

# The `savetrees` package\*

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## 1 Introduction

The goal of the `savetrees` package is to pack as much text as possible onto each page of a  $\text{\LaTeX}$  document. Admittedly, this makes the document far less attractive. Nevertheless, `savetrees` provides a simple way to save paper when printing draft copies of a document. It can also be useful when trying to meet a tight page-length requirement. For example, consider the difference between

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\*This document corresponds to `savetrees` v2.3, dated 2014/12/19.

The former (default) layout looks nicer, but the latter consumes approximately 10% less space.

The easiest way to use `savetrees` is simply to place one of the following in your document's preamble:

- `\usepackage[subtle]{savetrees}`
- `\usepackage[moderate]{savetrees}`
- `\usepackage[extreme]{savetrees}`

The first option, `subtle`, preserves all document layout and merely encourages  $\text{\LaTeX}$  to try harder to pack text onto the page while introducing white space only when absolutely necessary. The second option, `moderate`, additionally reduces paragraph indentation, typesets lists and mathematical displays without indentation or surrounding vertical space, reduces interline spacing, and makes the font slightly narrower, if supported. The third option, `extreme`, which is in fact the default if no package options are specified, turns on all of the space-saving techniques in `savetrees`'s repertoire, including using smaller title and section fonts, typesetting the bibliography with a smaller font and no inter-item spacing, and substantially reducing the page margins. For a demonstration of these package options, see the accompanying `st-sample2e.pdf` file, which presents Lamport's "An Example Document" typeset both normally and with each of `savetrees`'s `subtle`, `moderate`, and `extreme` options.

The following section describes those and the rest of `savetrees`'s space-saving capabilities in more detail.

## 2 Usage

Table 1 to Table 3 on pages 3–4 describe `savetrees`'s main package options and summarize their implementation. Some package options merely load a package or redefine some variables. Others redefine entire environments to consume less space. A few resort to some underhanded  $\text{\TeX}$  trickery to squeeze as much text as possible onto the page. See the annotated source code listing in Section 4 for the definitive description of the mechanics underlying the `savetrees` package.

Each of the options that appears in Table 1 through Table 3 can be set to either `tight` or `normal`. `tight`, the default, enables the space-saving technique while `normal` disables it. For example, specifying `\usepackage[title=normal]{savetrees}` instructs `savetrees` not to modify the font size and spacing used to typeset the document's title. The `all` option can be used to set all of `savetrees`'s options en masse to either `tight` or `normal`. For example, if only a few space-saving techniques should be enabled, it may be more convenient to specify `all=normal` followed by a small list of options set to `tight` than to specify `normal` typesetting for a large set of options. The arguments passed to `\usepackage` are processed left-to-right.

Table 1: `savetrees` package options for enabling/disabling space-saving techniques (`subtle`)

Option	Space-saving technique	Implementation
<code>bibbreaks</code>	Allow page breaks within bibliographic entries.	Redefine Bibl <span>at</span> ex’s <code>\bibsetup</code> hook.
<code>paragraphs</code>	Discourage T <span>E</span> X from allowing the last line of a paragraph to contain only a single word.	Reassign <code>\looseness</code> .
<code>floats</code>	Relax float placement (more floats per page, increased ability to share pages with text, etc.).	Reassign L <span>A</span> T <span>E</span> X 2 <sub>ε</sub> float variables.
<code>mathspacing</code>	Reduce the amount of space within mathematical expressions.	Reassign <code>\thinmuskip</code> , <code>\medmuskip</code> , and <code>\thickmuskip</code> .
<code>wordspacing</code>	Reduce the amount of space between words.	Reassign <code>\fontdimen2</code> .
<code>tracking</code>	Reduce the amount of space between characters.	Pass options to the <code>microtype</code> package.

Table 2: savetrees package options for enabling/disabling space-saving techniques (*moderate*)

Option	Space-saving technique	Implementation
<code>bibnotes</code>	Ignore <code>NOTE</code> fields in the bibliography.	Pass information to <code>savetrees.bst</code> ( <code>L<sup>A</sup>T<sub>E</sub>X</code> ) or <code>savetrees.bbx</code> (Bib <sub>l</sub> at <sub>e</sub> x).
<code>charwidths</code>	Allow character glyphs to be drawn slightly narrower than normal.	Pass options to the <code>microtype</code> package.
<code>mathdisplays</code>	Reduce the amount of vertical space surrounding displayed mathematics.	Reassign <code>\abovedisplayskip</code> , <code>\belowdisplayskip</code> , <code>\abovedisplayshortskip</code> , and <code>\belowdisplayshortskip</code> .
<code>leading</code>	Reduce interline spacing.	Reassign <code>\baselinestretch</code> .
<code>indent</code>	Decrease paragraph indentation.	Reassign <code>\parindent</code> .
<code>lists</code>	Remove both indentation and inter-item spacing from the various list environments.	Redefine the <code>itemize</code> , <code>enumerate</code> , and <code>description</code> environments.

Table 3: savetrees package options for enabling/disabling space-saving techniques (*extreme*)

Option	Space-saving technique	Implementation
<code>bibliography</code>	Typeset the bibliography in a smaller font and with no inter-item spacing.	Redefine <code>thebibliography</code> , <code>\bibfont</code> , and <code>\bibitemsep</code> .
<code>title</code>	Typeset the document title with smaller fonts and with less surrounding white space.	Redefine <code>\maketitle</code> .
<code>sections</code>	Typeset section titles with smaller fonts and with less surrounding white space.	Pass options to the <code>titlesec</code> package.
<code>margins</code>	Reduce the page margins.	Pass options to the <code>geometry</code> package.

As convenient shortcuts, the options in Table 1 can be enabled as a group by passing the `subtle` option to `savetrees`; the options in both Table 1 and Table 2 can be enabled as a group by passing the `moderate` option to `savetrees`; and all of the options in Table 1, Table 2, and Table 3 can be enabled as a group by passing the `extreme` option to `savetrees`.

The options in Table 1 through Table 3 are presented in roughly decreasing order of subtlety. If you find that `savetrees`'s default options—or the `subtle`, `moderate`, and `extreme` meta-options—produce too hideous a result, try incrementally setting to `normal` the options from the bottom of the options list up, and see if doing so improves the document's appearance while still saving space over the non-`savetrees` version. That is, start by including `margins=normal` in the optional argument to `\usepackage`. Then add `sections=normal`, then `title=normal`, and so forth, rebuilding the document and examining the result each time. Alternatively, if you need to save just a small amount of space (e.g., if your document is just barely over a maximum page length), specify `all=normal` then incrementally add options from the top of the three tables downwards: `paragraphs=tight`, then `floats=tight`, then `mathspacing=tight`, and so forth. Appendix B presents examples of some of `savetrees`'s space-saving features so you can decide for yourself which are worth the price paid in typesetting elegance.

Saving space in a document is always a balancing act between document aesthetics and the amount of space that can be saved. If you find that a particular space-saving option makes the document formatting just a little too ugly—or if you're willing to make it even uglier to save even more space—`savetrees` provides additional package options that let you adjust the aggressiveness of various space-saving techniques. Table 4 on the following page lists and describes these package options. As an example,  $\text{\LaTeX}$ 's normal line height is defined to have a value of 1.0. When `savetrees` is loaded with `leading=tight` (the default), Table 4 indicates that the line height is reduced to 95% of that. Additionally including `leadingfraction=0.98` on the `\usepackage` line increases the line height to 98% of  $\text{\LaTeX}$ 's default—still a space reduction but possibly a somewhat less overt one.

