LONGDIVISION

Hood Chatham
hood@mit.edu
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The \texttt{LONGDIVISION} package defines two main commands: \texttt{\textbackslash longdivision} and \texttt{\textbackslash intlongdivision}. The usage for both is \texttt{\textbackslash longdivision[⟨options⟩]{⟨dividend⟩}{⟨divisor⟩}}. The difference is that \texttt{\textbackslash longdivision} divides until the remainders repeat or the quotient has too many digits to fit the page, whereas \texttt{\textbackslash intlongdivision} does integer division and leaves the remainder. The command \texttt{\textbackslash longdivisionkeys[⟨options⟩]} is also defined to set default options. At most 20 division steps worth of work will be displayed and at most 60 digits worth of division output will be produced. Thanks to Mike Jenck, Ben McKay, Cameron McLeman, Phelype Oleinik, Maximilian Schmidt, and Yu-Tsung Tai for bug reports and feature requests.

Here is an example usage:

\begin{verbatim}
\longdivision{100}{22}
\quad \intlongdivision{100}{22}
\end{verbatim}

<table>
<thead>
<tr>
<th>\longdivision{100}{22}</th>
<th>\intlongdivision{100}{22}</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.54 \quad 22 \big</td>
<td>100.00 \quad 22 \big</td>
</tr>
<tr>
<td>88 \quad 22 \big</td>
<td>88 \quad 22 \big</td>
</tr>
<tr>
<td>12.0 \quad 88 \quad 22 \big</td>
<td>12 \quad 88 \big</td>
</tr>
<tr>
<td>11.0 \quad 88 \quad 22 \big</td>
<td>88 \quad 22 \big</td>
</tr>
<tr>
<td>1.00 \quad 22 \big</td>
<td>12 \quad 22 \big</td>
</tr>
</tbody>
</table>

These commands have several key-value options:

\texttt{max extra digits = ⟨nonnegative integer⟩}

This key determines the maximum amount of “extra” zeroes to add to the end of the dividend in the process of division – if the quotient has more digits before it repeats, the division will just stop. This is only an option for \texttt{\textbackslash longdivision}, the command \texttt{\textbackslash intlongdivision[⟨dividend⟩]{⟨divisor⟩}} is equivalent to \texttt{\textbackslash longdivision[max extra digits=0]{⟨dividend⟩}{⟨divisor⟩}}. For brevity, this option has the short form where just the value is provided: \texttt{\longdivision[2]{⟨dividend⟩}{⟨divisor⟩}} is the same as \texttt{\longdivision[max extra digits=2]{⟨dividend⟩}{⟨divisor⟩}}.

\begin{verbatim}
\longdivision[max extra digits = 1]{14.1}{7} \quad \longdivision[2]{14.1}{7}
\end{verbatim}

<table>
<thead>
<tr>
<th>\longdivision[max extra digits = 1]{14.1}{7}</th>
<th>\longdivision[2]{14.1}{7}</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.01 \quad 7 \big</td>
<td>14.10 \quad 7 \big</td>
</tr>
<tr>
<td>0.10 \quad 7 \big</td>
<td>0.10 \quad 7 \big</td>
</tr>
<tr>
<td>7 \quad 28 \quad 7 \big</td>
<td>3 \quad 28 \big</td>
</tr>
</tbody>
</table>

\texttt{stage = ⟨nonnegative integer⟩}

This controls how many steps worth of division to do. Thanks to Cam McLeman for suggesting this feature.
\longdivision{stage=0}{5.3}{37} \quad \longdivision{stage=1}{5.3}{37} \quad \longdivision{stage=2}{5.3}{37} \quad \longdivision{stage=3}{5.3}{37} \quad \longdivision{stage=4}{5.3}{37}

\begin{tabular}{l}
37 \longdiv{5.3} \\
\hline
37 \longdiv{5.3} \\
3.7 \longdiv{0.1} \\
\hline
3.7 \longdiv{0.1} \\
3.7 \longdiv{1.6} \\
\hline
1.6 \longdiv{1.48} \\
1.2 \longdiv{1.48} \\
\hline
1.2 \longdiv{1.48} \\
1.2 \longdiv{1.20} \\
\hline
1.2 \longdiv{1.20} \\
1.2 \longdiv{111} \\
\hline
111 \longdiv{90} \\
90 \longdiv{74} \\
\hline
74 \longdiv{16}
\end{tabular}

\begin{itemize}
\item \texttt{style} = \langle \texttt{style} \rangle \\
\text{(initially \texttt{standard})}
\end{itemize}

Control the style for typesetting the result of long division. The options are \texttt{default}, \texttt{standard}, \texttt{tikz}, or \texttt{german}. The option \texttt{default} is the same as \texttt{tikz} if \texttt{TikZ} is loaded and otherwise is the same as \texttt{standard}. You probably should load \texttt{TikZ} because the \texttt{TikZ} version looks significantly better. If you use this option, you'll probably want to set the style once and for all in your preamble with \texttt{\longdivisionkeys{style=\langle \texttt{style} \rangle}}.

