

# The dozenal Package

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## Abstract

The **dozenal** package provides some simple mechanisms for working with the dozenal (duodecimal or “base 12”) numerical system. It redefines all basic L<sup>A</sup>T<sub>E</sub>X counters, provides a command for converting arbitrary decimal numbers into dozenal, and provides new, real Metafont characters for ten and eleven, though the commands for producing them can be redefined to produce any figure. As of v2.0, it also includes Type 1 versions of the fonts, used automatically whenever T1 encoding is selected for the document. This package uses the `\basexii` algorithm by David Kastrup.

## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Usage</b>	<b>2</b>
<b>3</b>	<b>Implementation</b>	<b>3</b>

## 1 Introduction

While most would probably call it at best overoptimistic and at worst foolish, some people (the author included) do still find themselves attracted to the dozenal (base-twelve) system. These people, however, have been pretty hard up<sup>1</sup> in the L<sup>A</sup>T<sub>E</sub>X world. There is no package file available which produces dozenal counters, like page and chapter numbers, nor were there *any* (I made a pretty diligent search) dozenal characters for ten and eleven, leaving dozenalists forced to use such makeshift ugliness as the “X/E” or “T/E” or “\*/#” or whatever other standard they decided to use. While this sort of thing may be acceptable in ASCII, it’s absolutely unacceptable in a beautiful, typeset document.

Enter the **dozenal** package. This package automates all the messiness of being a dozenalist and using L<sup>A</sup>T<sub>E</sub>X. It redefines all the counters (though you’ll have to redefine them yourself if you’re using your own), provides an algorithm (generously

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<sup>1</sup>This is an Americanism for “out of luck” or “in difficult circumstances,” for those who do not know.

donated by the intrepid David Kastrup) for converting arbitrary positive whole numbers into dozenal (this is eTeX, but all modern distributions will compile that), and finally, it includes original dozenal characters, specifically designed to blend in well with Knuth's Computer Modern fonts, though they should do fine with the more common body fonts, as well.

This document was typeset in accordance with the L<sup>A</sup>T<sub>E</sub>X DOCSTRIP utility.

## 2 Usage

The `dozenal` package provides four new commands (though I can only take credit for two of them). The first, and by far the most important given the purpose and content of this package, is `\basexii`. This is a very simple command which takes the following structure:

```
\basexii{<number>}{<ten symbol>}{<eleven symbol>}
```

What the above means is that the command is `\basexii` and it takes three mandatory arguments: first, the number to be converted into dozenal; second, the symbol that should be used for ten; and third, the symbol that should be used for eleven. This number should be positive and whole; that is, it should be zero or higher, and it should not contain a fractional part. T<sub>E</sub>X is a typesetting program, after all; if you want a robust decimal to dozenal converter, there are many options that any dozenalists caring enough to use this package will already know about.

This `\basexii` algorithm was produced by David Kastrup, well known and admired in the T<sub>E</sub>X world for his many useful packages and other contributions. He posted this algorithm on comp.text.tex; it is included here with his kind and generous permission.

That one would want to use the same ten and eleven symbols throughout a document seems a reasonable assumption; therefore, I have provided a simplified version of the `\basexii` command, `\dozens`. `\dozens` takes only a single argument, the number to be converted; the ten and eleven symbols used are those produced by the commands `\x` and `\e`, to which we'll get in a moment.

`\x` and `\e` are the commands used to quickly and easily access the symbols for ten and eleven without having to use active characters (the T<sub>E</sub>X gurus will know what that means; if you don't know, that's okay; you don't need to to use this package effectively). In any case, `\x` and `\e` default to using the special dozenal characters that are part of this package; they could be easily redefined if for some reason you don't like the Pitman characters (which this package, and the Dozenal Society of Great Britain, prefer), in the following manner:

```
\renewcommand\x{X}
```

Or whichever characters you like to use. If you prefer the Dozenal Society of America's proposed characters (a stylized X and E), then this package will disappoint you. May I suggest `\chi` ( $\chi$ ) and `\xi` ( $\xi$ ) as a stopgap while you locate or produce real characters of your own? Sorry; I'm an American myself, but I much prefer the Pitman characters for a variety of reasons (feel free to email me if you

care), and creating fonts in METAFONT, even small and inconsequential ones like this, is too much work for characters that I don't even like.

The `dozenal` package also redefines all the standard L<sup>A</sup>T<sub>E</sub>X counters, such as `section` and `enumii`. If you've defined your own counters, you'll need to define them yourself; however, this is an easy matter:

```
\renewcommand\thecounter{\basexii{\arabic{counter}}{\x}{\e}}
```

For example. Of course, you can fill in the `\x` and `\e` with whatever you want (though it would make more sense to simply redefine `\x` and `\e`, so that all the counters would use the same characters), or you could use the `\dozens` command instead. Whatever your pleasure might be.

