The `cabal` package*

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June 25, 2007

1 Basics

Read *The Short Math Guide to LaTeX*[1] by the late Michael Downes. It includes both a reference for a bunch of stuff you're likely going to need (the various AMS equation layout commands, for instance) and, more importantly, some discussion of typographical standards for math typesetting. Don't assume that you don't have to read this just because you know LaTeX. If you haven't read it, you should.

In addition to retyping the old texts, we are also trying to uniformize their notation using the current standardized notation. Therefore, please familiarize yourself with all of the commands in this style file and use them. So, do not write `\{n\in\omega~:~n\geq 2\}`, but use the proper `\set` command for this, and write

```
\(\set{n\in\omega}{n\geq 2}\)
```

$\{n \in \omega : n \geq 2\}$

Retyping will also change the numbering of theorem environments. Some papers have unnumbered lemmas and claims to which they later refer (as "the lemma in the proof of Theorem 2"). All of these should become numbered lemmas and claims with proper references. Make sure that you **never** hard-code any reference numbers, but always use labels and the `\ref` command (see below).

2 Preamble

Use the `asl` documentclass with the `conference` option. Of course you want to use the `cabal` package, so your preamble should start like this:

```
\documentclass[conference]{asl}
\usepackage{cabal}
```

The bibliography will be handled by Joel. Make sure that you replace citations by `\cite{`*label*`}` where you will get a list of labels for your bibliographic entries. Just ignore the bibliography.

*This document corresponds to `cabal` v2.1, dated 2007/06/25.

[1] `http://tex.loria.fr/general/downes-short-math-guide.pdf`

The end of your document must look like this:

```
\bibliographystyle{cabal}
\bibliography{cab-strings,cabal,thisvolume,cab-crossrefs}
\bibtexhack
\end{document}
```

3 Implementation

This section gives a rough guide to the use of the macros, as well as showing their definitions. If you're not a TEX afficionado don't worry about the code snippets (with line numbers), just read the usage bits.

The rest of this section is written according to the conventions of a DTX file: a self-documenting style file containing both TEX code and usage information. The package wasn't originally written this way, so it's not very orderly I'm afraid.

We start by fixing the volume information for page one of each article. The volume information is fixed as "Volume II" and will have to be adjusted by hand later when the files are sent to the publisher. Please don't worry about this.

```
\renewcommand{\copyrightyear}{2007}
\renewcommand{\confname}{The Cabal Seminar: Reprints,
Unpublished Papers, and Surveys, Volume II}
\renewcommand{\editors}{A.\ S.\ Kechris, B.\ L\"owe,
J.\ R.\ Steel}
```

We set up hyphenation patters for words TEX won't know about.

```
\hyphenation{pre-well-or-der-ing Mos-cho-va-kis}
```

`\markdef` Use `\markdef{}` to mark the definition of new terms:

```
``\dots a \markdef{scale} is a sequence of norms\dots''
```

"... a **scale** is a sequence of norms..."

```
\newcommand*{\markdef}[1]{{\normalfont\textbf{#1}}}
```

`\set` `\setdiv` Use `\set{}{}` to typeset sets with a domain and restriction:

```
  ``\dots the set \(\set{i \in X}{i > 3}\) \dots''
```

"... the set $\{i \in X : i > 3\}$ ..."

The `\setdiv` command gives the divider in the middle, with the right spacing — you may need to use this if the braces are in different cells of an eqnarray or similar.

Many authors use a vertical line instead of ":".

```
\newcommand*{\setdiv}{\,:\,}
\newcommand*{\set}[2]{\{#1\setdiv #2\}}
\newcommand*{\bset}[2]{\big\{#1\setdiv #2\big\}}
\newcommand*{\Bset}[2]{\Big\{#1\setdiv #2\Big\}}
```

`\seq` `\seqif` The macros for sequences are slightly different: `\seq{}` is the one-argument form, while `\seqif{}{}` gives the divider.

```
``\dots abbreviate \(\seqif{\phi_i}{i < \omega}\)
by \(\seq{\phi_i}\) \dots''
```

"…abbreviate $\langle \varphi_i : i < \omega \rangle$ by $\langle \varphi_i \rangle$ …"

```
\newcommand*{\seq}[1]{\langle #1 \rangle}
\newcommand*{\seqif}[2]{\langle #1\setdiv #2 \rangle}
```

`\tuple` You might want to distinguish between sequences and tuples (for instance defining a structure as a "sequence" `\seq{X,<}` seems odd, while `\tuple{X,<}` seems perfectly natural). The output produced is the same, but it sometimes helps keeping things straight in complex definitions.

```
\newcommand*{\tuple}[1]{\langle #1 \rangle}
```

`\Card` Cardinality, absolute value, norms, and the power set operator.

