# keytheorems package

version 0.1.2-dev

github.com/mbertucci47/keytheorems

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#### Abstract

An expl3-implementation of a key-value interface to amsthm, implementing most of the functionality provided by thmtools. Several issues encountered with thmtools are avoided (see the README for a list) and a few new features are added.

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## 1 Dependencies

Without using the  $tcolorbox^{\rightarrow P.7}$  or  $tcolorbox-no-titlebar^{\rightarrow P.7}$  options, the package loads the aliasent, amsthm, refcount, and translations packages. A LATEX kernel no older than 2023-06-01 is required; if older than 2024-06-01, nameref is required.

## 2 Global Options

### $\keytheoremset{\langle options \rangle}$

Every key in this section can be given as a package option with  $\scalebox{usepackage}[\langle options \rangle]$  {keytheorems} or in  $\scalebox{keytheoremset}\{\langle options \rangle\}$ , with the exception that continues-code and only be used in the latter.

overload (initially unset)

Redefines \newtheorem to internally use the keytheorems machinery. The syntax remains the same. This is automatically set by thmtools-compat.

thmtools-compat (initially unset)

For compatibility with thmtools syntax. Currently defines the commands in the left column below. The right column lists the corresponding keytheorems replacement that should be used in new documents.

| thmtools command            | keytheorems replacement                                    |
|-----------------------------|--|
| \declaretheorem             | \newkeytheorem   |
| \declaretheoremstyle        | $\verb+\newkeytheoremstyle^{ ightarrow P.7}$               |
| \listoftheorems             | $ackslash 	ext{listofkeytheorems}^{ ightarrow 	ext{P.} 9}$ |
| $\addtotheorempreheadhook$  |  |
| $\addtotheorempostheadhook$ | $\addtotheoremhook \rightarrow P.11$                       |
| $\addtotheoremprefoothook$  | \addtotheoremnook  |
| $\addtotheorempostfoothook$ |  |
| restatable environment      | $\mathtt{store}^{	o\mathrm{P.3}}\;\mathrm{key}$            |
|                             |  |

Also defined are the shaded and thmbox keys, implemented internally with tcolorbox rather than the shadethm and thmbox packages, respectively.

store-all (initially unset)

Tells keytheorems to grab the body of each theorem so it can later be printed with the print-body P.11 option of \listofkeytheorems P.9. Note that this means a theorem body cannot contain verbatim material.

```
restate-counters=\{\langle comma-list\ of\ counters \rangle\}
```

Additional counters whose values are preserved when a theorem is restated. This key does not reset the list, so you don't need to include equation in  $\langle comma-list \rangle$ .

(initially {equation})

```
\verb|continues-code|| & (initially \texttt{\GetTranslation\{keythms\_continues\} \texttt{\pageref\{\#1\}})}| \\
```

The code used to typeset the note produced by the continues<sup>P.3</sup> key. If English or an unknown language is used, defaults to continuing from p.\,\pageref{#1}. Currently (likely inaccurate!) translations exist for French, German, and Spanish.

```
qed-symbol = \langle symbol \rangle (initially \openbox)
```

Redefines  $\qedsymbol$  to be  $\langle symbol \rangle$ .

```
auto-translate=true|false (default true, initially true)
```

If false, keytheorems does not automatically translate the title text for  $\$ listofkeytheorems $^{P.9}$  and the note produced by the continues $^{P.3}$  key. These texts can be manually customized with the title $^{P.10}$  and continues-code keys, respectively.

## 3 Defining Theorems

## $\mbox{\ensurement} \mbox{\ensurement} \mbox{\ensu$

Defines a theorem environment  $\langle env \ name \rangle$  which itself takes a few options (see subsection 3.1). You can also declare multiple theorems at once by replacing  $\langle env \ name \rangle$  with a comma-list of names, e.g.  $\new \text{theorem,lemma,proposition} [\langle options \rangle]$ .

