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 LaTeX document. Admittedly, this makes the document far less attractive. Nevertheless, savetrees is 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 a conference or journal submission.

To use savetrees, simply place

```
\usepackage{savetrees}
```

in your document's preamble. This enables all of the space-saving techniques of which savetrees is capable and should make your document considerably shorter. The longer the document, the greater the space savings can be expected to be. Often, however, savetrees makes the document unacceptably ugly; or it may violate some imposed formatting restriction (e.g., margin width or paragraph indentation); or, even worse, certain space-saving techniques may be incompatible with the document class or another package and produce a LaTeX error. savetrees therefore provides the ability to selectively enable and disable space-saving techniques via package options. For example,

```
\usepackage[all=normal,floats=tight,leading=tight,%
  paragraphs=tight,charwidths=tight,tracking=tight,%
  wordspacing=tight]{savetrees}
```

or, more tersely,

```
\usepackage[all=normal,floats,leading,paragraphs,%
  charwidths,tracking,wordspacing]{savetrees}
```

first turns off *all* of savetrees's space-saving techniques then turns on the floats, leading, paragraphs, charwidths, tracking, and wordspacing techniques, which are all more-or-less "safe" techniques. These are described in the following section.

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[*] This document corresponds to savetrees v2.0, dated 2011/05/14.

2 Usage

Table 1 on the following page describes savetrees's main package options and summarizes 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 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 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. If only a few space-saving techniques should be enabled, it may be more convenient to specify `all=normal` followed by a list of options set to `tight` than to specify `normal` typesetting for a large number of options. The arguments passed to `\usepackage` are processed left-to-right.

The options in Table 1 are presented in roughly decreasing order of subtlety. If savetrees's default options produce too hideous a result, try incrementally setting the options at the bottom of the table (excluding all) to `normal`, and see if that 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 `bibliography=normal`, then `sections=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 table downwards: `paragraphs=tight`, then `floats=tight`, then `bibnotes=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 2 on page 4 lists and describes these package options. As an example, LaTeX's normal line height is defined to have a value of 1.0. When savetrees is loaded with `leading=tight` (the default), Table 2 indicates that the line height is reduced to 90% of that. Additionally including `leadingfraction=0.95` on the `\usepackage` line increases the line height to 95% of 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 pdfLaTeX. The charwidths option requires either pdfLaTeX or luaLaTeX. For both options, pdfLaTeX must be in PDF mode, not DVI mode. See the microtype documentation for additional (and possibly more up-to-date) information.

Table 1: savetrees package options for enabling/disabling space-saving techniques

Option	Space-saving technique	Implementation
paragraphs	Discourage TeX from allowing the last line of a paragraph to contain only a single word.	Reassign `\looseness`.
floats	Relax float placement (more floats per page, increased ability to share pages with text, etc.).	Reassign LaTeX 2_ε float variables.
bibnotes	Ignore `NOTE` fields in the bibliography.	Pass information to `savetrees.bst`.
wordspacing	Reduce the amount of space between words.	Reassign `\fontdimen2`.
tracking	Reduce the amount of space between characters.	Pass options to the microtype package.
charwidths	Allow character glyphs to be drawn slightly narrower than normal.	Pass options to the microtype package.
leading	Reduce interline spacing.	Reassign `\baselinestretch`.
indent	Decrease paragraph indentation.	Reassign `\parindent`.
lists	Remove both indentation and inter-item spacing from the various list environments.	Redefine the `itemize`, `enumerate`, and `description` environments.
title	Typeset the document title with smaller fonts and with less surrounding whitespace.	Redefine `\maketitle`.
sections	Typeset section titles smaller and with less surrounding whitespace.	Pass options to the titlesec package.
bibliography	Typeset the bibliography in a smaller font and with no inter-item spacing.	Redefine `thebibliography`.
margins	Reduce the page margins.	Pass options to the geometry package.
all	Perform all of the above.	