\begin{itemize}
\item \texttt{\intlongdivision{style = \texttt{tikz}}{100.0}{13}} \quad \texttt{\intlongdivision{style = \texttt{standard}}{100.0}{13}} \quad \texttt{\intlongdivision{style = \texttt{german}}{100.0}{13}}
\end{itemize}

\begin{itemize}
\item You can define your own style with \texttt{\longdivisiondefinestyle{\langle \texttt{style name} \rangle}{\langle \texttt{code} \rangle}}. In the \texttt{\marg{code}} you can use the commands \texttt{\longdivdivisor} which contains the divisor, \texttt{\longdivdividend} which contains the dividend, \texttt{\longdivquotient} which contains the quotient, \texttt{\longdivwork} which contains the division work and \texttt{\longdivremainder} which contains the remainder. For instance, a simplified version of the \texttt{german} style is:
\begin{verbatim}
\longdivisiondefinestyle{my style}{
  \begin{tabular}{l}
    \longdivdividend : \, \longdivdivisor \, = \longdivquotient \\
    \longdivwork \\
  \end{tabular}
}
\end{verbatim}
\item \texttt{\longdivision{style = my style}{2}{3}}
\end{itemize}

Send me an email if you cannot figure out how to make a style to your liking.

\begin{itemize}
\item \texttt{repeating decimal style} = \langle \texttt{style} \rangle \\
\text{(initially \texttt{overline})}
\end{itemize}
Control the way that repeating decimals are typeset. The options are overline, dots, dots all, parentheses, or none. The default is overline. The parentheses style creates ugly spacing problems and the dots style is insufficiently visible, so the overline style is the best. If you use this option, you'll probably want to set the style once and for all in your preamble with \longdivisionkeys{repeating decimal style=(style)}. Like the style key, this is designed to be extensible. However, the process of creating new repeating decimal styles is a bit involved. Send me an email if you want a new repeating decimal style.

\longdivision[repeating decimal style = overline ]{5.3}{37} \quad \longdivision[repeating decimal style = dots ]{5.3}{37} \quad \longdivision[repeating decimal style = dots all ]{5.3}{37} \quad \longdivision[repeating decimal style = parentheses ]{5.3}{37} \quad \longdivision[repeating decimal style = none ]{5.3}{37}

\begin{tabular}{|c|}
\hline
0.1\overline{432} & 0.\overline{1432} & 0.1\overline{432} & 0.1(432) & 0.1432 \\
37 \overline{3.7000} & 37 \overline{3.7000} & 37 \overline{3.3000} & 37 \overline{3.3 000} & 37 \overline{3.3000} \\
\hline
1.60 & 1.60 & 1.60 & 1.60 & 1.60 \\
1.48 & 1.48 & 1.48 & 1.48 & 1.48 \\
120 & 120 & 120 & 120 & 120 \\
111 & 111 & 111 & 111 & 111 \\
90 & 90 & 90 & 90 & 90 \\
74 & 74 & 74 & 74 & 74 \\
16 & 16 & 16 & 16 & 16 \\
\hline
\end{tabular}

decimal separator = \langle separator character \rangle  

Control the character used to indicated the decimal point. Most people want this to be a period or a comma. The default is a period. Note that this changes the decimal separator BOTH in the input and in the output. If you set the decimal separator to a comma and then use a period in the input, it will throw an error (though this could be inconvenient for people – if this behavior causes you trouble, email me and I can fix it). If you want to use the comma decimal separator, I recommend saying \longdivisionkeys{decimal separator = ,(,)} in your preamble.

\longdivision[decimal separator = .]{2.1}{3} \quad \longdivision[decimal separator = ,]{2,1}{3}

digit separator = \langle separator character \rangle  

Control the character used to separate groups of digits in the output. By default digit groups have length 3, but that can be configured with the digit group length key. If value is empty, then no separator is used. Most people want this to be a period or a comma. Note that this changes the decimal separator BOTH in the input and in the output. If you set the decimal separator to a comma and then use a period in the input, it will throw an error.

\longdivision{0.7}{3.21} \quad \longdivision[decimal separator = ,]{0.7}{3,21} 

\begin{tabular}{|c|}
\hline
0.7 & 0.7 \\
3 \overline{2.1} & 3 \overline{2.1} \\
2 & 2 \\
0 & 0 \\
\hline
\end{tabular}
**digit group length** = ⟨integer⟩  
Specify how often to include a digit separator. Does nothing without the digit separator key.

**separators in work** = ⟨bool⟩  
Specifies whether to include the decimal and digit separators in division work. When this is false, \longdivision will leave a space instead so that the digits are aligned correctly.
\text{german division sign} = \langle \text{division sign} \rangle 

\begin{align*}
\text{\longdivisionkeys{style = german}} \\
\text{\longdivision[german division sign = $\div$ ]{14.1}{3} quad} \quad \text{\longdivision[german division sign = : ]{14.1}{3}}
\end{align*}

\begin{tabular}{cc}
14.1 & 3 = 4.7  \\
12 & 12  \\
2.1 & 2.1  \\
2.1 & 2.1  \\
6 & 6
\end{tabular}