By default, the theorem's printed name is a title-cased  $\langle env \; name \rangle$ . This can be changed with the name  $^{\rightarrow P.4}$  key. All  $\langle options \rangle$  are described in subsections 3.2 and 3.3.

| <pre>% preamble \newkeytheorem{theorem}</pre>                 |                      |
|---|----------------------|
| <pre>% document \begin{theorem} Some text \end{theorem}</pre> | Theorem 1. Some text |

## 3.1 Keys available to theorem environments

As in amsthm, theorems can take an optional argument that contains a note or heading.

```
\begin{theorem}[some heading]
Some text
\end{theorem}

Theorem 2 (some heading). Some text
```

Alternatively, the optional argument may contain any of the following keys.

 $note = \langle text \rangle$  (initially unset)

Alias name. This is the key-value equivalent of the optional argument described above. This syntax, however, allows the argument to contain other keys.

```
\begin{theorem} [some heading]
Some text
\end{theorem}
\begin{theorem} [note=another heading]
Some more text
\end{theorem}
Theorem 3 (some heading). Some text
Theorem 4 (another heading). Some
more text
\end{theorem}
```

 $short-note=\langle text \rangle$  (initially unset)

Alias short-name. This replaces the value of note when displayed in \listofkeytheorems \(^{+}P.9\).

 $label = \langle label \ name \rangle$  (initially unset)

This is the key-value equivalent of  $\begin{theorem} \label{label name} \$ 

| <pre>\begin{theorem} [label=foo] Some text \end{theorem} \ref{foo}</pre> | <b>Theorem 5.</b> Some text 5 |
|--|-------------------------------|
|--|-------------------------------|

```
continues*=\langle label\ name \rangle
```

(initially unset)

Pick up a theorem where you left off. The theorem number remains the same. The printed text can be customized with the continues- $code^{\rightarrow P.2}$  option. The starred version also copies the theorem note, if it exists.

```
\begin{theorem} [continues=foo] \dots and some more text. \end{theorem}

Theorem 5 (continuing from p. 3). ... and some more text.
```

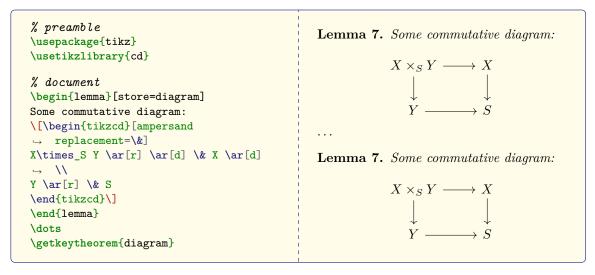
 $store = \langle tag \rangle$  (initially unset)

Alias restate. Stores the the theorem to be restated at any point in the document with \getkeytheorem \cdot P.8.

```
\begin{theorem} [store=blub] Theorem 6. A theorem worth restating.
\end{theorem} More brilliant mathematics.
\getkeytheorem{blub}
Theorem 6. A theorem worth restating.

Theorem 6. A theorem worth restating.
```

A theorem given this key *cannot* contain verbatim material or other unexpected catcodes, such as a tikz-cd diagram. The latter issue can be averted with the ampersand-replacement key.



listhack=true|false

(initially false)

Meant only to be used with the break P.8 style key for a theorem starting with a list. Compare:

```
% preamble
\newkeytheoremstyle{breaksty}{break}
\newkeytheorem{observation}[style=breaksty]
% document
\begin{observation}
                                              Observation 1. 1. First item
\begin{enumerate}
\item First item
                                              Observation 2.
\end{enumerate}
\end{observation}
                                                 1. First item
\begin{observation}[listhack=true]
\begin{enumerate}
\item First item
\end{enumerate}
\end{observation}
```

Note that the value **true** must be explicitly set so that **listhack** is not interpreted as the note text.

 $seq=\langle name \rangle$  (initially unset)

Adds the theorem to a custom sequence  $\langle name \rangle$  that can then be listed with \listofkeytheorems [seq= $\langle name \rangle$ ]. See seq $^{\rightarrow P.\,10}$  for more details.