Table 2: savetrees package options for refining the way space is saved

Option	Description	Requires tight	Default
charwidthfraction	Fraction of normal character widths	charwidths	0.95
leadingfraction	Fraction of normal line height	leading	0.9
marginwidth	Width of the page margins	margins	1.5cm
parindent	Paragraph indentation	indent	1em
trackingfraction	Fraction of normal inter-character spacing	tracking	0.975
wordspacingfraction	Fraction of normal inter-word spacing	wordspacing	0.8

3 Abbreviating bibliographic information

One of the advantages of a tool like BibTeX 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 BibTeX style file, savetrees.bst, which exhibits the following salient differences from plain.bst:

- Abbreviations are used wherever possible:

chapter	$\Longrightarrow$	chap.
edition	$\Longrightarrow$	ed.
editor *or* editors	$\Longrightarrow$	ed. *or* eds.
January, February, . . .	$\Longrightarrow$	Jan., Feb., . . .
page *or* pages	$\Longrightarrow$	p. *or* pp.
Technical Report	$\Longrightarrow$	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* BIBTEX 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 BIBTEX 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 Rafaella 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.

As of version 2.0 of `savetrees`, `savetrees.bib` 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 LaTeX newcomers who want to learn more about fine-tuning document formatting.

```
1 ⟨*package⟩
```

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.

\st@margin@width   When `margins=tight`, `\st@margin@width` 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.

```
2 \newcommand*{\st@margin@width}{1.5cm}
```

\st@parindent   The standard LaTeX classes (`article`, `report`, and `book`) define paragraph indentation as follows. If `twocolumn` is in effect, `\parindent` is set to 1 em. Otherwise, if the base font size is 10 pt., `\parindent` is set to 15 pt.; if the base font size is 11 pt., `\parindent` is set to 17 pt.; and if the base font size is 12 pt., `\parindent` is set to 1.5 em. When `indent=tight`, savetrees uses a default of 1 em—approximately a third of the no-savetrees value—regardless of font size.

```
3 \newcommand*{\st@parindent}{1em}
```

\st@baselinestretch   Depending on font size, the standard LaTeX classes (`article`, `report`, and `book`) 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 `leading=tight`, savetrees reduces the line spacing to 90% of normal or an average of about 1.3 pt. less lead than LaTeX's defaults: 10/10.8, 11/12.24, or 12/13.05. 90% gives very good compression but still prevents descenders from running into successive ascenders.

```
4 \newcommand*{\st@baselinestretch}{0.9}
```

\st@char@shrink   When `charwidths=tight`, savetrees 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.

```
5 \newcommand*{\st@char@shrink}{50}
```

\st@cspace@shrink   savetrees reduces tracking (inter-character spacing) when `tracking=tight`. 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.

```
6 \newcommand*{\st@cspace@shrink}{-25}
```

\st@wspace@factor savetrees reduces inter-word spacing when `wordspacing=tight`. 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.

```
7 \newcommand*{\st@wspace@factor}{0.8}
```

4.2   Option processing

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.

```
8 \RequirePackage{xkeyval}
```

\st@more@packages
\st@RequirePackage   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 LaTeX 2ε to eventually pass the given arguments, if any, to the package.

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

```
10 \newcommand*{\st@RequirePackage}[2][]{%
11   \PassOptionsToPackage{#1}{#2}%
12   \@cons\st@more@packages{{#2}}%
13 }
```

```
14 \AtEndOfPackage{%
15   \let\@elt=\RequirePackage
16   \st@more@packages
17   \let\@elt=\relax
18 }
```

\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.

```
19 \newcommand*{\st@define@option}[1]{%
20   \expandafter\newif\csname if@st@tight@#1\endcsname
21   \csname @st@tight@#1true\endcsname
22   \define@choicekey{savetrees}{#1}[\st@arg\st@arg@num]{tight,normal}[tight]{%
23     \ifnum\st@arg@num=0
24       \csname @st@tight@#1true\endcsname
25     \else
26         \csname @st@tight@#1false\endcsname
```

```
27    \fi
28  }%
29  \DeclareOptionX{#1}[tight]{\csname KV@savetrees@#1\endcsname{##1}}%
30 }
```

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
\@st@tight@sectionstrue
\@st@tight@sectionsfalse

The **sections** package option enables or disables **savetrees**'s modifications to section titles by setting \@st@tight@sectionstrue or \@st@tight@sectionsfalse, respectively.

```
31 \st@define@option{sections}
```

\if@st@tight@margins
\@st@tight@marginstrue
\@st@tight@marginsfalse

The **margins** package option enables or disables **savetrees**'s modifications to page margins by setting \@st@tight@marginstrue or \@st@tight@marginsfalse, respectively.

```
32 \st@define@option{margins}
```

\if@st@tight@lists
\@st@tight@liststrue
\@st@tight@listsfalse

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.

```
33 \st@define@option{lists}
```