`\abs`

```
\newcommand*{\Card}[1]{\mathrm{Card}\left(#1\right)}
\newcommand*{\abs}[1]{\lvert#1\rvert}
\newcommand*{\norm}[1]{\lVert#1\rVert}
\newcommand*{\Pot}[1]{\boldsymbol\wp(#1)}
```

`\to` `\inj` `\surj` `\bij` Arrow macros for function specifications (function, injection, surjection, bijection). Some authors use an arrow with sub- or superscripts ("1-1" for injection is pretty common).

```
\(f \colon \omega_1 \to \{0,1\}\)\\
\(f \colon \R \surj \omega_1\)
```

$f \colon \omega_1 \to \{0,1\}$
$f \colon \mathbb{R} \twoheadrightarrow \omega_1$

`\colon` Note the use of `\colon` in the example. This gives different spacing to `:`, and should always be used for function type specifications.

```
\newcommand*{\inj}{\hookrightarrow}
\newcommand*{\surj}{\twoheadrightarrow}
\newcommand*{\bij}{\leftrightarrow}
```

`\restr` A restriction harpoon with no surrounding space. Usually looks better (use `\restriction` if you really need the spacing).

```
``\dots \(f \restr \omega\) \dots''
```

"…$f \upharpoonright \omega$ …"

```
\newcommand*{\restr}{{\upharpoonright}}
```

`\eqv` `\imp` `\conj` `\disj` These connectives were intended for standardising in formulas.

```
\newcommand*{\eqv}{\Longleftrightarrow}
\newcommand*{\imp}{\Longrightarrow}
\newcommand*{\conj}{\wedge}
\newcommand*{\disj}{\vee}
```

`\E` Convenience shorthand for `\emptyset`.

```
\newcommand*{\E}{\emptyset}
```

\R \R is used for the set of real numbers. The others stand for Gödel's constructible universe (\LL), the constructible universe based on the reals (\LR), the cumulative hierarchy (\V), and the Jensen hierarchy (\J).

\LL \LR \V \J Note that there are two kinds of relative constructibility, denoted by $\mathbf{L}(X)$ (constructibility based on X) and $\mathbf{L}[X]$ (constructibility using X as a predicate). These denote different mathematical constructions. Unfortunately, some of the authors use square brackets when they should use round brackets. All occurrances of $\mathbf{L}[\mathbb{R}]$ should be replaced with $\mathbf{L}(\mathbb{R})$.

(Note that \L gives Ł, an easy typo to make.)

```
\newcommand*{\R}{\mathbb{R}}
\newcommand*{\V}{{\normalfont\textbf{V}}}
\newcommand*{\LL}{{\normalfont\textbf{L}}}
\newcommand*{\LR}{\LL(\R)}
\newcommand*{\J}{\mathbf{J}}
```

\HOD \OD **HOD** is the class of all heriditarily ordinal definable sets, **OD** that of the ordinal definable sets. They may occur in different fonts but should be typeset with the commands \HOD and \OD.

```
\newcommand*{\HOD}{\mathbf{HOD}}
\newcommand*{\OD}{\mathbf{OD}}
```

\axiom \AC \AD \ADR \CH \DC \Det \Unif \Red Axioms, axiom systems, and related constructions. Use \axiom{} for one-off axioms you haven't seen before, or define a new macro in the preamble. Most of these are straight axioms or systems. \Det, \Unif, \Red, \Sep, and \Scale take a pointclass as argument:

```
\(\Det(\bfSigma^1_2)\) means ``all \(\bfSigma^1_2\) sets are
determined''\\
\(\Unif(\bfSigma^1_2)\) means ``every \(\bfSigma^1_2\) set is
uniformized by a \(\bfSigma^1_2\) function''\\
\(\Red(\bfSigma^1_2)\) means ``the pointclass \(\bfSigma^1_2\)
has the reduction property''\\
\(\Sep(\bfSigma^1_2)\) means ``the pointclass \(\bfSigma^1_2\)
has the separation property''\\
\(\Scale(\bfSigma^1_2)\) means ``the pointclass \(\bfSigma^1_2\)
has the scale property''\\
\(\PWO(\bfSigma^1_2)\) means ``the pointclass \(\bfSigma^1_2\)
has the prewellordering property''
```

$\mathsf{Det}(\mathbf{\Sigma}^1_2)$ means "all $\mathbf{\Sigma}^1_2$ sets are determined"
$\mathsf{Unif}(\mathbf{\Sigma}^1_2)$ means "every $\mathbf{\Sigma}^1_2$ set is uniformized by a $\mathbf{\Sigma}^1_2$ function"
$\mathsf{Red}(\mathbf{\Sigma}^1_2)$ means "the pointclass $\mathbf{\Sigma}^1_2$ has the reduction property"
$\mathsf{Sep}(\mathbf{\Sigma}^1_2)$ means "the pointclass $\mathbf{\Sigma}^1_2$ has the separation property"
$\mathsf{Scale}(\mathbf{\Sigma}^1_2)$ means "the pointclass $\mathbf{\Sigma}^1_2$ has the scale property"
$\mathsf{PWO}(\mathbf{\Sigma}^1_2)$ means "the pointclass $\mathbf{\Sigma}^1_2$ has the prewellordering property"