## 3.2 Keys inherited from thmtools

These are the  $[\langle options \rangle]$  available to \newkeytheorem. Except for name and style<sup> $\rightarrow$ P.5</sup>, each key below can also be used in \newkeytheoremstyle<sup> $\rightarrow$ P.7</sup>. For more description, see the thmtools package.

 $\begin{aligned} \text{name=} \langle \textit{display name} \rangle & \text{(initially title-cased } \langle \textit{env name} \rangle) \\ & \text{Aliases title and heading.} \end{aligned}$ 

```
% preamble
\newkeytheorem{mythm} [name=Some Name]

% document
\begin{mythm}
Some text
\end{mythm}
Some Name 1. Some text
```

#### numbered=true|false|unless-unique

(default true, initially true)

For compatibility with thmtools, also accepts the values yes, no, and unless unique.

```
% preamble
\newkeytheorem{theorem*}[
  name=Theorem, numbered=false
]

Theorem. An unnumbered theorem.

% document
\begin{theorem*}
An unnumbered theorem.
\end{theorem*}
```

 $parent=\langle counter \rangle$ 

(initially unset)

Aliases number within and within.

```
% preamble
\newkeytheorem{conjecture}[parent=section]

% document
\begin{conjecture}
The first number is the section.
\end{conjecture}
Conjecture 3.1. The first number is the section.
```

 $\verb|sibling=|\langle counter\rangle|$ 

(initially unset)

Aliases numberlike and sharenumber.

```
% preamble
\newkeytheorem{lemma}[sibling=theorem]

% document
\begin{lemma}
This shares its counter with
\texttt{theorem}.
\end{lemma}
Lemma 8. This shares its counter with
theorem.
```

style=(style name)

(initially unset)

Accepts any  $\langle style \ name \rangle$  defined by  $\ensuremath{\text{Newkeytheoremstyle}}^{\to P.7}$ , as well as any of the predefined amsthm styles: plain, definition, and remark.

```
% preamble
\newkeytheorem{remark}[style=remark]

% document
\begin{remark}
Some text
\end{remark}
```

 $preheadhook = \langle code \rangle$  $postheadhook = \langle code \rangle$  (initially unset) (initially unset)

```
prefoothook = \langle code \rangle
                                                                                              (initially unset)
postfoothook = \langle code \rangle
                                                                                              (initially unset)
    Details in section 7.
        % preamble
        \newkeytheorem{test}[
          preheadhook=PREHEAD,
          postheadhook=POSTHEAD,
                                                             PREHEAD
          prefoothook=PREFOOT,
          postfoothook=POSTFOOT
                                                             Test 1. POSTHEADSome text PREFOOT
                                                             POSTFOOT
        % document
        \begin{test}
        Some text
        \end{test}
refname = \langle refname \rangle or \{\langle singular \ name \rangle, \langle plural \ name \rangle\}
                                                                                    (initially \langle display \ name \rangle)
    If a single string, then the name used by hyperref's \autoref and cleveref's \cref. If two strings
    separated by a comma, then the second string is the plural form used by \cref.
Refname=\langle ref \ name \rangle or \{\langle singular \ name \rangle, \langle plural \ name \rangle\}
                                                                                    (initially \langle display \ name \rangle)
    Same as refname but for \Autoref and \Cref. Note that \Autoref is defined by keytheorems, but
    requires hyperref to work.
        % preamble
        \newkeytheorem{prop}[
          name=Proposition,
          refname={proposition,propositions},
          Refname={Proposition,Propositions}
                                                             Proposition 1. Some text
        % document
        \begin{prop}[label=abc]
                                                             Proposition 2. Some more text
        Some text
                                                             Theorem 9. Consider propositions 1
        \end{prop}
        \begin{prop}[label=def]
                                                             and 2. Proposition 1 . . .
        Some more text
        \end{prop}
        \begin{theorem}
        Consider \cref{abc,def}.
        \Autoref{abc} \dots
        \end{theorem}
qed=\langle symbol \rangle
                                                                          (default \openbox, initially unset)
    Adds \langle symbol \rangle to the end of the theorem body. If no value is given, the symbol \square is used.
        % preamble
        \newkeytheorem{example}[qed]
        \newkeytheorem{solution}[qed=$\clubsuit$]
        % document
                                                             Example 1. Some text
                                                                                                         \begin{example}
        Some text
                                                             Solution 1. Some more text
```

