

# L<sup>A</sup>T<sub>E</sub>X Table Tricks

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# 1 Standard Tables

Tables are made in  $\LaTeX$  using the `tabular` environment like this

```
\begin{tabular}{|1|1|1|1|}
\hline
\multicolumn{3}{|c|}{A Table}\hline
\hline
1,1 & 1,2 & 1,3\hline
2,1 & 2,2 & 2,3\hline
3,1 & 3,2 & 3,3\hline
\end{tabular}
```

A Table		
1,1	1,2	1,3
2,1	2,2	2,3
3,1	3,2	3,3

For more information on basic tables consult a good text like *The Not So Short Introduction to  $\LaTeX$  2 $\epsilon$*  [9].

## 2 Spacing

### 2.1 Row Spacing

The standard row height is too small when `\hline` is used. There are three ways of correcting this: modifying the `arraystretch` command, changing the `extrarowheight` length, or using the `bigstrut` command.

#### 2.1.1 Arraystretch

The crudest way to increase row spacing, which works without any addition packages, is to increase the `arraystretch` ratio. This injects space above and below all the rows' text. It is done like this:

```
{
\renewcommand{\arraystretch}{1.2}
\begin{tabular}{|c|l|}
\hline
a & Row 1 \\\hline
b & Row 2 \\\hline
c & Row 2 \\\hline
d & Row 4 \\\hline
\end{tabular}
}
```

The `renewcommand` and the table are enclosed in braces to limit the scope of the redefinition. Its effect is to turn

<table border="1"><tr><td>a</td><td>Row 1</td></tr><tr><td>b</td><td>Row 2</td></tr><tr><td>c</td><td>Row 3</td></tr><tr><td>d</td><td>Row 4</td></tr></table>	a	Row 1	b	Row 2	c	Row 3	d	Row 4	into	<table border="1"><tr><td>a</td><td>Row 1</td></tr><tr><td>b</td><td>Row 2</td></tr><tr><td>c</td><td>Row 3</td></tr><tr><td>d</td><td>Row 4</td></tr></table>	a	Row 1	b	Row 2	c	Row 3	d	Row 4	and with a bigger value	<table border="1"><tr><td>a</td><td>Row 1</td></tr><tr><td>b</td><td>Row 2</td></tr><tr><td>c</td><td>Row 3</td></tr><tr><td>d</td><td>Row 4</td></tr></table>	a	Row 1	b	Row 2	c	Row 3	d	Row 4
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a	Row 1																											
b	Row 2																											
c	Row 3																											
d	Row 4																											
a	Row 1																											
b	Row 2																											
c	Row 3																											
d	Row 4																											

### 2.1.2 Extrarowheight

A more sophisticated approach is to use the `array` package [8] and change the length `\extrarowheight` as follows:

```
\usepackage{array}
...
{
\setlength{\extrarowheight}{1.5pt}
\begin{tabular}{|l|l|}
\hline
a & Row 1 \\ \hline
b & Row 2 \\ \hline
c & Row 3 \\ \hline
d & Row 4 \\ \hline
\end{tabular}
}
```

This adds space only above the rows' text, which with the correct value compensates for the `\hline` commands. Its effect is to turn

a	Row 1	into	a	Row 1	and with a bigger value	a	Row 1
b	Row 2		b	Row 2		b	Row 2
c	Row 3		c	Row 3		c	Row 3
d	Row 4		d	Row 4		d	Row 4

### 2.1.3 Bigstruts

The above methods apply the compensation to all rows, even if they do not have `\hline` commands. A subtler alternative is to use the `bigstrut` package [6] like this:

```
\usepackage{bigstrut}
...
\begin{tabular}{|l|l|}
\hline
a & Row 1 \\ \hline
b & Row 2 \\ \hline
c & Row 2 \\ \hline
d & Row 4 \\ \hline
\end{tabular}
```

which changes the basic table

a	Row 1	into	a	Row 1
b	Row 2		b	Row 2
c	Row 3		c	Row 2
d	Row 4		d	Row 4

The `\bigstrut` command is used when there is are `\hline` above and below; `\bigstrut[t]` when there is an `\hline` only above; and `\bigstrut[b]` when this is only one below.

The `bigstrut` package only works well with tables that have single line cells. It does not work with the text wrap column specifiers `p{}`, `m{}` and `b{}`. (For more information on text wrap see §3).

