194   \exp_args:Nnx \defemph@uri {
5195     \exp_after:wN \stex_capitalize:n \l_tmpa_str\l__stex_statements_definiendum_post_tl
5196   } { \l_stex_get_symbol_uri_str }
5197 }
5198 }
5199 \stex_deactivate_macro:Nn \Definame {definition-environments}
5200
5201 \NewDocumentCommand \premise { m }{
5202   \noindent\stex_annotate:nnn{ premise }{}{\ignorespaces #1 }
5203 }
5204 \NewDocumentCommand \conclusion { m }{
5205   \noindent\stex_annotate:nnn{ conclusion }{}{\ignorespaces #1 }
5206 }
5207 \NewDocumentCommand \definiens { 0{} m }{
5208   \str_clear:N \l_stex_get_symbol_uri_str
5209   \tl_if_empty:nF {#1} {
5210     \stex_get_symbol:n { #1 }
5211   }
5212   \str_if_empty:NT \l_stex_get_symbol_uri_str {
5213     \int_compare:nNnTF {\clist_count:N \l__stex_statements_sdefinition_for_clist} = 1 {
5214       \str_set:Nx \l_stex_get_symbol_uri_str {\clist_item:Nn \l__stex_statements_sdefinition
5215     }{
5216       % TODO throw error
5217     }
5218   }
5219   \str_if_eq:eeT {\prop_item:cn {l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{module}}
5220   {\l_stex_current_module_str}{
5221     \str_if_eq:eeF {\prop_item:cn {l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{defin
5222   }{true}{
5223     \prop_put:cnn{l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{defined}{true}
5224     \exp_args:Nx \stex_add_to_current_module:n {
5225       \prop_put:cnn{l_stex_symdecl_ \l_stex_get_symbol_uri_str _prop}{defined}{true}
5226     }
5227   }
5228 }
5229 \stex_annotate:nnn{ definiens }{\l_stex_get_symbol_uri_str}{ #2 }
5230 }
5231
5232 \NewDocumentCommand \varbindforall {m}{
5233   \stex_symbol_or_var:n {#1}
5234   \bool_if:NTF\l_stex_symbol_or_var_bool{
5235     \stex_if_do_html:T {
5236       \stex_annotate_invisible:nnn {bindtype}{forall,\l_stex_get_symbol_uri_str}{}
5237     }
5238   }{
5239     % todo throw error

```

```

5240 }
5241 }
5242
5243 \stex_deactivate_macro:Nn \premise {definition,~example~or~assertion~environments}
5244 \stex_deactivate_macro:Nn \conclusion {example~or~assertion~environments}
5245 \stex_deactivate_macro:Nn \definiens {definition~environments}
5246 \stex_deactivate_macro:Nn \varbindforall {definition~or~assertion~environments}
5247

```

(End definition for definame. This function is documented on page 41.)

sdefinition

```

5248
5249 \keys_define:nn {stex / sdefinition }{
5250   type      .str_set_x:N = \sdefinitiontype,
5251   id        .str_set_x:N = \sdefinitionid,
5252   name      .str_set_x:N = \sdefinitionname,
5253   for       .clist_set:N = \l__stex_statements_sdefinition_for_clist ,
5254   title     .tl_set:N     = \sdefinitiontitle
5255 }
5256 \cs_new_protected:Nn \__stex_statements_sdefinition_args:n {
5257   \str_clear:N \sdefinitiontype
5258   \str_clear:N \sdefinitionid
5259   \str_clear:N \sdefinitionname
5260   \clist_clear:N \l__stex_statements_sdefinition_for_clist
5261   \tl_clear:N \sdefinitiontitle
5262   \keys_set:nn { stex / sdefinition }{ #1 }
5263 }
5264
5265 \NewDocumentEnvironment{sdefinition}{0{}}{
5266   \__stex_statements_sdefinition_args:n{ #1 }
5267   \stex_reactivate_macro:N \definiendum
5268   \stex_reactivate_macro:N \definame
5269   \stex_reactivate_macro:N \Definame
5270   \stex_reactivate_macro:N \premise
5271   \stex_reactivate_macro:N \definiens
5272   \stex_reactivate_macro:N \varbindforall
5273   \stex_if_smsmode:F{
5274     \seq_clear:N \l_tmpb_seq
5275     \clist_map_inline:Nn \l__stex_statements_sdefinition_for_clist {
5276       \tl_if_empty:nF{ ##1 }{
5277         \stex_get_symbol:n { ##1 }
5278         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5279           \l_stex_get_symbol_uri_str
5280         }
5281       }
5282     }
5283     \clist_set_from_seq:NN \l__stex_statements_sdefinition_for_clist \l_tmpb_seq
5284     \exp_args:Nnnx
5285     \begin{stex_annotate_env}{definition}{\seq_use:Nn \l_tmpb_seq {,}}
5286     \str_if_empty:NF \sdefinitiontype {
5287       \stex_annotate_invisible:nnn{typestrings}{\sdefinitiontype}{ }
5288     }
5289     \str_if_empty:NF \sdefinitionname {

```

```

5290     \stex_annotate_invisible:nnn{statementname}{\sdefinitionname}{}
5291   }
5292   \clist_set:No \l_tmpa_clist \sdefinitiontype
5293   \tl_clear:N \l_tmpa_tl
5294   \clist_map_inline:Nn \l_tmpa_clist {
5295     \tl_if_exist:cT {__stex_statements_sdefinition_##1_start:}{
5296       \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sdefinition_##1_start:}}
5297     }
5298   }
5299   \tl_if_empty:NTF \l_tmpa_tl {
5300     \__stex_statements_sdefinition_start:
5301   }{
5302     \l_tmpa_tl
5303   }
5304 }
5305 \stex_ref_new_doc_target:n \sdefinitionid
5306 \stex_smsmode_do:
5307 ){
5308   \stex_suppress_html:n {
5309     \str_if_empty:NF \sdefinitionname { \stex_symdecl_do:nn{}{\sdefinitionname} }
5310   }
5311   \stex_if_smsmode:F {
5312     \clist_set:No \l_tmpa_clist \sdefinitiontype
5313     \tl_clear:N \l_tmpa_tl
5314     \clist_map_inline:Nn \l_tmpa_clist {
5315       \tl_if_exist:cT {__stex_statements_sdefinition_##1_end:}{
5316         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sdefinition_##1_end:}}
5317       }
5318     }
5319     \tl_if_empty:NTF \l_tmpa_tl {
5320       \__stex_statements_sdefinition_end:
5321     }{
5322       \l_tmpa_tl
5323     }
5324     \end{stex_annotate_env}
5325   }
5326 }

```

\stexpatchdefinition

```

5327 \cs_new_protected:Nn \__stex_statements_sdefinition_start: {
5328   \stex_par:\noindent\titleemph{Definition}\tl_if_empty:NF \sdefinitiontitle {
5329     ~(\sdefinitiontitle)
5330   }~}
5331 }
5332 \cs_new_protected:Nn \__stex_statements_sdefinition_end: {\stex_par:\medskip}
5333
5334 \newcommand\stexpatchdefinition[3]{} {
5335   \str_set:Nx \l_tmpa_str{ #1 }
5336   \str_if_empty:NTF \l_tmpa_str {
5337     \tl_set:Nn \__stex_statements_sdefinition_start: { #2 }
5338     \tl_set:Nn \__stex_statements_sdefinition_end: { #3 }
5339   }{
5340     \exp_after:wN \tl_set:Nn \csname __stex_statements_sdefinition_#1_start:\endcsname{ #2 }
5341     \exp_after:wN \tl_set:Nn \csname __stex_statements_sdefinition_#1_end:\endcsname{ #3 }

```

```

5342     }
5343 }

```

(End definition for `\stexpatchdefinition`. This function is documented on page 47.)

`\inlinedef` inline:

```

5344 \keys_define:nn {stex / inlinedef }{
5345   type      .str_set_x:N = \sdefinitiontype,
5346   id        .str_set_x:N = \sdefinitionid,
5347   for       .clist_set:N = \l__stex_statements_sdefinition_for_clist ,
5348   name      .str_set_x:N = \sdefinitionname
5349 }
5350 \cs_new_protected:Nn \__stex_statements_inlinedef_args:n {
5351   \str_clear:N \sdefinitiontype
5352   \str_clear:N \sdefinitionid
5353   \str_clear:N \sdefinitionname
5354   \clist_clear:N \l__stex_statements_sdefinition_for_clist
5355   \keys_set:nn { stex / inlinedef }{ #1 }
5356 }
5357 \NewDocumentCommand \inlinedef { 0{} m } {
5358   \begingroup
5359   \__stex_statements_inlinedef_args:n{ #1 }
5360   \stex_reactivate_macro:N \definiendum
5361   \stex_reactivate_macro:N \definame
5362   \stex_reactivate_macro:N \Definame
5363   \stex_reactivate_macro:N \premise
5364   \stex_reactivate_macro:N \definiens
5365   \stex_reactivate_macro:N \varbindforall
5366   \stex_ref_new_doc_target:n \sdefinitionid
5367   \stex_if_smsmode:TF{\stex_suppress_html:n {
5368     \str_if_empty:NF \sdefinitionname { \stex_symdecl_do:nn{}{\sdefinitionname} }
5369   }}{
5370     \seq_clear:N \l_tmpb_seq
5371     \clist_map_inline:Nn \l__stex_statements_sdefinition_for_clist {
5372       \tl_if_empty:nF{ ##1 }{
5373         \stex_get_symbol:n { ##1 }
5374         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5375           \l_stex_get_symbol_uri_str
5376         }
5377       }
5378     }
5379     \clist_set_from_seq:NN \l__stex_statements_sdefinition_for_clist \l_tmpb_seq
5380     \exp_args:Nnx
5381     \stex_annotate:nnn{definition}{\seq_use:Nn \l_tmpb_seq {,}}{
5382       \str_if_empty:NF \sdefinitiontype {
5383         \stex_annotate_invisible:nnn{typestrings}{\sdefinitiontype}{}
5384       }
5385       #2
5386       \str_if_empty:NF \sdefinitionname {
5387         \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sdefinitionname}}
5388         \stex_annotate_invisible:nnn{statementname}{\sdefinitionname}{}
5389       }
5390     }
5391   }

```


(End definition for \inlinedef. This function is documented on page ??.)

32.2 Assertions

sassertion

```

5395 \keys_define:nn {stex / sassertion }{
5396   type      .str_set_x:N = \sassertiontype,
5397   id        .str_set_x:N = \sassertionid,
5398   title     .tl_set:N     = \sassertiontitle ,
5399   for       .clist_set:N  = \l__stex_statements_sassertion_for_clist ,
5400   name      .str_set_x:N  = \sassertionname
5401 }
5402
5403 \cs_new_protected:Nn \__stex_statements_sassertion_args:n {
5404   \str_clear:N \sassertiontype
5405   \str_clear:N \sassertionid
5406   \str_clear:N \sassertionname
5407   \clist_clear:N \l__stex_statements_sassertion_for_clist
5408   \tl_clear:N \sassertiontitle
5409   \keys_set:nn { stex / sassertion }{ #1 }
5410 }
5411
5412 %\tl_new:N \g__stex_statements_aftergroup_tl
5413
5414 \NewDocumentEnvironment{sassertion}{0}{}{
5415   \__stex_statements_sassertion_args:n{ #1 }
5416   \stex_reactivate_macro:N \premise
5417   \stex_reactivate_macro:N \conclusion
5418   \stex_reactivate_macro:N \varbindforall
5419   \stex_if_smsmode:F {
5420     \seq_clear:N \l_tmpb_seq
5421     \clist_map_inline:Nn \l__stex_statements_sassertion_for_clist {
5422       \tl_if_empty:nF{ ##1 }{
5423         \stex_get_symbol:n { ##1 }
5424         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5425           \l_stex_get_symbol_uri_str
5426         }
5427       }
5428     }
5429     \exp_args:Nnnx
5430     \begin{sassertion_env}{assertion}{\seq_use:Nn \l_tmpb_seq {},}}
5431     \str_if_empty:NF \sassertiontype {
5432       \stex_annotate_invisible:nnn{type}{\sassertiontype}{}
5433     }
5434     \str_if_empty:NF \sassertionname {
5435       \stex_annotate_invisible:nnn{statementname}{\sassertionname}{}
5436     }
5437     \clist_set:N \l_tmpa_clist \sassertiontype
5438     \tl_clear:N \l_tmpa_tl

```

```

5439 \clist_map_inline:Nn \l_tmpa_clist {
5440   \tl_if_exist:cT {__stex_statements_sassertion_##1_start:}{
5441     \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sassertion_##1_start:}}
5442   }
5443 }
5444 \tl_if_empty:NTF \l_tmpa_tl {
5445   \__stex_statements_sassertion_start:
5446 }{
5447   \l_tmpa_tl
5448 }
5449 }
5450 \str_if_empty:NTF \sassertionid {
5451   \str_if_empty:NF \sassertionname {
5452     \stex_ref_new_doc_target:n {}
5453   }
5454 } {
5455   \stex_ref_new_doc_target:n \sassertionid
5456 }
5457 \stex_smsmode_do:
5458 ){
5459   \str_if_empty:NF \sassertionname {
5460     \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sassertionname}}
5461     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sassertionname}
5462   }
5463   \stex_if_smsmode:F {
5464     \clist_set:No \l_tmpa_clist \sassertiontype
5465     \tl_clear:N \l_tmpa_tl
5466     \clist_map_inline:Nn \l_tmpa_clist {
5467       \tl_if_exist:cT {__stex_statements_sassertion_##1_end:}{
5468         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sassertion_##1_end:}}
5469       }
5470     }
5471     \tl_if_empty:NTF \l_tmpa_tl {
5472       \__stex_statements_sassertion_end:
5473     }{
5474       \l_tmpa_tl
5475     }
5476     \end{stex_annotate_env}
5477   }
5478 }

```

\stexpatchassertion

```

5479
5480 \cs_new_protected:Nn \__stex_statements_sassertion_start: {
5481   \stex_par:\noindent\titleemph{Assertion~\tl_if_empty:NF \sassertiontitle {
5482     (\sassertiontitle)
5483   }~}
5484 }
5485 \cs_new_protected:Nn \__stex_statements_sassertion_end: {\stex_par:\medskip}
5486
5487 \newcommand\stexpatchassertion[3] [] {
5488   \str_set:Nx \l_tmpa_str{ #1 }
5489   \str_if_empty:NTF \l_tmpa_str {
5490     \tl_set:Nn \__stex_statements_sassertion_start: { #2 }

```

```

5491     \tl_set:Nn \__stex_statements_sassertion_end: { #3 }
5492   }{
5493     \exp_after:wN \tl_set:Nn \csname __stex_statements_sassertion_#1_start:\endcsname{ #2
5494     \exp_after:wN \tl_set:Nn \csname __stex_statements_sassertion_#1_end:\endcsname{ #3 }
5495   }
5496 }

```

(End definition for `\stexpatchassertion`. This function is documented on page 47.)

`\inlineass` inline:

```

5497 \keys_define:nn {stex / inlineass }{
5498   type      .str_set_x:N = \sassertiontype,
5499   id        .str_set_x:N = \sassertionid,
5500   for       .clist_set:N = \l__stex_statements_sassertion_for_clist ,
5501   name      .str_set_x:N = \sassertionname
5502 }
5503 \cs_new_protected:Nn \__stex_statements_inlineass_args:n {
5504   \str_clear:N \sassertiontype
5505   \str_clear:N \sassertionid
5506   \str_clear:N \sassertionname
5507   \clist_clear:N \l__stex_statements_sassertion_for_clist
5508   \keys_set:nn { stex / inlineass }{ #1 }
5509 }
5510 \NewDocumentCommand \inlineass { 0{} m } {
5511   \beginngroup
5512   \stex_reactivate_macro:N \premise
5513   \stex_reactivate_macro:N \conclusion
5514   \stex_reactivate_macro:N \varbindforall
5515   \__stex_statements_inlineass_args:n{ #1 }
5516   \str_if_empty:NTF \sassertionid {
5517     \str_if_empty:NF \sassertionname {
5518       \stex_ref_new_doc_target:n {}
5519     }
5520   } {
5521     \stex_ref_new_doc_target:n \sassertionid
5522   }
5523
5524   \stex_if_smsmode:TF{
5525     \str_if_empty:NF \sassertionname {
5526       \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sassertionname}}
5527     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sassertionname}
5528   }
5529 }{
5530   \seq_clear:N \l_tmpb_seq
5531   \clist_map_inline:Nn \l__stex_statements_sassertion_for_clist {
5532     \tl_if_empty:nF{ ##1 }{
5533       \stex_get_symbol:n { ##1 }
5534       \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5535         \l_stex_get_symbol_uri_str
5536       }
5537     }
5538   }
5539   \exp_args:Nnx
5540   \stex_annotate:nnn{assertion}{\seq_use:Nn \l_tmpb_seq {,}}{

```

```

5541     \str_if_empty:NF \sassassertiontype {
5542       \stex_annotate_invisible:nnn{typestrings}{\sassassertiontype}{ }
5543     }
5544     #2
5545     \str_if_empty:NF \sassassertionname {
5546       \stex_suppress_html:n{\stex_symdecl_do:nn}{\sassassertionname}}
5547       \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sassassertionname}
5548       \stex_annotate_invisible:nnn{statementname}{\sassassertionname}{ }
5549     }
5550   }
5551 }
5552 \endgroup
5553 \stex_smsmode_do:
5554 }

```

(End definition for `\inlineass`. This function is documented on page ??.)

32.3 Examples

`sexample`

```

5555
5556 \keys_define:nn {stex / sexample }{
5557   type      .str_set_x:N = \exampletype,
5558   id        .str_set_x:N = \sexampleid,
5559   title     .tl_set:N    = \sexampletitle,
5560   name      .str_set_x:N = \sexamplename ,
5561   for       .clist_set:N = \l__stex_statements_sexample_for_clist,
5562 }
5563 \cs_new_protected:Nn \__stex_statements_sexample_args:n {
5564   \str_clear:N \sexampletype
5565   \str_clear:N \sexampleid
5566   \str_clear:N \sexamplename
5567   \tl_clear:N \sexampletitle
5568   \clist_clear:N \l__stex_statements_sexample_for_clist
5569   \keys_set:nn { stex / sexample }{ #1 }
5570 }
5571
5572 \NewDocumentEnvironment{sexample}{0{}}{
5573   \__stex_statements_sexample_args:n{ #1 }
5574   \stex_reactivate_macro:N \premise
5575   \stex_reactivate_macro:N \conclusion
5576   \stex_if_smsmode:F {
5577     \seq_clear:N \l_tmpb_seq
5578     \clist_map_inline:Nn \l__stex_statements_sexample_for_clist {
5579       \tl_if_empty:nF{ ##1 }{
5580         \stex_get_symbol:n { ##1 }
5581         \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5582           \l_stex_get_symbol_uri_str
5583         }
5584       }
5585     }
5586     \exp_args:Nnnx
5587     \begin{stex_annotate_env}{example}{\seq_use:Nn \l_tmpb_seq {,}}

```

```

5588 \str_if_empty:NF \sexamplotype {
5589 \stex_annotate_invisible:nnn{typestrings}{\sexamplotype}{}
5590 }
5591 \str_if_empty:NF \sexamplename {
5592 \stex_annotate_invisible:nnn{statementname}{\sexamplename}{}
5593 }
5594 \clist_set:No \l_tmpa_clist \sexamplotype
5595 \tl_clear:N \l_tmpa_tl
5596 \clist_map_inline:Nn \l_tmpa_clist {
5597 \tl_if_exist:cT {__stex_statements_sexample_##1_start:}{
5598 \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sexample_##1_start:}}
5599 }
5600 }
5601 \tl_if_empty:NTF \l_tmpa_tl {
5602 \__stex_statements_sexample_start:
5603 }{
5604 \l_tmpa_tl
5605 }
5606 }
5607 \str_if_empty:NF \sexampleid {
5608 \stex_ref_new_doc_target:n \sexampleid
5609 }
5610 \stex_smsmode_do:
5611 }{
5612 \str_if_empty:NF \sexamplename {
5613 \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sexamplename}}
5614 }
5615 \stex_if_smsmode:F {
5616 \clist_set:No \l_tmpa_clist \sexamplotype
5617 \tl_clear:N \l_tmpa_tl
5618 \clist_map_inline:Nn \l_tmpa_clist {
5619 \tl_if_exist:cT {__stex_statements_sexample_##1_end:}{
5620 \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sexample_##1_end:}}
5621 }
5622 }
5623 \tl_if_empty:NTF \l_tmpa_tl {
5624 \__stex_statements_sexample_end:
5625 }{
5626 \l_tmpa_tl
5627 }
5628 \end{stex_annotate_env}
5629 }
5630 }

```

\stexpatchexample

```

5631
5632 \cs_new_protected:Nn \__stex_statements_sexample_start: {
5633 \stex_par:\noindent\titllemph{Example~\tl_if_empty:NF \sexampltitle {
5634 (\sexampltitle)
5635 }~}
5636 }
5637 \cs_new_protected:Nn \__stex_statements_sexample_end: {\stex_par:\medskip}
5638
5639 \newcommand\stexpatchexample[3]{} {

```

```

5640 \str_set:Nx \l_tmpa_str{ #1 }
5641 \str_if_empty:NTF \l_tmpa_str {
5642   \tl_set:Nn \__stex_statements_sexample_start: { #2 }
5643   \tl_set:Nn \__stex_statements_sexample_end: { #3 }
5644 }{
5645   \exp_after:wN \tl_set:Nn \csname __stex_statements_sexample_#1_start:\endcsname{ #2 }
5646   \exp_after:wN \tl_set:Nn \csname __stex_statements_sexample_#1_end:\endcsname{ #3 }
5647 }
5648 }

```

(End definition for `\stexpatchexample`. This function is documented on page 47.)

`\inlineex` inline:

```

5649 \keys_define:nn {stex / inlineex }{
5650   type      .str_set_x:N = \sexamplotype,
5651   id        .str_set_x:N = \sexampleid,
5652   for       .clist_set:N = \l__stex_statements_sexample_for_clist ,
5653   name      .str_set_x:N = \sexamplename
5654 }
5655 \cs_new_protected:Nn \__stex_statements_inlineex_args:n {
5656   \str_clear:N \sexamplotype
5657   \str_clear:N \sexampleid
5658   \str_clear:N \sexamplename
5659   \clist_clear:N \l__stex_statements_sexample_for_clist
5660   \keys_set:nn { stex / inlineex }{ #1 }
5661 }
5662 \NewDocumentCommand \inlineex { 0{} m } {
5663   \begingroup
5664   \stex_reactivate_macro:N \premise
5665   \stex_reactivate_macro:N \conclusion
5666   \__stex_statements_inlineex_args:n{ #1 }
5667   \str_if_empty:NF \sexampleid {
5668     \stex_ref_new_doc_target:n \sexampleid
5669   }
5670   \stex_if_smsmode:TF{
5671     \str_if_empty:NF \sexamplename {
5672       \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sexamplename}}
5673   }
5674 }{
5675   \seq_clear:N \l_tmpb_seq
5676   \clist_map_inline:Nn \l__stex_statements_sexample_for_clist {
5677     \tl_if_empty:nF{ ##1 }{
5678       \stex_get_symbol:n { ##1 }
5679       \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5680         \l_stex_get_symbol_uri_str
5681       }
5682     }
5683   }
5684   \exp_args:Nnx
5685   \stex_annotate:nnn{example}{\seq_use:Nn \l_tmpb_seq {,}}{
5686     \str_if_empty:NF \sexamplotype {
5687       \stex_annotate_invisible:nnn{typestrings}{\sexamplotype}{ }
5688     }
5689     #2

```

```

5690     \str_if_empty:NF \sexamplename {
5691       \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sexamplename}}
5692       \stex_annotate_invisible:nnn{statementname}{\sexamplename}{ }
5693     }
5694   }
5695 }
5696 \endgroup
5697 \stex_smsmode_do:
5698 }

```

(End definition for `\inlineex`. This function is documented on page ??.)

32.4 Logical Paragraphs

`sparagraph`

```

5699 \keys_define:nn { stex / sparagraph } {
5700   id      .str_set:x:N = \sparagraphid ,
5701   title   .tl_set:N    = \l_stex_sparagraph_title_tl ,
5702   type    .str_set:x:N = \sparagraphtype ,
5703   for     .clist_set:N  = \l__stex_statements_sparagraph_for_clist ,
5704   from    .tl_set:N     = \sparagraphfrom ,
5705   to      .tl_set:N     = \sparagraphto ,
5706   start   .tl_set:N     = \l_stex_sparagraph_start_tl ,
5707   name     .str_set:N   = \sparagraphname ,
5708   imports .tl_set:N     = \l__stex_statements_sparagraph_imports_tl
5709 }
5710
5711 \cs_new_protected:Nn \stex_sparagraph_args:n {
5712   \tl_clear:N \l_stex_sparagraph_title_tl
5713   \tl_clear:N \sparagraphfrom
5714   \tl_clear:N \sparagraphto
5715   \tl_clear:N \l_stex_sparagraph_start_tl
5716   \tl_clear:N \l__stex_statements_sparagraph_imports_tl
5717   \str_clear:N \sparagraphid
5718   \str_clear:N \sparagraphtype
5719   \clist_clear:N \l__stex_statements_sparagraph_for_clist
5720   \str_clear:N \sparagraphname
5721   \keys_set:nn { stex / sparagraph } { #1 }
5722 }
5723 \newif\if@in@omtext\@in@omtextfalse
5724
5725 \NewDocumentEnvironment {sparagraph} { 0{ } } {
5726   \stex_sparagraph_args:n { #1 }
5727   \tl_if_empty:NTF \l_stex_sparagraph_start_tl {
5728     \tl_set_eq:NN \sparagraphtitle \l_stex_sparagraph_title_tl
5729   }{
5730     \tl_set_eq:NN \sparagraphtitle \l_stex_sparagraph_start_tl
5731   }
5732   \@in@omtexttrue
5733   \stex_if_smsmode:F {
5734     \seq_clear:N \l_tmpb_seq
5735     \clist_map_inline:Nn \l__stex_statements_sparagraph_for_clist {
5736       \tl_if_empty:nF{ ##1 }{

```

```

5737     \stex_get_symbol:n { ##1 }
5738     \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5739         \l_stex_get_symbol_uri_str
5740     }
5741 }
5742 }
5743 \exp_args:Nnnx
5744 \begin{stex_annotate_env}{paragraph}{\seq_use:Nn \l_tmpb_seq {,}}
5745 \str_if_empty:NF \sparagraphtype {
5746     \stex_annotate_invisible:nnn{typestrings}{\sparagraphtype}{}
5747 }
5748 \str_if_empty:NF \sparagraphfrom {
5749     \stex_annotate_invisible:nnn{from}{\sparagraphfrom}{}
5750 }
5751 \str_if_empty:NF \sparagraphto {
5752     \stex_annotate_invisible:nnn{to}{\sparagraphto}{}
5753 }
5754 \str_if_empty:NF \sparagraphname {
5755     \stex_annotate_invisible:nnn{statementname}{\sparagraphname}{}
5756 }
5757 \clist_set:No \l_tmpa_clist \sparagraphtype
5758 \tl_clear:N \l_tmpa_tl
5759 \clist_map_inline:Nn \sparagraphtype {
5760     \tl_if_exist:cT {__stex_statements_sparagraph_##1_start:}{
5761         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sparagraph_##1_start:}}
5762     }
5763 }
5764 \stex_csl_to_imports:No \usemodule \l__stex_statements_sparagraph_imports_tl
5765 \tl_if_empty:NTF \l_tmpa_tl {
5766     \__stex_statements_sparagraph_start:
5767 }{
5768     \l_tmpa_tl
5769 }
5770 }
5771 \clist_set:No \l_tmpa_clist \sparagraphtype
5772 \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{symdoc}}{
5773     {
5774         \stex_reactivate_macro:N \definiendum
5775         \stex_reactivate_macro:N \definame
5776         \stex_reactivate_macro:N \Definame
5777         \stex_reactivate_macro:N \premise
5778         \stex_reactivate_macro:N \definiens
5779     }
5780 \str_if_empty:NTF \sparagraphid {
5781     \str_if_empty:NTF \sparagraphname {
5782         \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{symdoc}}{
5783             \stex_ref_new_doc_target:n {}
5784         }
5785     } {
5786         \stex_ref_new_doc_target:n {}
5787     }
5788 } {
5789     \stex_ref_new_doc_target:n \sparagraphid
5790 }

```



```

5791 \exp_args:NNx
5792 \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{syndoc}}{
5793   \clist_map_inline:Nn \l__stex_statements_sparagraph_for_clist {
5794     \tl_if_empty:nF{ ##1 }{
5795       \stex_get_symbol:n { ##1 }
5796       \stex_ref_new_sym_target:n \l_stex_get_symbol_uri_str
5797     }
5798   }
5799 }
5800 \stex_smsmode_do:
5801 \ignorespacesandpars
5802 }{
5803   \str_if_empty:NF \sparagraphname {
5804     \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sparagraphname}}
5805     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sparagraphname}
5806   }
5807   \stex_if_smsmode:F {
5808     \clist_set:No \l_tmpa_clist \sparagraphtype
5809     \tl_clear:N \l_tmpa_tl
5810     \clist_map_inline:Nn \l_tmpa_clist {
5811       \tl_if_exist:cT {__stex_statements_sparagraph_##1_end:}{
5812         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_statements_sparagraph_##1_end:}}
5813       }
5814     }
5815     \tl_if_empty:NTF \l_tmpa_tl {
5816       \__stex_statements_sparagraph_end:
5817     }{
5818       \l_tmpa_tl
5819     }
5820     \end{stex_annotate_env}
5821   }
5822 }

```

\stexpatchparagraph

```

5823
5824 \cs_new_protected:Nn \__stex_statements_sparagraph_start: {
5825   \stex_par:\noindent\tl_if_empty:NTF \l_stex_sparagraph_start_tl {
5826     \tl_if_empty:NF \l_stex_sparagraph_title_tl {
5827       \titleemph{\l_stex_sparagraph_title_tl}:~
5828     }
5829   }{
5830     \titleemph{\l_stex_sparagraph_start_tl}~
5831   }
5832 }
5833 \cs_new_protected:Nn \__stex_statements_sparagraph_end: {\stex_par:\medskip}
5834
5835 \newcommand\stexpatchparagraph[3] [] {
5836   \str_set:Nx \l_tmpa_str{ #1 }
5837   \str_if_empty:NTF \l_tmpa_str {
5838     \tl_set:Nn \__stex_statements_sparagraph_start: { #2 }
5839     \tl_set:Nn \__stex_statements_sparagraph_end: { #3 }
5840   }{
5841     \exp_after:wN \tl_set:Nn \csname __stex_statements_sparagraph_#1_start:\endcsname{ #2
5842     \exp_after:wN \tl_set:Nn \csname __stex_statements_sparagraph_#1_end:\endcsname{ #3 }

```

```

5843     }
5844 }
5845
5846 \keys_define:nn { stex / inlinepara } {
5847   id      .str_set:N = \sparagraphid ,
5848   type    .str_set:N = \sparagraphtype ,
5849   for     .clist_set:N = \l__stex_statements_sparagraph_for_clist ,
5850   from    .tl_set:N   = \sparagraphfrom ,
5851   to      .tl_set:N   = \sparagraphto ,
5852   name    .str_set:N   = \sparagraphname
5853 }
5854 \cs_new_protected:Nn \__stex_statements_inlinepara_args:n {
5855   \tl_clear:N \sparagraphfrom
5856   \tl_clear:N \sparagraphto
5857   \str_clear:N \sparagraphid
5858   \str_clear:N \sparagraphtype
5859   \clist_clear:N \l__stex_statements_sparagraph_for_clist
5860   \str_clear:N \sparagraphname
5861   \keys_set:nn { stex / inlinepara }{ #1 }
5862 }
5863 \NewDocumentCommand \inlinepara { 0{} m } {
5864   \begingroup
5865   \__stex_statements_inlinepara_args:n{ #1 }
5866   \clist_set:Nn \l_tmpa_clist \sparagraphtype
5867   \str_if_empty:NTF \sparagraphid {
5868     \str_if_empty:NTF \sparagraphname {
5869       \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{syndoc}}{
5870         \stex_ref_new_doc_target:n {}
5871       }
5872     } {
5873       \stex_ref_new_doc_target:n {}
5874     }
5875   } {
5876     \stex_ref_new_doc_target:n \sparagraphid
5877   }
5878   \stex_if_smsmode:TF{
5879     \str_if_empty:NF \sparagraphname {
5880       \stex_suppress_html:n{\stex_symdecl_do:nn{}}{\sparagraphname}}
5881     \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sparagraphname}
5882   }
5883 }{
5884   \seq_clear:N \l_tmpb_seq
5885   \clist_map_inline:Nn \l__stex_statements_sparagraph_for_clist {
5886     \tl_if_empty:nF{ ##1 }{
5887       \stex_get_symbol:n { ##1 }
5888       \exp_args:NNo \seq_put_right:Nn \l_tmpb_seq {
5889         \l_stex_get_symbol_uri_str
5890       }
5891     }
5892   }
5893   \exp_args:Nnx
5894   \stex_annotate:nnn{paragraph}{\seq_use:Nn \l_tmpb_seq {,}}{
5895     \str_if_empty:NF \sparagraphtype {
5896       \stex_annotate_invisible:nnn{typestrings}{\sparagraphtype}{

```

```

5897     }
5898     \str_if_empty:NF \sparagraphfrom {
5899       \stex_annotate_invisible:nnn{from}{\sparagraphfrom}{}
5900     }
5901     \str_if_empty:NF \sparagraphto {
5902       \stex_annotate_invisible:nnn{to}{\sparagraphto}{}
5903     }
5904     \str_if_empty:NF \sparagraphname {
5905       \stex_suppress_html:n{\stex_symdecl_do:nn{}{\sparagraphname}}
5906       \stex_annotate_invisible:nnn{statementname}{\sparagraphname}{}
5907       \stex_ref_new_sym_target:n {\l_stex_current_module_str ? \sparagraphname}
5908     }
5909     \exp_args:NNx \clist_if_in:NnT \l_tmpa_clist {\tl_to_str:n{syndoc}}{
5910       \clist_map_inline:Nn \l_tmpb_seq {
5911         \stex_ref_new_sym_target:n {##1}
5912       }
5913     }
5914     #2
5915   }
5916 }
5917 \endgroup
5918 \stex_smsmode_do:
5919 }
5920

```

(End definition for `\stexpatchparagraph`. This function is documented on page [47](#).)

```

5921 </package>

```

Chapter 33

The Implementation

```
5922 <*package>
5923 <@@=stex_sproof>
5924
5925 %%%%%%%%%%    sproof.dtx    %%%%%%%%%%
5926
```

33.1 Proofs

We first define some keys for the proof environment.

```
5927 \keys_define:nn { stex / spf } {
5928   id          .str_set_x:N = \spfid,
5929   for         .clist_set:N = \l__stex_sproof_spf_for_clist ,
5930   from        .tl_set:N    = \l__stex_sproof_spf_from_tl ,
5931   proofend    .tl_set:N    = \l__stex_sproof_spf_proofend_tl,
5932   type        .str_set_x:N = \spftype,
5933   title       .tl_set:N    = \spftitle,
5934   continues   .tl_set:N    = \l__stex_sproof_spf_continues_tl,
5935   functions   .tl_set:N    = \l__stex_sproof_spf_functions_tl,
5936   method      .tl_set:N    = \l__stex_sproof_spf_method_tl
5937 }
5938 \cs_new_protected:Nn \__stex_sproof_spf_args:n {
5939   \str_clear:N \spfid
5940   \tl_clear:N \l__stex_sproof_spf_for_tl
5941   \tl_clear:N \l__stex_sproof_spf_from_tl
5942   \tl_set:Nn \l__stex_sproof_spf_proofend_tl {\sproof@box}
5943   \str_clear:N \spftype
5944   \tl_clear:N \spftitle
5945   \tl_clear:N \l__stex_sproof_spf_continues_tl
5946   \tl_clear:N \l__stex_sproof_spf_functions_tl
5947   \tl_clear:N \l__stex_sproof_spf_method_tl
5948   \bool_set_false:N \l__stex_sproof_inc_counter_bool
5949   \keys_set:nn { stex / spf }{ #1 }
5950 }
```

```
\c__stex_sproof_flow_str We define this macro, so that we can test whether the display key has the value flow
5951 \str_set:Nn\c__stex_sproof_flow_str{inline}
```

(End definition for `\c__stex_sproof_flow_str`.)

For proofs, we will have to have deeply nested structures of enumerated list-like environments. However, L^AT_EX only allows `enumerate` environments up to nesting depth 4 and general list environments up to listing depth 6. This is not enough for us. Therefore we have decided to go along the route proposed by Leslie Lamport to use a single top-level list with dotted sequences of numbers to identify the position in the proof tree. Unfortunately, we could not use his `pf.sty` package directly, since it does not do automatic numbering, and we have to add keyword arguments all over the place, to accomodate semantic information.

```

5952 \intarray_new:Nn\l__stex_sproof_counter_intarray{50}
5953 \cs_new_protected:Npn \sproofnumber {
5954   \int_set:Nn \l_tmpa_int {1}
5955   \bool_while_do:nn {
5956     \int_compare_p:nNn {
5957       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
5958     } > 0
5959   }{
5960     \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int .
5961     \int_incr:N \l_tmpa_int
5962   }
5963 }
5964 \cs_new_protected:Npn \__stex_sproof_inc_counter: {
5965   \int_set:Nn \l_tmpa_int {1}
5966   \bool_while_do:nn {
5967     \int_compare_p:nNn {
5968       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
5969     } > 0
5970   }{
5971     \int_incr:N \l_tmpa_int
5972   }
5973   \int_compare:nNnF \l_tmpa_int = 1 {
5974     \int_decr:N \l_tmpa_int
5975   }
5976   \intarray_gset:Nnn \l__stex_sproof_counter_intarray \l_tmpa_int {
5977     \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int + 1
5978   }
5979 }
5980
5981 \cs_new_protected:Npn \__stex_sproof_add_counter: {
5982   \int_set:Nn \l_tmpa_int {1}
5983   \bool_while_do:nn {
5984     \int_compare_p:nNn {
5985       \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
5986     } > 0
5987   }{
5988     \int_incr:N \l_tmpa_int
5989   }
5990   \intarray_gset:Nnn \l__stex_sproof_counter_intarray \l_tmpa_int { 1 }
5991 }
5992
5993 \cs_new_protected:Npn \__stex_sproof_remove_counter: {
5994   \int_set:Nn \l_tmpa_int {1}
5995   \bool_while_do:nn {

```

```

5996 \int_compare_p:nNn {
5997 \intarray_item:Nn \l__stex_sproof_counter_intarray \l_tmpa_int
5998 } > 0
5999 }{
6000 \int_incr:N \l_tmpa_int
6001 }
6002 \int_decr:N \l_tmpa_int
6003 \intarray_gset:Nnn \l__stex_sproof_counter_intarray \l_tmpa_int { 0 }
6004 }

```

\sproofend This macro places a little box at the end of the line if there is space, or at the end of the next line if there isn't

```

6005 \def\sproof@box{
6006 \hbox{\vrule\vbox{\hrule width 6 pt\vskip 6pt\hrule}\vrule}
6007 }
6008 \def\sproofend{
6009 \tl_if_empty:NF \l__stex_sproof_spf_proofend_tl {
6010 \hfil\null\nobreak\hfill\l__stex_sproof_spf_proofend_tl\par\smallskip
6011 }
6012 }

```

(End definition for \sproofend. This function is documented on page 46.)

spf@*@kw

```

6013 \def\spf@proofsketch@kw{Proof~Sketch}
6014 \def\spf@proof@kw{Proof}
6015 \def\spf@step@kw{Step}

```

(End definition for spf@*@kw. This function is documented on page ??.)

For the other languages, we set up triggers

```

6016 \AddToHook{begindocument}{
6017 \ltx@ifpackageloaded{babel}{
6018 \makeatletter
6019 \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
6020 \clist_if_in:NnT \l_tmpa_clist {ngerman}{
6021 \input{sproof-ngerman.ldf}
6022 }
6023 \clist_if_in:NnT \l_tmpa_clist {finnish}{
6024 \input{sproof-finnish.ldf}
6025 }
6026 \clist_if_in:NnT \l_tmpa_clist {french}{
6027 \input{sproof-french.ldf}
6028 }
6029 \clist_if_in:NnT \l_tmpa_clist {russian}{
6030 \input{sproof-russian.ldf}
6031 }
6032 \makeatother
6033 }{}
6034 }

```

spfsketch

```

6035 \newcommand\spfsketch[2][]{
6036 \begin{group}
6037 \let \premise \stex_proof_premise:

```

```

6038 \__stex_sproof_spf_args:n{#1}
6039 \stex_if_smsmode:TF {
6040   \str_if_empty:NF \spfid {
6041     \stex_ref_new_doc_target:n \spfid
6042   }
6043 }{
6044   \seq_clear:N \l_tmpa_seq
6045   \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6046     \tl_if_empty:nF{ ##1 }{
6047       \stex_get_symbol:n { ##1 }
6048       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6049         \l_stex_get_symbol_uri_str
6050       }
6051     }
6052   }
6053   \exp_args:Nnx
6054   \stex_annotate:nnn{proofsketch}{\seq_use:Nn \l_tmpa_seq {,}}{
6055     \str_if_empty:NF \spftype {
6056       \stex_annotate_invisible:nnn{type}{\spftype}{
6057     }
6058     \clist_set:No \l_tmpa_clist \spftype
6059     \tl_set:Nn \l_tmpa_tl {
6060       \titleemph{
6061         \tl_if_empty:NTF \spftitle {
6062           \spf@proofsketch@kw
6063         }{
6064           \spftitle
6065         }
6066       }:\sim
6067     }
6068     \clist_map_inline:Nn \l_tmpa_clist {
6069       \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6070         \tl_clear:N \l_tmpa_tl
6071       }
6072     }
6073     \str_if_empty:NF \spfid {
6074       \stex_ref_new_doc_target:n \spfid
6075     }
6076     \l_tmpa_tl #2 \sproofend
6077   }
6078 }
6079 \endgroup
6080 \stex_smsmode_do:
6081 }
6082

```

(End definition for *spfsketch*. This function is documented on page 44.)

spfeq This is very similar to `\spfsketch`, but uses a computation array¹⁴¹⁵

```

6083 \newenvironment{spfeq}[2][ ]{
6084   \__stex_sproof_spf_args:n{#1}

```

¹⁴EDNOTE: This should really be more like a tabular with an ensuremath in it. or invoke text on the last column

¹⁵EDNOTE: document above

```

6085 \let \premise \stex_proof_premise:
6086 \stex_if_smsmode:TF {
6087   \str_if_empty:NF \spfid {
6088     \stex_ref_new_doc_target:n \spfid
6089   }
6090 }{
6091   \seq_clear:N \l_tmpa_seq
6092   \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6093     \tl_if_empty:nF{ ##1 }{
6094       \stex_get_symbol:n { ##1 }
6095       \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6096         \l_stex_get_symbol_uri_str
6097       }
6098     }
6099   }
6100   \exp_args:Nnnx
6101   \begin{stex_annotate_env}{spfeq}{\seq_use:Nn \l_tmpa_seq {,}}
6102   \str_if_empty:NF \spftype {
6103     \stex_annotate_invisible:nnn{type}{\spftype}{ }
6104   }
6105
6106   \clist_set:No \l_tmpa_clist \spftype
6107   \tl_clear:N \l_tmpa_tl
6108   \clist_map_inline:Nn \l_tmpa_clist {
6109     \tl_if_exist:cT {__stex_sproof_spfeq_##1_start:}{
6110       \tl_set:Nn \l_tmpa_tl {\use:c{__stex_sproof_spfeq_##1_start:}}
6111     }
6112     \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6113       \tl_set:Nn \l_tmpa_tl {\use:n{}}
6114     }
6115   }
6116   \tl_if_empty:NTF \l_tmpa_tl {
6117     \__stex_sproof_spfeq_start:
6118   }{
6119     \l_tmpa_tl
6120   }{~#2}
6121   \str_if_empty:NF \spfid {
6122     \stex_ref_new_doc_target:n \spfid
6123   }
6124   \begin{displaymath}\begin{array}{rcll}
6125   }
6126   \stex_smsmode_do:
6127 }{
6128   \stex_if_smsmode:F {
6129     \end{array}\end{displaymath}
6130     \clist_set:No \l_tmpa_clist \spftype
6131     \tl_clear:N \l_tmpa_tl
6132     \clist_map_inline:Nn \l_tmpa_clist {
6133       \tl_if_exist:cT {__stex_sproof_spfeq_##1_end:}{
6134         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_sproof_spfeq_##1_end:}}
6135       }
6136     }
6137     \tl_if_empty:NTF \l_tmpa_tl {
6138       \__stex_sproof_spfeq_end:

```



```

6139     }{
6140         \l_tmpa_tl
6141     }
6142     \end{stex_annotate_env}
6143 }
6144 }
6145
6146 \cs_new_protected:Nn \__stex_sproof_spfeq_start: {
6147     \titleemph{
6148         \tl_if_empty:NTF \spftitle {
6149             \spf@proof@kw
6150         }{
6151             \spftitle
6152         }
6153     }:
6154 }
6155 \cs_new_protected:Nn \__stex_sproof_spfeq_end: {\sproofend}
6156
6157 \newcommand\stexpatchspfeq[3] [] {
6158     \str_set:Nx \l_tmpa_str{ #1 }
6159     \str_if_empty:NTF \l_tmpa_str {
6160         \tl_set:Nn \__stex_sproof_spfeq_start: { #2 }
6161         \tl_set:Nn \__stex_sproof_spfeq_end: { #3 }
6162     }{
6163         \exp_after:wN \tl_set:Nn \csname __stex_sproof_spfeq_#1_start:\endcsname{ #2 }
6164         \exp_after:wN \tl_set:Nn \csname __stex_sproof_spfeq_#1_end:\endcsname{ #3 }
6165     }
6166 }
6167

```

(End definition for `spfeq`. This function is documented on page ??.)

sproof In this environment, we initialize the proof depth counter `\count10` to 10, and set up the description environment that will take the proof steps. At the end of the proof, we position the proof end into the last line.