\end{example}
\begin{solution}
Some more text
\end{solution}

#### 3.3 Keys added by keytheorems

```
tcolorbox = \{\langle tcolorbox \ options \rangle\}
```

(initially unset)

This key specifies that the theorem be placed inside a toolorbox environment with  $\langle options \rangle$ . The theorem head is typeset as a toolorbox title; to avoid this see tcolorbox-no-titlebar.

```
% preamble
\tcbset{
 defstyle/.style={
    arc=0mm,
    colback=blue!5!white,
    colframe=blue!75!black
                                                  Corollary 1.
 }
\newkeytheorem{corollary}[tcolorbox]
                                                  Some text
\newkeytheorem{definition}[
 style=definition,
 tcolorbox={defstyle}
                                                  Definition 1.
                                                  Some more text
% document
\begin{corollary}
Some text
\end{corollary}
\begin{definition}
Some more text
\end{definition}
```

 $\verb|tcolorbox-no-titlebar=|{\langle tcolorbox\ options\rangle}|$ 

(initially unset)

Same usage as tcolorbox but the theorem head is typeset as usual, not as a tcolorbox title.

```
% preamble
\newkeytheorem{boxcor}[
  tcolorbox-no-titlebar={
    colback=red!10
    },
  name=Corollary,sibling=corollary
  ]

% document
\begin{boxcor}
Some text
\end{boxcor}

Corollary 2. Some text
```

## 4 Theorem Styles

 $\newkeytheoremstyle{\langle name \rangle} {\langle options \rangle}$ 

This is keytheorems' version of thmtools' \declaretheoremstyle [ $\langle options \rangle$ ] { $\langle name \rangle$ }. Since it makes little sense to define a style with no keys, we've made the  $\langle options \rangle$  argument mandatory. Note that unlike amsthm's \newtheoremstyle, this command will error if a style has already been defined. To overwrite an existing style, there is the analogous \renewkeytheoremstyle. For completeness, there is also \declarekeytheoremstyle and \providekeytheoremstyle.

For the AMS classes amsart, amsbook, and amsproc, as well as the amsart-based acmart, the initial key values are slightly different than what's below in order to match those class's defaults.

#### 4.1 Keys inherited from thmtools

The following keys have the same meaning and syntax as the corresponding thmtools keys. In addition to the list below, most of the keys available to \newkeytheorem \text{P.2} can be used in \newkeytheoremstyle.

```
spaceabove = \langle length \rangle
                                                                                                                (initially \topsep)
                                                                                                                (initially \topsep)
spacebelow=\langle length \rangle
bodyfont=\langle font declarations \rangle
                                                                                                               (initially \itshape)
headindent = \langle length \rangle
                                                                                                                       (initially Opt)
headfont = \langle font \ declarations \rangle
                                                                                                             (initially \bfseries)
                                                                                                                       (initially {.})
headpunct=\langle code \rangle
postheadspace=\langle length \rangle
                                                                                        (initially 5pt plus 1pt minus 1pt)
      Do not use this with the break key.
                                                                                                                    (initially unset)
break
      Do not use this with the postheadspace key.
notefont = \langle font \ declarations \rangle
                                                                             (initially \fontseries\mddefault\upshape)
notebraces=\{\langle left \ brace \rangle\}\{\langle right \ brace \rangle\}
                                                                                                                  (initially \{(\}\{)\})
headstyle=margin|swapnumber|\langle code \ using \ \backslash NAME, \ \backslash NUMBER, \ and \ \backslash NOTE \rangle
```

Alias headstyle. Within  $\langle code \rangle$ , the commands \NAME, \NUMBER, and \NOTE correspond to the formatted parts of the theorem head.

## Keys added by keytheorems

 $inherit-style=\langle style \ name \rangle$ 

(initially unset)

Inherit the keys of any style declared with \newkeytheoremstyle \(^{1}P.^{7}\). Additionally, the three styles predefined by amsthm are possible values: plain, definition, and remark.