### 2.1.4 Comparison of Methods

The affect of the three methods is as follows:

<code>arraystretch{1.2}</code>	<code>extrarowheight{1.5pt}</code>	<code>bigstrut</code>																								
<table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td style="padding: 2px 10px;">a</td><td style="padding: 2px 10px;">Row 1</td></tr> <tr><td style="padding: 2px 10px;">b</td><td style="padding: 2px 10px;">Row 2</td></tr> <tr><td style="padding: 2px 10px;">c</td><td style="padding: 2px 10px;">Row 3</td></tr> <tr><td style="padding: 2px 10px;">d</td><td style="padding: 2px 10px;">Row 4</td></tr> </table>	a	Row 1	b	Row 2	c	Row 3	d	Row 4	<table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td style="padding: 2px 10px;">a</td><td style="padding: 2px 10px;">Row 1</td></tr> <tr><td style="padding: 2px 10px;">b</td><td style="padding: 2px 10px;">Row 2</td></tr> <tr><td style="padding: 2px 10px;">c</td><td style="padding: 2px 10px;">Row 3</td></tr> <tr><td style="padding: 2px 10px;">d</td><td style="padding: 2px 10px;">Row 4</td></tr> </table>	a	Row 1	b	Row 2	c	Row 3	d	Row 4	<table border="1" style="border-collapse: collapse; width: 100%;"> <tr><td style="padding: 2px 10px;">a</td><td style="padding: 2px 10px;">Row 1</td></tr> <tr><td style="padding: 2px 10px;">b</td><td style="padding: 2px 10px;">Row 2</td></tr> <tr><td style="padding: 2px 10px;">c</td><td style="padding: 2px 10px;">Row 2</td></tr> <tr><td style="padding: 2px 10px;">d</td><td style="padding: 2px 10px;">Row 4</td></tr> </table>	a	Row 1	b	Row 2	c	Row 2	d	Row 4
a	Row 1																									
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c	Row 3																									
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c	Row 3																									
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a	Row 1																									
b	Row 2																									
c	Row 2																									
d	Row 4																									

For tables without text wrapping, the `bigskip` approach is definitely the best if the table has some rows without horizontal lines. Otherwise, `extrarowheight` is less verbose and gives a more compact layout. Use `arraystretch` if the table needs a large row height. For tables with text wrapping, `extrarowheight`, its probably best.

## 2.2 Column Spacing

Column width can be modified by changing `\tabcolsep` like this:

```
\setlength{\tabcolsep}{10pt}
\setlength{\extrarowheight}{1.5pt}
\begin{tabular}{|l|l|}
\hline
a & Row 1 \\ \hline
b & Row 2 \\ \hline
c & Row 3 \\ \hline
\end{tabular}
```

which changes the default

a	Row 1	into	a	Row 1
b	Row 2		b	Row 2
c	Row 3		c	Row 3

There is a standard column specifier `@{cmd}`, which suppresses inter-column space and inserts `cmd` instead. This can be used to insert or remove space into a particular column. For example:

```

\setlength{\extrarowheight}{1.5pt}
\begin{tabular}{|@{\hspace{1cm}}1|@{1}|}
\hline
Abcd & Abcd \\ \hline
Abcd & Abcd \\ \hline
\end{tabular}

```

Abcd	Abcd
Abcd	Abcd

### 3 Vertical Alignment and Text Wrapping

Vertical alignment can be controlled with the `array` package [8], which has additional text wrap formatting commands:

```

p{width} Top align, the same as usual.
m{width} Middle align
b{width} Bottom align

```

These produce the following layouts:

Column Format		
p{}	p{}	1
1 1	2 2	3 3
1 1	2 2	
1 1		

Column Format		
m{}	m{}	1
1 1	2 2	3 3
1 1	2 2	3 3
1 1	2 2	

Column Format		
b{}	b{}	1
1 1		
1 1	2 2	
1 1	2 2	3 3

Notice how the `m{}` or `b{}` alignment affects the whole table. In addition, `p{}`, `m{}` and `b{}` formats cannot be successfully mixed in the same table.

Occasionally the text wrap formats cause ‘bad box’ warnings, which can often be resolved by with `\raggedright` (see §4).

## 4 Ragged Right Alignment

For narrow wrapped text blocks left justification often looks best, and can get rid of ‘bad box’ warnings. There are three ways to achieve this: a simple command, column types, and the `tabulary` package. All of these methods support or can be adapted to provide alignments other than left justified. The first two are very versatile and can be used to inject general formatting commands.