```

6168 \newenvironment{sproof}[2] []{
6169     \let \premise \stex_proof_premise:
6170     \intarray_gzero:N \l__stex_sproof_counter_intarray
6171     \intarray_gset:Nnn \l__stex_sproof_counter_intarray 1 1
6172     \__stex_sproof_spf_args:n{#1}
6173     \stex_if_smsmode:TF {
6174         \str_if_empty:NF \spfid {
6175             \stex_ref_new_doc_target:n \spfid
6176         }
6177     }{
6178         \seq_clear:N \l_tmpa_seq
6179         \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6180             \tl_if_empty:nF{ ##1 }{
6181                 \stex_get_symbol:n { ##1 }
6182                 \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6183                     \l_stex_get_symbol_uri_str
6184                 }
6185             }
6186         }
6187     }
6188 }

```

```

6187 \exp_args:Nnnx
6188 \begin{stex_annotate_env}{sproof}{\seq_use:Nn \l_tmpa_seq {,}}
6189 \str_if_empty:NF \spftype {
6190   \stex_annotate_invisible:nnn{type}{\spftype}{}
6191 }
6192
6193 \clist_set:No \l_tmpa_clist \spftype
6194 \tl_clear:N \l_tmpa_tl
6195 \clist_map_inline:Nn \l_tmpa_clist {
6196   \tl_if_exist:cT {__stex_sproof_sproof_##1_start:}{
6197     \tl_set:Nn \l_tmpa_tl {\use:c{__stex_sproof_sproof_##1_start:}}
6198   }
6199   \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6200     \tl_set:Nn \l_tmpa_tl {\use:n{}}
6201   }
6202 }
6203 \tl_if_empty:NTF \l_tmpa_tl {
6204   \__stex_sproof_sproof_start:
6205 }{
6206   \l_tmpa_tl
6207 }{~#2}
6208 \str_if_empty:NF \spfid {
6209   \stex_ref_new_doc_target:n \spfid
6210 }
6211 \begin{description}
6212 }
6213 \stex_smsmode_do:
6214 }{
6215   \stex_if_smsmode:F{
6216     \end{description}
6217     \clist_set:No \l_tmpa_clist \spftype
6218     \tl_clear:N \l_tmpa_tl
6219     \clist_map_inline:Nn \l_tmpa_clist {
6220       \tl_if_exist:cT {__stex_sproof_sproof_##1_end:}{
6221         \tl_set:Nn \l_tmpa_tl {\use:c{__stex_sproof_sproof_##1_end:}}
6222       }
6223     }
6224     \tl_if_empty:NTF \l_tmpa_tl {
6225       \__stex_sproof_sproof_end:
6226     }{
6227       \l_tmpa_tl
6228     }
6229     \end{stex_annotate_env}
6230   }
6231 }
6232
6233 \cs_new_protected:Nn \__stex_sproof_sproof_start: {
6234   \par\noindent\titleemph{
6235     \tl_if_empty:NTF \spftype {
6236       \spf@proof@kw
6237     }{
6238       \spftype
6239     }
6240   }::

```

```

6241 }
6242 \cs_new_protected:Nn \__stex_sproof_sproof_end: {\sproofend}
6243
6244 \newcommand\stexpatchproof[3] [] {
6245   \str_set:Nx \l_tmpa_str{ #1 }
6246   \str_if_empty:NTF \l_tmpa_str {
6247     \tl_set:Nn \__stex_sproof_sproof_start: { #2 }
6248     \tl_set:Nn \__stex_sproof_sproof_end: { #3 }
6249   }{
6250     \exp_after:wN \tl_set:Nn \csname __stex_sproof_sproof_#1_start:\endcsname{ #2 }
6251     \exp_after:wN \tl_set:Nn \csname __stex_sproof_sproof_#1_end:\endcsname{ #3 }
6252   }
6253 }

```

\spfidea

```

6254 \newcommand\spfidea[2] []{
6255   \__stex_sproof_spf_args:n{#1}
6256   \titleemph{
6257     \tl_if_empty:NTF \spftype {Proof~Idea}{
6258       \spftype
6259     }:
6260   }~#2
6261   \sproofend
6262 }

```

(End definition for \spfidea. This function is documented on page 44.)

The next two environments (proof steps) and comments, are mostly semantical, they take KeyVal arguments that specify their semantic role. In draft mode, they read these values and show them. If the surrounding proof had `display=flow`, then no new \item is generated, otherwise it is. In any case, the proof step number (at the current level) is incremented.

spfstep

```

6263 \newenvironment{spfstep}[1] []{
6264   \__stex_sproof_spf_args:n{#1}
6265   \stex_if_smsmode:TF {
6266     \str_if_empty:NF \spfid {
6267       \stex_ref_new_doc_target:n \spfid
6268     }
6269   }{
6270     \@in@omtexttrue
6271     \seq_clear:N \l_tmpa_seq
6272     \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6273       \tl_if_empty:nF{ ##1 }{
6274         \stex_get_symbol:n { ##1 }
6275         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6276           \l_stex_get_symbol_uri_str
6277         }
6278       }
6279     }
6280     \exp_args:Nnnx
6281     \begin{stex_annotate_env}{spfstep}{\seq_use:Nn \l_tmpa_seq {,}}
6282     \str_if_empty:NF \spftype {
6283       \stex_annotate_invisible:nnn{type}{\spftype}{ }

```

```

6284 }
6285 \clist_set:No \l_tmpa_clist \spftype
6286 \tl_set:Nn \l_tmpa_tl {
6287   \item[\sproofnumber]
6288   \bool_set_true:N \l__stex_sproof_inc_counter_bool
6289 }
6290 \clist_map_inline:Nn \l_tmpa_clist {
6291   \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6292     \tl_clear:N \l_tmpa_tl
6293   }
6294 }
6295 \l_tmpa_tl
6296 \tl_if_empty:NF \spftitle {
6297   {(\titleemph{\spftitle})\enspace}
6298 }
6299 \str_if_empty:NF \spfid {
6300   \stex_ref_new_doc_target:n \spfid
6301 }
6302 }
6303 \stex_smsmode_do:
6304 \ignorespacesandpars
6305 }{
6306   \bool_if:NT \l__stex_sproof_inc_counter_bool {
6307     \__stex_sproof_inc_counter:
6308   }
6309   \stex_if_smsmode:F {
6310     \end{stex_annotate_env}
6311   }
6312 }

```

spfcomment

```

6313 \newenvironment{spfcomment}[1][]{
6314   \__stex_sproof_spf_args:n{#1}
6315   \clist_set:No \l_tmpa_clist \spftype
6316   \tl_set:Nn \l_tmpa_tl {
6317     \item[\sproofnumber]
6318     \bool_set_true:N \l__stex_sproof_inc_counter_bool
6319   }
6320   \clist_map_inline:Nn \l_tmpa_clist {
6321     \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6322       \tl_clear:N \l_tmpa_tl
6323     }
6324   }
6325   \l_tmpa_tl
6326 }{
6327   \bool_if:NT \l__stex_sproof_inc_counter_bool {
6328     \__stex_sproof_inc_counter:
6329   }
6330 }

```

The next two environments also take a `KeyVal` argument, but also a regular one, which contains a start text. Both environments start a new numbered proof level.

subproof In the `subproof` environment, a new (lower-level) `proproof` environment is started.

```

6331 \newenvironment{subproof}[2][]{
6332   \_stex_sproof_spf_args:n{#1}
6333   \stex_if_smsmode:TF{
6334     \str_if_empty:NF \spfid {
6335       \stex_ref_new_doc_target:n \spfid
6336     }
6337   }{
6338     \seq_clear:N \l_tmpa_seq
6339     \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6340       \tl_if_empty:nF{ ##1 }{
6341         \stex_get_symbol:n { ##1 }
6342         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6343           \l_stex_get_symbol_uri_str
6344         }
6345       }
6346     }
6347     \exp_args:Nnnx
6348     \begin{stex_annotate_env}{subproof}{\seq_use:Nn \l_tmpa_seq {,}}
6349     \str_if_empty:NF \spftype {
6350       \stex_annotate_invisible:nnn{type}{\spftype}{ }
6351     }
6352
6353     \clist_set:No \l_tmpa_clist \spftype
6354     \tl_set:Nn \l_tmpa_tl {
6355       \item[\sproofnumber]
6356       \bool_set_true:N \l__stex_sproof_inc_counter_bool
6357     }
6358     \clist_map_inline:Nn \l_tmpa_clist {
6359       \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6360         \tl_clear:N \l_tmpa_tl
6361       }
6362     }
6363     \l_tmpa_tl
6364     \tl_if_empty:NF \spftitle {
6365       {(\titleemph{\spftitle})\enspace}
6366     }
6367     {~#2}
6368     \str_if_empty:NF \spfid {
6369       \stex_ref_new_doc_target:n \spfid
6370     }
6371   }
6372   \_stex_sproof_add_counter:
6373   \stex_smsmode_do:
6374 }{
6375   \_stex_sproof_remove_counter:
6376   \bool_if:NT \l__stex_sproof_inc_counter_bool {
6377     \_stex_sproof_inc_counter:
6378   }
6379   \stex_if_smsmode:F{
6380     \end{stex_annotate_env}
6381   }
6382 }

```

spfcases In the **pfcases** environment, the start text is displayed as the first comment of the proof.

```

6383 \newenvironment{spfcases}[2] [] {
6384   \tl_if_empty:nTF{#1}{
6385     \begin{subproof}[method=by-cases]{#2}
6386   }{
6387     \begin{subproof}[#1,method=by-cases]{#2}
6388   }
6389 }{
6390   \end{subproof}
6391 }

```

spfcase In the pfcase environment, the start text is displayed specification of the case after the `\item`

```

6392 \newenvironment{spfcase}[2] [] {
6393   \__stex_sproof_spf_args:n{#1}
6394   \stex_if_smsmode:TF {
6395     \str_if_empty:NF \spfid {
6396       \stex_ref_new_doc_target:n \spfid
6397     }
6398   }{
6399     \seq_clear:N \l_tmpa_seq
6400     \clist_map_inline:Nn \l__stex_sproof_spf_for_clist {
6401       \tl_if_empty:nF{ ##1 }{
6402         \stex_get_symbol:n { ##1 }
6403         \exp_args:NNo \seq_put_right:Nn \l_tmpa_seq {
6404           \l_stex_get_symbol_uri_str
6405         }
6406       }
6407     }
6408     \exp_args:Nnnx
6409     \begin{stex_annotate_env}{spfcase}{\seq_use:Nn \l_tmpa_seq {,}}
6410     \str_if_empty:NF \spftype {
6411       \stex_annotate_invisible:nnn{type}{\spftype}{ }
6412     }
6413     \clist_set:No \l_tmpa_clist \spftype
6414     \tl_set:Nn \l_tmpa_tl {
6415       \item[\sproofnumber]
6416       \bool_set_true:N \l__stex_sproof_inc_counter_bool
6417     }
6418     \clist_map_inline:Nn \l_tmpa_clist {
6419       \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6420         \tl_clear:N \l_tmpa_tl
6421       }
6422     }
6423     \l_tmpa_tl
6424     \tl_if_empty:nF{#2}{
6425       \titleemph{#2}:~
6426     }
6427   }
6428   \__stex_sproof_add_counter:
6429   \stex_smsmode_do:
6430 }{
6431   \__stex_sproof_remove_counter:
6432   \bool_if:NT \l__stex_sproof_inc_counter_bool {
6433     \__stex_sproof_inc_counter:

```

```

6434 }
6435 \stex_if_smsmode:F{
6436   \clist_set:No \l_tmpa_clist \spftype
6437   \tl_set:Nn \l_tmpa_tl{\sproofend}
6438   \clist_map_inline:Nn \l_tmpa_clist {
6439     \exp_args:No \str_if_eq:nnT \c__stex_sproof_flow_str {##1} {
6440       \tl_clear:N \l_tmpa_tl
6441     }
6442   }
6443   \l_tmpa_tl
6444   \end{stex_annotate_env}
6445 }
6446 }

```

spfcase similar to **spfcase**, takes a third argument.

```

6447 \newcommand\spfcasesketch[3] [] {
6448   \begin{spfcase}[#1]{#2}#3\end{spfcase}
6449 }

```

33.2 Justifications

We define the actions that are undertaken, when the keys for justifications are encountered. Here this is very simple, we just define an internal macro with the value, so that we can use it later.

```

6450 \keys_define:nn { stex / just }{
6451   id      .str_set_x:N = \l__stex_sproof_just_id_str,
6452   method  .tl_set:N   = \l__stex_sproof_just_method_tl,
6453   premises .tl_set:N   = \l__stex_sproof_just_premises_tl,
6454   args    .tl_set:N   = \l__stex_sproof_just_args_tl
6455 }

```

The next three environments and macros are purely semantic, so we ignore the keyval arguments for now and only display the content.¹⁶

\spfjust

```

6456 \newcommand\spfjust[1] [] {}

```

(End definition for **\spfjust**. This function is documented on page 45.)

\premise

```

6457 \newcommand\stex_proof_premise:[2] [] {#2}

```

(End definition for **\premise**. This function is documented on page 45.)

\justarg the **\justarg** macro is purely semantic, so we ignore the keyval arguments for now and only display the content.

```

6458 \newcommand\justarg[2] [] {#2}
6459 \</package>

```

(End definition for **\justarg**. This function is documented on page 45.)

Some auxiliary code, and clean up to be executed at the end of the package.

¹⁶EdNOTE: need to do something about the premise in draft mode.

Chapter 34

STEX -Others Implementation

```
6460 <*package>
6461
6462 %%%%%%%%%% others.dtx %%%%%%%%%%
6463
6464 <@@=stex_others>
        Warnings and error messages
6465 % None

\MSC Math subject classifier

6466 \NewDocumentCommand \MSC {m} {
6467 % TODO
6468 }

(End definition for \MSC. This function is documented on page ??.)
        Patching tikzinput, if loaded

6469 \@ifpackageloaded{tikzinput}{
6470 \RequirePackage{stex-tikzinput}
6471 }{}
6472
6473 \bool_if:NT \c_stex_persist_mode_bool {
6474 \let__stex_notation_restore_notation_old:nnnnn
6475 \__stex_notation_restore_notation:nnnnn
6476 \def__stex_notation_restore_notation_new:nnnnn#1#2#3#4#5{
6477 \__stex_notation_restore_notation_old:nnnnn{#1}{#2}{#3}{#4}{#5}
6478 \ExplSyntaxOn
6479 }
6480 \def__stex_notation_restore_notation:nnnnn{
6481 \ExplSyntaxOff
6482 \catcode'\sim10
6483 \__stex_notation_restore_notation_new:nnnnn
6484 }
6485 \input{\jobname.sms}
6486 \let__stex_notation_restore_notation:nnnnn
6487 \__stex_notation_restore_notation_old:nnnnn
6488 \prop_if_exist:NT\c_stex_mathhub_main_manifest_prop{
```



```

6489     \prop_get:NnN \c_stex_mathhub_main_manifest_prop {id}
6490     \l_tmpa_str
6491     \prop_set_eq:cN { c_stex_mathhub_\l_tmpa_str_manifest_prop }
6492     \c_stex_mathhub_main_manifest_prop
6493     \exp_args:Nx \stex_set_current_repository:n { \l_tmpa_str }
6494   }
6495 }
6496 </package>

```

Chapter 35

STEX -Metatheory Implementation

```
6497 <*package>
6498 <@@=stex_modules>
6499
6500 %%%%%%%%%%% metatheory.dtx %%%%%%%%%%%
6501
6502 \str_const:Nn \c_stex_metatheory_ns_str {http://mathhub.info/sTeX/meta}
6503 \begingroup
6504 \stex_module_setup:nn{
6505   ns=\c_stex_metatheory_ns_str,
6506   meta=NONE
6507 }{Metatheory}
6508 \stex_reactivate_macro:N \symdecl
6509 \stex_reactivate_macro:N \notation
6510 \stex_reactivate_macro:N \symdef
6511 \ExplSyntaxOff
6512 \csname stex_suppress_html:n\endcsname{
6513   % is-a (a:A, a \in A, a is an A, etc.)
6514   \symdecl{isa}[args=ai]
6515   \notation{isa}[typed,op=:]{#1 \comp{:} #2}{##1 \comp, ##2}
6516   \notation{isa}[in]{#1 \comp\in #2}{##1 \comp, ##2}
6517   \notation{isa}[pred]{#2\comp(#1 \comp)}{##1 \comp, ##2}
6518
6519   % bind (\forall, \Pi, \lambda etc.)
6520   \symdecl{bind}[args=Bi,assoc=pre]
6521   \notation{bind}[depfun,prec=nobrackets,op={(\cdot)\;\to\;\cdot}]{\comp( #1 \comp{}\;\to\;)}
6522   \notation{bind}[forall]{\comp\forall #1.\;#2}{##1 \comp, ##2}
6523   \notation{bind}[Pi]{\comp\prod_{#1}#2}{##1 \comp, ##2}
6524
6525   % implicit bind
6526   \symdecl{implicitbind}[args=Bi,assoc=pre]
6527   \notation{implicitbind}[braces,prec=nobrackets,op={(\cdot\;)_I\;\cdot}]{\comp\{ #1 \comp{}
6528   \notation{implicitbind}[depfun,prec=nobrackets]{\comp( #1 \comp{}\;\to_I\; } #2}{##1 \comp,
6529   \notation{implicitbind}[Pi]{\comp\prod^I_{#1}#2}{##1\comp,##2}
6530
6531   % dummy variable
```