There are a few restrictions on the space-saving techniques that can be applied. The `tracking` option requires `pdf $\text{\LaTeX}$` . The `charwidths` option requires either `pdf $\text{\LaTeX}$`  or `Lua $\text{\LaTeX}$` . For both options, `pdf $\text{\LaTeX}$`  must be in PDF mode, not DVI mode. See the microtype documentation for additional (and possibly more up-to-date) information.

### 3 Abbreviating bibliographic information

One of the advantages of a tool like `BIB $\text{\TeX}$`  is that the bibliographic database can—and should—contain complete bibliographic information for each reference while style files determine the subset of that information that is actually typeset. Hence, to help further reduce a document's length, the `savetrees` package additionally provides a `BIB $\text{\TeX}$`  style file, `savetrees.bst`, which exhibits the following salient differences from `plain.bst`:

- Abbreviations are used wherever possible:

Table 4: `savetrees` package options for refining the way space is saved

Option	Description	Requires <code>tight</code>	Default
<code>charwidthfraction</code>	Fraction of normal character widths	<code>charwidths</code>	0.95
<code>leadingfraction</code>	Fraction of normal line height	<code>leading</code>	0.95
<code>marginwidth</code>	Width of the page margins	<code>margins</code>	1.5cm
<code>parindent</code>	Paragraph indentation	<code>indent</code>	1em
<code>trackingfraction</code>	Fraction of normal inter-character spacing	<code>tracking</code>	0.975
<code>wordspacingfraction</code>	Fraction of normal inter-word spacing	<code>wordspacing</code>	0.8

`chapter`                    $\implies$  `chap.`  
`edition`                    $\implies$  `ed.`  
`editor or editors`        $\implies$  `ed. or eds.`  
`January, February, ...`    $\implies$  `Jan., Feb., ...`  
`page or pages`            $\implies$  `p. or pp.`  
`Technical Report`        $\implies$  `Tech. Rep.`

- At most two authors are listed. The remainder are replaced by “et al.”
- Authors’ names are abbreviated to their initials plus surname (e.g., “S. D. Pakin”).

In addition, `savetrees.bst` does not normally typeset NOTE fields, although it can be instructed to do so by passing `savetrees` the `bibnotes=normal` package option.

To use `savetrees.bst`, simply replace your document’s existing `\bibliographystyle` line with `“\bibliographystyle{savetrees}”`. Then, to give `savetrees.bst`—or *any* BIB<sub>T</sub><sub>E</sub><sub>X</sub> style file—maximum flexibility, you should obey the following rules when writing your `.bib` file:

1. Use the three-letter month macros defined by virtually all BIB<sub>T</sub><sub>E</sub><sub>X</sub> style files instead of spelling out month names explicitly:

---

Good: `MONTH = sep,`  
       Can be typeset as “September”, “Sept.”, “SEP”, “Septiembre”, etc.  
 Bad: `MONTH = {September},`  
       Can be typeset only as “September”.

---

2. Include authors' full names (or as much of each name as is available); let `BIBTEX` abbreviate as necessary:

---

Good: `AUTHOR = {Rufus Xavier Sarsaparilla}`,  
 Can be typeset either in full or abbreviated to “Rufus X. Sarsaparilla”, “R. X. Sarsaparilla”, etc.

Bad: `AUTHOR = {R. X. Sarsaparilla}`,  
 Can be typeset only as “R. X. Sarsaparilla” and can't be expanded to the full name.

---

3. Include the names of *all* authors; let `BIBTEX` decide where to truncate the list:

---

Good: `AUTHOR = {Rufus Xavier Sarsaparilla and Rafaela Gabriela Sarsaparilla and Albert Andreas Armadillo}`,  
 All authors can be named, or the list can be truncated at any point with “et al.”, “and others”, or whatever.

Bad: `AUTHOR = {Rufus Xavier Sarsaparilla and others}`,  
 At most one author can be named, but “and others” can still be replaced by “et al.” or a different phrase, and the author's name can still be abbreviated, as discussed in the previous rule.

Worse: `AUTHOR = {{Rufus Xavier Sarsaparilla, et al.}}`,  
 Can be typeset only precisely as “Rufus Xavier Sarsaparilla, et al.”

---

The `savetrees` `BIBTEX` style utilizes the same fields as the standard `BIBTEX` styles (`plain`, `alpha`, `abbrv`, `unsrt`, etc.), with the exception that the `NOTE` field is suppressed unless the `bibnotes=normal` package option is provided.

In addition to `savetrees.bst`, `savetrees` provides analogous Biblatex style files: `savetrees.bbx` and `savetrees.cbx`. Like their `BIBTEX` counterpart, they use abbreviated terms whenever possible, list at most two authors before truncating them with “et al.”, and abbreviate authors' names to initials plus surname.

To use the `savetrees` Biblatex style files, simply load `biblatex` with “`\usepackage[style=savetrees]{biblatex}`”. By default, the bibliography style suppresses the `isbn url`, `doi`, and `eprint` fields from typesetting, but these can be re-enabled explicitly:

```
\usepackage[style=savetrees, isbn, url, doi, eprint]{biblatex}
```

The `savetrees` `BIBTEX` and Biblatex style files can be used independently of `savetrees.sty`.

## 4 Implementation of `savetrees.sty`

This section presents the complete, commented source code for the `savetrees` package. Although reading this section—and the subsequent implementation

sections—is not necessary for understanding how to use `savetrees`, it may be a useful teaching instrument for L<sup>A</sup>T<sub>E</sub>X newcomers who want to learn more about fine-tuning document formatting.

## 4.1 Default values

`savetrees` attempts to provide a reasonable balance between aesthetics and the amount of space saved in a document. However, `savetrees` does enable the document author to adjust a number of parameters to bias `savetrees`'s behavior towards either reduced document length or prettier output. This section defines the default values for various package parameters.

<code>\st@margin@width</code>	When <code>margins=tight</code> , <code>\st@margin@width</code> specifies how wide the page margins should be. The default, 1.5 cm, is extremely small, but it can sure save a lot of space on the page. 1 <code>\newcommand*{\st@margin@width}{1.5cm}</code>
<code>\st@parindent</code>	The standard L <sup>A</sup> T <sub>E</sub> X classes ( <code>article</code> , <code>report</code> , and <code>book</code> ) define paragraph indentation as follows. If <code>twocolumn</code> is in effect, <code>\parindent</code> is set to 1 em. Otherwise, if the base font size is 10 pt., <code>\parindent</code> is set to 15 pt.; if the base font size is 11 pt., <code>\parindent</code> is set to 17 pt.; and if the base font size is 12 pt., <code>\parindent</code> is set to 1.5 em. When <code>indent=tight</code> , <code>savetrees</code> uses a default of 1 em—approximately a third of the no- <code>savetrees</code> value—regardless of font size. 2 <code>\newcommand*{\st@parindent}{1em}</code>
<code>\st@baselinestretch</code>	Depending on font size, the standard L <sup>A</sup> T <sub>E</sub> X classes ( <code>article</code> , <code>report</code> , and <code>book</code> ) use 2–2.6 pt. lead (inter-line spacing), or approximately 20% of font size. Specifically, they typeset body text at 10/12, 11/13.6, or 12/14.5. When <code>leading=tight</code> , <code>savetrees</code> reduces the line spacing to 95% of normal or an average of about 0.67 pt. less lead than L <sup>A</sup> T <sub>E</sub> X's defaults: 10/11.4, 11/12.92, or 12/13.78. 95% gives very good compression but still prevents descenders from running into successive ascenders. 3 <code>\newcommand*{\st@baselinestretch}{0.95}</code>
<code>\st@char@shrink</code>	When <code>charwidths=tight</code> , <code>savetrees</code> disables font expansion but enables font compaction. The default contraction of 5% (50/1000) of normal character widths is largely undetectable to the casual observer but can save a great deal of space over the course of a long document. 4 <code>\newcommand*{\st@char@shrink}{50}</code>
<code>\st@csp@shrink</code>	<code>savetrees</code> reduces tracking (inter-character spacing) when <code>tracking=tight</code> . By default, tracking is set to -2.5% (-25/1000) of an em width. When decreased much more than that, characters begin to overlap and become hard to read. 5 <code>\newcommand*{\st@csp@shrink}{-25}</code>
<code>\st@wsp@factor</code>	<code>savetrees</code> reduces inter-word spacing when <code>wordspacing=tight</code> . By default, inter-word spacing is set to 80% of normal. If decreased much beyond that, words start to run together and become hard to read. 6 <code>\newcommand*{\st@wsp@factor}{0.8}</code>



## 4.2 Option processing

### 4.2.1 Enabling/disabling space-saving techniques

By default, `savetrees` tries to make documents extremely dense. However, this also makes them rather ugly. The package options defined below let the author specify which space-saving routines are unacceptably grotesque and should not be utilized.