### 4.1 Simple Command

The most verbose but flexible way to achieve left justification is just to use `\raggedright` in the cell:

```

\newcommand{\rr}{\raggedright}
\newcommand{\tn}{\tabularnewline}
...
{ \renewcommand{\arraystretch}{1.2}
  \begin{tabular}{|c|p{5cm}|}
  \hline
  1,1 & \rr ... text ... \tn \hline
  2,1 & ... text ... \ \ \hline
  \end{tabular} }

```

1,1	Lorem ipsum dolor sit amet, consectetur adipiscing elit.
2,1	Nullam rhon- cus, sem luctus ultrices.

Using this method left justification can be applied to individual cells. Note that `\tabularnewline` replaces `\` in the row containing the `\raggedright` command. The definitions for `\rr` and `\tn` are just to make things a little more compact.

## 4.2 Column Types

Another way of managing ragged right formatting is to define a new column type using the `array` package [8]. Its `>{decl}` option inserts `decl` directly before the entry for the column; and `<{decl}` directly after. The following shows how it can be used:

```

\usepackage{array}
...
\newcolumntype{x}[1]
  >{\raggedright}p{#1}}
\newcommand{\tn}{\tabularnewline}
...
{ \renewcommand{\arraystretch}{1.2}
  \begin{tabular}{|c|x{5cm}|}
  \hline
  1,1 & ... text ... \tn \hline
  2,1 & ... text ... \tn \hline
  \end{tabular} }

```

1,1	Lorem ipsum dolor sit amet, consectetur adipiscing elit.
2,1	Nullam rhoncus, sem luctus ultrices.

With this method ragged right formatting is applied to a whole column. The `newcolumntype` command is used to define a column type that can be reused. The formatting could have been embedded in the tabular heading. Again `\tabularnewline` is needed when `\raggedright` is used.

## 4.3 Tabluary

Another alternative is to use the `tabluary` package[4]. With this method ragged right columns are simply declared with the `L` command. However, the total table width must be defined as a parameter. See §6.2

```

\usepackage{tabulary}
...
\renewcommand{\arraystretch}{1.2}
\begin{tabulary}{6.5cm}{|c|L|}
\hline
1,1 & ... text ... \\ \hline
2,1 & ... text ... \\ \hline
\end{tabulary}

```

1,1	Lorem ipsum dolor sit amet, consectetur adipiscing elit.
2,1	Nullam rhoncus, sem luctus ultrices.

#### 4.4 Comparison of Methods

Simple commands are useful for small tables or when the formatting does not apply to the whole column. The `tabulary` package is much simpler than column types, but requires the table width to be specified. Column types can be used for any appropriate formatting or space requirements.

### 5 Multiple Rows

The easiest way to have tables with spanning rows is to use the `multirow` package [7]. In its simplest form it can be used like this:

```

\usepackage{multirow}
...
\begin{tabular}{|c|l|}
\hline
a & Row 1 \\ \hline
b & \multirow{2}{*}{Spanning rows} \\ \hline
c & \\ \hline
d & Row 4 \\ \hline
\end{tabular}

```

giving the following:

a	Row 1
b	Spanning rows
c	
d	Row 4

The `\multirow` command declares the location of the spanning rows. Its first argument is the number of rows to span. The second states, in this case, that the text argument's natural width should be used. The relevant columns in lower rows must be left blank. The full `multirow` command is more complicated:

```

\multirow{nrows}[bigstruts]{width}[fixup]{text}

```

If the `bigstrut` package is used, the number of struts in the spanned rows should be stated as the `bigstruts` parameter. Count 2 for every `\bigstrut` and 1 for a `\bigstrut[t]` or `\bigstrut[b]`.

The text width can be set with the `width` parameter, in which case the text will be wrapped and left justified. Line breaks can be forced with a `\`





justified. This is shown in the following example, which generates two ‘bad box’ warnings:

1,1	Lorem ipsum dolor sit amet.
2,1	Lorem ipsum dolor sit amet consectetur.
3,1	
4,1	
5,1	
6,1	Lorem ipsum dolor sit amet.

The easiest way to resolve this is to make everything flush left by defining a ragged right column type as described in §4:

```

\newcolumntype{P}[1]{>{\raggedright}p{#1}}
\newcolumntype{M}[1]{>{\raggedright}m{#1}}

\setlength{\extrarowheight}{1.5pt}
\begin{tabular}{|c|P{2cm}|} % could be |c|M{2cm}|
\hline
1,1 & \muchlessText \tn\hline
2,1 & \multirow{2}{2cm}[-1.5pt]{\lessText }
      \\ \hline
3,1 & 
      \\ \hline
4,1 & 
      \\ \hline
5,1 & 
      \\ \hline
6,1 & \muchlessText \tn\hline
\end{tabular}

```

which creates the following layouts:

With P{}	With M{}																		
<table style="border-collapse: collapse; width: 100%;"> <tbody> <tr> <td style="text-align: center; width: 10%;">1,1</td> <td style="padding: 2px;">Lorem ipsum dolor sit amet.</td> </tr> <tr> <td style="text-align: center;">2,1</td> <td rowspan="4" style="padding: 2px;">Lorem ipsum dolor sit amet consectetur.</td> </tr> <tr> <td style="text-align: center;">3,1</td> </tr> <tr> <td style="text-align: center;">4,1</td> </tr> <tr> <td style="text-align: center;">5,1</td> </tr> <tr> <td style="text-align: center;">6,1</td> <td style="padding: 2px;">Lorem ipsum dolor sit amet.</td> </tr> </tbody> </table>	1,1	Lorem ipsum dolor sit amet.	2,1	Lorem ipsum dolor sit amet consectetur.	3,1	4,1	5,1	6,1	Lorem ipsum dolor sit amet.	<table style="border-collapse: collapse; width: 100%;"> <tbody> <tr> <td style="text-align: center; width: 10%;">1,1</td> <td style="padding: 2px;">Lorem ipsum dolor sit amet.</td> </tr> <tr> <td style="text-align: center;">2,1</td> <td rowspan="4" style="padding: 2px;">Lorem ipsum dolor sit amet consectetur.</td> </tr> <tr> <td style="text-align: center;">3,1</td> </tr> <tr> <td style="text-align: center;">4,1</td> </tr> <tr> <td style="text-align: center;">5,1</td> </tr> <tr> <td style="text-align: center;">6,1</td> <td style="padding: 2px;">Lorem ipsum dolor sit amet.</td> </tr> </tbody> </table>	1,1	Lorem ipsum dolor sit amet.	2,1	Lorem ipsum dolor sit amet consectetur.	3,1	4,1	5,1	6,1	Lorem ipsum dolor sit amet.
1,1	Lorem ipsum dolor sit amet.																		
2,1	Lorem ipsum dolor sit amet consectetur.																		
3,1																			
4,1																			
5,1																			
6,1	Lorem ipsum dolor sit amet.																		
1,1	Lorem ipsum dolor sit amet.																		
2,1	Lorem ipsum dolor sit amet consectetur.																		
3,1																			
4,1																			
5,1																			
6,1	Lorem ipsum dolor sit amet.																		

## 5.2 Over Sized Spanning Rows

Having a `\multirow` that has more lines than the rows it spans is not so easy to layout well. Expanding the spanned rows with struts appears to be the only

solution, but it requires a lot of trial-and-error adjustments. The following table shows the method:

```

\newlength{\rowA}
\setlength{\rowA}{8ex} % modify as needed
\newcommand{\strutA}{% no space before strut
\rule[-0.45\rowA]{0pt}{\rowA}% put text approx mid strut
}
...
\begin{tabular}{|c|l|c|}
\hline
1,1 & 1,2 & 1,3 & \bigstrut \\ \hline
2,1 & \multirow{2}{5cm}[1ex]{ ... lots of text ... }
& 2,3\strutA
& \\
3,1 & & 3,3\strutA & \\ \hline
4,1 & 4,2 & 4,3 & \bigstrut \\ \hline
\end{tabular}

```

1,1	1,2	1,3
2,1	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Curabitur id nisl nunc, non adipiscing arcu. Morbi nec leo sit amet.	2,3
3,1		3,3
4,1	4,2	4,3

A `\rule` of zero width is used for the strut. A negative raise height positions the text in the rows vertical centre. In the example, the strut is put in a centre aligned column. In this context it must be put next to the column's text with no spaces, or the alignment will be disturbed. This is not normally an issue for other alignments.

For convenience the strut is defined as a command called `\strutA`, which is used in the spanned rows 2 and 3. The height of the strut is given by the length `rowA`. This is more complicated to write, but makes the trial-and-error layout process easier. Adjust `rowA` until there is room for the spanning row's text. The `fixup` parameter in the `\multirow` command is used to correct the vertical position of its text as necessary.

## 6 Specifying Table Width

The `tabularx` [2] and `tabulary` [4] packages are much better than the standard `tabular*` for specifying table width.

### 6.1 Tabularx

The `tabularx` environment expands specific columns to meet the table's width requirement.

The width of the table is given as a parameter, and the columns that can be expanded are denoted with the X alignment command, as the following shows:

```
\begin{center}
\setlength{\extrarowheight}{1.5pt}
\begin{tabularx}{0.75\textwidth}{|l|X|}
\hline
1,1 & ** some text ** \\ \hline
2,1 & ** some text ** \\ \hline
\end{tabularx}
\end{center}
```

1,1	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Curabitur id nisl nunc, non adipiscing arcu. Morbi nec leo sit amet.
2,1	Nullam rhoncus, sem luctus ultrices accumsan, urna enim fermentum.