\GCH \PD \ZF \ZFC \Unif If you're doing something similar be sure not to put the argument in the scope of \axiom{}.

```
\newcommand*{\axiom}[1]{\ensuremath{\mathsf{#1}}}
\newcommand*{\AC}{\axiom{AC}}
\newcommand*{\AD}{\axiom{AD}}
```

```
\newcommand*{\ADR}{\axiom{AD}_{\R}}
\newcommand*{\CH}{\axiom{CH}}
\newcommand*{\DC}{\axiom{DC}}
\newcommand*{\Det}{\axiom{Det}}
\newcommand*{\GCH}{\axiom{GCH}}
\newcommand*{\PD}{\axiom{PD}}
\newcommand*{\ZF}{\axiom{ZF}}
\newcommand*{\ZFC}{\axiom{ZFC}}
\newcommand*{\Unif}{\axiom{Unif}}
\newcommand*{\Red}{\axiom{Red}}
\newcommand*{\Sep}{\axiom{Sep}}
\newcommand*{\Scale}{\axiom{Scale}}
\newcommand*{\PWO}{\axiom{PWO}}
```

We standardised on using *preposed* superscripts for "sequences of length…". So ${}^{\omega}X$ means "sequences of length ω with elements drawn from the set X". This will be different to the conventions of a lot of papers. A lot of authors use ordinary superscripts, and you'll have to read quite carefully sometimes to work out when this is ordinal exponentiation and when it's really a sequence.

`\up` `\Baire` `\Cantor`

Use `\up{}` for the prefixes. The "logician's reals" have a separate macro `\Baire` (${}^{\omega}\omega$ — you'll often see this written ω^{ω}). There's also a macro `\Cantor` for ${}^{\omega}2$, partly because it has a name and partly because I intended to fix the spacing, which doesn't work so well with upright figures. Obviously I didn't get around to it. Very common (probably deserve their own macros actually) are the "finite-sequence" and "countable sequences" prefixes:

```
finite \(\up{<\omega}X\) and countable \(\up{\omega}X\)
```

finite ${}^{<\omega}X$ and countable ${}^{\omega}X$

```
\newcommand{\up}[1]{{\,}^{#1}\!}
\newcommand*{\Baire}{\up\omega\omega}
\newcommand*{\Cantor}{\up\omega2}
```

`\phi` `\eps` `\emptyset`

We're swapping `\phi` and `\varphi` and `\epsilon` and `\varepsilon`. This is simply a matter of taste: φ and ε should be the default. You can use `\eps` for ε as well. Similarly, we've redefined `\emptyset`.

```
{\let\oldphi=\phi
\global\let\phi=\varphi
\global\let\varphi=\oldphi}
{\let\oldeps=\epsilon
\global\let\epsilon=\varepsilon
\global\let\varepsilon=\oldeps}
\newcommand*{\eps}{\epsilon}

{\let\oldemptyset=\emptyset
\global\let\emptyset=\varnothing
\global\let\varnothing=\oldemptyset}
```

We're also swapping the standard and variant theta, but this is more than just a matter of taste. Capital theta Θ has a separate meaning (it's a particular cardinal), and some authors don't seem to realise that Θ and θ are different letters. The distinction with ϑ is clearer. Watch out for this sort of error in the manuscripts you're typing from.

```
{\let\oldtheta=\theta
\global\let\theta=\vartheta
\global\let\vartheta=\oldtheta}
```

\X \C \Q

\X is for Polish spaces, \C for largest countable sets, and \Q for the Q-sets (which are the odd-level analogues of the largest countable sets introduced by Kechris, Martin and Solovay).

```
\newcommand*{\X}{\mathfrak{X}}
\newcommand*{\C}{\mathrm{C}}
\newcommand*{\Q}{\mathrm{Q}}
```

\degree \d

There's a macro \degree{} for degrees (Turing degrees usually), but it's pretty longwinded. Since these are often just $\mathbf{d}_1, \mathbf{d}_2$, we have the shorthand \d. Note however that this overwrites a text-mode accent.

```
\dots\(\d_i \leq_{\T} \d_j\)\dots
```

$\dots \mathbf{d}_i \leq_{\mathrm{T}} \mathbf{d}_j \dots$

```
\newcommand{\degree}[1]{\mathbf{#1}}
\renewcommand{\d}{\degree{d}}
```