```

6532 \symdecl{dummyvar}
6533 \notation{dummyvar}[underscore]{\comp\_}
6534 \notation{dummyvar}[dot]{\comp\cdot}
6535 \notation{dummyvar}[dash]{\comp{\rm --}}
6536
6537 %fromto (function space, Hom-set, implication etc.)
6538 \symdecl{fromto}[args=ai]
6539 \notation{fromto}[xarrow]{#1 \comp\to #2}{##1 \comp\times ##2}
6540 \notation{fromto}[arrow]{#1 \comp\to #2}{##1 \comp\to ##2}
6541
6542 % mapto (lambda etc.)
6543 \symdecl{mapto}[args=Bi]
6544 \notation{mapto}[mapsto]{#1 \comp\mapsto #2}{#1 \comp, #2}
6545 \notation{mapto}[lambda]{\comp\lambda #1 \comp.\; #2}{#1 \comp, #2}
6546 \notation{mapto}[lambdau]{\comp\lambda_{#1} \comp.\; #2}{#1 \comp, #2}
6547
6548 % function/operator application
6549 \symdecl{apply}[args=ia]
6550 \notation{apply}[prec=0;0x\infpres,parens]{#1 \comp( #2 \comp)}{##1 \comp, ##2}
6551 \notation{apply}[prec=0;0x\infpres,lambda]{#1 \; #2 }{##1 \; ; ##2}
6552
6553 % collection of propositions/booleans/truth values
6554 \symdecl{prop}[name=proposition]
6555 \notation{prop}[prop]{\comp{\rm prop}}
6556 \notation{prop}[BOOL]{\comp{\rm BOOL}}
6557
6558 \symdecl{judgmentholds}[args=1]
6559 \notation{judgmentholds}[vdash,op=\vdash]{\comp\vdash\; #1}
6560
6561 % sequences
6562 \symdecl{seqtype}[args=1]
6563 \notation{seqtype}[kleene]{#1^{\comp\ast}}
6564
6565 \symdecl{seqexpr}[args=a]
6566 \notation{seqexpr}[angle,prec=nobrackets]{\comp\langle #1\comp\rangle}{##1\comp,##2}
6567
6568 \symdef{seqmap}[args=abi,setlike]{\comp\{#3 \comp| #2\comp\in \dobrackets{#1} \comp\}}{##1\comp,##2}
6569 \symdef{seqprepend}[args=ia]{#1 \comp{::} #2}{##1 \comp, ##2}
6570 \symdef{seqappend}[args=ai]{#1 \comp{::} #2}{##1 \comp, ##2}
6571 \symdef{seqfoldleft}[args=iabbi]{ \comp{foldl}\dobrackets{#1,#2}\dobrackets{#3\comp,#4\comp}}{##1\comp,##2}
6572 \symdef{seqfoldright}[args=iabbi,op=foldr]{ \comp{foldr}\dobrackets{#1,#2}\dobrackets{#3\comp,#4\comp}}{##1\comp,##2}
6573 \symdef{seqhead}[args=a]{\comp{head}\dobrackets{#1}}{##1 \comp, ##2}
6574 \symdef{seqtail}[args=a]{\comp{tail}\dobrackets{#1}}{##1 \comp, ##2}
6575 \symdef{seqlast}[args=a]{\comp{last}\dobrackets{#1}}{##1 \comp, ##2}
6576 \symdef{seqinit}[args=a]{\comp{tail}\dobrackets{#1}}{##1 \comp, ##2}
6577
6578 \symdef{sequence-index}[args=2,li,prec=nobrackets]{\comp{#1}_{#2}}{##1 \comp, ##2}
6579 \notation{sequence-index}[ui,prec=nobrackets]{\comp{#1}^{\comp{#2}}}{##1 \comp, ##2}
6580
6581 \symdef{aseqdots}[args=a,prec=nobrackets]{#1\comp{\ellipses}}{##1\comp,##2}
6582 \symdef{aseqfromto}[args=ai,prec=nobrackets]{#1\comp{\ellipses},#2}{##1\comp,##2}
6583 \symdef{aseqfromtovia}[args=aii,prec=nobrackets]{#1\comp{\ellipses},#2\comp{\ellipses},#3}{##1\comp,##2,##3}
6584
6585 % nat literals

```

```

6586 \symdef{natliteral}{\comp{\mathtt{Ord}}}
6587
6588 % letin (''let'', local definitions, variable substitution)
6589 \symdecl{letin}[args=bii]
6590 \notation{letin}[let]{\comp{\rm let}}\;#1\comp{=}\;#2\;\comp{\rm in}}\;#3}
6591 \notation{letin}[subst]{#3 \comp[ #1 \comp/ #2 \comp]}
6592 \notation{letin}[frac]{#3 \comp[ \frac{#2}{#1} \comp]}
6593
6594 % structures
6595 \symdecl*{module-type}[args=1]
6596 \notation{module-type}{\comp{\mathtt{MOD}}} #1}
6597 \symdecl{mathstruct}[name=mathematical-structure,args=a] % TODO
6598 \notation{mathstruct}[angle,prec=nobrackets]{\comp\angle #1 \comp\rangle}{##1 \comp, ##2}
6599
6600 % objects
6601 \symdecl{object}
6602 \notation{object}{\comp{\mathtt{OBJECT}}}
6603
6604 }
6605
6606 % The following are abbreviations in the sTeX corpus that are left over from earlier
6607 % developments. They will eventually be phased out.
6608
6609 \ExplSyntaxOn
6610 \stex_add_to_current_module:n{
6611   \def\nappli#1#2#3#4{\apply{#1}{\naseqli{#2}{#3}{#4}}}
6612   \def\nappui#1#2#3#4{\apply{#1}{\nasequi{#2}{#3}{#4}}}
6613   \def\livar{\csname sequence-index\endcsname[li]}
6614   \def\uivar{\csname sequence-index\endcsname[ui]}
6615   \def\naseqli#1#2#3{\aseqfromto{\livar{#1}{#2}}{\livar{#1}{#3}}}
6616   \def\nasequi#1#2#3{\aseqfromto{\uivar{#1}{#2}}{\uivar{#1}{#3}}}
6617 }
6618 \__stex_modules_end_module:
6619 \endgroup
6620 \</package>

```

Chapter 36

Tikzinput Implementation

```
6621 <@@=tikzinput>
6622 <*package>
6623
6624 %%%%%%%%%% tikzinput.dtx %%%%%%%%%%
6625
6626 \ProvidesExplPackage{tikzinput}{2022/02/26}{3.0.1}{tikzinput package}
6627 \RequirePackage{l3keys2e}
6628
6629 \keys_define:nn { tikzinput } {
6630   image .bool_set:N = \c_tikzinput_image_bool,
6631   image .default:n = false ,
6632   unknown .code:n = {}
6633 }
6634
6635 \ProcessKeysOptions { tikzinput }
6636
6637 \bool_if:NTF \c_tikzinput_image_bool {
6638   \RequirePackage{graphicx}
6639
6640   \providecommand\usetikzlibrary[]{}
6641   \newcommand\tikzinput[2] [] {\includegraphics[#1]{#2}}
6642 }{
6643   \RequirePackage{tikz}
6644   \RequirePackage{standalone}
6645
6646   \newcommand \tikzinput [2] [] {
6647     \setkeys{Gin}{#1}
6648     \ifx \Gin@ewidth \Gin@exclamation
6649       \ifx \Gin@eheight \Gin@exclamation
6650         \input { #2 }
6651       \else
6652         \resizebox{!}{ \Gin@eheight }{
6653           \input { #2 }
6654         }
6655       \fi
6656     \else
6657       \ifx \Gin@eheight \Gin@exclamation
6658         \resizebox{ \Gin@ewidth }{!}{
```

```

6659         \input { #2 }
6660     }
6661     \else
6662         \resizebox{ \Gin@ewidth }{ \Gin@eheight }{
6663             \input { #2 }
6664         }
6665     \fi
6666 \fi
6667 }
6668 }
6669
6670 \newcommand \ctikzinput [2] [] {
6671     \begin{center}
6672         \tikzinput [#1] {#2}
6673     \end{center}
6674 }
6675
6676 \@ifpackageloaded{stex}{
6677     \RequirePackage{stex-tikzinput}
6678 }{}
6679
6680 </package>
6681 <*stex>
6682 \ProvidesExplPackage{stex-tikzinput}{2022/02/26}{3.0.1}{stex-tikzinput}
6683 \RequirePackage{stex}
6684 \RequirePackage{tikzinput}
6685
6686 \newcommand\mhtikzinput[2] []{%
6687     \def\Gin@mhrepos{ }\setkeys{Gin}{#1}%
6688     \stex_in_repository:nn\Gin@mhrepos{
6689         \tikzinput[#1]{\mhp@hpath{##1}{#2}}
6690     }
6691 }
6692 \newcommand\cmhtikzinput[2] [] {\begin{center}\mhtikzinput[#1]{#2}\end{center}}
6693
6694 \cs_new_protected:Nn \__tikzinput_usetikzlibrary:nn {
6695     \pgfkeys@spdef\pgf@temp{#1}
6696     \expandafter\ifx\csname tikz@library@\pgf@temp @loaded\endcsname\relax%
6697     \expandafter\global\expandafter\let\csname tikz@library@\pgf@temp @loaded\endcsname=\pgf@temp
6698     \expandafter\edef\csname tikz@library@#1@atcode\endcsname{\the\catcode'\@}
6699     \expandafter\edef\csname tikz@library@#1@barcode\endcsname{\the\catcode'\|}
6700     \expandafter\edef\csname tikz@library@#1@dollarcode\endcsname{\the\catcode'\$}
6701     \catcode'\@=11
6702     \catcode'\|=12
6703     \catcode'\$=3
6704     \pgfutil@InputIfFileExists{#2}{-}{-}
6705     \catcode'\@=\csname tikz@library@#1@atcode\endcsname
6706     \catcode'\|=\csname tikz@library@#1@barcode\endcsname
6707     \catcode'\$=\csname tikz@library@#1@dollarcode\endcsname
6708 }
6709
6710
6711 \newcommand\libusetikzlibrary[1]{

```

```

6712 \prop_if_exist:NF \l_stex_current_repository_prop {
6713   \msg_error:nnn{stex}{error/notinarchive}\libusetikzlibrary
6714 }
6715 \prop_get:NnNF \l_stex_current_repository_prop {id} \l_tmpa_str {
6716   \msg_error:nnn{stex}{error/notinarchive}\libusetikzlibrary
6717 }
6718 \seq_clear:N \l__tikzinput_libinput_files_seq
6719 \seq_set_eq:NN \l_tmpa_seq \c_stex_mathhub_seq
6720 \seq_set_split:NnV \l_tmpb_seq / \l_tmpa_str
6721
6722 \bool_while_do:nn { ! \seq_if_empty_p:N \l_tmpb_seq }{
6723   \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / meta-inf / lib / tikzlibrary
6724   \IfFileExists{ \l_tmpa_str }{
6725     \seq_put_right:No \l__tikzinput_libinput_files_seq \l_tmpa_str
6726   }{
6727     \seq_pop_left:NN \l_tmpb_seq \l_tmpa_str
6728     \seq_put_right:No \l_tmpa_seq \l_tmpa_str
6729   }
6730
6731   \str_set:Nx \l_tmpa_str {\stex_path_to_string:N \l_tmpa_seq / lib / tikzlibrary #1 .code.t
6732   \IfFileExists{ \l_tmpa_str }{
6733     \seq_put_right:No \l__tikzinput_libinput_files_seq \l_tmpa_str
6734   }{
6735
6736   \seq_if_empty:NTF \l__tikzinput_libinput_files_seq {
6737     \msg_error:nnxx{stex}{error/nofile}{\exp_not:N\libusetikzlibrary}{tikzlibrary #1 .code.t
6738   }{
6739     \int_compare:nNnTF {\seq_count:N \l__tikzinput_libinput_files_seq} = 1 {
6740       \seq_map_inline:Nn \l__tikzinput_libinput_files_seq {
6741         \__tikzinput_usetikzlibrary:nn{#1}{ ##1 }
6742       }
6743     }{
6744       \msg_error:nnxx{stex}{error/twofiles}{\exp_not:N\libusetikzlibrary}{tikzlibrary #1 .co
6745     }
6746   }
6747 }
6748 </stex>

```

LocalWords: bibfolder jobname.dtx tikzinput.dtx usetikzlibrary Gin@ewidth Gin@eheight
 LocalWords: resizebox ctikzinput mhtikzinput Gin@mhrepos mhpath

Chapter 37

document-structure.sty Implementation

```
6749 <*package>
6750 <@@=document_structure>
6751 \ProvidesExplPackage{document-structure}{2022/02/26}{3.0.1}{Modular Document Structure}
6752 \RequirePackage{13keys2e}
```

37.1 Package Options

We declare some switches which will modify the behavior according to the package options. Generally, an option xxx will just set the appropriate switches to true (otherwise they stay false).

```
6753
6754 \keys_define:nn{ document-structure }{
6755   class      .str_set_x:N = \c_document_structure_class_str,
6756   topsect    .str_set_x:N = \c_document_structure_topsect_str,,
6757   unknown    .code:n      = {
6758     \PassOptionsToClass{\CurrentOption}{stex}
6759     \PassOptionsToClass{\CurrentOption}{tikzinput}
6760   }
6761   % showignores .bool_set:N = \c_document_structure_showignores_bool,
6762 }
6763 \ProcessKeysOptions{ document-structure }
6764 \str_if_empty:NT \c_document_structure_class_str {
6765   \str_set:Nn \c_document_structure_class_str {article}
6766 }
6767 \str_if_empty:NT \c_document_structure_topsect_str {
6768   \str_set:Nn \c_document_structure_topsect_str {section}
6769 }
```

Then we need to set up the packages by requiring the `sref` package to be loaded, and set up triggers for other languages

```
6770 \RequirePackage{xspace}
6771 \RequirePackage{comment}
6772 \RequirePackage{stex}
6773 \AddToHook{begindocument}{}
```



```

6774 \ltx@ifpackageloaded{babel}{
6775   \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
6776   \clist_if_in:NnT \l_tmpa_clist {ngerman}{
6777     \makeatletter\input{document-structure-ngerman.ldf}\makeatother
6778   }
6779 }{}
6780 }

```

`\section@level` Finally, we set the `\section@level` macro that governs sectioning. The default is two (corresponding to the `article` class), then we set the defaults for the standard classes `book` and `report` and then we take care of the levels passed in via the `topsect` option.

```

6781 \int_new:N \l_document_structure_section_level_int
6782 \str_case:NnF \c_document_structure_topsect_str {
6783   {part}}{
6784     \int_set:Nn \l_document_structure_section_level_int {0}
6785   }
6786   {chapter}{
6787     \int_set:Nn \l_document_structure_section_level_int {1}
6788   }
6789 }{
6790   \str_case:NnF \c_document_structure_class_str {
6791     {book}{
6792       \int_set:Nn \l_document_structure_section_level_int {0}
6793     }
6794     {report}{
6795       \int_set:Nn \l_document_structure_section_level_int {0}
6796     }
6797   }{
6798     \int_set:Nn \l_document_structure_section_level_int {2}
6799   }
6800 }

```

37.2 Document Structure

The structure of the document is given by the `sfragment` environment. The hierarchy is adjusted automatically according to the L^AT_EX class in effect.

`\currentsectionlevel` For the `\currentsectionlevel` and `\Currentsectionlevel` macros we use an internal macro `\current@section@level` that only contains the keyword (no markup). We initialize it with “document” as a default. In the generated OMDoc, we only generate a text element of class `omdoc_currentsectionlevel`, which will be instantiated by CSS later.¹⁷

```

6801 \def\current@section@level{document}%
6802 \newcommand\currentsectionlevel{\lowercase\expandafter\current@section@level\xspace}%
6803 \newcommand\Currentsectionlevel{\expandafter\MakeUppercase\current@section@level\xspace}%

```

(End definition for `\currentsectionlevel`. This function is documented on page 52.)

`\skipfragment`

```

6804 \cs_new_protected:Npn \skipfragment {

```

¹⁷EDNOTE: MK: we may have to experiment with the more powerful uppercasing macro from `mfirstuc.sty` once we internationalize.

```

6805 \ifcase\l_document_structure_section_level_int
6806 \or\stepcounter{part}
6807 \or\stepcounter{chapter}
6808 \or\stepcounter{section}
6809 \or\stepcounter{subsection}
6810 \or\stepcounter{subsubsection}
6811 \or\stepcounter{paragraph}
6812 \or\stepcounter{subparagraph}
6813 \fi
6814 }

```

(End definition for `\skipfragment`. This function is documented on page 51.)

blindfragment

```

6815 \newcommand\at@begin@blindsfragment[1]{
6816 \newenvironment{blindfragment}
6817 {
6818 \int_incr:N\l_document_structure_section_level_int
6819 \at@begin@blindsfragment\l_document_structure_section_level_int
6820 }{}

```

\sfragment@nonum convenience macro: `\sfragment@nonum{<level>}{<title>}` makes an unnumbered sectioning with title `<title>` at level `<level>`.

```

6821 \newcommand\sfragment@nonum[2]{
6822 \ifx\hyper@anchor\@undefined\else\phantomsection\fi
6823 \addcontentsline{toc}{#1}{#2}\@nameuse{#1}*{#2}
6824 }

```

(End definition for `\sfragment@nonum`. This function is documented on page ??.)

\sfragment@num convenience macro: `\sfragment@num{<level>}{<title>}` makes numbered sectioning with title `<title>` at level `<level>`. We have to check the `short` key was given in the `sfragment` environment and – if it is use it. But how to do that depends on whether the `rdmeta` package has been loaded. In the end we call `\sref@label@id` to enable crossreferencing.

```

6825 \newcommand\sfragment@num[2]{
6826 \tl_if_empty:NTF \l__document_structure_sfragment_short_tl {
6827 \@nameuse{#1}{#2}
6828 }{
6829 \cs_if_exist:NTF\rdmeta@sectioning{
6830 \@nameuse{rdmeta@#1@old}[\l__document_structure_sfragment_short_tl]{#2}
6831 }{
6832 \@nameuse{#1}[\l__document_structure_sfragment_short_tl]{#2}
6833 }
6834 }
6835 %\sref@label@id@arg{\omdoc@sect@name~\@nameuse{the#1}}\sfragment@id
6836 }

```

(End definition for `\sfragment@num`. This function is documented on page ??.)

sfragment

```

6837 \keys_define:nn { document-structure / sfragment }{
6838 id .str_set_x:N = \l__document_structure_sfragment_id_str,
6839 date .str_set_x:N = \l__document_structure_sfragment_date_str,

```

```

6840 creators      .clist_set:N = \l__document_structure_sfragment_creators_clist,
6841 contributors   .clist_set:N = \l__document_structure_sfragment_contributors_clist,
6842 srccite        .tl_set:N    = \l__document_structure_sfragment_srccite_tl,
6843 type           .tl_set:N    = \l__document_structure_sfragment_type_tl,
6844 short          .tl_set:N    = \l__document_structure_sfragment_short_tl,
6845 display        .tl_set:N    = \l__document_structure_sfragment_display_tl,
6846 intro          .tl_set:N    = \l__document_structure_sfragment_intro_tl,
6847 imports        .tl_set:N    = \l__document_structure_sfragment_imports_tl,
6848 loadmodules    .bool_set:N  = \l__document_structure_sfragment_loadmodules_bool
6849 }
6850 \cs_new_protected:Nn \l__document_structure_sfragment_args:n {
6851   \str_clear:N \l__document_structure_sfragment_id_str
6852   \str_clear:N \l__document_structure_sfragment_date_str
6853   \clist_clear:N \l__document_structure_sfragment_creators_clist
6854   \clist_clear:N \l__document_structure_sfragment_contributors_clist
6855   \tl_clear:N \l__document_structure_sfragment_srccite_tl
6856   \tl_clear:N \l__document_structure_sfragment_type_tl
6857   \tl_clear:N \l__document_structure_sfragment_short_tl
6858   \tl_clear:N \l__document_structure_sfragment_display_tl
6859   \tl_clear:N \l__document_structure_sfragment_imports_tl
6860   \tl_clear:N \l__document_structure_sfragment_intro_tl
6861   \bool_set_false:N \l__document_structure_sfragment_loadmodules_bool
6862   \keys_set:nn { document-structure / sfragment } { #1 }
6863 }

```

we define a switch for numbering lines and a hook for the beginning of groups: The `\at@begin@sfragment` macro allows customization. It is run at the beginning of the `sfragment`, i.e. after the section heading.

`\at@begin@sfragment`

```

6864 \newif@if@mainmatter\@mainmattertrue
6865 \newcommand\at@begin@sfragment[3][]{ }

```

Then we define a helper macro that takes care of the sectioning magic. It comes with its own key/value interface for customization.

```

6866 \keys_define:nn { document-structure / sectioning }{
6867   name      .str_set_x:N = \l__document_structure_sect_name_str ,
6868   ref       .str_set_x:N = \l__document_structure_sect_ref_str  ,
6869   clear     .bool_set:N  = \l__document_structure_sect_clear_bool ,
6870   clear     .default:n   = {true} ,
6871   num       .bool_set:N  = \l__document_structure_sect_num_bool  ,
6872   num       .default:n   = {true}
6873 }
6874 \cs_new_protected:Nn \l__document_structure_sect_args:n {
6875   \str_clear:N \l__document_structure_sect_name_str
6876   \str_clear:N \l__document_structure_sect_ref_str
6877   \bool_set_false:N \l__document_structure_sect_clear_bool
6878   \bool_set_false:N \l__document_structure_sect_num_bool
6879   \keys_set:nn { document-structure / sectioning } { #1 }
6880 }
6881 \newcommand\omdoc@sectioning[3][]{
6882   \l__document_structure_sect_args:n {#1 }
6883   \let\omdoc@sect@name\l__document_structure_sect_name_str
6884   \bool_if:NT \l__document_structure_sect_clear_bool { \cleardoublepage }
6885   \if@mainmatter% numbering not overridden by frontmatter, etc.
6886     \bool_if:NTF \l__document_structure_sect_num_bool {

```

```

6887     \sfragment@num{#2}{#3}
6888   }{
6889     \sfragment@nonum{#2}{#3}
6890   }
6891   \def\current@section@level{\omdoc@sect@name}
6892 \else
6893   \sfragment@nonum{#2}{#3}
6894 \fi
6895 }% if@mainmatter

```

and another one, if redefines the `\addtocontentsline` macro of L^AT_EX to import the respective macros. It takes as an argument a list of module names.

```

6896 \newcommand\sfragment@redefine@addtocontents[1]{%
6897   %\edef\__document_structureimport{#1}%
6898   %\@for\@I:=\__document_structureimport\do{%
6899   %\edef\@path{\csname module@\@I @path\endcsname}%
6900   %\@ifundefined{tf@toc}\relax%
6901   %   {\protected@write\tf@toc}{\string\@requiremodules{\@path}}}%
6902   %\ifx\hyper@anchor\@undefined% hyperref.sty loaded?
6903   %\def\addcontentsline##1##2##3{%
6904   %\addtocontents{##1}{\protect\contentsline{##2}{\string\withusedmodules{##1}{##3}}{\thepage}}%
6905   %\else% hyperref.sty not loaded
6906   %\def\addcontentsline##1##2##3{%
6907   %\addtocontents{##1}{\protect\contentsline{##2}{\string\withusedmodules{##1}{##3}}{\thepage}}%
6908   %\fi
6909   }% hyperref.sty loaded?

```

now the `sfragment` environment itself. This takes care of the table of contents via the helper macro above and then selects the appropriate sectioning command from `article.cls`. It also registers the current level of sfragments in the `\sfragment@level` counter.