\if@st@tight@floats
\@st@tight@floatstrue
\@st@tight@floatsfalse

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.

```
34 \st@define@option{floats}
```

\if@st@tight@indent
\@st@tight@indenttrue
\@st@tight@indentfalse

The **indent** package option enables or disables **savetrees**'s modifications to paragraph indentation by setting \@st@tight@indenttrue or \@st@tight@indentfalse, respectively.

```
35 \st@define@option{indent}
```

\if@st@tight@title
\@st@tight@titletrue
\@st@tight@titlefalse

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

\if@st@tight@leading
\@st@tight@leadingtrue
\@st@tight@leadingfalse

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.

```
37 \st@define@option{leading}
```

`\if@st@tight@paragraphs`
`\@st@tight@paragraphstrue`
`\@st@tight@paragraphsfalse`
	The **paragraphs** package option enables or disables **savetrees**'s modifications to TeX's paragraph looseness (i.e., the number of lines by which TeX is instructed to shrink each paragraph) by setting `\@st@tight@paragraphstrue` or `\@st@tight@paragraphsfalse`, respectively.

```
38 \st@define@option{paragraphs}
```

`\if@st@tight@charwidths`
`\@st@tight@charwidthstrue`
`\@st@tight@charwidthsfalse`
	The **charwidths** package option enables or disables **savetrees**'s modifications to character width by setting `\@st@tight@charwidthstrue` or `\@st@tight@charwidthsfalse`, respectively.

```
39 \st@define@option{charwidths}
```

`\if@st@tight@tracking`
`\@st@tight@trackingtrue`
`\@st@tight@trackingfalse`
	The **tracking** package option enables or disables **savetrees**'s modifications to tracking (spacing between letters) by setting `\@st@tight@trackingtrue` or `\@st@tight@trackingfalse`, respectively.

```
40 \st@define@option{tracking}
```

`\if@st@tight@wordspacing`
`\@st@tight@wordspacingtrue`
`\@st@tight@wordspacingfalse`
	The **wordspacing** package option enables or disables **savetrees**'s modifications to inter-word spacing by setting `\@st@tight@wordspacingtrue` or `\@st@tight@wordspacingfalse`, respectively.

```
41 \st@define@option{wordspacing}
```

`\if@st@tight@bibliography`
`\@st@tight@bibliographytrue`
`\@st@tight@bibliographyfalse`
	The **bibliography** package option enables or disables **savetrees**'s modifications to bibliography formatting by setting `\@st@tight@bibliographytrue` or `\@st@tight@bibliographyfalse`, respectively.

```
42 \st@define@option{bibliography}
```

`\if@st@tight@bibnotes`
`\@st@tight@bibnotestrue`
`\@st@tight@bibnotesfalse`
	The **bibnotes** package option conditionally excludes or includes NOTE fields when using `savetrees.bst` by setting `\@st@tight@bibnotestrue` or `\@st@tight@bibnotesfalse`, respectively.

```
43 \st@define@option{bibnotes}
```

`\st@arg` `\st@arg@num`	For the document author's convenience, we define an `all` meta-option that can be used to enable or disable all of **savetrees**'s space-saving features at once.

```
44 \define@choicekey{savetrees}{all}[\st@arg\st@arg@num]{tight,normal}[tight]{%
45   \ifnum\st@arg@num=0
46     \@st@tight@sectionstrue
47     \@st@tight@marginstrue
48     \@st@tight@liststrue
49     \@st@tight@floatstrue
50     \@st@tight@indenttrue
51     \@st@tight@titletrue
52     \@st@tight@leadingtrue
53     \@st@tight@paragraphstrue
54     \@st@tight@charwidthstrue
55     \@st@tight@trackingtrue
56     \@st@tight@wordspacingtrue
57     \@st@tight@bibliographytrue
```

```
58     \@st@tight@bibnotestrue
59   \else
60     \@st@tight@sectionsfalse
61     \@st@tight@marginsfalse
62     \@st@tight@listsfalse
63     \@st@tight@floatsfalse
64     \@st@tight@indentfalse
65     \@st@tight@titlefalse
66     \@st@tight@leadingfalse
67     \@st@tight@paragraphsfalse
68     \@st@tight@charwidthsfalse
69     \@st@tight@trackingfalse
70     \@st@tight@wordspacingfalse
71     \@st@tight@bibliographyfalse
72     \@st@tight@bibnotesfalse
73   \fi
74 }
75 \DeclareOptionX{all}[tight]{\KV@savetrees@all{#1}}
```

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.