\compose

Function composition.

```
\newcommand*{\compose}{\circ}
```

\crit \Col \Th

The critical point of an elementary embedding, the Collapse partial order, and the theory of a model.

```
\(\crit(j)\), \(\Col(\kappa,\omega)\), \(\Th(\mathfrak{M})\)
```

$\mathrm{crit}(j)$, $\mathrm{Col}(\kappa, \omega)$, $\mathrm{Th}(\mathfrak{M})$

```
\newcommand*{\crit}{\mathrm{crit}}
\newcommand*{\Col}{\mathrm{Col}}
\newcommand*{\Th}{\mathrm{Th}}
```

\llex

A bunch of orderings.

```
Lexicographic ordering: \(\llex\), \(\leqlex\). Wadge ordering:
\(\lw\), \(\leqw\). Brouwer-Kleene ordering:
\(\lbk\), \(\leqbk\). Turing reducibility: \(\leqT\), \(\lT\).
And: \(\lstar\), \(\leqstar\).
```

Lexicographic ordering: $<_{\mathrm{lex}}$, $\leq_{\mathrm{lex}}$. Wadge ordering: $<_{\mathrm{W}}$, $\leq_{\mathrm{W}}$. Brouwer-Kleene ordering: $<_{\mathrm{BK}}$, $\leq_{\mathrm{BK}}$. Turing reducibility: $\leq_{\mathrm{T}}$, $<_{\mathrm{T}}$. And: $<^*$, $\leq^*$.

Note that if you're discussing orderings it often make sense to put an extra level of braces to get the right spacing:

```
We can prove that our \(\prec\) is equivalent to the
lexicographical ordering: \({\prec} = {\llex}\).
(Compare \(\prec = \llex\).)
```

We can prove that our $\prec$ is equivalent to the lexicographical ordering: $\prec = <_{\text{lex}}$. (Compare $\prec = <_{\text{lex}}$.)

```
\newcommand*{\leqlex}{\leq_{\mathrm{lex}}}
\newcommand*{\llex}{<_{\mathrm{lex}}}

\newcommand*{\leqbk}{\leq_{\mathrm{BK}}}
\newcommand*{\lbk}{<_{\mathrm{BK}}}

\newcommand*{\leqw}{\leq_{\W}}
\newcommand*{\lw}{<_{\W}}

\newcommand*{\leqT}{\leq_{\T}}
\newcommand*{\lT}{<_{\T}}

\newcommand*{\leqstar}{\leq^*}
\newcommand*{\lstar}{<^*}
```

`\W` `\T` "Wadge" and "Turing" for subscripting (used above in the ordering).

```
\newcommand*{\W}{\mathrm{W}}
\newcommand*{\T}{\mathrm{T}}
```

`\PR` This is for fragments of the powerset of the reals.

```
\(\PR[\alpha] := \set{A\subseteq\R}{\norm{A}_\W < \alpha}\)
```

$\wp_\alpha(\mathbb{R}) := \{A \subseteq \mathbb{R} : \|A\|_{\mathrm{W}} < \alpha\}$

```
\newcommand*{\PR}[1][]{\boldsymbol\wp_{#1}(\R)}
```

3.1 Operators

`\cf` `\dom` `\ran` `\Lim` `\lh` A long list of operators (or things that somebody decided should be typeset like operators). `\cf` is cofinality, `\dom` and `\ran` are domain and range. `\lh` is frequently used, and stands for "length" (of a sequence). `\proj` stands for "projection", you'll see it written as $\mathrm{p}[T]$, `\proj[T]`.

`\Ord` `\Ord` is not an operator at all, but the class of ordinals.

```
\DeclareMathOperator{\cf}{cf}
\DeclareMathOperator{\Con}{Con}
\DeclareMathOperator{\dom}{dom}
\DeclareMathOperator{\Id}{Id}
\DeclareMathOperator{\ran}{ran}
\DeclareMathOperator{\rank}{rank}
\DeclareMathOperator{\tcl}{tcl}
\DeclareMathOperator{\G}{G}
\DeclareMathOperator{\lh}{lh}
\DeclareMathOperator{\proj}{p}
\DeclareMathOperator{\Ord}{Ord}
```

3.2 Theorem environments

`\label` `\ref` Never copy numbers of equations, lemmas, theorems, etc. as numbers, but do use `\label{}` and `\ref{}` instead. I.e., if the original has "`Now the claim follows from (3).`", you should create a label for equation (3), say `eq:3` and type

```
Now the claim follows from (\ref{eq:3}).
```

Now the claim follows from (3).

Always include the original (numerical) label in the new one. So `\label{thm:1-A-3}` (it's a good habit to use the `thm:` tag and similar as well). Use the formatting defined here, even if it's different to how the original paper looks. (When the author has numbered something that's un-numbered here you'll need to do some hacking though.)

