Typesetting Order Theory Under LaTeX

Author
Andrew Lincoln Burrow
albcorp@internode.on.net

Abstract
The AlbOrderTheory package provides a single alb-order-theory LaTeX package to provide markup for set and order theory. It is designed to make the LaTeX input more readable, to allow the actual symbols to be adjusted from a single file, to enable the typesetting of set and order theoretic constructions to be designed in the context of the entire suite of required markup commands, and to place the extended markup in the a_lb namespace. Therefore, the package provides a large collection of math commands to markup operators, relations, and functions. The package is supported by an emacs lisp file customising AUCTeX, which provides command name completion and argument prompting.

Version Information
Revision: 1.12
Date: 2006-06-23 06:33:00

1 Introduction

The alb-order-theory LaTeX package is designed to typeset order theory. In practice, this means that it supplies a large collection of simple math commands. The main benefit is consistency, and the ability to easily change a decision about typesetting for all documents.

2 Using the Commands and Environments

The commands and environments of the `alb-order-theory` LaTeX package are divided into mathematical groups. They are all used within math mode.

2.1 Logical Connectives

In lattice theory we use the vee and the wedge for join and meet. Therefore, we lack an obvious symbol for the logical connectives. The current solution is just to use text labels.

`\albNot x`	$\text{not}\, x$
`x \albAnd y`	x and y
`x \albOr y`	x or y

2.2 Set Theory

Commands accepting arguments and generating set theory mathematical constructions.

`\albSingleton{x}`	$\{x\}$
`\albCardinality{X}`	$\lvert X\rvert$
`\albTuple{x, y, z}`	$\langle x, y, z\rangle$
`\albPowerset{X}`	$\mathcal{P}(X)$
`\albBinaryRelation{R}{X}{Y}`	$R \subseteq X \times Y$
`\albPartialMap{\alpha}{X}{Y}`	$\alpha : X \to Y$
`\albTotalMap{\alpha}{X}{Y}`	$\alpha : X \mapsto Y$
`\albDomain{\alpha}`	$\text{domain}(\alpha)$
`\albRange{\alpha}`	$\text{range}(\alpha)$
`f \albCompose g`	$f \circ g$

2.3 Standard Sets

Commands without arguments representing the standard sets of arithmetic.

`\albNaturals`	$\mathbb{N}$
`\albReals`	$\mathbb{R}$

2.4 Order Theory

Commands accepting arguments and generating order theory mathematical constructions.

`x \albIncomparable y`	$x \parallel y$
`x \albCoveredBy y`	$x \prec y$
`x \albCovers y`	$x \succ y$
`\albEquivClass{x}`	$[x]$
`\albDual{P}`	P^{∂}
`\albOver{P}{x}`	$\text{over}(P, x)$
`\albUnder{P}{x}`	$\text{under}(P, x)$
`\albMax{A}`	$\max(A)$
`\albMin{A}`	$\min(A)$
`\albHeads{P}`	$\text{heads}(P)$
`\albTails{P}`	$\text{tails}(P)$

`\albWidth{P}`	$\mathrm{width}(P)$
`\albHeight{P}`	$\mathrm{height}(P)$
`x \albJoin y`	$x \vee y$
`\albJoinOf{A}`	$\bigvee A$
`\albJoinInOf{P}{A}`	$\bigvee_P A$
`x \albMeet y`	$x \wedge y$
`\albMeetOf{A}`	$\bigwedge A$
`\albMeetInOf{P}{A}`	$\bigwedge_P A$
`\albOrderEmbedding{\alpha}{O}{P}`	$\alpha : O \hookrightarrow P$
`O \albOrderIsomorphic P`	$O \cong P$
`\albDown{A}`	$\downarrow A$
`\albUp{A}`	$\uparrow A$
`\albDownInOf{P}{A}`	$\downarrow_P A$
`\albUpInOf{P}{A}`	$\uparrow_P A$
`\albLower{A}`	$\Downarrow A$
`\albUpper{A}`	$\Uparrow A$
`\albLowerInOf{P}{A}`	$\Downarrow_P A$
`\albUpperInOf{P}{A}`	$\Uparrow_P A$
`\albDownSets{P}`	$\mathcal{O}(P)$
`\albRise{P}{x}`	$\mathrm{rise}(P, x)$
`\albFall{P}{x}`	$\mathrm{fall}(P, x)$
`\albDM{P}`	$\mathrm{DM}(P)$
`\albCD{P}`	$\mathrm{CD}(P)$
`\albExtenders{P}{A}`	$\mathrm{extenders}(P, A)$
`\albRetractors{P}{A}`	$\mathrm{retractors}(P, A)$

2.5 Notation for the Growth of Functions

Commands accepting arguments and generating expressions for the growth of functions.

`\albBigOh{f}`	$O(f)$
`\albBigOmega{f}`	$\Omega(f)$
`\albBigTheta{f}`	$\Theta(f)$

3 AUCTeX Customisations

Under AUCTeX the file `alb-order-theory.el` is automatically loaded whenever the `alb-order-theory` package is used. The customisation adds the math commands to AUCTeX. This provides the simple prompting for all the supplied math commands.

In addition, `alb-order-theory.el` causes a special equation number counter to be stored as a local variable. `alb-LaTeX-equation-counter` counts numbers assigned to labels for equations. This ensures dirty numbers are not reissued, as reissuing a number could make stale references hard to detect.

4 Makefile Targets

The `AlbLaTeXDocumentTemplate` makefile provides a target to relabel equations. The `alb-relabel-eq` target edits the LaTeX source in an attempt to match equation labels to equation numbers. Labels of the form `eq:`*identifier*`:`*number* are processed. *number* is rewritten to the last part of the equation number. This is helpful in proof reading.