`savetrees` uses the `xkeyval` package to parse its package options.

```
7 \RequirePackage{xkeyval}
```

`savetrees` uses the `ifpdf` and `ifluatex` packages to control the use of the microtype package.

```
8 \RequirePackage{ifpdf}
```

```
9 \RequirePackage{ifluatex}
```

`\st@more@packages` As we process the package options we may encounter additional packages that we need to load. Rather than load them eagerly, which may lead to the same package problematically being loaded twice with different options, we merely construct a list of required packages. Then, as `savetrees`'s last action before finishing, it loads all of the pending packages. `\st@RequirePackage` takes the same arguments as `\RequirePackage` but simply adds the package name to the `\st@more@packages` list and instructs L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> to eventually pass the given arguments, if any, to the package.

```
10 \def\st@more@packages{}
```

```
11 \newcommand*{\st@RequirePackage}[2] [] {%
```

```
12   \PassOptionsToPackage{#1}{#2}%
```

```
13   \@cons\st@more@packages{#2}}%
```

```
14 }
```

```
15 \AtEndOfPackage{%
```

```
16   \let\@elt=\RequirePackage
```

```
17   \st@more@packages
```

```
18   \let\@elt=\relax
```

```
19 }
```

`\st@define@option` `\st@arg` `\st@arg@num` `savetrees` accepts a large number of package options, each of which can be set to `tight` (the default) to enable a feature or `normal` to disable it. As the definitions of these options are fairly repetitive, we define a helper macro to assist with the processing.

```
20 \newcommand*{\st@define@option}[1] {%
```

```
21   \expandafter\newif\csname if@st@tight@#1\endcsname
```

```
22   \csname @st@tight@#1true\endcsname
```

```
23   \define@choicekey{savetrees}{#1}[\st@arg\st@arg@num]{tight,normal}[tight] {%
```

```
24     \ifnum\st@arg@num=0
```

```
25       \csname @st@tight@#1true\endcsname
```

```
26     \else
```

```
27       \csname @st@tight@#1false\endcsname
```

```
28     \fi
```

```

29 }%
30 \DeclareOptionX{#1}[tight]{\csname KV@savetrees@#1\endcsname{##1}}%
31 }

```

Using the preceding macro we define one conditional and one package option for each trick in `savetrees`'s book. When *true* (caused by passing `tight` to the package option), the conditional enables the corresponding space compression; when *false*, (caused by passing `normal` to the package option), `savetrees` leaves alone that aspect of the formatting.

```

\if@st@tight@sections The sections package option enables or disables savetrees's modifications to section titles by setting \st@tight@sectionstrue or \st@tight@sectionsfalse, respectively.
\st@tight@sectionstrue
\st@tight@sectionsfalse
\KV@savetrees@sections 32 \st@define@option{sections}

```

```

\if@st@tight@margins The margins package option enables or disables savetrees's modifications to page margins by setting \st@tight@marginstrue or \st@tight@marginsfalse, respectively.
\st@tight@marginstrue
\st@tight@marginsfalse
\KV@savetrees@margins 33 \st@define@option{margins}

```

```

\if@st@tight@lists The lists package option enables or disables savetrees's modifications to the various list environments by setting \st@tight@liststrue or \st@tight@listsfalse, respectively.
\st@tight@liststrue
\st@tight@listsfalse
\KV@savetrees@lists 34 \st@define@option{lists}

```

```

\if@st@tight@floats The floats package option enables or disables savetrees's modifications to LATEX's float-placement parameters by setting \st@tight@floatstrue or \st@tight@floatsfalse, respectively.
\st@tight@floatstrue
\st@tight@floatsfalse
\KV@savetrees@floats 35 \st@define@option{floats}

```

```

\if@st@tight@indent The indent package option enables or disables savetrees's modifications to paragraph indentation by setting \st@tight@indenttrue or \st@tight@indentfalse, respectively.
\st@tight@indenttrue
\st@tight@indentfalse
\KV@savetrees@indent 36 \st@define@option{indent}

```

```

\if@st@tight@title The title package option enables or disables savetrees's modifications to title formatting by setting \st@tight@titletrue or \st@tight@titlefalse, respectively.
\st@tight@titletrue
\st@tight@titlefalse
\KV@savetrees@title 37 \st@define@option{title}

```

```

\if@st@tight@leading The leading package option enables or disables savetrees's modifications to interline spacing by setting \st@tight@leadingtrue or \st@tight@leadingfalse, respectively. This interline spacing is known as "leading" because of the additional strips of lead placed between lines in the days of metal type.
\st@tight@leadingtrue
\st@tight@leadingfalse
\KV@savetrees@leading 38 \st@define@option{leading}

```

<pre> \ifst@tight@paragraphs \st@tight@paragraphstrue \st@tight@paragraphsfalse \KV@savetrees@paragraphs </pre>	<p>The paragraphs package option enables or disables savetrees's modifications to T<sub>E</sub>X's paragraph looseness (i.e., the number of lines by which T<sub>E</sub>X is instructed to shrink each paragraph) by setting <code>\st@tight@paragraphstrue</code> or <code>\st@tight@paragraphsfalse</code>, respectively.</p> <p>39 <code>\st@define@option{paragraphs}</code></p>
<pre> \ifst@tight@charwidths \st@tight@charwidthstrue \st@tight@charwidthsfalse \KV@savetrees@charwidths </pre>	<p>The charwidths package option enables or disables savetrees's modifications to character width by setting <code>\st@tight@charwidthstrue</code> or <code>\st@tight@charwidthsfalse</code>, respectively.</p> <p>40 <code>\st@define@option{charwidths}</code></p>
<pre> \ifst@tight@tracking \st@tight@trackingtrue \st@tight@trackingfalse \KV@savetrees@tracking </pre>	<p>The tracking package option enables or disables savetrees's modifications to tracking (spacing between letters) by setting <code>\st@tight@trackingtrue</code> or <code>\st@tight@trackingfalse</code>, respectively.</p> <p>41 <code>\st@define@option{tracking}</code></p>
<pre> \ifst@tight@wordspacing \st@tight@wordspacingtrue \st@tight@wordspacingfalse \KV@savetrees@wordspacing </pre>	<p>The wordspacing package option enables or disables savetrees's modifications to inter-word spacing by setting <code>\st@tight@wordspacingtrue</code> or <code>\st@tight@wordspacingfalse</code>, respectively.</p> <p>42 <code>\st@define@option{wordspacing}</code></p>
<pre> \ifst@tight@bibliography \st@tight@bibliographytrue \st@tight@bibliographyfalse \KV@savetrees@bibliography </pre>	<p>The bibliography package option enables or disables savetrees's modifications to bibliography formatting by setting <code>\st@tight@bibliographytrue</code> or <code>\st@tight@bibliographyfalse</code>, respectively.</p> <p>43 <code>\st@define@option{bibliography}</code></p>
<pre> \ifst@tight@bibnotes \st@tight@bibnotesttrue \st@tight@bibnotesfalse \KV@savetrees@bibnotes </pre>	<p>The bibnotes package option conditionally excludes or includes NOTE fields when using savetrees.bst by setting <code>\st@tight@bibnotesttrue</code> or <code>\st@tight@bibnotesfalse</code>, respectively.</p> <p>44 <code>\st@define@option{bibnotes}</code></p>
<pre> \ifst@tight@bibbreaks \st@tight@bibbreakstrue \st@tight@bibbreaksfalse \KV@savetrees@bibbreaks </pre>	<p>The bibbreaks package option allows Bibl<sub>at</sub>ex to break pages within bibliographic items.</p> <p>45 <code>\st@define@option{bibbreaks}</code></p>
<pre> \ifst@tight@mathspacing \st@tight@mathspacingtrue \st@tight@mathspacingfalse \KV@savetrees@mathspacing </pre>	<p>The mathspacing package option enables or disables savetrees's modifications to horizontal spacing within mathematical expressions by setting <code>\st@tight@mathspacingtrue</code> or <code>\st@tight@mathspacingfalse</code>, respectively.</p> <p>46 <code>\st@define@option{mathspacing}</code></p>
<pre> \ifst@tight@mathdisplays \st@tight@mathdisplaystrue \st@tight@mathdisplaysfalse \KV@savetrees@mathdisplays </pre>	<p>The mathdisplays package option enables or disables savetrees's modifications to vertical spacing surrounding mathematical displays by setting <code>\st@tight@mathdisplaystrue</code> or <code>\st@tight@mathdisplaysfalse</code>, respectively.</p> <p>47 <code>\st@define@option{mathdisplays}</code></p>