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

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

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

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

```
78 \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.

```
79 \DeclareOptionX{charwidthfraction}{%
80   \@tempdima=#1pt
81   \multiply\@tempdima by -1000
82   \advance\@tempdima by 1000pt
83   \divide\@tempdima by 65536
84   \@tempcnta=\@tempdima
85   \xdef\st@char@shrink{\the\@tempcnta}%
86 }
```

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.

```
87 \DeclareOptionX{trackingfraction}{%
```

```
88    \@tempdima=#1pt
89    \advance\@tempdima by -1pt
90    \multiply\@tempdima by 1000
91    \divide\@tempdima by 65536
92    \@tempcnta=\@tempdima
93    \xdef\st@cspace@shrink{\the\@tempcnta}%
94 }
```

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

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

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.

```
96 \newcommand*{\st@mark@as@obsolete}[2]{%
97    \define@key{savetrees}{#1}[tight]{%
98      \PackageError{savetrees}{Package option '#1' is no longer supported}{%
99        Rather than '#1', please specify '#2=normal'.\MessageBreak
100       Instead of enabling all features by default and letting the\MessageBreak
101       user selectively disable them, savetrees now provides the\MessageBreak
102       ability to turn features on or off as desired, including all\MessageBreak
103       features en masse.}%
```

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

```
104      \csname @st@tight@#2false\endcsname
105    }%
106    \DeclareOptionX{#1}[tight]{\csname KV@savetrees@#1\endcsname{##1}}%
107 }
```

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

```
108 \st@mark@as@obsolete{normalsections}{sections}
109 \st@mark@as@obsolete{normalmargins}{margins}
110 \st@mark@as@obsolete{normallists}{lists}
111 \st@mark@as@obsolete{normalfloats}{floats}
112 \st@mark@as@obsolete{normalindent}{indent}
113 \st@mark@as@obsolete{normaltitle}{title}
114 \st@mark@as@obsolete{normalleading}{leading}
115 \st@mark@as@obsolete{normallooseness}{paragraphs}
116 \st@mark@as@obsolete{normalcharwidths}{charwidths}
117 \st@mark@as@obsolete{normalbib}{bibliography}
118 \st@mark@as@obsolete{normalbibnotes}{bibnotes}
```

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

```
119 \ProcessOptionsX\relax
```

4.3   Section titles

The LaTeX default is to typeset section titles in a large font and with significant surrounding whitespace. 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.

```
120 \if@st@tight@sections
121    \st@RequirePackage[tiny,compact]{titlesec}
122 \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 LaTeX'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 LaTeX's original ones. Note that we accept geometry's default of zero space allocated to marginal notes.

```
123 \if@st@tight@margins
124    \st@RequirePackage[lmargin=\st@margin@width,
125                       rmargin=\st@margin@width,
126                       tmargin=\st@margin@width,
127                       bmargin=\st@margin@width,
128                       includefoot,
129                       footskip=2ex]{geometry}
130 \fi
```

4.5   List spacing

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

```
131 \if@st@tight@lists
```

The calc package helps simplify our list redefinitions.

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

itemize   Except where indicated, the following code was taken directly from LaTeX 2_ε's definition of the itemize environment, in ltlists.dtx:

```
133    \def\itemize{%
134      \ifnum \@itemdepth >\thr@@\@toodeep\else
135        \advance\@itemdepth\@ne
136        \edef\@itemitem{labelitem\romannumeral\the\@itemdepth}%
137        \expandafter
```

```
138        \list
139          \csname\@itemitem\endcsname
140          {\def\makelabel##1{\hss\llap{##1}}%
```

The following lines have been modified from the original.

```
141            \settowidth{\leftmargin}{\csname\@itemitem\endcsname}%
142            \addtolength{\leftmargin}{\labelsep * \@itemdepth}%
143            \setlength{\topsep}{4pt plus 1pt minus 2pt}%
144            \setlength{\itemsep}{0pt}%
145            \setlength{\parsep}{0pt}%
146            \setlength{\listparindent}{\st@parindent}%
```

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

```
147        }%
148      \fi}
```

