The \texttt{dcolumn} package*

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\textbf{Abstract}

This package defines a system for defining columns of entries in an \texttt{array} or \texttt{tabular} which are to be aligned on a 'decimal point'.

This package defines \texttt{D} to be a column specifier with three arguments.

\begin{verbatim}
D{(sep.tex)}{(sep.dvi)}{(decimal places)}
\end{verbatim}

\begin{itemize}
\item \texttt{(sep.tex)} should be a single character, this is used as the separator in the .\texttt{tex} file. Thus it will usually be `.' or `,'.
\item \texttt{(sep.dvi)} is used as the separator in the output, this may be the same as the first argument, but may be any math-mode expression, such as \texttt{	extbackslash cdot}. It should be noted that \texttt{dcolumn} always uses math mode for the digits as well as the separator.
\item \texttt{(decimal places)} should be the maximum number of decimal places in the column. If this is negative, any number of decimal places can be used in the column, and all entries will be centred on (the leading edge of) the separator. Note that this can cause a column to be too wide, compare the first two columns in the example below. If this argument is positive, the column uses macros equivalent to \texttt{\rightdots \endrightdots} of \texttt{array.sty}, otherwise the macros are essentially equivalent to \texttt{\centerdots \endcenterdots}.
\end{itemize}

You may not want to use all three entries in the \texttt{array} or \texttt{tabular} preamble, so you may define your own preamble specifiers using \texttt{\newcolumntype}.

For example we may say:
\begin{verbatim}
\newcolumntype{d}[1]{D{.}{.}{-1}}
\end{verbatim}
\begin{itemize}
\item \texttt{d} takes a single argument specifying the number of decimal places, and the \texttt{.\textit{tex}} file should use \texttt{.}, with \texttt{.} being used in the output.
\item \texttt{\newcolumntype{.}}\{D{.}{.}{-1}\} specifies a column of entries to be centred on the \texttt{.}.
\item \texttt{\newcolumntype{,}}\{D{.}{.}{2}\} specifies a column of entries with at most two decimal places after a \texttt{.}.
\end{itemize}

The following table begins \texttt{\begin{tabular}}\{d{-1}\}d{2}\{1,1}\}

\begin{tabular}{|c|c|c|c|}
\hline
1.2 & 1.2 & 1.2 & 1.2 \\
1.23 & 1.23 & 12.5 & 300.2 \\
121.2 & 121.2 & 861.20 & 674.29 \\
184 & 184 & 10 & 69 \\
-4 & -4 & .4 & .4 \\
\hline
\end{tabular}

\begin{flushright}
*This file has version number v1.06, last revised 2001/05/28.
\end{flushright}
Note that the first column, which had a negative \textit{(decimal places)} argument is wider than the second column, so that the decimal point appears in the middle of the column. Also note that this package deals correctly with entries with no decimal part, no integer part, and blank entries.

If you have table headings (inserted with \texttt{\textbackslash multicolumn}{1}{}\{c\}{}\{. \}) to over-ride the D column type) then it may be that neither of the above ‘centred’ or ‘right aligned’ forms is quite what you want.

![Table Example](image)

In both of these tables the first column is set with D{.}{.}{-1} to produce a column centered on the ., and the second column is set with D{.}{.}{1} to produce a right aligned column.

The centered column produces columns that are wider than necessary to fit in the numbers under a heading as it has to ensure that the decimal point is centred. The right aligned column two does not have this drawback, but under a wide heading a column of small right aligned figures looks a bit odd.

In version v1.03 a third possibility is introduced. The third \textit{(decimal places)} argument may specify both the number of digits to the left and to the right of the decimal place. The third column in the first table above is set with D{.}{.}{5.1} and in the second table, D{.}{.}{1.1}, to specify ‘five places to the left and one to the right’ and ‘one place to the left and one to the right’ respectively. (You may use ‘,’ or other tokens, not necessarily ‘.’ in this argument.) The column of figures is then positioned such that a number with the specified numbers of digits is centred in the column.

This notation also enables columns that are centred on the mid-point of the separator, rather than its leading edge; for example D{+}{.}{\pm}{3,3} will give nice, symmetric layout of up to three digits on either side of a \pm sign.

1 The Macros

1 \textit{(package)}

First we load \texttt{array.sty} if it not already loaded.

2 \texttt{\textbackslash RequirePackage\{array\}}

The basic ideas behind these macros are explained in the documentation for \texttt{array.sty}. However they use three tricks which may be useful in other contexts.

- The separator is surrounded in extra \{ \}, so that it is set with \texttt{\textbackslash mathord} spacing, otherwise, for instance a ‘,’ would have extra space after it.