## 4.2.2 Meta options

savetrees provides a large number of package options, which might be overwhelming for a casual user. Here, we define a few “meta options” that set multiple, related, package options en masse.

```
\KV@savetrees@all Define an all meta-option that can be used to enable or disable all of savetrees's
  \st@arg space-saving features at once.
  \st@arg@num 48 \define@choicekey{savetrees}{all}[\st@arg\st@arg@num]{tight,normal}[tight]{%
49   \ifnum\st@arg@num=0
50     \@st@tight@sectionstrue
51     \@st@tight@marginstrue
52     \@st@tight@liststrue
53     \@st@tight@floatstrue
54     \@st@tight@indenttrue
55     \@st@tight@titletrue
56     \@st@tight@leadingtrue
57     \@st@tight@paragraphstrue
58     \@st@tight@charwidthstrue
59     \@st@tight@trackingtrue
60     \@st@tight@wordspacingtrue
61     \@st@tight@bibliographytrue
62     \@st@tight@bibnotesttrue
63     \@st@tight@bibbreakstrue
64     \@st@tight@mathspacingtrue
65     \@st@tight@mathdisplaystrue
66   \else
67     \@st@tight@sectionsfalse
68     \@st@tight@marginfalse
69     \@st@tight@listsfalse
70     \@st@tight@floatsfalse
71     \@st@tight@indentfalse
72     \@st@tight@titlefalse
73     \@st@tight@leadingfalse
74     \@st@tight@paragraphsfalse
75     \@st@tight@charwidthsfalse
76     \@st@tight@trackingfalse
77     \@st@tight@wordspacingfalse
78     \@st@tight@bibliographyfalse
79     \@st@tight@bibnotesfalse
80     \@st@tight@bibbreaksfalse
81     \@st@tight@mathspacingfalse
82     \@st@tight@mathdisplayfalse
83   \fi
84 }
85 \DeclareOptionX{all}[tight]{\KV@savetrees@all{#1}}
```

`\KV@savetrees@subtle` The subtle package option turns off all of savetrees’s space-saving tricks except those that preserve document layout: margins, indentation, font heights, vertical

spacing surrounding titles, lists, displays, etc.

```
86 \define@key{savetrees}{subtle}{%
87   \setkeys{savetrees}{%
88     all=normal,
89     paragraphs=tight,
90     floats=tight,
91     mathspacing=tight,
92     wordspacing=tight,
93     tracking=tight,
94     bibbreaks=tight
95   }%
96 }
97 \DeclareOptionX{subtle}{\KV@savetrees@subtle}
```

`\KV@savetrees@moderate` The moderate package option includes everything covered by `subtle` but additionally makes the font narrower, removes vertical white space around lists and displays, cuts back on indentation, reduces interline spacing, and drops NOTE fields from the bibliography,

```
98 \define@key{savetrees}{moderate}{%
99   \setkeys{savetrees}{%
100     subtle=yes,
101     charwidths=tight,
102     mathdisplays=tight,
103     lists=tight,
104     indent=tight,
105     leading=tight,
106     bibnotes=tight
107   }%
108 }
109 \DeclareOptionX{moderate}{\KV@savetrees@moderate}
```

`\KV@savetrees@extreme` The extreme package option is simply a synonym for `all=tight`.

```
110 \DeclareOptionX{extreme}{%
111   \setkeys{savetrees}{all=tight}%
112 }
```

### 4.2.3 Parameter tuning

While `savetrees` tries to use reasonable defaults for the numerical values used by its space-saving techniques, many of these parameters can be modified conveniently via package options:

The `marginwidth` option specifies the width of the page margins when `margins=tight`.

```
113 \DeclareOptionX{marginwidth}{\gdef\st@margin@width{#1}}
```

The `parindent` option specifies the paragraph indent when `indent=tight`.

```
114 \DeclareOptionX{parindent}{\gdef\st@parindent{#1}}
```

The `leadingfraction` option specifies the fraction by which to multiply the line spacing when `leading=tight`.

```
115 \DeclareOptionX{leadingfraction}{\gdef\st@baselinestretch{#1}}
```

The `charwidthfraction` option specifies the fraction by which to multiply character-glyph widths when `charwidths=tight`. Because the `microtype` package takes a per mill width contraction we have to do some arithmetic to produce `\st@char@shrink`.

```
116 \DeclareOptionX{charwidthfraction}{%
117   \@tempdima=#1pt
118   \multiply\@tempdima by -1000
119   \advance\@tempdima by 1000pt
120   \divide\@tempdima by 65536
121   \@tempcnta=\@tempdima
122   \xdef\st@char@shrink{\the\@tempcnta}%
123 }
```

The `trackingfraction` option specifies the fraction by which to multiply character spacing when `tracking=tight`. Because the `microtype` package takes a per mill width expansion we have to do some arithmetic to produce `\st@cspace@shrink`.

```
124 \DeclareOptionX{trackingfraction}{%
125   \@tempdima=#1pt
126   \advance\@tempdima by -1pt
127   \multiply\@tempdima by 1000
128   \divide\@tempdima by 65536
129   \@tempcnta=\@tempdima
130   \xdef\st@cspace@shrink{\the\@tempcnta}%
131 }
```

The `wordspacingfraction` option specifies the fraction by which to multiply inter-word spacing when `wordspacing=tight`.

```
132 \DeclareOptionX{wordspacingfraction}{\gdef\st@wspace@factor{#1}}
```

#### 4.2.4 Obsolete options

`savetrees` used to name all of its options `normal` (*something*). None of these took arguments so the only usage model was for `savetrees` to turn all space-saving techniques on by default and let the user selectively disable them. Starting with version 2.0, `savetrees` package options take the form `(something)[=tight]` or `(something)=normal`, which gives a document author the ability to enable or disable options as desired. To move authors to the new set of parameters, we define all of the old options as error-generating calls.