#### **Restating Theorems** 5

When a theorem is given the store P.3 key, the contents of the theorem are saved and written to a .thlist file. At the start of the next run, this file is input at the beginning of the document and allows you to retrieve the stored theorems at any point, before or after the original theorem.

 $\getkeytheorem[\langle property \rangle] \{\langle tag \rangle\}$ 

Retrieves the theorem given the key store= $\langle taq \rangle$ . An optional  $\langle property \rangle$  can be given to retrieve only the corresponding part of the theorem. Currently only the property body is implemented, which retrieves the (unformatted) body of the theorem.

| \getkeytheorem{mytag}        |  |  |
|------------------------------|--|--|
| \begin{example}[store=mytag] | <b>Example 2.</b> Fascinating example. |  |
| Fascinating example.         | <b>Example 2.</b> Fascinating example. |  |
| \end{example}                | Fascinating example.                   |  |
| \getkeytheorem[body]{mytag}  |  |  |

## 

Executes  $\langle true\ code \rangle$  if being retrieved with \getkeytheorem and  $\langle false\ code \rangle$  if in the original theorem.

## 6 Listing Theorems

 $\label{listofkeytheorems} [\langle options \rangle]$ 

 $\key theorem list set {\langle options \rangle}$ 

|                    |     | of Theorems                    |     |
|--------------------|-----|--------------------------------|-----|
|                    |     | Theorem                        | 2 3 |
|                    | 3   | Theorem (some heading)         | 3   |
|                    | 4   | Theorem (another heading)      | 3   |
|                    | 5   | Theorem                        | 3   |
|                    | 5   | Theorem (continuing from p. 3) | 3   |
|                    | 6   | Theorem                        | 3   |
|                    | 7   | Lemma                          | 4   |
|                    | 1   | Observation                    | 4   |
|                    | 2   | Observation                    | 4   |
|                    | 1   | Some Name                      | 4   |
| \1: -+ -61+1       |     | Theorem                        | 5   |
| \listofkeytheorems | 3.1 | Conjecture                     | 5   |
|                    | 8   | Lemma                          | 5   |
|                    | 1   | Remark                         | 5   |
|                    | 1   | Test                           | 6   |
|                    | 1   | Proposition                    | 6   |
|                    | 2   | Proposition                    | 6   |
|                    | 9   | Theorem                        | 6   |
|                    | 1   | Example                        | 6   |
|                    | 1   | Solution                       | 6   |
|                    | 1   | Corollary                      | 7   |
|                    | 1   | Definition                     | 7   |
|                    | 2   | Corollary                      | 7   |
|                    | 2   | Example                        | 8   |
|                    | 3   | Example                        | 8   |

## 6.1 Keys inherited from thmtools

```
onlynamed = \{\langle comma-list \ of \ env \ names \rangle\}  (initially unset)
```

ignoreall (initially unset)

|   | List of Theorems   |  |  |
|---|--|--|--|
| <pre>\listofkeytheorems[ignoreall,show=theorem] \listofkeytheorems[   ignoreall, show=conjecture,   title=List of Conjectures ]</pre> | 1       Theorem        2         2       Theorem (some heading)        3         3       Theorem (some heading)        3         4       Theorem (another heading)        3         5       Theorem         3         5       Theorem (continuing from p. 3)         3         6       Theorem         3         9       Theorem         6 |  |  |
|   | List of Conjectures  |  |  |
|   | 3.1 Conjecture 5   |  |  |

showall (initially set)

title=\langle text \rangle \text \te

Defaults to "List of Theorems" if English or an unknown language is used. Currently French, German, and Spanish have (likely inaccurate!) translations. A translation can be added with a GitHub pull request or manually with  $\ensuremath{\mbox{DeclareTranslation}}{\langle lang \rangle}_{keythms_listof_title}_{\langle text \rangle}.$ 

swapnumber=true|false (initially false)