- The separator is not given its special definition by making it active, as this would not work for an entry such as & .5 & k, as the first token of an alignment entry is read before the preamble part, incase it is an \texttt{\textbackslash omit}, in which case the preamble is to be omitted. Instead we switch the mathcode to (hex) 8000, which makes the token act as if it were active.

- Although \texttt{\textbackslash mathcode\{.\}}\texttt{=8000} makes . act as if it were active, it is still not allowed in constructions such as \texttt{\textbackslash def\{}{}, even in math-mode, so we have
to construct an active version of the separator, this is done by making it the 
uppercase of ~, and then using the construct 
\uppercase{\def{~}}{\langle definition\rangle}.
Note that the \langle definition\rangle is not uppercased, so the definition can refer to 
the standard, non-active use of the separator.

\DC@ Set up uppercase tables as required, and then grab the first part of the numerical 
argument into \count@.
3 \def\DC@#1#2#3{% 
4 \uccode`\~=`#1\relax 
5 \m@th 
6 \afterassignment\DC@x\count@#3\relax{#1}{#2}}

\DC@x If \count@ is negative, centre on the decimal point. If it is positive either #1 will 
be empty in which case bad out decimal part to the number of digits specified 
by \count@ or (new feature in v1.03) it is none empty in which case \count@ 
contains the number of digits to the left of the point, and #1 contains a junk token 
(probably .) followed by the number of digits to the right of the point. In either 
of these latter cases, \DC@right is used.
7 \def\DC@x#1\relax#2#3{% 
8 \ifnum\z@>\count@ 
9 \expandafter\DC@centre 
10 \else 
11 \expandafter\DC@right 
12 \fi 
13 \{#2}{#3}{#1}}

\DC@centre If centering on the decimal point, just need to box up the two halves.
14 \def\DC@centre#1#2#3{% 
15 \let\DC@end\DC@endcentre 
16 \uppercase{\def{~}}{\langle definition\rangle} 
17 \setbox\tw@=\hbox{\bgroup{#2}}% 
18 \setbox\z@=\hbox{\bgroup{\phantom{#2}}}% 
19 \setbox\z@=\hbox{\bgroup{\mathcode`#1=\textbackslash ^{8000}}}
\DC@endcentre and then pad out the smaller of the two boxes so there is the same amount of stuff 
either side of the point.
20 \def\DC@endcentre#1#2#3{% 
21 \ifdim\wd\z@>\wd\tw@ 
22 \setbox\tw@=\hbox to\wd\z@{\unhbox\tw@\hfill}\% 
23 \else 
24 \setbox\z@=\hbox to\wd\tw@{\hfill\unhbox\z@}{\fi 
25 \box\z@\box\tw@}

\DC@right This deals with both the cases where a specified number of decimal places is given.
26 \def\DC@right#1#2#3{% 
27 \ifx\relax#3\relax 
28 \hfill 
29 \let\DC@r1\bgroup 
30 \else
Otherwise set \DC@rl so that the whole number part is put in a box \count@ times as wide as a digit. In order to share code with the other branch, then move #3 (the number of decimal places) into \count@ throwing away the ‘.’ from the user syntax.

\edef\DC@rl{to\the\count@\dimen@ii\bgroup\hss\hfill}\
\count@\@gobble#3\relax
\fi
\let\DC@end\DC@endright

Box 2 contains the decimal part, set to \dimen@ which is calculated below to be \count@ times the width of a digit, plus the width of the ‘decimal point’.

\uppercase{\def~}{$\egroup\setbox\tw@\hbox to\dimen@\bgroup${#2}}% 
\setbox\z@\hbox{$1$}\dimen@ii\wd\z@ 
\setbox\z@\hbox{${#2}$}\advance\dimen@\wd\z@ 
\setbox\tw@\hbox to\dimen@{}%

Box 0 contains the whole number part, either just at its natural size for right aligned columns, or set to (the old value of) \count@ times the width of a digit. \DC@rl defined above determines the two cases.

\setbox\z@\hbox{\DC@rl$\mathcode`#1=8000$}
\DC@endright Just finish off the second box, and then put out both boxes.

\def\DC@endright{$\hfil\egroup\box\z@\box\tw@}$

D The user interface, define the D column to take three arguments. For special purposes, you may need to directly access \DC@ rather than the D column, eg to get a bold version you could use

\newcolumntype{E}[3]{>{\boldmath\DC@{#1}{#2}{#3}}c<{{\DC@end}}}
\newcolumntype{D}[3]{>{\DC@{#1}{#2}{#3}}c<{{\DC@end}}}

\end{package}