`\st@mark@as@obsolete` We define a helper macro that processes the given option by issuing an error message that instructs the document author to use a different option instead.

```
133 \newcommand*{\st@mark@as@obsolete}[2]{%
134   \define@key{savetrees}{#1}[tight]{%
135     \PackageError{savetrees}{Package option ‘#1’ is no longer supported}{%
136       Rather than ‘#1’, please specify ‘#2=normal’.\MessageBreak
```

```

137     Instead of enabling all features by default and letting the\MessageBreak
138     user selectively disable them, savetrees now provides the\MessageBreak
139     ability to turn features on or off as desired, including all\MessageBreak
140     features en masse.}%

```

Out of the goodness of our heart, we automatically convert the obsolete option to a new option and evaluate that.

```

141     \csname @st@tight@#2false\endcsname
142   }%
143   \DeclareOptionX{#1}[tight]{\csname KV@savetrees@#1\endcsname{##1}}%
144 }

```

We now invoke `\st@mark@as@obsolete` once for each obsolete savetrees option,

```

145 \st@mark@as@obsolete{normalsections}{sections}
146 \st@mark@as@obsolete{normalmargins}{margins}
147 \st@mark@as@obsolete{normallists}{lists}
148 \st@mark@as@obsolete{normalfloats}{floats}
149 \st@mark@as@obsolete{normalindent}{indent}
150 \st@mark@as@obsolete{normaltitle}{title}
151 \st@mark@as@obsolete{normalleading}{leading}
152 \st@mark@as@obsolete{normallooseness}{paragraphs}
153 \st@mark@as@obsolete{normalcharwidths}{charwidths}
154 \st@mark@as@obsolete{normalbib}{bibliography}
155 \st@mark@as@obsolete{normalbibnotes}{bibnotes}

```

At long last, we can process all of the options defined in Section Section 4.2.

```

156 \ProcessOptionsX\relax

```

### 4.3 Section titles

The L<sup>A</sup>T<sub>E</sub>X default is to typeset section titles in a large font and with significant surrounding white space. We use the `titlesec` package to typeset section titles in the same font size as the body text and to leave only a single blank line above and below them.

```

157 \if@st@tight@sections
158   \st@RequirePackage[tiny,compact]{titlesec}
159 \fi

```

### 4.4 Page margins

The typesetting wisdom of the ages says that the human eye is most comfortable reading approximately 60 characters per line of text, and this is what L<sup>A</sup>T<sub>E</sub>X's default margins aim to achieve. Of course, narrower margins mean fewer pages, and that's what `savetrees` is striving for.

We use the `geometry` package to narrow our page margins unless the author wants to keep L<sup>A</sup>T<sub>E</sub>X's original ones. Note that we accept `geometry`'s default of zero space allocated to marginal notes.

```

160 \if@st@tight@margins

```

```

161 \st@RequirePackage[lmargin=\st@margin@width,
162                    rmargin=\st@margin@width,
163                    tmargin=\st@margin@width,
164                    bmargin=\st@margin@width,
165                    includefoot,
166                    footskip=2ex]{geometry}
167 \fi

```

## 4.5 List spacing

We try to save space in itemized lists, enumerated lists, and description lists by reducing indentation and by eliminating pre-list and inter-item spacing altogether.

```
168 \if@st@tight@lists
```

The `calc` package helps simplify our list redefinitions.

```
169 \st@RequirePackage{calc}
```

**itemize** Except where indicated, the following code was taken directly from L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>'s definition of the `itemize` environment, in `ltlists.dtx`:

```

170 \def\itemize{%
171   \ifnum \@itemdepth >\thr@@\@toodeep\else
172     \advance\@itemdepth\@ne
173     \edef\@itemitem{labelitem\romannumeral\the\@itemdepth}%
174     \expandafter
175     \list
176     \csname\@itemitem\endcsname
177     {\def\makelabel##1{\hss\llap{##1}}}%

```

The following lines have been modified from the original.

```

178     \settowidth{\leftmargin}{\csname\@itemitem\endcsname}%
179     \addtolength{\leftmargin}{\labelsep * \@itemdepth}%
180     \setlength{\partopsep}{0pt plus 4pt}%
181     \setlength{\topsep}{0pt plus 4pt}%
182     \setlength{\itemsep}{0pt}%
183     \setlength{\parsep}{0pt}%
184     \setlength{\listparindent}{\st@parindent}%

```

That's it for the modifications. We can now finish up the redefinition of `itemize`.

```

185   }%
186 \fi}

```

**enumerate** Except where indicated, the following code was taken directly from L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>'s definition of the `enumerate` environment, in `ltlists.dtx`:

```

187 \def\enumerate{%
188   \ifnum \@enumdepth >\thr@@\@toodeep\else
189     \advance\@enumdepth\@ne
190     \edef\@enumctr{enum\romannumeral\the\@enumdepth}%
191     \expandafter
192     \list
193     \csname label\@enumctr\endcsname

```



```

194         {\usecounter\@enumctr\def\makelabel##1{\hss\llap{##1}}}%
The following lines have been modified from the original.
195         \settowidth{\leftmargin}{\csname label\@enumctr\endcsname}%
196         \addtolength{\leftmargin}{\labelsep * \@enumdepth}%
197         \setlength{\partopsep}{0pt plus 4pt}%
198         \setlength{\topsep}{0pt plus 4pt}%
199         \setlength{\itemsep}{0pt}%
200         \setlength{\parsep}{0pt}%
201         \setlength{\listparindent}{\st@parindent}%
That's it for the modifications. We can now finish up the redefinition of enumerate.
202     }
203 \fi}

```

**description** The `description` environment is a bit simpler than the `itemize` and `enumerate` environments; it's a direct application of `list`. All we need to do is reduce the left margin from the `list` default of 2 em to a slightly denser 1 pc.

```

204 \renewenvironment{description}{%
205     \begin{list}{}{\setlength{\leftmargin}{1pc}%
206         \setlength{\itemindent}{-\leftmargin}%
207         \setlength{\partopsep}{0pt plus 4pt}%
208         \setlength{\topsep}{0pt plus 4pt}%
209         \setlength{\itemsep}{0pt}%
210         \setlength{\parsep}{0pt}%
211         \setlength{\labelwidth}{0pt}%
212         \setlength{\listparindent}{\st@parindent}%
213         \let\makelabel\descriptionlabel}%
214 }{%
215     \end{list}
216 }
217 \fi

```

## 4.6 Float placement

```

\topfraction LATEX normally doesn't try very hard to pack floats onto a page. The following
\bottomfraction parameter changes attempt to reduce the number of float pages (and hence, total
\textfraction pages).
\floatpagefraction 218 \if@st@tight@floats
\dbltopfraction 219 \renewcommand{\topfraction}{0.85}
\dblfloatpagefraction 220 \renewcommand{\bottomfraction}{0.85}
221 \renewcommand{\textfraction}{0.1}
222 \renewcommand{\floatpagefraction}{0.85}
223 \renewcommand{\dbltopfraction}{0.85}
224 \renewcommand{\dblfloatpagefraction}{.85}
225 \setcounter{topnumber}{25}
226 \setcounter{bottomnumber}{25}
227 \setcounter{totalnumber}{25}
228 \setcounter{dbltopnumber}{25}
229 \fi

```

## 4.7 Paragraph indentation

L<sup>A</sup>T<sub>E</sub>X normally provides approximately 1.5em of indentation at the start of each paragraph. We can save a little space by slightly reducing the indentation amount.

```
230 \if@st@tight@indent
231   \setlength{\parindent}{\st@parindent}
232 \fi
```