```

6910 \newenvironment{sfragment}[2] []% keys, title
6911 {
6912   \__document_structure_sfragment_args:n { #1 }%\sref@target%

```

If the `loadmodules` key is set on `\begin{sfragment}`, we redefine the `\addcontetsline` macro that determines how the sectioning commands below construct the entries for the table of contents.

```

6913   \stex_csl_to_imports:No \usemodule \l__document_structure_sfragment_imports_tl
6914
6915   \bool_if:NT \l__document_structure_sfragment_loadmodules_bool {
6916     \sfragment@redefine@addtocontents{
6917       %\@ifundefined{module@id}\used@modules%
6918       %{\@ifundefined{module@\module@id @path}{\used@modules}\module@id}
6919     }
6920   }

```

now we only need to construct the right sectioning depending on the value of `\section@level`.

```

6921
6922   \stex_document_title:n { #2 }
6923
6924   \int_incr:N\l__document_structure_section_level_int
6925   \ifcase\l__document_structure_section_level_int
6926     \or\omdoc@sectioning[name=\omdoc@part@kw,clear,num]{part}{#2}
6927     \or\omdoc@sectioning[name=\omdoc@chapter@kw,clear,num]{chapter}{#2}

```

```

6928 \or\omdoc@sectioning[name=\omdoc@section@kw,num]{section}{#2}
6929 \or\omdoc@sectioning[name=\omdoc@subsection@kw,num]{subsection}{#2}
6930 \or\omdoc@sectioning[name=\omdoc@subsubsection@kw,num]{subsubsection}{#2}
6931 \or\omdoc@sectioning[name=\omdoc@paragraph@kw,ref=this \omdoc@paragraph@kw]{paragraph}{#2}
6932 \or\omdoc@sectioning[name=\omdoc@subparagraph@kw,ref=this \omdoc@subparagraph@kw]{subparagraph}{#2}
6933 \fi
6934 \at@begin@sfragment[#1]\l_document_structure_section_level_int{#2}
6935 \str_if_empty:NF \l__document_structure_sfragment_id_str {
6936   \stex_ref_new_doc_target:n\l__document_structure_sfragment_id_str
6937 }
6938 }% for customization
6939 {}

```

and finally, we localize the sections

```

6940 \newcommand\omdoc@part@kw{Part}
6941 \newcommand\omdoc@chapter@kw{Chapter}
6942 \newcommand\omdoc@section@kw{Section}
6943 \newcommand\omdoc@subsection@kw{Subsection}
6944 \newcommand\omdoc@subsubsection@kw{Subsubsection}
6945 \newcommand\omdoc@paragraph@kw{paragraph}
6946 \newcommand\omdoc@subparagraph@kw{subparagraph}

```

37.3 Front and Backmatter

Index markup is provided by the `omtext` package [[Kohlhase:smmf:git](#)], so in the `document-structure` package we only need to supply the corresponding `\printindex` command, if it is not already defined

`\printindex`

```

6947 \providecommand\printindex{\IfFileExists{\jobname.ind}{\input{\jobname.ind}}{}}

```

(End definition for `\printindex`. This function is documented on page ??.)

some classes (e.g. `book.cls`) already have `\frontmatter`, `\mainmatter`, and `\backmatter` macros. As we want to define `frontmatter` and `backmatter` environments, we save their behavior (possibly defining it) in `orig@*matter` macros and make them undefined (so that we can define the environments).

```

6948 \cs_if_exist:NTF\frontmatter{
6949   \let\__document_structure_orig_frontmatter\frontmatter
6950   \let\frontmatter\relax
6951 }{
6952   \tl_set:Nn\__document_structure_orig_frontmatter{
6953     \clearpage
6954     \@mainmatterfalse
6955     \pagenumbering{roman}
6956   }
6957 }
6958 \cs_if_exist:NTF\backmatter{
6959   \let\__document_structure_orig_backmatter\backmatter
6960   \let\backmatter\relax
6961 }{
6962   \tl_set:Nn\__document_structure_orig_backmatter{
6963     \clearpage
6964     \@mainmatterfalse

```

```

6965     \pagenumbering{roman}
6966   }
6967 }

```

Using these, we can now define the `frontmatter` and `backmatter` environments

frontmatter we use the `\orig@frontmatter` macro defined above and `\mainmatter` if it exists, otherwise we define it.

```

6968 \newenvironment{frontmatter}{
6969   \_document_structure_orig_frontmatter
6970 }{
6971   \cs_if_exist:NTF\mainmatter{
6972     \mainmatter
6973   }{
6974     \clearpage
6975     \@mainmattertrue
6976     \pagenumbering{arabic}
6977   }
6978 }

```

backmatter As `backmatter` is at the end of the document, we do nothing for `\endbackmatter`.

```

6979 \newenvironment{backmatter}{
6980   \_document_structure_orig_backmatter
6981 }{
6982   \cs_if_exist:NTF\mainmatter{
6983     \mainmatter
6984   }{
6985     \clearpage
6986     \@mainmattertrue
6987     \pagenumbering{arabic}
6988   }
6989 }

```

finally, we make sure that page numbering is arabic and we have main matter as the default

```

6990 \@mainmattertrue\pagenumbering{arabic}

```

\prematurestop We initialize `\afterprematurestop`, and provide `\prematurestop@endsfragment` which looks up `\sfragment@level` and recursively ends enough `{sfragment}`s.

```

6991 \def \c__document_structure_document_str{document}
6992 \newcommand\afterprematurestop{}
6993 \def\prematurestop@endsfragment{
6994   \unless\ifx\@currenvir\c__document_structure_document_str
6995     \expandafter\expandafter\expandafter\end\expandafter\expandafter\expandafter{\expandafter
6996       \expandafter\prematurestop@endsfragment
6997     }
6998   }
6999 \providecommand\prematurestop{
7000   \message{Stopping~sTeX~processing~prematurely}
7001   \prematurestop@endsfragment
7002   \afterprematurestop
7003   \end{document}
7004 }

```

(End definition for `\prematurestop`. This function is documented on page 52.)

37.4 Global Variables

\setSGvar set a global variable

```
7005 \RequirePackage{etoolbox}
7006 \newcommand\setSGvar[1]{\@namedef{sTeX@Gvar@#1}}
```

(End definition for \setSGvar. This function is documented on page 52.)

\useSGvar use a global variable

```
7007 \newrobustcmd\useSGvar[1]{%
7008   \@ifundefined{sTeX@Gvar@#1}
7009   {\PackageError{document-structure}
7010    {The sTeX Global variable #1 is undefined}
7011    {set it with \protect\setSGvar}}
7012   \@nameuse{sTeX@Gvar@#1}}
```

(End definition for \useSGvar. This function is documented on page 52.)

\ifSGvar execute something conditionally based on the state of the global variable.

```
7013 \newrobustcmd\ifSGvar[3]{\def\@test{#2}%
7014   \@ifundefined{sTeX@Gvar@#1}
7015   {\PackageError{document-structure}
7016    {The sTeX Global variable #1 is undefined}
7017    {set it with \protect\setSGvar}}
7018   {\expandafter\ifx\csname sTeX@Gvar@#1\endcsname\@test #3\fi}}
```

(End definition for \ifSGvar. This function is documented on page 52.)

Chapter 38

NotesSlides – Implementation

38.1 Class and Package Options

We define some Package Options and switches for the `notesslides` class and activate them by passing them on to `beamer.cls` and `omdoc.cls` and the `notesslides` package. We pass the `nontheorem` option to the `statements` package when we are not in notes mode, since the `beamer` package has its own (overlay-aware) theorem environments.

```
7019 \*cls)
7020 \@@=notesslides}
7021 \ProvidesExplClass{notesslides}{2022/02/28}{3.1.0}{notesslides Class}
7022 \RequirePackage{13keys2e}
7023
7024 \keys_define:nn{notesslides / cls}{
7025   class .str_set_x:N = \c__notesslides_class_str,
7026   notes .bool_set:N = \c__notesslides_notes_bool ,
7027   slides .code:n = { \bool_set_false:N \c__notesslides_notes_bool },
7028   docopt .str_set_x:N = \c__notesslides_docopt_str,
7029   unknown .code:n = {
7030     \PassOptionsToPackage{\CurrentOption}{document-structure}
7031     \PassOptionsToClass{\CurrentOption}{beamer}
7032     \PassOptionsToPackage{\CurrentOption}{notesslides}
7033     \PassOptionsToPackage{\CurrentOption}{stex}
7034   }
7035 }
7036 \ProcessKeysOptions{ notesslides / cls }
7037
7038 \str_if_empty:NF \c__notesslides_class_str {
7039   \PassOptionsToPackage{class=\c__notesslides_class_str}{document-structure}
7040 }
7041
7042 \exp_args:No \str_if_eq:nnT\c__notesslides_class_str{book}{
7043   \PassOptionsToPackage{defaultttopsect=part}{notesslides}
7044 }
7045 \exp_args:No \str_if_eq:nnT\c__notesslides_class_str{report}{
7046   \PassOptionsToPackage{defaultttopsect=part}{notesslides}
7047 }
7048
7049 \RequirePackage{stex}
```



```

7050 \stex_html_backend:T {
7051   \bool_set_true:N\c__notesslides_notes_bool
7052 }
7053
7054 \bool_if:NTF \c__notesslides_notes_bool {
7055   \PassOptionsToPackage{notes=true}{notesslides}
7056   \message{notesslides.cls:~Formatting~course~materials~in~notes~mode}
7057 }{
7058   \PassOptionsToPackage{notes=false}{notesslides}
7059   \message{notesslides.cls:~Formatting~course~materials~in~slides~mode}
7060 }
7061 \</cls>

```

now we do the same for the notesslides package.

```

7062 <*package>
7063 \ProvidesExplPackage{notesslides}{2022/02/28}{3.1.0}{notesslides Package}
7064 \RequirePackage{l3keys2e}
7065
7066 \keys_define:nn{notesslides / pkg}{
7067   topsect          .str_set_x:N = \c__notesslides_topsect_str,
7068   defaulttopsect   .str_set_x:N = \c__notesslides_defaulttopsec_str,
7069   notes            .bool_set:N  = \c__notesslides_notes_bool ,
7070   slides           .code:n       = { \bool_set_false:N \c__notesslides_notes_bool },
7071   sectocframes     .bool_set:N  = \c__notesslides_sectocframes_bool ,
7072   frameimages      .bool_set:N  = \c__notesslides_frameimages_bool ,
7073   fiboxed          .bool_set:N  = \c__notesslides_fiboxed_bool ,
7074   noproblems       .bool_set:N  = \c__notesslides_noproblems_bool,
7075   unknown          .code:n       = {
7076     \PassOptionsToClass{\CurrentOption}{stex}
7077     \PassOptionsToClass{\CurrentOption}{tikzinput}
7078   }
7079 }
7080 \ProcessKeysOptions{ notesslides / pkg }
7081
7082 \RequirePackage{stex}
7083 \stex_html_backend:T {
7084   \bool_set_true:N\c__notesslides_notes_bool
7085 }
7086
7087 \newif\ifnotes
7088 \bool_if:NTF \c__notesslides_notes_bool {
7089   \notesttrue
7090 }{
7091   \notesfalse
7092 }
7093

```

we give ourselves a macro \@@topsect that needs only be evaluated once, so that the \ifdefstring conditionals work below.

```

7094 \str_if_empty:NTF \c__notesslides_topsect_str {
7095   \str_set_eq:NN \__notesslides_topsect \c__notesslides_defaulttopsec_str
7096 }{
7097   \str_set_eq:NN \__notesslides_topsect \c__notesslides_topsect_str
7098 }
7099 \PassOptionsToPackage{topsect=\__notesslides_topsect}{document-structure}

```

```
7100 </package>
```

Depending on the options, we either load the `article`-based document-structure or the `beamer` class (and set some counters).

```
7101 <*cls>
7102 \bool_if:NTF \c__notesslides_notes_bool {
7103   \str_if_empty:NT \c__notesslides_class_str {
7104     \str_set:Nn \c__notesslides_class_str {article}
7105   }
7106   \exp_after:wN\LoadClass\exp_after:wN[\c__notesslides_dcopt_str]
7107     {\c__notesslides_class_str}
7108 }{
7109   \LoadClass[10pt,notheorems,xcolor={dvipsnames,svgnames}]{beamer}
7110   \newcounter{Item}
7111   \newcounter{paragraph}
7112   \newcounter{subparagraph}
7113   \newcounter{Hfootnote}
7114 }
7115 \RequirePackage{document-structure}
```

now it only remains to load the `notesslides` package that does all the rest.

```
7116 \RequirePackage{notesslides}
7117 </cls>
```

In `notes` mode, we also have to make the `beamer`-specific things available to `article` via the `beamerarticle` package. We use options to avoid loading theorem-like environments, since we want to use our own from the \LaTeX packages. The first batch of packages we want are loaded on `notesslides.sty`. These are the general ones, we will load the \LaTeX -specific ones after we have done some work (e.g. defined the counters `m*`). Only the `stex-logo` package is already needed now for the default theme.

```
7118 <*package>
7119 \bool_if:NT \c__notesslides_notes_bool {
7120   \RequirePackage{a4wide}
7121   \RequirePackage{marginnote}
7122   \PassOptionsToPackage{usenames,dvipsnames,svgnames}{xcolor}
7123   \RequirePackage{mdframed}
7124   \RequirePackage[noxcolor,noamsthm]{beamerarticle}
7125   \RequirePackage[bookmarks,bookmarksopen,bookmarksnumbered,breaklinks,hidelinks]{hyperref}
7126 }
7127 \RequirePackage{stex-tikzinput}
7128 \RequirePackage{etoolbox}
7129 \RequirePackage{amssymb}
7130 \RequirePackage{amsmath}
7131 \RequirePackage{comment}
7132 \RequirePackage{textcomp}
7133 \RequirePackage{url}
7134 \RequirePackage{graphicx}
7135 \RequirePackage{pgf}
```

38.2 Notes and Slides

For the lecture notes cases, we also provide the `\usetheme` macro that would otherwise come from the `beamer` class. While the latter loads `beamertheme<theme>.sty`, the

notes version loads `beamernotestheme(theme).sty`.¹⁸

```

7136 \bool_if:NT \c__notesslides_notes_bool {
7137   \renewcommand\usetheme[2] [] {\usepackage[#1]{beamernotestheme#2}}
7138 }
7139
7140
7141 \NewDocumentCommand \libusetheme {O{} m} {
7142   \bool_if:NTF \c__notesslides_notes_bool {
7143     \libusepackage[#1]{beamernotestheme#2}
7144   }{
7145     \libusepackage[#1]{beamertheme#2}
7146   }
7147 }

```

We define the sizes of slides in the notes. Somehow, we cannot get by with the same here.

```

7148 \newcounter{slide}
7149 \newlength{\slidewidth}\setlength{\slidewidth}{13.5cm}
7150 \newlength{\slideheight}\setlength{\slideheight}{9cm}

```

note The `note` environment is used to leave out text in the `slides` mode. It does not have a counterpart in OMDoc. So for course notes, we define the `note` environment to be a no-operation otherwise we declare the `note` environment as a comment via the `comment` package.

```

7151 \bool_if:NTF \c__notesslides_notes_bool {
7152   \renewenvironment{note}{\ignorespaces}{}
7153 }{
7154   \excludcomment{note}
7155 }

```

We first set up the slide boxes in `article` mode. We set up sizes and provide a box register for the frames and a counter for the slides.

```

7156 \bool_if:NT \c__notesslides_notes_bool {
7157   \newlength{\slideframewidth}
7158   \setlength{\slideframewidth}{1.5pt}

```

frame We first define the keys.

```

7159 \cs_new_protected:Nn \__notesslides_do_yes_param:Nn {
7160   \exp_args:Nx \str_if_eq:nnTF { \str_uppercase:n{ #2 } }{ yes }{
7161     \bool_set_true:N #1
7162   }{
7163     \bool_set_false:N #1
7164   }
7165 }
7166 \keys_define:nn{notesslides / frame}{
7167   label .str_set_x:N = \l__notesslides_frame_label_str,
7168   allowframebreaks .code:n = {
7169     \__notesslides_do_yes_param:Nn \l__notesslides_frame_allowframebreaks_bool { #1 }
7170   },
7171   allowdisplaybreaks .code:n = {

```

¹⁸EdNOTE: MK: This is not ideal, but I am not sure that I want to be able to provide the full theme functionality there.

```

7172     \_notesslides_do_yes_param:Nn \l__notesslides_frame_allowdisplaybreaks_bool { #1 }
7173 },
7174 fragile .code:n = {
7175     \_notesslides_do_yes_param:Nn \l__notesslides_frame_fragile_bool { #1 }
7176 },
7177 shrink .code:n = {
7178     \_notesslides_do_yes_param:Nn \l__notesslides_frame_shrink_bool { #1 }
7179 },
7180 squeeze .code:n = {
7181     \_notesslides_do_yes_param:Nn \l__notesslides_frame_squeeze_bool { #1 }
7182 },
7183 t .code:n = {
7184     \_notesslides_do_yes_param:Nn \l__notesslides_frame_t_bool { #1 }
7185 },
7186 unknown .code:n = {}
7187 }
7188 \cs_new_protected:Nn \_notesslides_frame_args:n {
7189     \str_clear:N \l__notesslides_frame_label_str
7190     \bool_set_true:N \l__notesslides_frame_allowframebreaks_bool
7191     \bool_set_true:N \l__notesslides_frame_allowdisplaybreaks_bool
7192     \bool_set_true:N \l__notesslides_frame_fragile_bool
7193     \bool_set_true:N \l__notesslides_frame_shrink_bool
7194     \bool_set_true:N \l__notesslides_frame_squeeze_bool
7195     \bool_set_true:N \l__notesslides_frame_t_bool
7196     \keys_set:nn { notesslides / frame }{ #1 }
7197 }

```

We define the environment, read them, and construct the slide number and label.

```

7198 \renewenvironment{frame}[1][]{
7199     \_notesslides_frame_args:n{#1}
7200     \sffamily
7201     \stepcounter{slide}
7202     \def\@currentlabel{\theslide}
7203     \str_if_empty:NF \l__notesslides_frame_label_str {
7204         \label{\l__notesslides_frame_label_str}
7205     }

```

We redefine the `itemize` environment so that it looks more like the one in `beamer`.

```

7206 \def\itemize@level{outer}
7207 \def\itemize@outer{outer}
7208 \def\itemize@inner{inner}
7209 \renewcommand\newpage{\addtocounter{framenum}{1}}
7210 %\newcommand\metakeys@show@keys[2]{\marginnote{\scriptsize ##2}}
7211 \renewenvironment{itemize}{
7212     \ifx\itemize@level\itemize@outer
7213         \def\itemize@label{\$ \rhd \$}
7214     \fi
7215     \ifx\itemize@level\itemize@inner
7216         \def\itemize@label{\$ \scriptstyle \rhd \$}
7217     \fi
7218     \begin{list}
7219     {\itemize@label}
7220     {\setlength{\labelsep}{.3em}
7221      \setlength{\labelwidth}{.5em}
7222      \setlength{\leftmargin}{1.5em}

```

```

7223     }
7224     \edef\itemize@level{\itemize@inner}
7225   }{
7226     \end{list}
7227   }

```

We create the box with the `mdframed` environment from the `equinymous` package.

```

7228     \stex_html_backend:TF {
7229       \begin{stex_annotate_env}{frame}{}\vbox\bgroup
7230         \mdf@patchamsthm
7231       }{
7232         \begin{mdframed}[linewidth=\slideframewidth,skipabove=1ex,skipbelow=1ex,userdefinedwid
7233       }
7234     }{
7235       \stex_html_backend:TF {
7236         \miko@slidelabel\egroup\end{stex_annotate_env}
7237       }{\medskip\miko@slidelabel\end{mdframed}}
7238     }

```

Now, we need to redefine the `frametitle` (we are still in course notes mode).

`\frametitle`

```

7239     \renewcommand{\frametitle}[1]{
7240       \stex_document_title:n { #1 }
7241       {\Large\bf\sf\color{blue}{#1}}\medskip
7242     }
7243   }

```

(End definition for `\frametitle`. This function is documented on page ??.)

EdN:19

`\pause`

```

19
7244   \bool_if:NT \c__notesslides_notes_bool {
7245     \newcommand\pause{}
7246   }

```

(End definition for `\pause`. This function is documented on page ??.)

`nparagraph`

```

7247   \bool_if:NTF \c__notesslides_notes_bool {
7248     \newenvironment{nparagraph}[1] []{\begin{sparagraph}[#1]}\end{sparagraph}}
7249   }{
7250     \excludecomment{nparagraph}
7251   }

```

`nfragment`

```

7252   \bool_if:NTF \c__notesslides_notes_bool {
7253     \newenvironment{nfragment}[2] []{\begin{sfragment}[#1]{#2}}\end{sfragment}}
7254   }{
7255     \excludecomment{nfragment}
7256   }

```

¹⁹EdNOTE: MK: fake it in notes mode for now

ndefinition

```
7257 \bool_if:NTF \c__notesslides_notes_bool {
7258   \newenvironment{ndefinition}[1] [] {\begin{sdefinition}[#1]}\end{sdefinition}}
7259 }{
7260   \excludecomment{ndefinition}
7261 }
```

nassertion

```
7262 \bool_if:NTF \c__notesslides_notes_bool {
7263   \newenvironment{nassertion}[1] [] {\begin{sassertion}[#1]}\end{sassertion}}
7264 }{
7265   \excludecomment{nassertion}
7266 }
```

nsproof

```
7267 \bool_if:NTF \c__notesslides_notes_bool {
7268   \newenvironment{nproof}[2] [] {\begin{sproof}[#1]{#2}}\end{sproof}}
7269 }{
7270   \excludecomment{nproof}
7271 }
```

nexample

```
7272 \bool_if:NTF \c__notesslides_notes_bool {
7273   \newenvironment{nexample}[1] [] {\begin{sexample}[#1]}\end{sexample}}
7274 }{
7275   \excludecomment{nexample}
7276 }
```

\inputref@*skip We customize the hooks for in \inputref.