`thm` A bunch of standard theorem-like environments. Most of the papers will use these environments which use a continuous numbering based on sections (i.e., Lemma 1.1, Definition 1.2, Theorem 1.3, Definition 2.1, Theorem 2.2, etc.).

```
\theoremstyle{definition}
\newtheorem{thm}{Theorem}[section]
\newtheorem{lem}[thm]{Lemma}
\newtheorem{pro}[thm]{Proposition}
\newtheorem{cor}[thm]{Corollary}
\newtheorem{dfn}[thm]{Definition}
\newtheorem{exa}[thm]{Example}
\newtheorem{openproblem}[thm]{Open Problem}
\newtheorem{conjecture}[thm]{Conjecture}
\newtheorem{subclaim}[thm]{Subclaim}
\newtheorem{quest}[thm]{Question}
\newtheorem{rem}[thm]{Remark}
\newtheorem{clm}[thm]{Claim}
```

`xthm` Very short papers may not have sections or have too few theorem environments per section to make this numbering system useful. In this case, environments should use a continuous numbering throughout the paper (i.e., Lemma 1, Definition 2, Theorem 3, Definition 4, Theorem 5, etc.). These use the same environment names with an `x` prefix.

```
\theoremstyle{definition}
\newtheorem{xthm}{Theorem}
\newtheorem{xlem}[xthm]{Lemma}
\newtheorem{xpro}[xthm]{Proposition}
\newtheorem{xcor}[xthm]{Corollary}
\newtheorem{xdfn}[xthm]{Definition}
\newtheorem{xexa}[xthm]{Example}
\newtheorem{xopenproblem}[xthm]{Open Problem}
\newtheorem{xconjecture}[xthm]{Conjecture}
\newtheorem{xsubclaim}[xthm]{Subclaim}
\newtheorem{xquest}[xthm]{Question}
\newtheorem{xrem}[xthm]{Remark}
\newtheorem{xclm}[xthm]{Claim}
```

`numberedproof` `binumberedproof` The papers contain a lot of nested proofs: lemmas inside of the proof of a theorem; claims inside the proof of propositions, lemmas, or theorems; even subclaims inside of proofs of claims. Often, these are not properly marked. In the retyping all of these should get proper proof environments, and in order to be able to recognize which proof is ended by which QED mark, they should be labelled. The environment `numberedproof` provides an environment requiring a parameter that starts with the word "proof" and end with a labelled QED mark. The environ-

ment `binumberedproof` gives the label both at the beginning and the end of the proof and should be used if the proof does not immediately follow the statement.

(Sometimes it's very unclear which QED marks match which proofs, and occasionally there is even an error.)

```
\begin{thm}\label{thm:1}
This is a Theorem.
\end{thm}
\begin{numberedproof}{Theorem \ref{thm:1}}
Now we start the proof of the theorem. After a while, we state
a lemma:
\begin{lem}\label{lem:2}
This is the lemma.
\end{lem}
We explain a little bit about how the lemma will help us to
prove Theorem \ref{thm:1}, and then proceed to the proof of
the lemma.
\begin{binumberedproof}{Lemma \ref{lem:2}}
This is now the proof of the lemma.
\end{binumberedproof}
And this finishes the proof of the theorem as well.
\end{numberedproof}
```

Theorem 3.1. This is a Theorem.

Proof. Now we start the proof of the theorem. After a while, we state a lemma:

Lemma 3.2. This is the lemma.

We explain a little bit about how the lemma will help us to prove Theorem 3.1, and then proceed to the proof of the lemma.

Proof of Lemma 3.2. This is now the proof of the lemma. □ (Lemma 3.2)

And this finishes the proof of the theorem as well. □ (Theorem 3.1)

```
\newcommand{\blubb}{}

\newenvironment{numberedproof}[1]
    {\renewcommand{\blubb}{#1}\begin{proof}}%
    {\let\oldqedsymbol\qedsymbol\renewcommand*{\qedsymbol}%
    {\oldqedsymbol~{\footnotesize (\blubb)}}\end{proof}}

\newenvironment{binumberedproof}[1]
    {\renewcommand{\blubb}{#1}\begin{proof}[Proof of \blubb]}%
    {\let\oldqedsymbol\qedsymbol\renewcommand*{\qedsymbol}%
    {\oldqedsymbol~{\footnotesize (\blubb)}}\end{proof}}


\newenvironment{clmproof}
    {\begin{proof}[Proof of Claim]}%
    {\let\oldqedsymbol\qedsymbol\renewcommand*{\qedsymbol}%
```

```
    {\oldqedsymbol~{\footnotesize (Claim)}}\end{proof}}

\newenvironment{sclmproof}
    {\begin{proof}[Proof of Subclaim]}%
    {\let\oldqedsymbol\qedsymbol\renewcommand*{\qedsymbol}%
    {\oldqedsymbol~{\footnotesize (Subclaim)}}\end{proof}}
```