## 4.8 Document title formatting

By default, the document title is typeset in the `\LARGE` font size, and the author list and date are typeset `\large`. We redefine `\@maketitle` to typeset the title `\large` and everything else in the body font. In addition, we remove the extra white space above the title and lessen the white space below the title.

```
233 \if@st@tight@title
```

`\@maketitle` The following was taken largely from `classes.dtx`, but modified as specified above.

```
234   \def\@maketitle{%
235     \newpage
236     \null
237     \begin{center}%
238       \let \footnote \thanks
239       {\large \textbf{\@title}\par}
240       \vskip 0.5\baselineskip
241       \begin{tabular}[t]{c}%
242         \@author
243       \end{tabular}\par
244       \vskip 0.5\baselineskip
245       \@date
246     \end{center}%
247     \par
248     \vskip \baselineskip
249   }
250 \fi
```

## 4.9 Interline spacing

`\baselinestretch` A document's page count can be reduced quite significantly by reducing the amount of white space between successive lines of text so that's exactly what we do below.

```
251 \if@st@tight@leading
252   \renewcommand{\baselinestretch}{\st@baselinestretch}
253 \fi
```

## 4.10 Paragraph looseness

Some paragraphs end with a lone word on the last line. If we can discourage such typesetting we can gain an extra line. The underlying mechanism we use is T<sub>E</sub>X's `\looseness` primitive, which encourages T<sub>E</sub>X to expand the current paragraph by

a given number of lines. However, `\looseness` can be set to a negative number, which encourages  $\TeX$  to shrink the current paragraph by a given number of lines. For this technique to work, the paragraph must be relatively long so  $\TeX$  has enough shrinkable white space to work with.

Unfortunately, `\looseness` applies only to the current paragraph. We therefore use `\everypar` to inject `\looseness=-1` into every paragraph. However, the approach is not quite so simple as the `\looseness=-1` is not injected into list environments. We therefore use some tricky code due to Donald Arseneau to make the effect of `\looseness=-1` as global as possible:

```
254 \if@st@tight@paragraphs
255   \let\markeverypar\everypar
256   \newtoks\everypar
257   \everypar\markeverypar
258   \markeverypar{\the\everypar\looseness=-1\relax}
259 \fi
```

Even when `\everypar` is used in the ordinary fashion it is likely to conflict with various  $\LaTeX$  packages. Because the preceding code is a particularly tricky redefinition of `\everypar` it's likely that many documents will need to disable paragraph looseness by providing the `paragraphs=normal` option to `savetrees`.

## 4.11 Font width

The `microtype` package provides  $\LaTeX$  support for the font-expansion feature supported by `pdf $\TeX$`  and `lua $\TeX$` . Font expansion is intended to improve text “color”—the even balance between ink and absence of ink on a page—by subtly expanding or narrowing character widths instead of by adding or removing white space. `savetrees` hijacks this feature as a space-saving mechanisms by specifying a maximum expansion of 0% of a character’s natural width but a maximum contraction of greater than 0%. At the time of this writing, this feature works only with `pdf $\LaTeX$`  and `Lua $\LaTeX$` .

```
260 \if@st@tight@charwidths
261   \ifpdf
262     \st@RequirePackage[stretch=0,shrink=\st@char@shrink]{microtype}
263   \fi
264 \fi
```

## 4.12 Inter-character spacing

The `microtype` package provides  $\LaTeX$  support for `pdf $\TeX$` ’s tracking feature. Rather than using tracking with a light touch and just in certain contexts (e.g., small caps), we instruct `microtype` to track somewhat aggressively, shaving off a few percent of an em width between *every* pair of characters. At the time of this writing, this feature works only with `pdf $\LaTeX$` .

```
265 \if@st@tight@tracking
266   \ifpdf
267     \ifluatex
```

```

268     \else
269         \st@RequirePackage[letterspace=\st@ospace@shrink,tracking=all]{microtype}
270     \fi
271 \fi
272 \fi

```

### 4.13 Inter-word spacing

Any font used by T<sub>E</sub>X is required to have at least seven `\fontdimen` parameters. `\fontdimen2` represents the base inter-word spacing. (`\fontdimen3` and `\fontdimen4` represent, respectively, the amount by which inter-word spacing can stretch or shrink; `savetrees` does not currently alter those.) Here, we hook into L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>'s font-loading mechanism. Whenever a new font is loaded, we specify that the inter-word spacing for that font should be reduced.

```

273 \if@st@tight@wordspacing
274   \g@addto@macro\define@newfont{%
275     \fontdimen2\font@name=\st@ospace@factor\fontdimen2\font@name
276   }%

```

We also reduce the inter-word spacing for whatever font is currently loaded.

```

277 \fontdimen2\font@name=\st@ospace@factor\fontdimen2\font@name
278 \fi

```

### 4.14 Bibliography formatting

There are two ways we save space when typesetting bibliographies. First, we omit blank lines between entries. And second, we typeset the entire bibliography—excluding the section title—with `\small`.

```

279 \if@st@tight@bibliography

```

`thebibliography` The following was taken largely from `classes.dtx`; see that file for additional documentation. `savetrees`'s modifications are indicated below.

```

280 \renewenvironment{thebibliography}[1]{%

```

In the `article` document class, a bibliography is a *section* called “`\refname`”. In the `report` and `book` document classes, a bibliography is a *chapter* called “`\bibname`”. In `classes.dtx`, the correct code is extracted by `DocStrip`. Here, we have to use an `\ifx` primitive to select the appropriate title and formatting.

```

281   \@ifundefined{chapter}{%
282     \section*{\refname
283       \@mkboth{\MakeUppercase\refname}{\MakeUppercase\refname}}%
284   }{%
285     \chapter*{\bibname
286       \@mkboth{\MakeUppercase\bibname}{\MakeUppercase\bibname}}%
287   }%

```

Back to the original code...

```

288   \list{\@biblabel{\@arabic\c@enumiv}}%
289         {\settowidth\labelwidth{\@biblabel{#1}}%

```

```

290         \leftmargin\labelwidth
291         \advance\leftmargin\labelsep

```

We eliminate the space between paragraphs, and we set the space between items to only 1 pt. We could have set this to 0 pt., but the extra space helps keep the citation numbers' brackets from getting too close to each other, vertically.

```

292         \setlength{\parsep}{0pt}%
293         \setlength{\itemsep}{1pt}%

```

Back to the original code...

```

294         \@openbib@code
295         \usecounter{enumiv}%
296         \let\p@enumiv\@empty
297         \renewcommand\theenumiv{\@arabic\c@enumiv}}%

```

Although we kept the section title in its original size, we typeset the rest of the bibliography a little bit smaller.

```

298     \small

```

We finish up using the original code, except we reduce the club and widow penalties from 4000 to 150.

```

299     \sloppy
300     \clubpenalty150
301     \@clubpenalty \clubpenalty
302     \widowpenalty150%
303     \sfcode'\.\@m
304 }{%
305     \def\@noitemerr
306     {\@latex@warning{Empty 'thebibliography' environment}}%
307     \endlist
308 }

```

`\bibfont` If the biblatex package was loaded we use Biblatex's mechanisms for reducing the font size to `\small` (`\bibfont`) and for omitting blank lines between bibliographic entries (`\bibitemsep`).

```

309 \AtBeginDocument{%
310     \@ifundefined{bibfont}{-}{%
311         \renewcommand*\bibfont{\normalfont\small}%
312         \bibitemsep=0pt plus 2pt\relax
313     }%
314 }%
315 \fi

```

## 4.15 Bibliographic notes

`\savetreesbibnote` The bibliographies output by the `savetrees.bst` BibTeX style (presented in Section 5) surround all NOTE fields with a call to the `\savetreesbibnote` macro. As a result, this macro must be defined for `savetrees.bst` to work. By default,