### 3 Implementation

First, we name the package that we provide. This is not exactly the most difficult part of the code.

```
1 \ProvidesPackage{dozenal}[2011/11/05 v3.2 support for dozenal fonts]
```

Now we need to make sure that we have `fixltx2e` loaded, so that the `\TextorMath` magic will work.

```
2 \RequirePackage{fixltx2e}
```

Now we ensure that `ifpdf` is loaded, so that we can test for pdf or dvi modes.

```
3 \RequirePackage{ifpdf}
```

We then define the font that we're using for our METAFONT-produced Pitman characters. Incidentally, we also define the command `\doz`, though I can't foresee any decent use for it except in packages and preambles; it is then used to define `\x` and `\e`, which provide the ten and eleven symbols for all the counter redefinitions. This includes definitions for both T1 and OT1 encodings, so it will work with either.

```
4 \DeclareFontFamily{OT1}{dozch}{}
5 \DeclareFontShape{OT1}{dozch}{m}{n}{<-7> dozchars6 <7> dozchars7 <8> dozchars8 <9> dozchars9 <10> dozchars10 <11> dozchars11}{}
6 \DeclareFontShape{OT1}{dozch}{b}{n}{<-> dozchb10 }{}
7 \DeclareFontShape{OT1}{dozch}{bx}{n}{<-6> dozchbx6 <7> dozchbx7 <8> dozchbx8 <9> dozchbx9 <10-11> dozchbx10 }{}
8 \DeclareFontShape{OT1}{dozch}{m}{sl}{<-8> dozchsl8 <9> dozchsl9 <10-11> dozchsl10 <12-13> dozchsl12 }{}
9 \DeclareFontShape{OT1}{dozch}{bx}{sl}{<-> dozchbxsl10 }{}
10 \DeclareFontShape{OT1}{dozch}{m}{it}{<-7> dozchit7 <8> dozchit8 <9> dozchit9 <10-11> dozchit10 }{}
11 \DeclareFontShape{OT1}{dozch}{bx}{it}{<-> dozchbxi10 }{}
12 \ifpdf
13 \pdfmapfile{=fdz.map}
14 \fi
15 \DeclareFontFamily{T1}{dozch}{}
16 \DeclareFontShape{T1}{dozch}{m}{n}{<-> fdzr8r }{}
17 \DeclareFontShape{T1}{dozch}{bx}{n}{<-> fdzb8r }{}
18 \DeclareFontShape{T1}{dozch}{m}{sl}{<-> fdzs8r }{}
19 \DeclareFontShape{T1}{dozch}{bx}{sl}{<-> fdzbo8r }{}
20 \DeclareFontShape{T1}{dozch}{m}{it}{<-> fdzso8r }{}

```

```

21 \DeclareFontShape{T1}{dozch}{bx}{it}{<-> fdzbi8r }{}
22 \newcommand\doz[1]{\fontfamily{dozch}\selectfont #1}
23 \newcommand\x{\TextOrMath{\protect\doz{X}}{\X}}%
24 \newcommand\e{\TextOrMath{\protect\doz{E}}{\E}}%
25 \DeclareSymbolFont{dozens}{OT1}{dozch}{m}{n}
26 \DeclareMathSymbol{\X}{\mathord}{dozens}{88}
27 \DeclareMathSymbol{\E}{\mathord}{dozens}{69}

```

Then we define our command which will produce the dozenal numbers from decimal sources. This algorithm was taken directly from the publicly available archives of comp.text.tex, where it was posted by the well-known and redoubtable David Kastrup. We also define the `\dozens` command, a simplified `\basexii` (which, in fact, depends utterly upon `\basexii`), just to make it easy for everyone.

```

28 \def\basexii#1#2#3{\ifcase\numexpr(#1)\relax
29 0\or1\or2\or3\or4\or5\or6\or7\or8\or9\or#2\or#3\else
30 \expandafter\basexii\expandafter{\number\numexpr((#1)-6)/12}{#2}{#3}\expandafter\basexii\expandafter
31 \newcommand\dozens[1]{\basexii{#1}{\x}{\e}}

```

Now, of course, we simply redefine all the counters. This covers only those counters included in the basic L<sup>A</sup>T<sub>E</sub>X document classes, however, so if you've written your own, you'll need to redefine them yourself.