3.3 Standardising written expressions

\ie
\eg
\etc
\compare

Use these to get consistent italicising. Also note that we don't superscript "th" (as in "nth", not "n^{th}") and similar. `\ie` and `\eg` should generally be followed by a comma (this is a general standard; if they're not, they also need `{}` or `\␣` or `~` to avoid eating a space). `\compare` needs a forced space, `\compare\ stuff` or `\compare~stuff`. `\etc` should usually be followed by a period, for the same reason. (NB: `\compare` gives "*cf.*"; `\cf` was already taken.)

```
\newcommand{\ie}{\textit{i.e.}}
\newcommand{\eg}{\textit{e.g.}}
\newcommand{\etc}{\textit{etc}}
\newcommand{\compare}{\textit{cf.}}
```

\axplus
\axminus
\axeq

There's sometimes a font style problem when you have axioms within a theorem environment (for instance "*proven under* ZF+ DC"). These macros get around that.

```
\newcommand{\axplus}{\ensuremath{\textup{+}}}
\newcommand{\axminus}{\ensuremath{\textup{-}}}
\newcommand{\axeq}{\ensuremath{\textup{=}}}
```

3.4 Boldface pointclasses

This subject deserves a whole subsection to itself. First, you need to know that pointclasses (the most common ones are capital Greek letters with both a subscript and a superscript) occur in boldface and lightface versions, and that the difference is important. Second, depending on the font, it can be very hard to tell the difference. Third, the macros for *indicating* the difference are a bit temperamental.

\bfSigma
\bfPi
\bfDelta
\bfGamma
\bfdelta

Here are the common ones that you'll see most often. Because the boldface/lightface distinction is hard to see in some fonts, the boldface version has a tilde underneath it. ("Lightface" just means the symbol itself, without bolding or extra baggage.) The Borel hierarchy is made up of pointclasses $\mathbf{\Sigma}^0_\alpha$, $\mathbf{\Pi}^0_\alpha$ and $\mathbf{\Delta}^0_\alpha$, with α an ordinal — these and variants turn up everywhere.

```
\newcommand{\bfSigma}{\ensuremath{\tboldsymbol{\Sigma}}}
\newcommand{\bfPi}{\ensuremath{\tboldsymbol{\Pi}}}
\newcommand{\bfDelta}{\ensuremath{\tboldsymbol{\Delta}}}
\newcommand{\bfGamma}{\ensuremath{\tboldsymbol{\Gamma}}}
\newcommand{\bfdelta}{\ensuremath{\tboldsymbol{\delta}}}
```

\tboldsymbol

You can use `\tboldsymbol{}` to make similar boldface-plus-tilde versions of other symbols if you need to.

```
\(\tboldsymbol{\textbf{HYP}}\)
```

$\mathbf{\underset{\sim}{HYP}}$

```
\newlength\knuthian@fdfive
\def\mathpal@save#1{\let\was@math@style=#1\relax}
\def\utilde#1{\mathpalette\mathpal@save
              {\setbox124=\hbox{$\was@math@style#1$}%
\setbox125=\hbox{$\fam=3\global\knuthian@fdfive=\fontdimen5\font$}
\setbox125=\hbox{$\widetilde{\vrule height 0pt depth 0pt width \wd124}$}%
               \baselineskip=1pt\relax
               \vtop{\copy124\copy125\vskip -\knuthian@fdfive}}}
\renewcommand\tboldsymbol[1]{%
\utilde{\boldsymbol{#1}}\mbox{\hskip 0pt}}
```

`\HYP` `\IND` `\bfHYP` `\bfIND`

The classes of inductive and hyperprojective sets also come in a boldface (`\bfIND` and `\bfHYP`) and a lightface (`\IND` and `\HYP`) variant.

```
\newcommand{\IND}{\ensuremath{\mathrm{IND}}}
\newcommand{\HYP}{\ensuremath{\mathrm{HYP}}}
\newcommand{\bfIND}{\ensuremath{\tboldsymbol{\IND}}}
\newcommand{\bfHYP}{\ensuremath{\tboldsymbol{\HYP}}}
```

IND, HYP, $\tboldsymbol{\IND}$, $\tboldsymbol{\HYP}$.