`\savetreesbibnote` is defined to do nothing. However, setting `bibnotes=normal` indicates that `\savetreesbibnote` should instead output its argument as is.

```
316 \if@st@tight@bibnotes
```

To suppress a NOTE field, we also have to gobble the period following the note. Otherwise, the bibliography will show two periods surrounding an empty note.

```
317 \newcommand{\savetreesbibnote}[1]{\@gobble}
318 \else
319 \newcommand{\savetreesbibnote}[1]{#1}
320 \fi
```

## 4.16 Page breaks within bibliographies

The Bibl<sub>at</sub>ex package strongly discourages T<sub>E</sub>X from breaking pages within a bibliographic entry. Instead, T<sub>E</sub>X is told to favor pushing an entire bibliographic entry onto the next page. Setting `bibbreaks=tight` changes Bibl<sub>at</sub>ex's behavior to allow page breaks to appear anywhere in a bibliography. The setting has no effect on BIBT<sub>E</sub>X, only Bibl<sub>at</sub>ex.

```
321 \if@st@tight@bibbreaks
322 \AtBeginDocument{%
323   \ifundefined{bibsetup}{-}{%
```

`\bibsetup` The bibl<sub>at</sub>ex package was loaded. Redefine its `\bibsetup` hook.

```
324     \renewcommand*{\bibsetup}{%
325       \interlinepenalty=100\relax
326       \widowpenalty=100\relax
327       \clubpenalty=100\relax
328       \raggedbottom
329       \frenchspacing
330       \biburlsetup
331     }%
332   }%
333 }%
334 \fi
```

## 4.17 Mathematical expressions

By default, mathematical expressions contain substantial white space around operators, relations, etc. Here, we shave approximately three math units off each of `\thinmuskip`, `\medmuskip`, and `\thickmuskip`. This needs to happen after the `\begin{document}` so that the new values don't get overwritten.

```
335 \if@st@tight@mathspacing
336 \AtBeginDocument{%
337   \thinmuskip=0mu plus 3mu
338   \medmuskip=1mu plus 4mu
339   \thickmuskip=2mu plus 5mu
340 }
341 \fi
```

## 4.18 Displayed mathematics

Displayed mathematical expressions are normally offset from the surrounding text with vertical white space. Here, we set the amount of vertical white space to zero. This needs to happen after the `\begin{document}` so that the new values don't get overwritten.

```
342 \if@st@tight@mathdisplays
343   \AtBeginDocument{%
344     \abovedisplayskip=0pt plus 3pt
345     \belowdisplayskip=0pt plus 3pt
346     \abovedisplayshortskip=0pt plus 3pt
347     \belowdisplayshortskip=0pt plus 3pt
348   }
349 \fi
```

## 5 Implementation of the Bib<sub>T</sub><sub>E</sub><sub>X</sub> style file

In addition to a L<sup>A</sup>T<sub>E</sub>X<sub>2</sub><sub>ε</sub> style, the `savetrees` package also includes a Bib<sub>T</sub><sub>E</sub><sub>X</sub> style, `savetrees.bst`. `savetrees.bst` was generated with the help of Patrick W. Daly's `custom-bib` package. The following options were provided to `merlin.mbs`:

```
lang, nm-init, ed-au, nmdash, nmlm, x2, m2, isbn,
issn, pp, ed, abr, ednx, xedn, jabr, nfss
```

Because `savetrees.bst` is a generated file—and can be regenerated using the options listed above—it is unnecessary to list the complete source code in this document. Rather, only the hand-modified parts are presented below.

```
⋮
(443 lines of code omitted)
⋮
```

`format.note` is the first of two functions modified by hand. The modification involves placing the entire note field within `\savetreesbibnote{...}`. This enables `savetrees.sty` to selectively define `\savetreesbibnote` to either output its argument as is or discard it (and the subsequent period). See Section 4.15 for `savetrees.sty`'s definition of `\savetreesbibnote`.

```
350 FUNCTION {format.note}
351 {
352   note empty$
353   { "" }
354   { "\savetreesbibnote{"
355     note #1 #1 substring$
356     duplicate$ "{ " =
357     'skip$
358     { output.state mid.sentence =
359       { "1" }
```

```

360         { "u" }
361         if$
362         change.case$
363         }
364     if$
365     note #2 global.max$ substring$ *
366     "]" * *
367 }
368 if$
369 }

```

∷  
 (914 lines of code omitted)  
 ∷

`begin.bib` is the second of two functions modified by hand. The modification is to have the function write some additional code to the `.bb1` file to define `\savetreesbibnote` as the identity function if that macro is not already defined.

```

370 FUNCTION {begin.bib}
371 { preamble$ empty$
372   'skip$
373   { preamble$ write$ newline$ }
374   if$
375   "\begin{thebibliography}{ longest.label * }" *
376   write$ newline$
377   "\providecommand*\selectlanguage}[1]{\relax}%"
378   write$ newline$
379   "\providecommand*\savetreesbibnote}[1]{#1}%"
380   write$ newline$
381 }

```

∷  
 (13 lines of code omitted)  
 ∷

## 6 Implementation of the Biblatex style files

We define an analogue of `savetrees.bst` (Section 5) for Biblatex. This comprises two files: a bibliography style, `savetrees.bbx` (Section 6.1), and a citation style, `savetrees.cbx` (Section 6.2).

### 6.1 Implementation of `savetrees.bbx`

Biblatex’s default `numeric-comp` bibliography style is already fairly abbreviated so we begin with that and merely make a few changes to reduce the number of authors before “et al.” kicks in; use initials for all given and middle names; suppress



typesetting ISBNs, URLs, DOIs, and eprint IDs; and honor `savetrees`'s `bibnotes` option.

```
382 \RequireBibliographyStyle{numeric-comp}
383
384 \ExecuteBibliographyOptions{%
385   maxnames = 2,
386   minnames = 2,
387   firstinits = true,
388   isbn = false,
389   url = false,
390   doi = false,
391   eprint = false
392 }
393
394 \AtBeginDocument{%
395   \ifundefined{if@st@tight@bibnotes}{-}{%
396     \if@st@tight@bibnotes
397       \DeclareFieldFormat{note}{-}{%
398         \fi
399   }%
400 }
```

## 6.2 Implementation of `savetrees.cbx`

The corresponding `savetrees.cbx` citation style is even more trivial than `savetrees.bbx`. It simply defines itself as an alias for Bibl<sub>at</sub>ex's standard `numeric-comp` citation style.

```
401 \RequireCitationStyle{numeric-comp}
```

## A Average character widths of common fonts

**Question:** What's the narrowest font?

**Answer:** It depends upon how you measure. Table 5 shows, for various 10 pt. fonts, the width in points of 1000 lowercase letters with relative frequencies chosen to match "typical" English text. There are 130 e's, 93 t's, 78 n's, 77 r's, and so forth down the frequency distribution. According to the table, Times is statistically likely to be the best typeface for maximizing the amount of text on the page. However, Times may not be the narrowest for *your* document; you'll have to experiment and see.

Although `savetrees` does not automatically change the document font it does specify that character glyphs may be typeset narrower than normal (cf. the `charwidth` option). Note, however, that `savetrees` unfortunately has no control over precisely which lines of text are typeset with narrow characters. This narrowing technique works only with pdf<sub>L</sub>A<sub>T</sub>E<sub>X</sub>, so that program should be used if possible to maximize the space-saving achievable with `savetrees`.