## 6.2 Keys added by keytheorems

```
onlynumbered={\(\circ\) comma-list of env names\)} (initially unset)
```

Similar to onlynamed, but lists only those theorems which are numbered. This is useful if you'd like to exclude things like unnumbered definitions and remarks from the list of theorems.

```
seq=\langle name \rangle (initially unset)
```

Used to list only the theorems added to the custom sequence  $\langle name \rangle$  with the  $seq^{-P.4}$  theorem key. This is the only way to fully customize which theorems appear in the list of theorems. Unlike with  $show^{-P.9}$ , you do not need to use ignoreal1 to prevent theorems not in  $\langle name \rangle$  from being printed.

```
title-code=\langle code \ with \ \#1 \rangle  (initially \section*{\pm 1})
```

If \chapter is defined, then initially this is instead \chapter\*{#1}.

```
no-title (initially unset)
```

Suppresses the title of the list of theorems. Useful for custom ordering of the list.

```
note-code=(code \ with \ \#1)  (initially { (\pm 1)})
```

Formats the optional note in the list of theorems.

print-body (initially unset)

Instead of listing the theorem headings, the theorems are restated with their body text. Not very useful without the store-all<sup>-P.2</sup> load-time option.

```
no-continues=true|false (initially false)
```

Suppresses the printing of theorems given the continues P.3 key in the list of theorems.

```
no-chapter-skip=true|false
```

(initially false)

By default a small vertical space is inserted between each chapter's chunk of theorems. Setting this key to true removes this space.

```
chapter-skip-length=\langle dimension \rangle
```

(initially 10pt)

Controls the amount of space inserted between chunks.

## 6.3 Adding code to list of theorems

There are analogous commands to \addcontentsline and \addtocontents for adding entries or arbitrary code to the list of theorems.

You must use these commands rather than the aforementioned because the .thlist file is also used to define restated theorems and cannot contain unexpected code.

 $\addtheoremcontentsline{\langle level \rangle} {\langle text \rangle}$ 

 $\addtotheoremcontents{\langle code \rangle}$ 

## 7 Theorem Hooks

 $\langle hook\ name \rangle$  can be prehead, posthead, prefoot, postfoot, or restated. If no  $\langle env\ name \rangle$  is given, the  $\langle code \rangle$  is added to the "generic" hook, i.e. applied to all theorems. As in thmtools, the order of hooks is as follows:

```
generic
\langle env \ name \rangle
                                                                                        \langle env \ name \rangle
                                                                                                                   generic
                                                 \ \left( env \ name 
ight) 
 prehead
                          prehead
                                                                                         posthead
                                                                                                                  posthead
                                                     \langle theorem\ body \rangle
  generic
                        \langle env \ name \rangle
                                                                                           generic
                                                                                                                 \langle env \ name \rangle
                                                   \end{\langle env \ name \rangle}
 prefoot
                          prefoot
                                                                                         postfoot
                                                                                                                  postfoot
```

The restated hook is applied at the start of theorems retrieved with \getkeytheorem, before the prehead hook. This can be useful for disabling commands such as \footnote in the restated theorems, e.g.

```
\addtotheoremhook{restated}{%
\renewcommand\footnote[2][]{}%
}
```

By default, keytheorems disables the  $\label$  and  $\RecordProperties$  commands in restated theorems.

In thmtools, the prefoot and postfoot hooks always prepend code, i.e. the code

```
\label{eq:local_addtotheorem} $$ \addtotheorempostfoothook{B} $$
```

results in BA after the theorem. With keytheorems, code is added in the order declared, meaning

results in AB after the theorem. This is the behavior of the  $\LaTeX$  kernel hooks that keytheorems uses under the hood.

Right now, code added using the hook keys preheadhook  $^{\rightarrow P.5}$ , etc. is outermost, meaning executed first in prehead and posthead and last in prefoot and postfoot. This may change if I think of good reasons to do so...

## 8 Further examples

More examples will be added soon – rather, eventually... For now, you can find a keytheorems adaptation of amsthm's classic file thmtest.tex in our Github tests folder: keytheorems-amsthmtest.tex.

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