`\compl` `\bfc`

Pointclasses often have *complements*, which we indicate with a breve using `\compl{}`, $\breve{\Gamma}$ but which various authors show with a check $\check{\Gamma}$, an overbar $\overline{\Gamma}$, or negation sign $\neg\Gamma$ instead. `\compl` doesn't like a boldface argument, so to make the complement of a boldface pointclass use `\bfc{}` ("boldface complement"), like so (note that the scripts go outside the macro — the same goes for boldfacing with `\tboldsymbol`):

```
\(\bfc{\Sigma}^0_1\)
```

$\tboldsymbol{\breve{\Sigma}}^0_1$

```
\newcommand{\compl}[1]{\breve{#1}}
\newcommand{\bfc}[1]{\tboldsymbol{\breve{#1}}}
```

3.5 Bits and pieces

`\lang`

Use `\lang` for calligraphic L. You need to add `{}` or `\␣` if you are in text mode in order to get the spacing right.

```
\(\lang\) produces proper spacing, \lang doesn't, but \lang{} does.
```

$\mathcal{L}$ produces proper spacing, $\mathcal{L}$doesn't, but $\mathcal{L}$ does.

```
\newcommand*{\lang}{\ensuremath{\mathcal{L}}}
```

`\playerI`

Commands for the two players. What you should remember is to make sure that "I" and "II" are upright even in italic contexts. We were standardising on "I" and "II" against other possibilities like "0" and "1" or "1" and "2", but there are times when the definitions only make sense with a player 0. Also always write "player I" and "player II", even if the original author only wrote "I" or "II". **Example.** If the original says "`In this case, I has a winning strategy`", you should type

```
In this case, \playerI\ has a winning strategy.
```

In this case, player I has a winning strategy.

```
\newcommand{\playerI}{\textrm{player I}}
\newcommand{\playerII}{\textrm{player II}}
\newcommand{\PlayerI}{\textrm{Player I}}
\newcommand{\PlayerII}{\textrm{Player II}}
```

`\godel` Coding from sequences of natural numbers to natural numbers.

```
\newcommand{\godel}[1]{\ensuremath{\ulcorner \! #1 \! \urcorner}}
```

`\scale` You'll hear a lot about scales. Sometimes they get an overbar, sometimes nothing. We give them a vector-like arrow: $\vec{\varphi}$.

```
\newcommand{\scale}[1]{\vec{#1}}
```

`\concat` Operator for concatenating two sequences. The intention of the definitions is to get absolutely no spacing around the operator, regardless of the context. There are better ways to do this.

```
The concatenation of two sequences \(s\) and \(t\)
is denoted by \(s\concat t\).
```

The concatenation of two sequences s and t is denoted by $s^\frown t$.

```
\newcommand{\concat}{\mathchoice%
  {\mathinner{}^{\mkern-\medmuskip\smallfrown}\mkern-
    \medmuskip\mathinner{}\mkern-\medmuskip}%
  {\mathinner{}^{\mkern-\medmuskip\smallfrown}\mkern-
    \medmuskip\mathinner{}\mkern-\medmuskip}%
  {^{\mkern-2mu\smallfrown}\mkern-\thinmuskip\mathinner{}}%
  {^{\mkern-2mu\smallfrown}\mathinner{}\mkern-\thinmuskip}}
```

3.6 Bibliography hackery

Hackery for the local/global bibliographies. Don't worry.

Samson put together several hacks regarding the bibliography. The system as it stands is pretty complicated, and not very amenable to having multiple people working on the files at the same time.

Here's how it works at present:

There are four bib files:

- `cab-strings.bib` holds string definitions; names of the main authors, institutions, journals &c. It has to be processed first.
- `cab-crossrefs.bib` holds the references that turn up in the `crossref` field — in particular, the original CABAL volumes go here. The file is separate for purely technical reasons: BibTEX requires these to be processed *after* the entries that reference them.
- `thisvolume.bib` has the entries for this volume; they are separate for convenience, since they get a different —non-standard— typographical treatment (which I didn't provide, incidentally, Benedikt should know how this was dealt with in the end).
- . . . and everything else goes in `cabal.bib`.

The setup is designed for a non-standard references setup: each paper has its own references section, but the book as a whole has a references section as well, with everything referenced from within the papers. And the reference keys are *the same* in the global and local bibliographies.

\bibtexhack

There are three components to the hack that makes this work. One is the `cabal.bst` file, a hacked version of `asl.bst`. You don't want to know the details (I did the hackery, so if you need to know you can ask). The second is a dummy entry in the bibliography: the key `bibtexhack:endofcitations` is actually a flag that will be picked up by `cabal.bst`. It has to be the very last key in the bibliography database, so in the scheme above it's the last entry in `cab-crossrefs.bib`.[2] And finally, immediately before `\end{document}` you need to issue the command `\bibtexhack`.[3]