Typeface	Package	Avg. width (pt.)
Times	<code>mathptmx</code>	4.26901
Computer Modern	(default)	4.62675
Charter	<code>charter</code>	4.6762
Helvetica	<code>helvet</code>	4.70108
Palatino	<code>mathpazo</code>	4.79744
Utopia	<code>utopia</code>	4.92876
New Century Schoolbook	<code>newcent</code>	4.98047
Avant Garde	<code>avant</code>	5.22113
Bookman	<code>bookman</code>	5.23056
Courier	<code>courier</code>	6

Table 5: Common fonts sorted by increasing width

## B Gallery of space-saving techniques

Figure 1 through Figure 7 on pages 27–29 provide examples of some of the ways that `savetrees` saves space when typesetting text. Each figure showcases a single space-saving technique in isolation. The default parameters are used for each technique. Table 4 on page 6 documents the package options that can be used to refine these parameters either to save more space or to make the typesetting less offensive.

Figure 1 shows how setting `lists=tight` saves space by reducing the white space above, below, and within list environments (in this case, the `itemize` environment). Figure 2 shows how setting `mathspacing=tight` saves space by typesetting mathematical expressions denser. Figure 3 shows how setting `mathdisplays=tight` removes the space around mathematical displays (e.g., `\[...\]` or `\begin{equation}...\end{equation}`). Figure 4 shows how setting `wordspacing=tight` saves space by typesetting words closer together. Figure 5 shows how setting `tracking=tight` saves space by typesetting the characters within a word closer together. Figure 6 shows how setting `charwidths=tight` saves space by narrowing the individual character glyphs without affecting the font’s point size (height) or amount of white space. Finally, Figure 7 shows how setting `leading=tight` saves space by removing white space between adjacent lines of text. Again, these techniques are shown with their default parameters, which can be adjusted if desired.

While Figure 1 through Figure 7 each illustrate a single space-saving technique, Figure 8 on page 30 demonstrates that when multiple techniques are used in combination, the benefits are essentially additive.

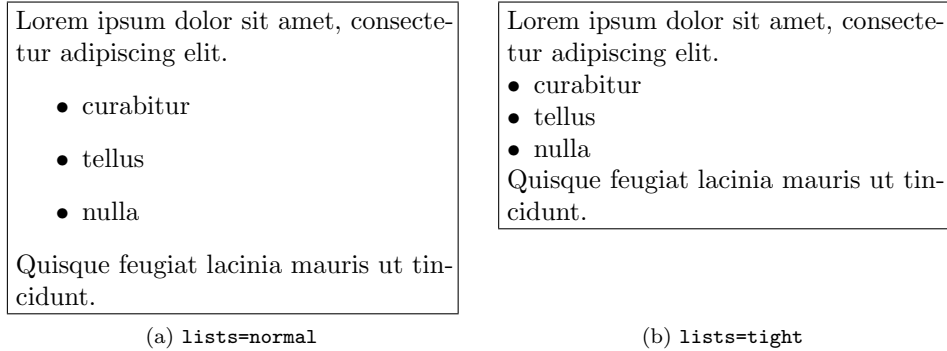


Figure 1: Effect of the `lists` option

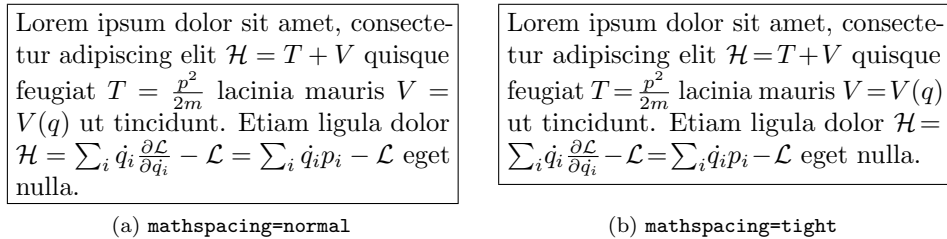


Figure 2: Effect of the `mathspacing` option

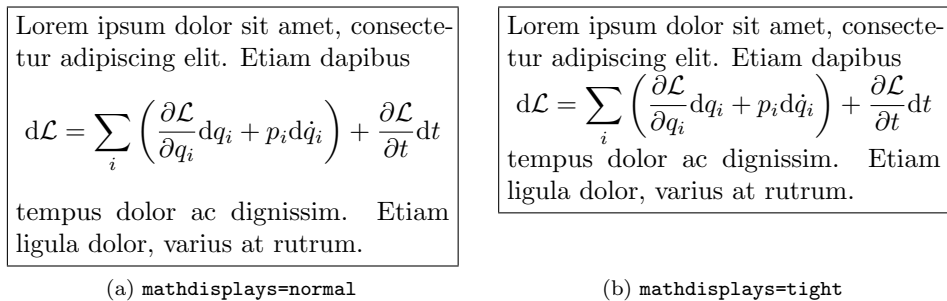


Figure 3: Effect of the `mathdisplays` option

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(a) `wordspacing=normal`

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(b) `wordspacing=tight`

Figure 4: Effect of the `wordspacing` option

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(a) `tracking=normal`

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(b) `tracking=tight`

Figure 5: Effect of the `tracking` option

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(a) `charwidths=normal`

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(b) `charwidths=tight`

Figure 6: Effect of the `charwidths` option

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(a) `leading=normal`

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(b) `leading=tight`

Figure 7: Effect of the `leading` option

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(a) `all=normal`

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(b) `wordspacing=tight, tracking=tight, charwidths=tight, leading=tight`

Figure 8: Combined effect of using multiple options

## Change History

v1.0	General: Initial version . . . . .	1	v1.3	General: Added support for narrowing font widths . . . . .	19
v1.1	<code>thebibliography</code> : Modified to test for <code>\chapter</code> , not <code>\bibname</code> . . . . .	20	v2.0	General: Added package options for altering various formatting parameters . . . . .	13
v1.2	General: Added support for reducing paragraph looseness . . . . .	18	Added support for reducing inter-character spacing . . . . .	19	
	Made the top margin consistent with the other margins and allocated space for the footer . . . . .	15	Added support for reducing inter-word spacing . . . . .	20	
	<code>thebibliography</code> : Modified to use the more robust <code>\@ifundefined</code> macro to test for the existence of <code>\chapter</code> . . . . .	20	Made <code>savetrees.bib</code> work independently of <code>savetrees.sty</code> by having it define <code>\savetreesbibnote</code> if not already defined . . . . .	24	
v1.2a	General: Appended <code>\relax</code> to <code>\looseness=-1</code> to avoid discarding any leading digits appearing in a paragraph . . . . .	19	Removed the awkward-to-use <code>makethin</code> script now that the <code>microtype</code> package can shrink character widths more automat-		

ically	7	v2.2	General: Disabled tracking's effect except when called from pdfL <sup>A</sup> T <sub>E</sub> X, and disabled charwidths's effect except when called from either pdfL <sup>A</sup> T <sub>E</sub> X or LuaL <sup>A</sup> T <sub>E</sub> X	1
v2.1				
General: Added support for removing vertical space around displayed mathematics	23			
Added support for squeezing space out of mathematical expressions	22	v2.3	General: Added support for allowing page breaks within Bibl <sub>at</sub> ex bibliographies	22
Introduced the <code>subtle</code> , <code>moderate</code> , and <code>extreme</code> package options	12		Included style files for Bibl <sub>at</sub> ex	25
<code>description</code> : Reduced vertical space before and within the list	17		Made <code>bibliography=tight</code> work with Bibl <sub>at</sub> ex, not just BiB <sub>T</sub> E <sub>X</sub>	21
<code>enumerate</code> : Reduced vertical space before the list	17		<code>thebibliography</code> : Reduced club and widow penalties from 4000 to 150	21
<code>itemize</code> : Reduced vertical space before the list	16			

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Numbers written in *italic* refer to the page where the corresponding entry is described; numbers underlined refer to the code line of the definition; numbers in *roman* refer to the code lines where the entry is used.

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