```
7277 \def\inputref@preskip{\smallskip}
7278 \def\inputref@postskip{\medskip}
```

(End definition for \inputref@*skip. This function is documented on page ??.)

\inputref*

```
7279 \let\orig@inputref\inputref
7280 \def\inputref{\@ifstar\ninputref\orig@inputref}
7281 \newcommand\ninputref[2] [] {
7282   \bool_if:NT \c__notesslides_notes_bool {
7283     \orig@inputref[#1]{#2}
7284   }
7285 }
```

(End definition for \inputref*. This function is documented on page 54.)

38.3 Header and Footer Lines

Now, we set up the infrastructure for the footer line of the slides, we use boxes for the logos, so that they are only loaded once, that considerably speeds up processing.

\setslidelo The default logo is the \TeX logo. Customization can be done by `\setslidelo{<logo name>}`.

```

7286 \newlength{\slideloheight}
7287
7288 \bool_if:NTF \c_notesslides_notes_bool {
7289   \setlength{\slideloheight}{.4cm}
7290 }{
7291   \setlength{\slideloheight}{1cm}
7292 }
7293 \newsavebox{\slidelo}
7294 \sbox{\slidelo}{\TeX}
7295 \newrobustcmd{\setslidelo}[1]{
7296   \sbox{\slidelo}{\includegraphics[height=\slideloheight]{#1}}
7297 }

```

(End definition for `\setslidelo`. This function is documented on page 54.)

\setsource `\source` stores the writer's name. By default it is *Michael Kohlhase* since he is the main user and designer of this package. `\setsource{<name>}` can change the writer's name.

```

7298 \def\source{Michael Kohlhase}% customize locally
7299 \newrobustcmd{\setsource}[1]{\def\source{#1}}

```

(End definition for `\setsource`. This function is documented on page 54.)

\setlicensing Now, we set up the copyright and licensing. By default we use the Creative Commons Attribution-ShareAlike license to strengthen the public domain. If package `hyperref` is loaded, then we can attach a hyperlink to the license logo. `\setlicensing[<url>]{<logo name>}` is used for customization, where `<url>` is optional.

```

7300 \def\copyrightnotice{\footnotesize\copyright : \hspace{.3ex}{\source}}
7301 \newsavebox{\cclogo}
7302 \sbox{\cclogo}{\includegraphics[height=\slideloheight]{stex-cc_somerights}}
7303 \newif\ifcchref\cchreffalse
7304 \AtBeginDocument{
7305   \ifpackageloaded{hyperref}{\cchreftrue}{\cchreffalse}
7306 }
7307 \def\licensing{
7308   \ifcchref
7309     \href{http://creativecommons.org/licenses/by-sa/2.5/}{\usebox{\cclogo}}
7310   \else
7311     {\usebox{\cclogo}}
7312   \fi
7313 }
7314 \newrobustcmd{\setlicensing}[2][]{
7315   \def\@url{#1}
7316   \sbox{\cclogo}{\includegraphics[height=\slideloheight]{#2}}
7317   \ifx\@url\@empty
7318     \def\licensing{{\usebox{\cclogo}}}
7319   \else
7320     \def\licensing{
7321       \ifcchref
7322         \href{#1}{\usebox{\cclogo}}
7323       \else
7324         {\usebox{\cclogo}}
7325       \fi

```

```

7326     }
7327     \fi
7328 }

```

(End definition for `\setlicensing`. This function is documented on page 54.)

EdN:20

`\slidelabel` Now, we set up the slide label for the article mode.²⁰

```

7329 \newrobustcmd\miko@slidelabel{
7330   \vbox to \slidelogoheight{
7331     \vss\hbox to \slidewidth
7332     {\licensing\hfill\copyrightnotice\hfill\arabic{slide}\hfill\usebox{\slidelogo}}
7333   }
7334 }

```

(End definition for `\slidelabel`. This function is documented on page ??.)

38.4 Frame Images

`\frameimage` We have to make sure that the width is overwritten, for that we check the `\Gin@ewidth` macro from the `graphicx` package. We also add the `label` key.

```

7335 \def\Gin@mhrepos{}
7336 \define@key{Gin}{mhrepos}{\def\Gin@mhrepos{#1}}
7337 \define@key{Gin}{label}{\def\currentlabel{\arabic{slide}}\label{#1}}
7338 \newrobustcmd\frameimage[2][]{
7339   \stepcounter{slide}
7340   \bool_if:NT \c__notesslides_frameimages_bool {
7341     \def\Gin@ewidth{}\setkeys{Gin}{#1}
7342     \bool_if:NF \c__notesslides_notes_bool { \vfill }
7343     \begin{center}
7344       \bool_if:NTF \c__notesslides_fiboxed_bool {
7345         \fbox{
7346           \ifx\Gin@ewidth\@empty
7347             \ifx\Gin@mhrepos\@empty
7348               \mhgraphics[width=\slidewidth,#1]{#2}
7349             \else
7350               \mhgraphics[width=\slidewidth,#1,mhrepos=\Gin@mhrepos]{#2}
7351             \fi
7352           \else% Gin@ewidth empty
7353             \ifx\Gin@mhrepos\@empty
7354               \mhgraphics[#1]{#2}
7355             \else
7356               \mhgraphics[#1,mhrepos=\Gin@mhrepos]{#2}
7357             \fi
7358           \fi% Gin@ewidth empty
7359         }
7360       }{
7361         \ifx\Gin@ewidth\@empty
7362           \ifx\Gin@mhrepos\@empty
7363             \mhgraphics[width=\slidewidth,#1]{#2}
7364           \else
7365             \mhgraphics[width=\slidewidth,#1,mhrepos=\Gin@mhrepos]{#2}
7366           \fi

```

²⁰EdNOTE: see that we can use the themes for the slides some day. This is all fake.


```

7367         \ifx\Gin@mhrepos\@empty
7368             \mhgraphics[#1]{#2}
7369         \else
7370             \mhgraphics[#1,mhrepos=\Gin@mhrepos]{#2}
7371         \fi
7372     \fi% Gin@ewidth empty
7373 }
7374 \end{center}
7375 \par\strut\hfill{\footnotesize Slide \arabic{slide}}}%
7376 \bool_if:NF \c__notesslides_notes_bool { \vfill }
7377 }
7378 } % ifmks@sty@frameimages

```

(End definition for `\frameimage`. This function is documented on page 55.)

38.5 Colors and Highlighting

We first specify sans serif fonts as the default.

```

7379 \sffamily

```

Now, we set up an infrastructure for highlighting phrases in slides. Note that we use content-oriented macros for highlighting rather than directly using color markup. The first thing to do is to adapt the green so that it is dark enough for most beamers

```

7380 \AddToHook{begindocument}{
7381     \definecolor{green}{rgb}{0,.5,0}
7382     \definecolor{purple}{cmyk}{.3,1,0,.17}
7383 }

```

We customize the `\defemph`, `\symrefemph`, `\compemph`, and `\titleemph` macros with colors. Furthermore we customize the `__omtextlec` macro for the appearance of line end comments in `\lec`.

```

7384 % \def\STpresent#1{\textcolor{blue}{#1}}
7385 \def\defemph#1{\textcolor{magenta}{#1}}
7386 \def\symrefemph#1{\textcolor{cyan}{#1}}
7387 \def\compemph#1{\textcolor{blue}{#1}}
7388 \def\titleemph#1{\textcolor{blue}{#1}}
7389 \def\__omtext_lec#1{\textcolor{green}{#1}}

```

I like to use the dangerous bend symbol for warnings, so we provide it here.

`\textwarning` as the macro can be used quite often we put it into a box register, so that it is only loaded once.

```

7390 \pgfdeclareimage[width=.8em]{miko@small@dbend}{stex-dangerous-bend}
7391 \def\smalltextwarning{
7392     \pgfuseimage{miko@small@dbend}
7393     \xspace
7394 }
7395 \pgfdeclareimage[width=1.2em]{miko@dbend}{stex-dangerous-bend}
7396 \newrobustcmd\textwarning{
7397     \raisebox{-.05cm}{\pgfuseimage{miko@dbend}}
7398     \xspace
7399 }
7400 \pgfdeclareimage[width=2.5em]{miko@big@dbend}{stex-dangerous-bend}

```

```

7401 \newrobustcmd\bigtextwarning{
7402   \raisebox{-.05cm}{\pgfuseimage{miko@big@dbend}}
7403   \xspace
7404 }
(End definition for \textwarning. This function is documented on page 55.)
7405 \newrobustcmd\putgraphicsat[3]{
7406   \begin{picture}(0,0)\put(#1){\includegraphics[#2]{#3}}\end{picture}
7407 }
7408 \newrobustcmd\putat[2]{
7409   \begin{picture}(0,0)\put(#1){#2}\end{picture}
7410 }

```

38.6 Sectioning

If the `sectocframes` option is set, then we make section frames. We first define counters for `part` and `chapter`, which `beamer.cls` does not have and we make the `section` counter which it does dependent on `chapter`.

```

7411 \stex_html_backend:F {
7412   \bool_if:NT \c__notesslides_sectocframes_bool {
7413     \str_if_eq:VnTF \__notesslidesstopsect{part}{
7414       \newcounter{chapter}\counterwithin*{section}{chapter}
7415     }{
7416       \str_if_eq:VnT \__notesslidesstopsect{chapter}{
7417         \newcounter{chapter}\counterwithin*{section}{chapter}
7418       }
7419     }
7420   }
7421 }

```

`\section@level` We set the `\section@level` counter that governs sectioning according to the class options. We also introduce the sectioning counters accordingly.

```

\section@level
7422 \def\part@prefix{}
7423 \@ifpackageloaded{document-structure}{}{
7424   \str_case:VnF \__notesslidesstopsect {
7425     {part}{
7426       \int_set:Nn \l_document_structure_section_level_int {0}
7427       \def\thesection{\arabic{chapter}.\arabic{section}}
7428       \def\part@prefix{\arabic{chapter}.}
7429     }
7430     {chapter}{
7431       \int_set:Nn \l_document_structure_section_level_int {1}
7432       \def\thesection{\arabic{chapter}.\arabic{section}}
7433       \def\part@prefix{\arabic{chapter}.}
7434     }
7435   }{
7436     \int_set:Nn \l_document_structure_section_level_int {2}
7437     \def\part@prefix{}
7438   }
7439 }
7440
7441 \bool_if:NF \c__notesslides_notes_bool { % only in slides

```

(End definition for `\section@level`. This function is documented on page ??.)

The new counters are used in the `sfragment` environment that choses the L^AT_EX sectioning macros according to `\section@level`.

`sfragment`

```

7442 \renewenvironment{sfragment}[2][]{
7443   \_document\_structure\_sfragment\_args:n { #1 }
7444   \int\_incr:N \l\_document\_structure\_section\_level\_int
7445   \bool\_if:NT \c\_notesslides\_sectocframes\_bool {
7446     \stepcounter{slide}
7447     \begin{frame}[noframenumbering]
7448     \vfill\Large\centering
7449     \red{
7450       \ifcase\l\_document\_structure\_section\_level\_int\or
7451         \stepcounter{part}
7452         \def\_notesslideslabel{\omdoc@part@kw}~\Roman{part}}
7453         \def\currentsectionlevel{\omdoc@part@kw}
7454       \or
7455         \stepcounter{chapter}
7456         \def\_notesslideslabel{\omdoc@chapter@kw}~\arabic{chapter}}
7457         \def\currentsectionlevel{\omdoc@chapter@kw}
7458       \or
7459         \stepcounter{section}
7460         \def\_notesslideslabel{\part@prefix\arabic{section}}
7461         \def\currentsectionlevel{\omdoc@section@kw}
7462       \or
7463         \stepcounter{subsection}
7464         \def\_notesslideslabel{\part@prefix\arabic{section}.\arabic{subsection}}
7465         \def\currentsectionlevel{\omdoc@subsection@kw}
7466       \or
7467         \stepcounter{subsubsection}
7468         \def\_notesslideslabel{\part@prefix\arabic{section}.\arabic{subsection}.\arabic{s
7469         \def\currentsectionlevel{\omdoc@subsubsection@kw}
7470       \or
7471         \stepcounter{paragraph}
7472         \def\_notesslideslabel{\part@prefix\arabic{section}.\arabic{subsection}.\arabic{s
7473         \def\currentsectionlevel{\omdoc@paragraph@kw}
7474       \else
7475         \def\_notesslideslabel{}
7476         \def\currentsectionlevel{\omdoc@paragraph@kw}
7477       \fi% end ifcase
7478       \_notesslideslabel%\sref@label@id\_notesslideslabel
7479       \quad #2%
7480     }%
7481     \vfill%
7482     \end{frame}%
7483   }
7484   \str\_if\_empty:NF \l\_document\_structure\_sfragment\_id\_str {
7485     \stex\_ref\_new\_doc\_target:n\l\_document\_structure\_sfragment\_id\_str
7486   }
7487 }{}
7488 }
```

We set up a `beamer` template for theorems like `ams` style, but without a block environment.

```

7489 \def\inserttheorembodyfont{\normalfont}
7490 %\bool_if:NF \c_notesslides_notes_bool {
7491 % \defbeamertemplate{theorem begin}{miko}
7492 % {\inserttheoremheadfont\inserttheoremname\inserttheoremnumber
7493 % \ifx\inserttheoremaddition\empty\else\ (\inserttheoremaddition)\fi%
7494 % \inserttheorempunctuation\inserttheorembodyfont\xspace}
7495 % \defbeamertemplate{theorem end}{miko}{}
```

and we set it as the default one.

```

7496 % \setbeamertemplate{theorems}[miko]
```

The following fixes an error I do not understand, this has something to do with `beamer` compatibility, which has similar definitions but only up to 1.

```

7497 % \expandafter\def\csname Parent2\endcsname{}
7498 %}
7499
7500 \AddToHook{begindocument}{ % this does not work for some reason
7501 \setbeamertemplate{theorems}[ams style]
7502 }
7503 \bool_if:NT \c_notesslides_notes_bool {
7504 \renewenvironment{columns}[1][{}%
7505 \par\noindent%
7506 \begin{minipage}%
7507 \slidewidth\centering\leavevmode%
7508 }{}%
7509 \end{minipage}\par\noindent%
7510 }%
7511 \newsavebox\columnbox%
7512 \renewenvironment<>{column}[2][{}%
7513 \begin{lrbox}{\columnbox}\begin{minipage}{#2}%
7514 }{}%
7515 \end{minipage}\end{lrbox}\usebox\columnbox%
7516 }%
7517 }
7518 \bool_if:NTF \c_notesslides_noproblems_bool {
7519 \newenvironment{problems}{}{}
7520 }{
7521 \excludacomment{problems}
7522 }
```

38.7 Excursions

\excursion The excursion macros are very simple, we define a new internal macro `\excursionref` and use it in `\excursion`, which is just an `\inputref` that checks if the new macro is defined before formatting the file in the argument.

```

7523 \gdef\printexcursions{}
7524 \newcommand\excursionref[2]{% label, text
7525 \bool_if:NT \c_notesslides_notes_bool {
7526 \begin{sparagraph}[title=Excursion]
7527 #2 \sref[fallback=the appendix]{#1}.
7528 \end{sparagraph}}
```

```

7529 }
7530 }
7531 \newcommand\activate@excursion[2][]{
7532   \gappto\printexcursions{\inputref{#1}{#2}}
7533 }
7534 \newcommand\excursion[4][]{% repos, label, path, text
7535   \bool_if:NT \c__notesslides_notes_bool {
7536     \activate@excursion{#1}{#3}\excursionref{#2}{#4}
7537   }
7538 }

```

(End definition for \excursion. This function is documented on page 55.)

\excursiongroup

```

7539 \keys_define:nn{notesslides / excursiongroup }{
7540   id          .str_set_x:N = \l__notesslides_excursion_id_str,
7541   intro       .tl_set:N    = \l__notesslides_excursion_intro_tl,
7542   mhrepos     .str_set_x:N = \l__notesslides_excursion_mhrepos_str
7543 }
7544 \cs_new_protected:Nn \__notesslides_excursion_args:n {
7545   \tl_clear:N \l__notesslides_excursion_intro_tl
7546   \str_clear:N \l__notesslides_excursion_id_str
7547   \str_clear:N \l__notesslides_excursion_mhrepos_str
7548   \keys_set:nn {notesslides / excursiongroup }{ #1 }
7549 }
7550 \newcommand\excursiongroup[1][]{
7551   \__notesslides_excursion_args:n{ #1 }
7552   \ifdefempty\printexcursions{}% only if there are excursions
7553   {\begin{note}
7554     \begin{sfragment}[#1]{Excursions}%
7555     \ifdefempty\l__notesslides_excursion_intro_tl{\{
7556       \inputref[\l__notesslides_excursion_mhrepos_str]{
7557         \l__notesslides_excursion_intro_tl
7558       }
7559     }
7560     \printexcursions%
7561     \end{sfragment}
7562   }\end{note}}
7563 }
7564 \ifcsname beameritemnestingprefix\endcsname\else\def\beameritemnestingprefix{\fi
7565 \</package>

```

(End definition for \excursiongroup. This function is documented on page 56.)

Chapter 39

The Implementation

39.1 Package Options

The first step is to declare (a few) package options that handle whether certain information is printed or not. They all come with their own conditionals that are set by the options.

```
7566 <*package>
7567 <@@=problems>
7568 \ProvidesExplPackage{problem}{2022/02/26}{3.0.1}{Semantic Markup for Problems}
7569 \RequirePackage{13keys2e,stex}
7570
7571 \keys_define:nn { problem / pkg }{
7572   notes      .default:n    = { true },
7573   notes      .bool_set:N   = \c__problems_notes_bool,
7574   gnotes     .default:n    = { true },
7575   gnotes     .bool_set:N   = \c__problems_gnotes_bool,
7576   hints      .default:n    = { true },
7577   hints      .bool_set:N   = \c__problems_hints_bool,
7578   solutions  .default:n    = { true },
7579   solutions  .bool_set:N   = \c__problems_solutions_bool,
7580   pts        .default:n    = { true },
7581   pts        .bool_set:N   = \c__problems_pts_bool,
7582   min        .default:n    = { true },
7583   min        .bool_set:N   = \c__problems_min_bool,
7584   boxed      .default:n    = { true },
7585   boxed      .bool_set:N   = \c__problems_boxed_bool,
7586   unknown    .code:n       = {}
7587 }
7588 \newif\ifsolutions
7589
7590 \ProcessKeysOptions{ problem / pkg }
7591 \bool_if:NTF \c__problems_solutions_bool {
7592   \solutionstrue
7593 }{
7594   \solutionsfalse
7595 }
```

Then we make sure that the necessary packages are loaded (in the right versions).

```
7596 \RequirePackage{comment}
```

The next package relies on the L^AT_EX3 kernel, which L^AT_EXML only partially supports. As it is purely presentational, we only load it when the boxed option is given and we run L^AT_EXML.

```
7597 \bool_if:NT \c__problems_boxed_bool { \RequirePackage{mdframed} }
```

\prob@*@kw For multilinguality, we define internal macros for keywords that can be specialized in *.ldf files.

```
7598 \def\prob@problem@kw{Problem}
7599 \def\prob@solution@kw{Solution}
7600 \def\prob@hint@kw{Hint}
7601 \def\prob@note@kw{Note}
7602 \def\prob@gnote@kw{Grading}
7603 \def\prob@pt@kw{pt}
7604 \def\prob@min@kw{min}
```

(End definition for \prob@*@kw. This function is documented on page ??.)

For the other languages, we set up triggers

```
7605 \AddToHook{begindocument}{
7606   \ltx@ifpackageloaded{babel}{
7607     \makeatletter
7608     \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
7609     \clist_if_in:NnT \l_tmpa_clist {ngerman}{
7610       \input{problem-ngerman.ldf}
7611     }
7612     \clist_if_in:NnT \l_tmpa_clist {finnish}{
7613       \input{problem-finnish.ldf}
7614     }
7615     \clist_if_in:NnT \l_tmpa_clist {french}{
7616       \input{problem-french.ldf}
7617     }
7618     \clist_if_in:NnT \l_tmpa_clist {russian}{
7619       \input{problem-russian.ldf}
7620     }
7621     \makeatother
7622   }{}
7623 }
```

39.2 Problems and Solutions

We now prepare the KeyVal support for problems. The key macros just set appropriate internal macros.

```
7624 \keys_define:nn{ problem / problem }{
7625   id      .str_set_x:N = \l__problems_prob_id_str,
7626   pts     .tl_set:N    = \l__problems_prob_pts_tl,
7627   min     .tl_set:N    = \l__problems_prob_min_tl,
7628   title   .tl_set:N    = \l__problems_prob_title_tl,
7629   type    .tl_set:N    = \l__problems_prob_type_tl,
7630   imports .tl_set:N    = \l__problems_prob_imports_tl,
7631   name    .str_set_x:N = \l__problems_prob_name_str,
7632   refnum  .int_set:N   = \l__problems_prob_refnum_int
```

```

7633 }
7634 \cs_new_protected:Nn \__problems_prob_args:n {
7635   \str_clear:N \l__problems_prob_id_str
7636   \str_clear:N \l__problems_prob_name_str
7637   \tl_clear:N \l__problems_prob_pts_tl
7638   \tl_clear:N \l__problems_prob_min_tl
7639   \tl_clear:N \l__problems_prob_title_tl
7640   \tl_clear:N \l__problems_prob_type_tl
7641   \tl_clear:N \l__problems_prob_imports_tl
7642   \int_zero_new:N \l__problems_prob_refnum_int
7643   \keys_set:nn { problem / problem }{ #1 }
7644   \int_compare:nNnT \l__problems_prob_refnum_int = 0 {
7645     \let\l__problems_prob_refnum_int\undefined
7646   }
7647 }

```

Then we set up a counter for problems.

`\numberproblemsin`

```

7648 \newcounter{problem}[section]
7649 \newcommand\numberproblemsin[1]{\@addtoreset{problem}{#1}}

```

(End definition for `\numberproblemsin`. This function is documented on page ??.)

`\prob@label` We provide the macro `\prob@label` to redefine later to get context involved.