Note that this hackery also means that you can't reuse the file `cabal.bib`; if you do, you'll end up including in the global bibliography of Volume II all the papers cited in Volume I. The strings file can be reused, obviously `thisvolume.bib` will change and I guess most of the cross-references file will end up being reused as well.

```
\def\bibtexhack{%
  \immediate\write\@auxout{\noexpand\bibxcite{bibtexhack:endofcitations}{}{}{}{}{}{0}}%
  \nocite{bibtexhack:endofcitations} \nocite{*} }
```

The following definitions are quick hacks to override the ASL bibliography style. Quick and very *dirty* hacks.

```
\renewcommand{\@bib@item}[8][]{%
\item[\@wrap@list{%
    \@ifisempty{#8}{\composelist{#1}{#2}{#3}{#4}{#5}{#6}}{#8}%
  }]%
  \if@filesw{%
    \def\protect##1{\string ##1\space}%
    \@ifisempty{#7}{ \@auxstring={\bibxcite{#2}{}{}{}{}{#1\yearLast{#4}#5}}
    }{ \@auxstring={\bibxcite{#2}{}{}{}{}{#8}} }
    \immediate\write\@auxout{\the\@auxstring{\the\value{\@listctr}}}} \fi
  \mbox{ }\ignorespaces } \renewcommand{\composelist}[6]{#1\yearLast{#4}#5}
\newcommand{\yearLast}[1]{\if\IsPositive{#1}\l@stTw@#1\else #1\fi}
\def\l@stTw@#1#2#3#4{#3#4}
```

(this one comes from the UK TUG FAQ)

```
\def\IsPositive#1{%
  TT\fi \ifcat_\ifnum0<0#1 _\else A\fi }

\def\bibritem{\@bib@item}

\setlength\intergroupsep{0.5\baselineskip}
```

Particularly for the global bibliography, most authors have multiple papers. We print the name in small caps, then a block of all their papers.

```
\renewcommand{\bibfitem}[7][]{%
  \vspace{\intergroupsep}%
  \let\oldguy=\guy%
  \def\guy##1##2##3##4##5{##2 ##3\ignorespaces ##4}%
```

[2] Which means you shouldn't sort that file!

[3] This essentially cites `bibtexhack:endofcitations` then cites everything —using nocite— so that the entire database is included in the processing but flagged as uncited.

```
\item[\textsc{#3}]%
  \nopagebreak% !! Need something else.. This doesn't work !!
  \let\guy=\oldguy%
  \@bib@item[#1]{#2}{#3}{#4}{#5}{#6}{#7}} \renewcommand{\guysmagic}[1]{}

\renewenvironment{thebibliography}[1]{%
  \ifnum\@mainsize=10 % (at 10pt, the normal for the jsl)
  \par
        \vspace{18pt}%
        \centerline{\fontsize{7}{7\p@}\selectfont \refname}%
        \nobreak\vspace*{5pt}\nobreak%
  \fontsize{8}{10\p@}\selectfont\relax
  \def\and{{\normalfont \lowercase{and}\ }}%
  \list{[\@arabic\c@enumi]\ }{%
% all I changed was this line -- sjagerde
\leftmargin12\p@ \labelwidth\z@ \itemindent-12\p@
% end of changes
\labelsep\z@ \usecounter{enumi}}%
  \sloppy \clubpenalty4000\relax \widowpenalty\clubpenalty
  \sfcode`\.\@m
\else                               % (at 11pt or bigger)
\par
        \vspace{20pt}%
        \centerline{\fontsize{8}{8\p@}\selectfont \refname}%
        \nobreak\vspace*{6pt}\nobreak%
  \fontsize{9}{11\p@}\selectfont\relax
  \def\and{{\normalfont \lowercase{and}\ }}%
  \list{[\@arabic\c@enumi]\ }{%
        \leftmargin\z@ \labelwidth\z@ \itemindent12\p@
        \labelsep\z@ \usecounter{enumi}}%
  \sloppy \clubpenalty4000\relax \widowpenalty\clubpenalty
  \sfcode`\.\@m%
\fi} % end of the pointsize choice
{\endlist}
```

3.7 Questions (as draftmarks)

`\question` If you add the package option `[draft]`, you can use `\question{}` to add a marginal note asking something or bringing something to the attention of the editors/typesetters. *Check* that your note appeared — the macro doesn't work in math mode and in various other restricted settings (it uses a marginpar, which sometimes simply gets silently eaten). In principle removing the draft option should make these silently ignored, but it's probably most sensible to remove them by hand before sending off for typesetting.

```
\@ifclasswith{asl}{draft}{%
  \usepackage{calc}
  \newcommand{\question}[1]{\footnotemark\marginpar{\small (\thefootnote)
      #1}} \setlength{\overfullrule}{0pt} }{%
  \newcommand{\question}[1]{} }
```

And that's it! I'm happy to take any questions about TEXnical matters, mail me at `tikitu@gmail.com`. Matters of standardisation and content I won't be much good for.