Except where indicated, the following code was taken directly from LaTeX 2$_\varepsilon$'s definition of the `enumerate` environment, in `ltlists.dtx`:

```
149    \def\enumerate{%
150      \ifnum \@enumdepth >\thr@@\@toodeep\else
151        \advance\@enumdepth\@ne
152        \edef\@enumctr{enum\romannumeral\the\@enumdepth}%
153          \expandafter
154          \list
155            \csname label\@enumctr\endcsname
156            {\usecounter\@enumctr\def\makelabel##1{\hss\llap{##1}}}%
```

The following lines have been modified from the original.

```
157              \settowidth{\leftmargin}{\csname label\@enumctr\endcsname}%
158              \addtolength{\leftmargin}{\labelsep * \@enumdepth}%
159              \setlength{\topsep}{4pt plus 1pt minus 2pt}%
160              \setlength{\itemsep}{0pt}%
161              \setlength{\parsep}{0pt}%
162              \setlength{\listparindent}{\st@parindent}%
```

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

```
163        }
164      \fi}
```

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 em.

```
165    \renewenvironment{description}{%
166      \begin{list}{}{\setlength{\leftmargin}{1em}%
167                     \labelwidth\z@ \itemindent-\leftmargin
168                     \let\makelabel\descriptionlabel}%
169    }{%
170      \end{list}
171    }
172 \fi
```

13

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    173 \if@st@tight@floats
    \dbltopfraction    174   \renewcommand{\topfraction}{0.85}
\dblfloatpagefraction  175   \renewcommand{\bottomfraction}{0.85}
                       176   \renewcommand{\textfraction}{0.1}
                       177   \renewcommand{\floatpagefraction}{0.85}
                       178   \renewcommand{\dbltopfraction}{0.85}
                       179   \renewcommand{\dblfloatpagefraction}{.85}
                       180   \setcounter{topnumber}{25}
                       181   \setcounter{bottomnumber}{25}
                       182   \setcounter{totalnumber}{25}
                       183   \setcounter{dbltopnumber}{25}
                       184 \fi
```

4.7   Paragraph indentation

LaTeX normally provides approximately 1.5 em of indentation at the start of each
paragraph. We can save a little space by slightly reducing the indentation amount.

```
185 \if@st@tight@indent
186   \setlength{\parindent}{\st@parindent}
187 \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
whitespace above the title and lessen the whitespace below the title.

```
188 \if@st@tight@title
```

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

```
189   \def\@maketitle{%
190     \newpage
191     \null
192     \begin{center}%
193       \let \footnote \thanks
194       {\large \textbf{\@title}\par}
195       \vskip 0.5\baselineskip
196       \begin{tabular}[t]{c}%
197         \@author
198       \end{tabular}\par
199       \vskip 0.5\baselineskip
200       \@date
201     \end{center}%
```

14

```
202    \par
203    \vskip \baselineskip
204  }
205 \fi
```

4.9 Interline spacing

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

```
206 \if@st@tight@leading
207  \renewcommand{\baselinestretch}{\st@baselinestretch}
208 \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 TEX's \looseness primitive, which encourages TEX 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 whitespace 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:

```
209 \if@st@tight@paragraphs
210  \let\markeverypar\everypar
211  \newtoks\everypar
212  \everypar\markeverypar
213  \markeverypar{\the\everypar\looseness=-1\relax}
214 \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 pdfTEX and luaTEX. 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 whitespace. 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%.

```
215 \if@st@tight@charwidths
216    \st@RequirePackage[stretch=0,shrink=\st@char@shrink]{microtype}
217 \fi
```

4.12   Inter-character spacing

The microtype package provides LaTeX support for pdfTeX'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.

```
218 \if@st@tight@tracking
219    \st@RequirePackage[letterspace=\st@cspace@shrink,tracking=all]{microtype}
220 \fi
```

4.13   Inter-word spacing

Any font used by TeX 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 LaTeX 2$_\varepsilon$'s font-loading mechanism. Whenever a new font is loaded, we specify that the inter-word spacing for that font should be reduced.

```
221 \if@st@tight@wordspacing
222    \g@addto@macro\define@newfont{%
223       \fontdimen2\font@name=\st@wspace@factor\fontdimen2\font@name
224    }%
```

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

```
225    \fontdimen2\font@name=\st@wspace@factor\fontdimen2\font@name
226 \fi
```

4.14   Bibliography formatting

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

```
227 \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.