There must be at least one X column. If there is more than one X column the necessary space is equally distributed. The columns are always padded to give the the table its specified width. Text is wrapped and justified if it does not fit into the column.

Note the use of `0.75\textwidth` to specify the width as a proportion of page width.

## 6.2 Tabulary

The `tabulary` environment expands specific columns to meet the table's width requirement and allows alignment to be specified for these columns as follows:

```
L \raggedright
C \centering
R \raggedleft
J normal justification
```

The maximum width for the table is given as a parameter. However, unlike `tabularx`, columns are not padded if they are too narrow.

```
\setlength{\extrarowheight}{1.5pt}
\begin{tabulary}{4cm}{|l|L|}
\hline
1,1 & ** some text ** \\ \hline
2,1 & ** some text ** \\ \hline
\end{tabulary}
```

full width ...

1,1	Lorem ipsum dolor sit amet, consectetur adipiscing elit.
2,1	Curabitur id nisl nunc, non adipiscing arcu.

not full width ...

1,1	Lorem ipsum.
2,1	Curabitur id.

### 6.3 Comparison of Methods

The `tabularx` package is useful for absolute table widths, but it has limited alignment options.

The `tabulary` package provides better alignment options; and its adaptive width behaviour does not normally cause problems. It is convenient to set its width at a suitable maximum, say `0.75\textwidth`, and let the package select appropriate column widths.

## 7 Larger Tables

Larger tables can sometimes be handled by turning them sideways, or by letting them span pages.

### 7.1 Sideways

The easiest way to turn a table sideways is to use the `rotate` package [1]. For example:

```
\usepackage{rotate}
...
\begin{sideways}
\begin{tabular}{|l|l|}
\hline
1,1 & 1,2\\ \hline
2,1 & 2,2\\ \hline
\end{tabular}
\end{sideways}
```

1,1	1,2
2,1	2,2

### 7.2 Longtable

The `longtable` package is designed to make tables that span page breaks. It is rather complicated to use, and the primary documentation [3] should be consulted for all of its features. It maintains column widths across page breaks, and centers the table. It is reported to be incompatible with many other packages, but for simple use it appears to be okay. Multiple compilation passes are normally needed to get the layout correct. Here is a very simple example:

```
\usepackage{longtable}
\usepackage{array} % for extrarowheight

\setlength{\extrarowheight}{1.5pt}
\begin{longtable}{|l|l|}
% header -----
\hline
Heading 1 & Heading 2 \\ \hline
\endhead
% header -----
```

```

Lorem ipsum ... & Consectetur ... \\ \hline
Lorem ipsum ... & Consectetur ... \\ \hline
.
.
\end{longtable}

```

Heading 1	Heading 2
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.

----- Page break -----

Heading 1	Heading 2
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.
Lorem ipsum dolor sit amet.	Consectetur adipiscing elit.

## 8 Footnotes in Tables

There are problems with tables and footnotes. They work with `longtable` or `tabularx` environments; but they do not work with `tabular` and `tabulary` environments,

Footnotes in a `longtable` or `tabulary` table are put at the end of the table's page with any normal footnotes. When a `longtable` breaks over a page, footnotes are placed on the correct page.

Footnotes can be kept next to their originating table by using a `minipage`. However this does not work for `tabulary`. This is a `tabular` example:

```

\begin{minipage}{6cm}
\begin{tabular}{|l|l|}
\hline
1,2 & 1,2\footnote{This is a footnote.} \\
\hline
2,1 & 2,2 \\
\hline
3,1 & 3,2 \\
\hline
\end{tabular}
\end{minipage}

```

1,2	1,2 <sup>a</sup>
2,1	2,2
3,1	3,2

<sup>a</sup>This is a footnote.

## 9 Professional Layout

The `booktabs` package [5] provides support for ‘formal tables’, which the package’s author promotes as a better way of presenting data. In particular he derides

the use of vertical rules and double rules. Here is an example taken from the package documentation:

Animal	Description	Price (\$)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33
Armadillo	frozen	8.99

## References

- [1] Robin Fairbairns, Sebastian Rahtz and Leonor Barroca, *A package for rotated objects in L<sup>A</sup>T<sub>E</sub>X*, Comprehensive T<sub>E</sub>X Archive Network (CTAN), 2009. ([rotating.pdf](http://www.ctan.org) from <http://www.ctan.org>)
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