```

7650 \newcommand\prob@label[1]{\thesection.#1}

```

(End definition for `\prob@label`. This function is documented on page ??.)

`\prob@number` We consolidate the problem number into a reusable internal macro

```

7651 \newcommand\prob@number{
7652   \int_if_exist:NTF \l__problems_inclprob_refnum_int {
7653     \prob@label{\int_use:N \l__problems_inclprob_refnum_int }
7654   }{
7655     \int_if_exist:NTF \l__problems_prob_refnum_int {
7656       \prob@label{\int_use:N \l__problems_prob_refnum_int }
7657     }{
7658       \prob@label\theproblem
7659     }
7660   }
7661 }

```

(End definition for `\prob@number`. This function is documented on page ??.)

`\prob@title` We consolidate the problem title into a reusable internal macro as well. `\prob@title` takes three arguments the first is the fallback when no title is given at all, the second and third go around the title, if one is given.

```

7662 \newcommand\prob@title[3]{%
7663   \tl_if_exist:NTF \l__problems_inclprob_title_tl {
7664     #2 \l__problems_inclprob_title_tl #3
7665   }{
7666     \tl_if_exist:NTF \l__problems_prob_title_tl {
7667       #2 \l__problems_prob_title_tl #3
7668     }{
7669       #1

```



```

7670     }
7671   }
7672 }

```

(End definition for `\prob@title`. This function is documented on page ??.)

With these the problem header is a one-liner

`\prob@heading` We consolidate the problem header line into a separate internal macro that can be reused in various settings.

```

7673 \def\prob@heading{
7674   {\prob@problem@kw}\ \prob@number\prob@title{~}{~}{~}\strut}
7675   %\sref@label@id{\prob@problem@kw~\prob@number}{~}
7676 }

```

(End definition for `\prob@heading`. This function is documented on page ??.)

With this in place, we can now define the `problem` environment. It comes in two shapes, depending on whether we are in boxed mode or not. In both cases we increment the problem number and output the points and minutes (depending) on whether the respective options are set.

`sproblem`

```

7677 \newenvironment{sproblem}[1][{}]{
7678   \__problems_prob_args:n{#1}%\sref@target%
7679   \@in@omtexttrue% we are in a statement (for inline definitions)
7680   \stepcounter{problem}\record@problem
7681   \def\current@section@level{\prob@problem@kw}
7682
7683   \str_if_empty:NT \l__problems_prob_name_str {
7684     \seq_get_right:NN \g_stex_currentfile_seq \l_tmpa_str
7685     \seq_set_split:NnV \l_tmpa_seq . \l_tmpa_str
7686     \seq_get_left:NN \l_tmpa_seq \l__problems_prob_name_str
7687   }
7688
7689   \stex_if_do_html:T{
7690     \tl_if_empty:NF \l__problems_prob_title_tl {
7691       \exp_args:No \stex_document_title:n \l__problems_prob_title_tl
7692     }
7693   }
7694
7695   \exp_args:Nno\stex_module_setup:nn{type=problem}\l__problems_prob_name_str
7696
7697   \stex_reactivate_macro:N \STEXexport
7698   \stex_reactivate_macro:N \importmodule
7699   \stex_reactivate_macro:N \symdecl
7700   \stex_reactivate_macro:N \notation
7701   \stex_reactivate_macro:N \symdef
7702
7703   \stex_if_do_html:T{
7704     \begin{stex_annotate_env} {problem} {
7705       \l_stex_module_ns_str ? \l_stex_module_name_str
7706     }
7707
7708     \stex_annotate_invisible:nnn{header}{} {
7709       \stex_annotate:nnn{language}{ \l_stex_module_lang_str }{}

```

```

7710     \stex_annotate:nnn{signature}{ \l_stex_module_sig_str }{}
7711     \str_if_eq:VnF \l_stex_module_meta_str {NONE} {
7712         \stex_annotate:nnn{metatheory}{ \l_stex_module_meta_str }{}
7713     }
7714 }
7715 }
7716
7717 \stex_csl_to_imports:No \importmodule \l__problems_prob_imports_tl
7718
7719
7720 \tl_if_exist:NTF \l__problems_inclprob_type_tl {
7721     \tl_set_eq:NN \sproblemtype \l__problems_inclprob_type_tl
7722 }{
7723     \tl_set_eq:NN \sproblemtype \l__problems_prob_type_tl
7724 }
7725 \str_if_exist:NTF \l__problems_inclprob_id_str {
7726     \str_set_eq:NN \sproblemid \l__problems_inclprob_id_str
7727 }{
7728     \str_set_eq:NN \sproblemid \l__problems_prob_id_str
7729 }
7730
7731
7732 \stex_if_smsmode:F {
7733     \clist_set:No \l_tmpa_clist \sproblemtype
7734     \tl_clear:N \l_tmpa_tl
7735     \clist_map_inline:Nn \l_tmpa_clist {
7736         \tl_if_exist:cT {__problems_sproblem_##1_start:}{
7737             \tl_set:Nn \l_tmpa_tl {\use:c{__problems_sproblem_##1_start:}}
7738         }
7739     }
7740     \tl_if_empty:NTF \l_tmpa_tl {
7741         \__problems_sproblem_start:
7742     }{
7743         \l_tmpa_tl
7744     }
7745 }
7746 \stex_ref_new_doc_target:n \sproblemid
7747 \stex_smsmode_do:
7748 }{
7749     \__stex_modules_end_module:
7750     \stex_if_smsmode:F{
7751         \clist_set:No \l_tmpa_clist \sproblemtype
7752         \tl_clear:N \l_tmpa_tl
7753         \clist_map_inline:Nn \l_tmpa_clist {
7754             \tl_if_exist:cT {__problems_sproblem_##1_end:}{
7755                 \tl_set:Nn \l_tmpa_tl {\use:c{__problems_sproblem_##1_end:}}
7756             }
7757         }
7758         \tl_if_empty:NTF \l_tmpa_tl {
7759             \__problems_sproblem_end:
7760         }{
7761             \l_tmpa_tl
7762         }
7763     }

```

```

7764 \stex_if_do_html:T{
7765     \end{stex_annotate_env}
7766 }
7767
7768 \smallskip
7769 }
7770
7771 \seq_put_right:Nx\g_stex_smsmode_allowedenvs_seq{\tl_to_str:n{sproblem}}
7772
7773
7774
7775 \cs_new_protected:Nn \__problems_sproblem_start: {
7776     \par\noindent\textbf{\prob@heading\show@pts\show@min\\\ignorespacesandpars
7777 }
7778 \cs_new_protected:Nn \__problems_sproblem_end: {\par\smallskip}
7779
7780 \newcommand\stexpatchproblem[3][] {
7781     \str_set:Nx \l_tmpa_str{ #1 }
7782     \str_if_empty:NTF \l_tmpa_str {
7783         \tl_set:Nn \__problems_sproblem_start: { #2 }
7784         \tl_set:Nn \__problems_sproblem_end: { #3 }
7785     }{
7786         \exp_after:wN \tl_set:Nn \csname __problems_sproblem_#1_start:\endcsname{ #2 }
7787         \exp_after:wN \tl_set:Nn \csname __problems_sproblem_#1_end:\endcsname{ #3 }
7788     }
7789 }
7790
7791
7792 \bool_if:NT \c__problems_boxed_bool {
7793     \surroundwithmdframed{problem}
7794 }

```

\record@problem This macro records information about the problems in the *.aux file.

```

7795 \def\record@problem{
7796     \protected@write\@auxout{}
7797     {
7798         \string\@problem{\prob@number}
7799         {
7800             \tl_if_exist:NTF \l__problems_inclprob_pts_tl {
7801                 \l__problems_inclprob_pts_tl
7802             }{
7803                 \l__problems_prob_pts_tl
7804             }
7805         }%
7806         {
7807             \tl_if_exist:NTF \l__problems_inclprob_min_tl {
7808                 \l__problems_inclprob_min_tl
7809             }{
7810                 \l__problems_prob_min_tl
7811             }
7812         }
7813     }
7814 }

```

(End definition for \record@problem. This function is documented on page ??.)

`\@problem` This macro acts on a problem's record in the `*.aux` file. It does not have any functionality here, but can be redefined elsewhere (e.g. in the `assignment` package).

```
7815 \def\@problem#1#2#3{}
```

(End definition for `\@problem`. This function is documented on page ??.)

`solution` The `solution` environment is similar to the `problem` environment, only that it is independent of the boxed mode. It also has it's own keys that we need to define first.

```
7816 \keys_define:nn { problem / solution }{
7817   id          .str_set_x:N = \l__problems_solution_id_str ,
7818   for         .tl_set:N   = \l__problems_solution_for_tl ,
7819   height      .dim_set:N  = \l__problems_solution_height_dim ,
7820   creators    .clist_set:N = \l__problems_solution_creators_clist ,
7821   contributors .clist_set:N = \l__problems_solution_contributors_clist ,
7822   srccite     .tl_set:N    = \l__problems_solution_srccite_tl
7823 }
7824 \cs_new_protected:Nn \__problems_solution_args:n {
7825   \str_clear:N \l__problems_solution_id_str
7826   \tl_clear:N \l__problems_solution_for_tl
7827   \tl_clear:N \l__problems_solution_srccite_tl
7828   \clist_clear:N \l__problems_solution_creators_clist
7829   \clist_clear:N \l__problems_solution_contributors_clist
7830   \dim_zero:N \l__problems_solution_height_dim
7831   \keys_set:nn { problem / solution }{ #1 }
7832 }
```

the next step is to define a helper macro that does what is needed to start a solution.

```
7833 \newcommand\@startsolution[1][]{
7834   \__problems_solution_args:n { #1 }
7835   \@in@omtexttrue% we are in a statement.
7836   \bool_if:NF \c__problems_boxed_bool { \hrule }
7837   \smallskip\noindent
7838   {\textbf{\prob@solution@kw :}\enspace}
7839   \begin{small}
7840   \def\current@section@level{\prob@solution@kw}
7841   \ignorespacesandpars
7842 }
```

`\startsolutions` for the `\startsolutions` macro we use the `\specialcomment` macro from the `comment` package. Note that we use the `\@startsolution` macro in the start codes, that parses the optional argument.

```
7843 \box_new:N \l__problems_solution_box
7844 \newenvironment{solution}[1][]{
7845   \stex_html_backend:TF{
7846     \stex_if_do_html:T{
7847       \begin{stex_annotate_env}{solution}{}}
7848   }
7849   }{
7850     \setbox\l__problems_solution_box\vbox\bgroup
7851     \par\smallskip\hrule\smallskip
7852     \noindent\textbf{Solution:}~
7853   }
7854   }{
7855     \stex_html_backend:TF{
```

```

7856 \stex_if_do_html:T{
7857 \end{stex_annotate_env}
7858 }
7859 }{
7860 \smallskip\hrule
7861 \egroup
7862 \bool_if:NT \c__problems_solutions_bool {
7863 \box\l__problems_solution_box
7864 }
7865 }
7866 }
7867
7868 \newcommand\startsolutions{
7869 \bool_set_true:N \c__problems_solutions_bool
7870 % \specialcomment{solution}{\@startsolution}{
7871 % \bool_if:NF \c__problems_boxed_bool {
7872 % \hrule\medskip
7873 % }
7874 % \end{small}%
7875 % }
7876 % \bool_if:NT \c__problems_boxed_bool {
7877 % \surroundwithmdframed{solution}
7878 % }
7879 }

```

(End definition for \startsolutions. This function is documented on page 57.)

\stopsolutions

```

7880 \newcommand\stopsolutions{\bool_set_false:N \c__problems_solutions_bool}%\excludecomment{sol

```

(End definition for \stopsolutions. This function is documented on page 57.)

so it only remains to start/stop solutions depending on what option was specified.

```

7881 \ifsolutions
7882 \startsolutions
7883 \else
7884 \stopsolutions
7885 \fi

```

exnote

```

7886 \bool_if:NTF \c__problems_notes_bool {
7887 \newenvironment{exnote}[1][{}{
7888 \par\smallskip\hrule\smallskip
7889 \noindent\textbf{\prob@note@kw :~ }\small
7890 }{
7891 \smallskip\hrule
7892 }
7893 }{
7894 \excludecomment{exnote}
7895 }

```

hint

```

7896 \bool_if:NTF \c__problems_notes_bool {
7897 \newenvironment{hint}[1][{}{
7898 \par\smallskip\hrule\smallskip

```

```

7899 \noindent\textbf{\prob@hint@kw :~ }\small
7900 }{
7901 \smallskip\hrule
7902 }
7903 \newenvironment{exhint}[1][]{
7904 \par\smallskip\hrule\smallskip
7905 \noindent\textbf{\prob@hint@kw :~ }\small
7906 }{
7907 \smallskip\hrule
7908 }
7909 }{
7910 \excludecomment{hint}
7911 \excludecomment{exhint}
7912 }

```

gnote

```

7913 \bool_if:NTF \c__problems_notes_bool {
7914 \newenvironment{gnote}[1][]{
7915 \par\smallskip\hrule\smallskip
7916 \noindent\textbf{\prob@gnote@kw :~ }\small
7917 }{
7918 \smallskip\hrule
7919 }
7920 }{
7921 \excludecomment{gnote}
7922 }

```

39.3 Multiple Choice Blocks

EdN:21

mcb 21

```

7923 \newenvironment{mcb}{
7924 \begin{enumerate}
7925 }{
7926 \end{enumerate}
7927 }

```

we define the keys for the mcb macro

```

7928 \cs_new_protected:Nn \__problems_do_yes_param:Nn {
7929 \exp_args:Nx \str_if_eq:nnTF { \str_lowercase:n{ #2 } }{ yes }{
7930 \bool_set_true:N #1
7931 }{
7932 \bool_set_false:N #1
7933 }
7934 }
7935 \keys_define:nn { problem / mcb }{
7936 id .str_set:x:N = \l__problems_mcc_id_str ,
7937 feedback .tl_set:N = \l__problems_mcc_feedback_tl ,
7938 T .default:n = { false } ,
7939 T .bool_set:N = \l__problems_mcc_t_bool ,
7940 F .default:n = { false } ,
7941 F .bool_set:N = \l__problems_mcc_f_bool ,

```

²¹EdNOTE: MK: maybe import something better here from a dedicated MC package

```

7942 Ttext      .tl_set:N      = \l__problems_mcc_Ttext_str ,
7943 Ftext      .tl_set:N      = \l__problems_mcc_Ftext_str
7944 }
7945 \cs_new_protected:Nn \l__problems_mcc_args:n {
7946   \str_clear:N \l__problems_mcc_id_str
7947   \tl_clear:N \l__problems_mcc_feedback_tl
7948   \bool_set_false:N \l__problems_mcc_t_bool
7949   \bool_set_false:N \l__problems_mcc_f_bool
7950   \tl_clear:N \l__problems_mcc_Ttext_tl
7951   \tl_clear:N \l__problems_mcc_Ftext_tl
7952   \str_clear:N \l__problems_mcc_id_str
7953   \keys_set:nn { problem / mcc }{ #1 }
7954 }

```

\mcc

```

7955 \def\mccTrueText{\textbf{(true)~}}
7956 \def\mccFalseText{\textbf{(false)~}}
7957 \newcommand\mcc[2][] {
7958   \l__problems_mcc_args:n{ #1 }
7959   \item[\Box] #2
7960   \ifsolutions
7961     \\\
7962     \bool_if:NT \l__problems_mcc_t_bool {
7963       \tl_if_empty:NTF\l__problems_mcc_Ttext_tl\mccTrueText\l__problems_mcc_Ttext_tl
7964     }
7965     \bool_if:NT \l__problems_mcc_f_bool {
7966       \tl_if_empty:NTF\l__problems_mcc_Ttext_tl\mccFalseText\l__problems_mcc_Ftext_tl
7967     }
7968     \tl_if_empty:NF \l__problems_mcc_feedback_tl {
7969       \emph{(\l__problems_mcc_feedback_tl)}
7970     }
7971   \fi
7972 } %solutions

```

(End definition for \mcc. This function is documented on page 58.)

39.4 Including Problems

\includeproblem The \includeproblem command is essentially a glorified \input statement, it sets some internal macros first that overwrite the local points. Importantly, it resets the `inclprob` keys after the input.

```

7973
7974 \keys_define:nn{ problem / inclproblem }{
7975   id      .str_set_x:N = \l__problems_inclprob_id_str,
7976   pts     .tl_set:N    = \l__problems_inclprob_pts_tl,
7977   min     .tl_set:N    = \l__problems_inclprob_min_tl,
7978   title   .tl_set:N    = \l__problems_inclprob_title_tl,
7979   refnum  .int_set:N    = \l__problems_inclprob_refnum_int,
7980   type    .tl_set:N    = \l__problems_inclprob_type_tl,
7981   mhrepos .str_set_x:N = \l__problems_inclprob_mhrepos_str
7982 }
7983 \cs_new_protected:Nn \__problems_inclprob_args:n {
7984   \str_clear:N \l__problems_prob_id_str

```

```

7985 \tl_clear:N \l__problems_inclprob_pts_tl
7986 \tl_clear:N \l__problems_inclprob_min_tl
7987 \tl_clear:N \l__problems_inclprob_title_tl
7988 \tl_clear:N \l__problems_inclprob_type_tl
7989 \int_zero_new:N \l__problems_inclprob_refnum_int
7990 \str_clear:N \l__problems_inclprob_mhrepos_str
7991 \keys_set:nn { problem / inclproblem }{ #1 }
7992 \tl_if_empty:NT \l__problems_inclprob_pts_tl {
7993   \let\l__problems_inclprob_pts_tl\undefined
7994 }
7995 \tl_if_empty:NT \l__problems_inclprob_min_tl {
7996   \let\l__problems_inclprob_min_tl\undefined
7997 }
7998 \tl_if_empty:NT \l__problems_inclprob_title_tl {
7999   \let\l__problems_inclprob_title_tl\undefined
8000 }
8001 \tl_if_empty:NT \l__problems_inclprob_type_tl {
8002   \let\l__problems_inclprob_type_tl\undefined
8003 }
8004 \int_compare:nNnT \l__problems_inclprob_refnum_int = 0 {
8005   \let\l__problems_inclprob_refnum_int\undefined
8006 }
8007 }
8008
8009 \cs_new_protected:Nn \__problems_inclprob_clear: {
8010   \let\l__problems_inclprob_id_str\undefined
8011   \let\l__problems_inclprob_pts_tl\undefined
8012   \let\l__problems_inclprob_min_tl\undefined
8013   \let\l__problems_inclprob_title_tl\undefined
8014   \let\l__problems_inclprob_type_tl\undefined
8015   \let\l__problems_inclprob_refnum_int\undefined
8016   \let\l__problems_inclprob_mhrepos_str\undefined
8017 }
8018 \__problems_inclprob_clear:
8019
8020 \newcommand\includeproblem[2][ ]{
8021   \__problems_inclprob_args:n{ #1 }
8022   \exp_args:No \stex_in_repository:nn\l__problems_inclprob_mhrepos_str{
8023     \stex_html_backend:TF {
8024       \str_clear:N \l_tmpa_str
8025       \prop_get:NnNF \l_stex_current_repository_prop { narr } \l_tmpa_str {
8026         \prop_get:NnNF \l_stex_current_repository_prop { ns } \l_tmpa_str {}
8027       }
8028       \stex_annotate_invisible:nnn{includeproblem}{
8029         \l_tmpa_str / #2
8030       }{}
8031     }{
8032       \begingroup
8033         \inputreftrue
8034         \tl_if_empty:nTF{ ##1 }{
8035           \input{#2}
8036         }{
8037           \input{ \c_stex_mathhub_str / ##1 / source / #2 }
8038         }

```



```

8039     \endgroup
8040   }
8041 }
8042 \__problems_inclprob_clear:
8043 }

```

(End definition for `\includeproblem`. This function is documented on page 59.)

39.5 Reporting Metadata

For messages it is OK to have them in English as the whole documentation is, and we can therefore assume authors can deal with it.

```

8044 \AddToHook{enddocument}{
8045   \bool_if:NT \c__problems_pts_bool {
8046     \message{Total:~\arabic{pts}~points}
8047   }
8048   \bool_if:NT \c__problems_min_bool {
8049     \message{Total:~\arabic{min}~minutes}
8050   }
8051 }

```

The margin pars are reader-visible, so we need to translate

```

8052 \def\pts#1{
8053   \bool_if:NT \c__problems_pts_bool {
8054     \marginpar{#1~\prob@pt@kw}
8055   }
8056 }
8057 \def\min#1{
8058   \bool_if:NT \c__problems_min_bool {
8059     \marginpar{#1~\prob@min@kw}
8060   }
8061 }

```

`\show@pts` The `\show@pts` shows the points: if no points are given from the outside and also no points are given locally do nothing, else show and add. If there are outside points then we show them in the margin.

