

frege.sty
A L^AT_EX 2_ε Package for Typesetting
Begriffsschrift

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1 Background

1.1 `begriff.sty`

This package is based on `begriff.sty` released under the GNU General Public License. Copyright (C) 2003 by Josh Parsons (josh@coombs.anu.edu.au) with changes made in October 2004 by Richard Heck (heck@fas.harvard.edu) and minor changes by Josh Parsons to fix a problem with linespacing made in May 2005.

While I could not have done so without the aforementioned work, I have reworked the package from the ground up, to the point where some of the underlying approaches have changed. On the downside this means there is no simple way of converting anything typeset using `begriff.sty` to use this package instead. I felt this was necessary to achieve a end result I was happy with.

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You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111, USA. (or just search for it online... Seriously.)

1.3 Changes as Compared to `begriff.sty`

- correct relative lengths of the content stroke with respect to other strokes attached to it;
- content strokes point at the middle of the following symbols, rather than the bottom;
- greater width for the assertion stroke as compared to the content stroke;
- a more intuitive structure for the conditional (arguments are now given in the same order as they appear on the left of a completed formula);
- the command for the conditional with empty arguments now results in a vertical line (conditional stroke) on its own the other strokes are added as the arguments;
- the linewidth is properly accounted for so that things remain properly centered when scaled;

1.4 Changes in Version 1.1

- added an optional scale factor to all basic strokes;
- simplified the code for `Fbracket` in terms of that for `Fbox`;
- rearranged the code in the style file in a more logical way;

1.5 Changes in Version 1.2

- added a new command “`Fargument`” for typesetting arguments;
- added a new command “`Fstrut`” to be used in conjunction with `Fargument`;
- changed `Fbaselength` to be equal to the full length of a basic stroke (20pt);

- fixed a bug where the scale factor introduced in version 1.1 does not reset after all uses;

1.6 Changes and Features yet to come

- incorporation of other frege related material such as fge.sty so as to put all frege related material in a single package;
- a vertical shorthand stroke such as used by Frege for typesetting arguments in “Begriffsschrift”;

2 Features and Usage

2.1 Commands

2.1.1 Basic Commands

The following is a list of the basic commands provided by this package along with accompanying output. The conditional is treated sepperately.

<code>\Fcontent[1]</code>	
<code>\Fncontent[1]</code>	
<code>\Fnncontent[1]</code>	
<code>\Facontent[1]</code>	
<code>\Fancontent[1]</code>	
<code>\Fanncontent[1]</code>	
<code>\Fquant[1]{a}</code>	
<code>\Fnquant[1]{a}</code>	
<code>\Fnnquant[1]{a}</code>	
<code>\Fquantn[1]{a}</code>	
<code>\Fquantnn[1]{a}</code>	
<code>\Fnquantn[1]{a}</code>	
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<code>\Fanquantnn[1]{a}</code>	
<code>\Fannquantn[1]{a}</code>	
<code>\Fannquantnn[1]{a}</code>	

This may seem like a daunting list, but there is an exceedingly simple way to think about it. In a sense there are only two commands `\Fcontent[1]` and `\Fquant[1]{}`. These two commands can be augmented with a combination of `as` and `ns` so as to add assertion and negation strokes respectively. Any stroke that is asserted (has a fat vertical line at the start) starts with `\Fa`. This may be followed by either one or two or no `'n'` to add one or two or no negation strokes (the small vertical lines below the assertion stroke). Next comes the name of the main command, either `'quant'` or `'content'`. Finally the quantifiers may be followed by either one or two `'n'` to add one or two negation strokes to the content stroke after the quantifier's depression.

Consider also that many of these commands are only really present for completeness sake. It is difficult to imagine a situation where a twice negated quantifier with twice negated content would ever be needed.

Since version 1.1 all basic strokes also have an optional scaling factor. A command followed by `[.5]`, for example would produce a stroke exactly half the default length while `[2]` produces a stroke twice the default length. (The default length is given by `\Fbaselength` which is set to 20pt. Scaling allows for greater control in the total length of formula as well as for a shorter syntax. (We can replace expressions like `\Facontent` `\Fcontent` with `\Facontent[2]`.) Care must be taken not to set a length that is shorter than what is needed to fit all the parts of some basic stroke. This will lead to negative lengths and hence unpredictable output.

All quantifiers also have a mandatory argument that specifies the variable associated with the quantifier. (Mandatory arguments are contained in a set of curly brackets `{` and `}`). This argument should be a single small letter and will be typeset above the semi circular depression in the assertion stroke in `mathfrak` font which is provided by the `amssymb` package. This font can be used in `maths` mode by using the command `'\mathfrak{}`'. Note that all the commands provided by this package may be used in both `math` and `text` mode. (Though `math` mode usually results in better formatting.)

Finally one may combine the above commands in arbitrary combinations which will result in gapless longer strokes. (Eg.: $\mathbf{F}^{\mathfrak{a}}\neg\mathbf{F}^{\mathfrak{b}}\neg A$) which may be roughly translated into english as “for all `a` there exists a `b` such that `A`”. (The commands I used for this expression are `\Faquant{a}\Fnquantn{b}A`).

2.1.2 Conditional

The conditional is the most important command in this package since it gives Frege's Begriffsschrift its two dimensional structure.