```
228    \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.

```
229      \@ifundefined{chapter}{%
230        \section*{\refname
231          \@mkboth{\MakeUppercase\refname}{\MakeUppercase\refname}}%
232      }{%
233        \chapter*{\bibname
234          \@mkboth{\MakeUppercase\bibname}{\MakeUppercase\bibname}}%
235      }%
```

Back to the original code...

```
236      \list{\@biblabel{\@arabic\c@enumiv}}%
237          {\settowidth\labelwidth{\@biblabel{#1}}%
238           \leftmargin\labelwidth
239           \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.

```
240           \setlength{\parsep}{0pt}%
241           \setlength{\itemsep}{1pt}%
```

Back to the original code...

```
242           \@openbib@code
243           \usecounter{enumiv}%
244           \let\p@enumiv\@empty
245           \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.

```
246           \small
```

We finish up using the original code.

```
247           \sloppy
248           \clubpenalty4000
249           \@clubpenalty \clubpenalty
250           \widowpenalty4000%
251           \sfcode`\.\@m
252      }{%
253        \def\@noitemerr
254            {\@latex@warning{Empty `thebibliography' environment}}%
255        \endlist
256      }
257 \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. Howevever, setting `bibnotes=normal` indicates that `\savetreesbibnote` should instead output its argument as is.

```
258 \if@st@tight@bibnotes
```

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

```
259    \newcommand{\savetreesbibnote}[1]{\@gobble}
260 \else
261    \newcommand{\savetreesbibnote}[1]{#1}
262 \fi

263 ⟨/package⟩
```

5   Implementation of `savetrees.bst`

In addition to a LaTeX 2$_\varepsilon$ style, the savetrees package also includes a BibTeX 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.

```
264 ⟨∗bibstyle⟩
```

$$\vdots$$

(443 lines of code omitted)

$$\vdots$$

`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`.

```
265 FUNCTION {format.note}
266 {
267  note empty$
268     { "" }
269     { "\savetreesbibnote{"
270       note #1 #1 substring$
271       duplicate$ "{" =
272         'skip$
273         { output.state mid.sentence =
274           { "l" }
```

```
275            { "u" }
276          if$
277          change.case$
278          }
279       if$
280       note #2 global.max$ substring$ *
281       "}" * *
282     }
283   if$
284 }
```

$$\vdots$$

(914 lines of code omitted)

$$\vdots$$

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

```
285 FUNCTION {begin.bib}
286 { preamble$ empty$
287     'skip$
288     { preamble$ write$ newline$ }
289   if$
290   "\begin{thebibliography}{"  longest.label  * "}" *
291   write$ newline$
292   "\providecommand*{\selectlanguage}[1]{\relax}%"
293   write$ newline$
294   "\providecommand*{\savetreesbibnote}[1]{#1}%"
295   write$ newline$
296 }
```

$$\vdots$$

(13 lines of code omitted)

$$\vdots$$

297 ⟨/bibstyle⟩

A   Average character widths of common fonts

Question: What's the narrowest font?

Answer: It depends upon how you measure. Table 3 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.

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

Table 3: Common fonts sorted by increasing width

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 pdfLaTeX, so that program should be used if possible to maximize the space-saving achievable with savetrees.

B   Gallery of space-saving techniques

Figure 1 through Figure 5 on pages 21–23 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 2 on page 4 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 whitespace above, below, and within list environments (in this case, the `itemize` environment). Figure 2 shows how setting `wordspacing=tight` saves space by typesetting words closer together. Figure 3 shows how setting `tracking=tight` saves space by typesetting the characters within a word closer together. Figure 4 shows how setting `charwidths=tight` saves space by narrowing the individual character glyphs without affecting the font's point size (height) or amount of whitespace. Finally, Figure 5 shows how setting `leading=tight` saves space by removing whitespace 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 5 each illustrate a single space-saving technique, Figure 6 on page 23 demonstrates that when multiple techniques are used in combination, the benefits are essentially additive.

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

- curabitur

- tellus

- nulla

Quisque feugiat lacinia mauris ut tincidunt.

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

- curabitur
- tellus
- nulla

Quisque feugiat lacinia mauris ut tincidunt.

Figure 1: Effect of the `lists` option

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Figure 2: Effect of the `wordspacing` option

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(a) `tracking=normal`

(b) `tracking=tight`

Figure 3: Effect of the `tracking` option

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(a) `charwidths=normal`

(b) `charwidths=tight`

Figure 4: Effect of the `charwidths` option

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(a) `leading=normal`

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(b) `leading=tight`

Figure 5: 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 6: Combined effect of using multiple options

Change History

Index

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.