This first bit ensures that the counters are redefined even if the command `\mainmatter` is not defined. We have to do this outside of the `\g@addto@macro` below; otherwise, in documents where `\mainmatter` is defined but not used, the counters will not be redefined. This way, they're redefined in all cases.

```

32 \@ifundefined{c@page}{\renewcommand\thepage{\basexii{\value{page}}{\x}{\e}}}
33 \@ifundefined{c@footnote}{\renewcommand\thefootnote{\basexii{\value{footnote}}{\x}{\e}}}
34 \@ifundefined{c@part}{\renewcommand\thepart{\basexii{\value{part}}{\x}{\e}}}
35 \@ifundefined{c@subparagraph}{\renewcommand\thesubparagraph{\basexii{\value{subparagraph}}{\x}{\e}}}
36 \@ifundefined{c@paragraph}{\renewcommand\theparagraph{\basexii{\value{paragraph}}{\x}{\e}}}
37 \@ifundefined{c@equation}{\renewcommand\theequation{\basexii{\value{equation}}{\x}{\e}}}
38 \@ifundefined{c@figure}{\renewcommand\thefigure{\basexii{\value{figure}}{\x}{\e}}}
39 \@ifundefined{c@table}{\renewcommand\thetable{\basexii{\value{table}}{\x}{\e}}}
40 \@ifundefined{c@table}{\renewcommand\thempfootnote{\basexii{\value{mpfootnote}}{\x}{\e}}}
41 \@ifundefined{c@enumi}{\renewcommand\theenumi{\basexii{\value{enumi}}{\x}{\e}}}
42 \@ifundefined{c@enumii}{\renewcommand\theenumii{\basexii{\value{enumii}}{\x}{\e}}}
43 \@ifundefined{c@enumiii}{\renewcommand\theenumiii{\basexii{\value{enumiii}}{\x}{\e}}}
44 \@ifundefined{c@enumiv}{\renewcommand\theenumiv{\basexii{\value{enumiv}}{\x}{\e}}}
45 \@ifundefined{c@chapter}{% if it's undefined
46 \renewcommand\thesection{\basexii{\value{section}}{\x}{\e}}
47 \renewcommand\thesubsection{\thesection.\basexii{\value{subsection}}{\x}{\e}}
48 \renewcommand\thesubsubsection{\thesubsection.\basexii{\value{subsubsection}}{\x}{\e}}
49 } % end undefined
50 {% if it's defined
51 \renewcommand\thechapter{\basexii{\value{chapter}}{\x}{\e}}
52 \renewcommand\thesection{\thechapter.\basexii{\value{section}}{\x}{\e}}
53 \renewcommand\thesubsection{\thesection.\basexii{\value{subsection}}{\x}{\e}}
54 \renewcommand\thesubsubsection{\thesubsection.\basexii{\value{subsubsection}}{\x}{\e}}
55 }%end if chapter's defined

```

Finally, if the “mainmatter” command is used, we need to make sure that it doesn’t mess up our numbering scheme.

```

56 \ifundefined{mainmatter}{}{%
57 \g@addto@macro\mainmatter{%
58 \ifundefined{c@page}{}{\renewcommand\thepage{\basexii{\value{page}}}{\x}{\e}}}
59 \ifundefined{c@footnote}{}{\renewcommand\thefootnote{\basexii{\value{footnote}}}{\x}{\e}}}
60 \ifundefined{c@part}{}{\renewcommand\thepart{\basexii{\value{part}}}{\x}{\e}}}
61 \ifundefined{c@subparagraph}{}{\renewcommand\thesubparagraph{\basexii{\value{subparagraph}}}{\x}{\e}}}
62 \ifundefined{c@paragraph}{}{\renewcommand\theparagraph{\basexii{\value{paragraph}}}{\x}{\e}}}
63 \ifundefined{c@equation}{}{\renewcommand\theequation{\basexii{\value{equation}}}{\x}{\e}}}
64 \ifundefined{c@figure}{}{\renewcommand\thefigure{\basexii{\value{figure}}}{\x}{\e}}}
65 \ifundefined{c@table}{}{\renewcommand\thetable{\basexii{\value{table}}}{\x}{\e}}}
66 \ifundefined{c@table}{}{\renewcommand\thempfootnote{\basexii{\value{mpfootnote}}}{\x}{\e}}}
67 \ifundefined{c@enumi}{}{\renewcommand\theenumi{\basexii{\value{enumi}}}{\x}{\e}}}
68 \ifundefined{c@enumii}{}{\renewcommand\theenumii{\basexii{\value{enumii}}}{\x}{\e}}}
69 \ifundefined{c@enumiii}{}{\renewcommand\theenumiii{\basexii{\value{enumiii}}}{\x}{\e}}}
70 \ifundefined{c@enumiv}{}{\renewcommand\theenumiv{\basexii{\value{enumiv}}}{\x}{\e}}}
71 \ifundefined{c@chapter}{% if it's undefined
72 \renewcommand\thesection{\basexii{\value{section}}}{\x}{\e}}
73 \renewcommand\thesubsection{\thesection.\basexii{\value{subsection}}}{\x}{\e}}
74 \renewcommand\thesubsubsection{\thesubsection.\basexii{\value{subsubsection}}}{\x}{\e}}
75 } % end undefined
76 {% if it's defined
77 \renewcommand\thechapter{\basexii{\value{chapter}}}{\x}{\e}}
78 \renewcommand\thesection{\thechapter.\basexii{\value{section}}}{\x}{\e}}
79 \renewcommand\thesubsection{\thesection.\basexii{\value{subsection}}}{\x}{\e}}
80 \renewcommand\thesubsubsection{\thesubsection.\basexii{\value{subsubsection}}}{\x}{\e}}
81 } % end if it's defined
82 }}

```

And that’s the end. Thanks for reading, folks; please email me with any suggestions or improvements.