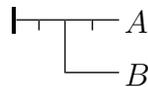
The syntax for the Fconditional command is as follows:

```
\Fconditional[<option>] {<consequent>}{<antecedent>}
```

The arguments may in principle be anything, but you will only get a Begriffsschrift formula if the arguments are themselves given by appropriate commands from the list of basic commands given earlier. As an example, an asserted conjunction between A and B would be given as follows:

```
$_\Fconditional[\Fcontent]{\Fcontent A}{\Fcontent B}$
```

and produce the following output:

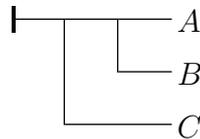


In addition Fconditional may be nested as its own argument to arbitrary depth. Nesting in the option is not recommended.

A conditional with nested consequent may be given as follows:

```
$_\Fconditional[\Fcontent]{\Fcontent \Fconditional{\Fcontent A}{\Fcontent B}}{\Fcontent C}$
```

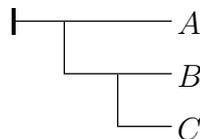
and produces the following output:



A conditional with nested antecedent may be given as follows:

```
$_\Fconditional[\Fcontent]{\Fcontent \Fcontent A}{\Fcontent \Fconditional{\Fcontent B}{\Fcontent C}}$
```

and produces the following output:



Each section of a content stroke may thus be replaced with any of the strokes given by the list of basic commands. Note that it is up to the user to place the appropriate number of strokes in each argument to ensure that the content strokes all line up on the right hand side.

2.1.3 Brackets and Boxes

There are two more commands to be considered:

`\Fbracket{<complex expression>}`

`\Fbox{<complex expression>}`

Both `Fbox` and `Fbracket` take what I have called a ‘complex expression’ for their argument. A ‘complex expression’ is any formula in *Begriffsschrift* that has at least one conditional in it. It is generally a good idea to put all complex expressions into either a `Fbox` or a `Fbracket`. It is never necessary to place a complex expressions into both an `Fbox` and an `Fbracket` since an `Fbox` simply is a `Fbracket` without the actual brackets. `Fbracket` exists only for convenience with the same effect being achieved by `\left(\Fbox{} \right)`.

The reason why the `Fbox` is a good idea, is that the baseline is very near the top of a complex expression of *Begriffsschrift*, which can make for some odd formatting effects. In addition to placing the baseline at the middle of a complex expression an `Fbox` ensures the expression is treated by LaTeX as a single object and given enough space.

Finally a complex expression may not format correctly in some environments (like the `align*` environment for example) unless it is placed in an `Fbox`. In short, always use an `Fbox` (or `Fbracket`).

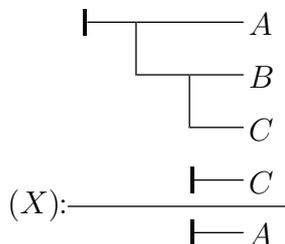
2.2 Arguments and Struts

Since version 1.2 two arguments have been added that allow for the typesetting of arguments. The syntax for the argument command is as follows:

`\Fargument[<absent premise>]{<premise 1>}{<premise 2>}{<conclusion>}`

In the following esample the optional argument for the absent premise takes the value ‘*X*’ the premises are the two formulas above the therefore line and the conclusion is the formula below the therefore line. The *Begriffsschrift* expressions in the arguments of the `Fargument` command do not need to be placed in an `Fbox`, since the `Fargument` command works by boxing it’s

arguments already.



where $X = \vdash B$; (this is typeset separately from the `Fargument` command);

The three `begriffsschrift` formulas above are in fact aligned leftbound. To make them appear rightbound no matter what the relative lengths of A , B , and C , the command “`Fstrut`” has been used in front of $\vdash C$ and $\vdash A$. The command `\Fstrut[1]` works exactly like an invisible content stroke, that is it inserts space of length `Fbaselength`. Like all basic strokes it can be scaled via an optional scale factor.

2.3 Lengths

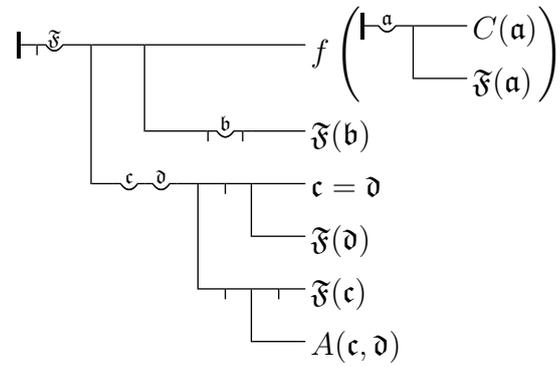
In theory all the dimensions in this package can be changed with the command `\setlength{<name of length>}{<new value>}`, though I have not done a great deal of testing and recommend sticking to the default values. The following then is a table of all lengths:

name	default value	description
<code>\Fbaselength</code>	20pt	the length of the basic strokes
<code>\Flinewidth</code>	0.5pt	the line width
<code>\Fspace</code>	2pt	separation between lines and text/formula
<code>\Fassertwidth</code>	$3\Flinewidth$	width of assert stroke
<code>\Fraiseheight</code>	$1ex-\Flinewidth$	height of content lines above baseline
<code>\Fnegsep</code>	$3\Flinewidth$	separation between a double negation
<code>\Fnegshort</code>	$2\Flinewidth$	space between negation stroke and baseline
<code>\Fquantwidth</code>	6pt	width of the semi-circular quantifier depression

the height of the conditional stroke is determined by the size of the contents of the conditionals argument, as well as the `baselineskip` of the surrounding text. It cannot be changed manually.

2.4 Final Example

The Geach-Kaplan sentence (with thanks to Marcus Rossberg):



And that is all.

For comments, suggestions, identified errors, email me at
 <Q.Pamp.2009@my.bristol.ac.uk>.