```

8062 \newcounter{pts}
8063 \def\show@pts{
8064   \tl_if_exist:NTF \l__problems_inclprob_pts_tl {
8065     \bool_if:NT \c__problems_pts_bool {
8066       \marginpar{\l__problems_inclprob_pts_tl\ \prob@pt@kw\smallskip}
8067       \addtocounter{pts}{\l__problems_inclprob_pts_tl}
8068     }
8069   }{
8070     \tl_if_exist:NT \l__problems_prob_pts_tl {
8071       \bool_if:NT \c__problems_pts_bool {
8072         \tl_if_empty:NT\l__problems_prob_pts_tl{
8073           \tl_set:Nn \l__problems_prob_pts_tl {0}
8074         }
8075         \marginpar{\l__problems_prob_pts_tl\ \prob@pt@kw\smallskip}
8076         \addtocounter{pts}{\l__problems_prob_pts_tl}
8077       }
8078     }

```

```

8079 }
8080 }

```

(End definition for \show@pts. This function is documented on page ??.)
and now the same for the minutes

\show@min

```

8081 \newcounter{min}
8082 \def\show@min{
8083   \tl_if_exist:NTF \l__problems_inclprob_min_tl {
8084     \bool_if:NT \c__problems_min_bool {
8085       \marginpar{\l__problems_inclprob_pts_tl\ min}
8086       \addtocounter{min}{\l__problems_inclprob_min_tl}
8087     }
8088   }{
8089     \tl_if_exist:NT \l__problems_prob_min_tl {
8090       \bool_if:NT \c__problems_min_bool {
8091         \tl_if_empty:NT\l__problems_prob_min_tl{
8092           \tl_set:Nn \l__problems_prob_min_tl {0}
8093         }
8094         \marginpar{\l__problems_prob_min_tl\ min}
8095         \addtocounter{min}{\l__problems_prob_min_tl}
8096       }
8097     }
8098   }
8099 }
8100 \</package>

```

(End definition for \show@min. This function is documented on page ??.)

Chapter 40

Implementation: The hwexam Package

40.1 Package Options

The first step is to declare (a few) package options that handle whether certain information is printed or not. Some come with their own conditionals that are set by the options, the rest is just passed on to the `problems` package.

```
8101 <*package>
8102 \ProvidesExplPackage{hwexam}{2022/02/26}{3.0.1}{homework assignments and exams}
8103 \RequirePackage{l3keys2e}
8104
8105 \newif\iftest\testfalse
8106 \DeclareOption{test}{\testtrue}
8107 \newif\ifmultiple\multiplefalse
8108 \DeclareOption{multiple}{\multipletrue}
8109 \DeclareOption*{\PassOptionsToPackage{\CurrentOption}{problem}}
8110 \ProcessOptions
```

Then we make sure that the necessary packages are loaded (in the right versions).

```
8111 \RequirePackage{keyval}[1997/11/10]
8112 \RequirePackage{problem}
```

`\hwexam@*kw` For multilinguality, we define internal macros for keywords that can be specialized in `*.ldf` files.

```
8113 \newcommand\hwexam@assignment@kw{Assignment}
8114 \newcommand\hwexam@given@kw{Given}
8115 \newcommand\hwexam@due@kw{Due}
8116 \newcommand\hwexam@testemptypage@kw{This~page~was~intentionally~left~
8117 blank~for~extra~space}
8118 \def\hwexam@minutes@kw{minutes}
8119 \newcommand\correction@probs@kw{prob.}
8120 \newcommand\correction@pts@kw{total}
8121 \newcommand\correction@reached@kw{reached}
8122 \newcommand\correction@sum@kw{Sum}
8123 \newcommand\correction@grade@kw{grade}
8124 \newcommand\correction@forgrading@kw{To~be~used~for~grading,~do~not~write~here}
```

(End definition for \hwexam@*kw. This function is documented on page ??.)

For the other languages, we set up triggers

```

8125 \AddToHook{begindocument}{
8126 \ltx@ifpackageloaded{babel}{
8127 \makeatletter
8128 \clist_set:Nx \l_tmpa_clist {\bbl@loaded}
8129 \clist_if_in:NnT \l_tmpa_clist {ngerman}{
8130 \input{hwexam-ngerman.ldf}
8131 }
8132 \clist_if_in:NnT \l_tmpa_clist {finnish}{
8133 \input{hwexam-finnish.ldf}
8134 }
8135 \clist_if_in:NnT \l_tmpa_clist {french}{
8136 \input{hwexam-french.ldf}
8137 }
8138 \clist_if_in:NnT \l_tmpa_clist {russian}{
8139 \input{hwexam-russian.ldf}
8140 }
8141 \makeatother
8142 }{}
8143 }
8144

```

40.2 Assignments

Then we set up a counter for problems and make the problem counter inherited from `problem.sty` depend on it. Furthermore, we specialize the `\prob@label` macro to take the assignment counter into account.

```

8145 \newcounter{assignment}
8146 %\numberproblemsin{assignment}

```

We will prepare the keyval support for the `assignment` environment.

```

8147 \keys_define:nn { hwexam / assignment } {
8148 id .str_set:N = \l_@@_assign_id_str,
8149 number .int_set:N = \l_@@_assign_number_int,
8150 title .tl_set:N = \l_@@_assign_title_tl,
8151 type .tl_set:N = \l_@@_assign_type_tl,
8152 given .tl_set:N = \l_@@_assign_given_tl,
8153 due .tl_set:N = \l_@@_assign_due_tl,
8154 loadmodules .code:n = {
8155 \bool_set_true:N \l_@@_assign_loadmodules_bool
8156 }
8157 }
8158 \cs_new_protected:Nn \_@@_assignment_args:n {
8159 \str_clear:N \l_@@_assign_id_str
8160 \int_set:Nn \l_@@_assign_number_int {-1}
8161 \tl_clear:N \l_@@_assign_title_tl
8162 \tl_clear:N \l_@@_assign_type_tl
8163 \tl_clear:N \l_@@_assign_given_tl
8164 \tl_clear:N \l_@@_assign_due_tl
8165 \bool_set_false:N \l_@@_assign_loadmodules_bool
8166 \keys_set:nn { hwexam / assignment }{ #1 }
8167 }

```

The next three macros are intermediate functions that handle the case gracefully, where the respective token registers are undefined.

The `\given@due` macro prints information about the given and due status of the assignment. Its arguments specify the brackets.

```

8168 \newcommand\given@due[2]{
8169 \bool_lazy_all:nF {
8170 { \tl_if_empty_p:V \l_@@_inclasssign_given_tl }
8171 { \tl_if_empty_p:V \l_@@_assign_given_tl }
8172 { \tl_if_empty_p:V \l_@@_inclasssign_due_tl }
8173 { \tl_if_empty_p:V \l_@@_assign_due_tl }
8174 }{ #1 }
8175
8176 \tl_if_empty:NTF \l_@@_inclasssign_given_tl {
8177 \tl_if_empty:NF \l_@@_assign_given_tl {
8178 \hwexam@given@kw\xspace\l_@@_assign_given_tl
8179 }
8180 }{
8181 \hwexam@given@kw\xspace\l_@@_inclasssign_given_tl
8182 }
8183
8184 \bool_lazy_or:nnF {
8185 \bool_lazy_and_p:nn {
8186 \tl_if_empty_p:V \l_@@_inclasssign_due_tl
8187 }{
8188 \tl_if_empty_p:V \l_@@_assign_due_tl
8189 }
8190 }{
8191 \bool_lazy_and_p:nn {
8192 \tl_if_empty_p:V \l_@@_inclasssign_due_tl
8193 }{
8194 \tl_if_empty_p:V \l_@@_assign_due_tl
8195 }
8196 }{ ,~ }
8197
8198 \tl_if_empty:NTF \l_@@_inclasssign_due_tl {
8199 \tl_if_empty:NF \l_@@_assign_due_tl {
8200 \hwexam@due@kw\xspace \l_@@_assign_due_tl
8201 }
8202 }{
8203 \hwexam@due@kw\xspace \l_@@_inclasssign_due_tl
8204 }
8205
8206 \bool_lazy_all:nF {
8207 { \tl_if_empty_p:V \l_@@_inclasssign_given_tl }
8208 { \tl_if_empty_p:V \l_@@_assign_given_tl }
8209 { \tl_if_empty_p:V \l_@@_inclasssign_due_tl }
8210 { \tl_if_empty_p:V \l_@@_assign_due_tl }
8211 }{ #2 }
8212 }

```

`\assignment@title` This macro prints the title of an assignment, the local title is overwritten, if there is one from the `\inputassignment`. `\assignment@title` takes three arguments the first is the

fallback when no title is given at all, the second and third go around the title, if one is given.

```

8213 \newcommand\assignment@title[3]{
8214 \tl_if_empty:NTF \l_@@_inclasssign_title_tl {
8215 \tl_if_empty:NTF \l_@@_assign_title_tl {
8216 #1
8217 }{
8218 #2\l_@@_assign_title_tl#3
8219 }
8220 }{
8221 #2\l_@@_inclasssign_title_tl#3
8222 }
8223 }

```

(End definition for \assignment@title. This function is documented on page ??.)

\assignment@number Like \assignment@title only for the number, and no around part.

```

8224 \newcommand\assignment@number{
8225 \int_compare:nNnTF \l_@@_inclasssign_number_int = {-1} {
8226 \int_compare:nNnTF \l_@@_assign_number_int = {-1} {
8227 \arabic{assignment}
8228 } {
8229 \int_use:N \l_@@_assign_number_int
8230 }
8231 }{
8232 \int_use:N \l_@@_inclasssign_number_int
8233 }
8234 }

```

(End definition for \assignment@number. This function is documented on page ??.)

With them, we can define the central **assignment** environment. This has two forms (separated by \ifmultiple) in one we make a title block for an assignment sheet, and in the other we make a section heading and add it to the table of contents. We first define an assignment counter

assignment For the assignment environment we delegate the work to the @assignment environment that depends on whether multiple option is given.

```

8235 \newenvironment{assignment}[1][ ]{
8236 \_@@_assignment_args:n { #1 }
8237 %\sref@target
8238 \int_compare:nNnTF \l_@@_assign_number_int = {-1} {
8239 \global\stepcounter{assignment}
8240 }{
8241 \global\setcounter{assignment}{\int_use:N\l_@@_assign_number_int}
8242 }
8243 \setcounter{problem}{0}
8244 \renewcommand\prob@label[1]{\assignment@number.##1}
8245 \def\current@section@level{\document@hwexamtype}
8246 %\sref@label{id}{\document@hwexamtype \thesection}
8247 \begin{@assignment}
8248 }{
8249 \end{@assignment}
8250 }

```

In the multi-assignment case we just use the omdoc environment for suitable sectioning.

```

8251 \def\ass@title{
8252 {\protect\document@hwexamtype}\arabic{assignment}
8253 \assignment@title{}\{;\}\; -- \given@due{}\{
8254 }
8255 \ifmultiple
8256 \newenvironment{@assignment}{
8257 \bool_if:NTF \l_@@_assign_loadmodules_bool {
8258 \begin{sfragment}[loadmodules]{\ass@title}
8259 }{
8260 \begin{sfragment}{\ass@title}
8261 }
8262 }{
8263 \end{sfragment}
8264 }

```

for the single-page case we make a title block from the same components.

```

8265 \else
8266 \newenvironment{@assignment}{
8267 \begin{center}\bf
8268 \Large@title\strut\
8269 \document@hwexamtype}\arabic{assignment}\assignment@title{}\{;\}\;{\}\}
8270 \large\given@due{--;\}\{;\}--}
8271 \end{center}
8272 }{}
8273 \fi% multiple

```

40.3 Including Assignments

\in*assignment This macro is essentially a glorified `\include` statement, it just sets some internal macros first that overwrite the local points. Importantly, it resets the `inclassig` keys after the input.

```

8274 \keys_define:nn { hwexam / inclassignment } {
8275 %id .str_set_x:N = \l_@@_assign_id_str,
8276 number .int_set:N = \l_@@_inclassign_number_int,
8277 title .tl_set:N = \l_@@_inclassign_title_tl,
8278 type .tl_set:N = \l_@@_inclassign_type_tl,
8279 given .tl_set:N = \l_@@_inclassign_given_tl,
8280 due .tl_set:N = \l_@@_inclassign_due_tl,
8281 mhrepos .str_set_x:N = \l_@@_inclassign_mhrepos_str
8282 }
8283 \cs_new_protected:Nn \_@@_inclassignment_args:n {
8284 \int_set:Nn \l_@@_inclassign_number_int {-1}
8285 \tl_clear:N \l_@@_inclassign_title_tl
8286 \tl_clear:N \l_@@_inclassign_type_tl
8287 \tl_clear:N \l_@@_inclassign_given_tl
8288 \tl_clear:N \l_@@_inclassign_due_tl
8289 \str_clear:N \l_@@_inclassign_mhrepos_str
8290 \keys_set:nn { hwexam / inclassignment }{ #1 }
8291 }
8292 \_@@_inclassignment_args:n {}
8293
8294 \newcommand\inputassignment[2][{}]{

```

```

8295 \_@@_inclassassignment_args:n { #1 }
8296 \str_if_empty:NTF \l_@@_inclasssign_mhrepos_str {
8297   \input{#2}
8298 }{
8299   \stex_in_repository:nn{\l_@@_inclasssign_mhrepos_str}{
8300     \input{\mhpath{\l_@@_inclasssign_mhrepos_str}{#2}}
8301   }
8302 }
8303 \_@@_inclassassignment_args:n {}
8304 }
8305 \newcommand\includeassignment[2][]{
8306   \newpage
8307   \inputassignment[#1]{#2}
8308 }

```

(End definition for \in*assignment. This function is documented on page ??.)

40.4 Typesetting Exams

\quizheading

```

8309 \ExplSyntaxOff
8310 \newcommand\quizheading[1]{%
8311   \def\@tas{#1}%
8312   \large\noindent NAME: \hspace{8cm} MAILBOX:\[2ex]%
8313   \ifx\@tas\@empty\else%
8314     \noindent TA:~\@for\@I:=\@tas\do{\Large$\Box$}\@I\hspace*{1em}}\[2ex]%
8315   \fi%
8316 }
8317 \ExplSyntaxOn

```

(End definition for \quizheading. This function is documented on page ??.)

\testheading

```

8318
8319 \def\hwexamheader{\input{hwexam-default.header}}
8320
8321 \def\hwexamminutes{
8322   \tl_if_empty:NTF \testheading@duration {
8323     {\testheading@min}~\hwexam@minutes@kw
8324   }{
8325     \testheading@duration
8326   }
8327 }
8328
8329 \keys_define:nn { hwexam / testheading } {
8330   min .tl_set:N = \testheading@min,
8331   duration .tl_set:N = \testheading@duration,
8332   reqpts .tl_set:N = \testheading@reqpts,
8333   tools .tl_set:N = \testheading@tools
8334 }
8335 \cs_new_protected:Nn \_@@_testheading_args:n {
8336   \tl_clear:N \testheading@min
8337   \tl_clear:N \testheading@duration

```



```

8338 \tl_clear:N \testheading@reqpts
8339 \tl_clear:N \testheading@tools
8340 \keys_set:nn { hwexam / testheading }{ #1 }
8341 }
8342 \newenvironment{testheading}[1][]{
8343 \_@@_testheading_args:n{ #1 }
8344 \newcount\check@time\check@time=\testheading@min
8345 \advance\check@time by -\theassignment@totalmin
8346 \newif\if@bonuspoints
8347 \tl_if_empty:NTF \testheading@reqpts {
8348 \@bonuspointsfalse
8349 }{
8350 \newcount\bonus@pts
8351 \bonus@pts=\theassignment@totalpts
8352 \advance\bonus@pts by -\testheading@reqpts
8353 \edef\bonus@pts{\the\bonus@pts}
8354 \@bonuspointstrue
8355 }
8356 \edef\check@time{\the\check@time}
8357
8358 \makeatletter\hwexamheader\makeatother
8359 }{
8360 \newpage
8361 }

```

(End definition for \testheading. This function is documented on page ??.)

\testspace

```

8362 \newcommand\testspace[1]{\iftest\vspace*{#1}\fi}

```

(End definition for \testspace. This function is documented on page ??.)

\testnewpage

```

8363 \newcommand\testnewpage{\iftest\newpage\fi}

```

(End definition for \testnewpage. This function is documented on page ??.)

\testemptypage

```

8364 \newcommand\testemptypage[1][]{\iftest\begin{center}\hwexam@testemptypage@kw\end{center}\vfi}

```

(End definition for \testemptypage. This function is documented on page ??.)

\@problem This macro acts on a problem's record in the *.aux file. Here we redefine it (it was defined to do nothing in problem.sty) to generate the correction table.

```

8365 <@=problems>
8366 \renewcommand\@problem[3]{
8367 \stepcounter{assignment@probs}
8368 \def\__problemspts{#2}
8369 \ifx\__problemspts\@empty\else
8370 \addtocounter{assignment@totalpts}{#2}
8371 \fi
8372 \def\__problemsmin{#3}\ifx\__problemsmin\@empty\else\addtocounter{assignment@totalmin}{#3}\fi
8373 \xdef\correction@probs{\correction@probs & #1}%
8374 \xdef\correction@pts{\correction@pts & #2}
8375 \xdef\correction@reached{\correction@reached &}

```

```

8376 }
8377 <@@=hwexam>

```

(End definition for \@problem. This function is documented on page ??.)

`\correction@table` This macro generates the correction table

```

8378 \newcounter{assignment@probs}
8379 \newcounter{assignment@totalpts}
8380 \newcounter{assignment@totalmin}
8381 \def\correction@probs{\correction@probs@kw}
8382 \def\correction@pts{\correction@pts@kw}
8383 \def\correction@reached{\correction@reached@kw}
8384 \stepcounter{assignment@probs}
8385 \newcommand\correction@table{
8386 \resizebox{\textwidth}{!}{%
8387 \begin{tabular}{|l|*{\theassignment@probs}{c|}|l|}\hline%
8388 &\multicolumn{\theassignment@probs}{c|}|%|
8389 {\footnotesize\correction@forgrading@kw} &\\ \hline
8390 \correction@probs & \correction@sum@kw & \correction@grade@kw\\ \hline
8391 \correction@pts & \theassignment@totalpts & \\ \hline
8392 \correction@reached & & \[.7cm]\hline
8393 \end{tabular}}
8394 </package>

```

(End definition for \correction@table. This function is documented on page ??.)

40.5 Leftovers

at some point, we may want to reactivate the logos font, then we use

here we define the logos that characterize the assignment

```

\font\bierfont=../assignments/bierglas
\font\denkerfont=../assignments/denker
\font\uhrfont=../assignments/uhr
\font\warnschildfont=../assignments/achtung

\newcommand\bierglas{{\bierfont\char65}}
\newcommand\denker{{\denkerfont\char65}}
\newcommand\uhr{{\uhrfont\char65}}
\newcommand\warnschild{{\warnschildfont\char 65}}
\newcommand\hardA{\warnschild}
\newcommand\longA{\uhr}
\newcommand\thinkA{\denker}
\newcommand\discussA{\bierglas}

```

Chapter 41

References

- [Bus+04] Stephen Buswell et al. *The Open Math Standard, Version 2.0*. Tech. rep. The OpenMath Society, 2004. URL: <http://www.openmath.org/standard/om20>.
- [CR99] David Carlisle and Sebastian Rathz. *The graphicx package*. Part of the T_EX distribution. The Comprehensive T_EX Archive Network. 1999. URL: <https://www.tug.org/texlive/devsrc/Master/texmf-dist/doc/latex/graphics/graphics.pdf>.
- [DCM03] The DCMI Usage Board. *DCMI Metadata Terms*. DCMI Recommendation. Dublin Core Metadata Initiative, 2003. URL: <http://dublincore.org/documents/dcmi-terms/>.
- [Koh06] Michael Kohlhase. *OMDoc – An open markup format for mathematical documents [Version 1.2]*. LNAI 4180. Springer Verlag, Aug. 2006. URL: <http://omdoc.org/pubs/omdoc1.2.pdf>.
- [LMH] *LMH Scripts*. URL: <https://github.com/sLaTeX/lmhtools>.
- [MMT] *MMT – Language and System for the Uniform Representation of Knowledge*. Project web site. URL: <https://uniformal.github.io/> (visited on 01/15/2019).
- [MRK18] Dennis Müller, Florian Rabe, and Michael Kohlhase. “Theories as Types”. In: *9th International Joint Conference on Automated Reasoning*. Ed. by Didier Galmiche, Stephan Schulz, and Roberto Sebastiani. Springer Verlag, 2018. URL: <https://kwarc.info/kohlhase/papers/ijcar18-records.pdf>.
- [Rab15] Florian Rabe. “The Future of Logic: Foundation-Independence”. In: *Logica Universalis* 10.1 (2015). 10.1007/s11787-015-0132-x; Winner of the Contest “The Future of Logic” at the World Congress on Universal Logic, pp. 1–20.
- [RK13] Florian Rabe and Michael Kohlhase. “A Scalable Module System”. In: *Information & Computation* 0.230 (2013), pp. 1–54. URL: <https://kwarc.info/frabe/Research/mmt.pdf>.
- [RT] *sLaTeX/RusTeX*. URL: <https://github.com/sLaTeX/RusTeX> (visited on 04/22/2022).

²²EDNOTE: we need an un-numbered version sfragment*

- [SIa] *sLaTeX/sTeX-IDE*. URL: <https://github.com/slatex/sTeX-IDE> (visited on 04/22/2022).
- [SIb] *sLaTeX/stexls-vscode-plugin*. URL: <https://github.com/slatex/stexls-vscode-plugin> (visited on 04/22/2022).
- [SLS] *sLaTeX/stexls*. URL: <https://github.com/slatex/stexls> (visited on 04/22/2022).
- [ST] *sTeX – An Infrastructure for Semantic Preloading of LaTeX Documents*. URL: <https://ctan.org/pkg/stex> (visited on 04/22/2022).
- [sTeX] *sTeX: A semantic Extension of TeX/LaTeX*. URL: <https://github.com/sLaTeX/sTeX> (visited on 05/11/2020).
- [Tana] Till Tantau. *beamer – A LaTeX class for producing presentations and slides*. URL: <http://ctan.org/pkg/beamer> (visited on 01/07/2014).
- [Tanb] Till Tantau. *User Guide to the Beamer Class*. URL: <http://ctan.org/macros/latex/contrib/beamer/doc/beameruserguide.pdf>.
- [TL] *TeX Live*. URL: <http://www.tug.org/texlive/> (visited on 12/11/2012).