

Tables, Arrays, & Matrices

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March 20, 2014

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Tables, arrays, and matrices are created by using complex environments in \LaTeX . All of them create a set of aligned cells.

- matrix - math mode, few formatting options
- array - math mode, many formatting options
- tabular - text mode, many formatting options

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A Matrix

- Matrices begin and end like all environments.
- Cells are indicated with the alignment character, &
- Number of columns does not need to be specified

```
\begin{matrix}  
&&&\\  
&&&\\  
&&&\\  
&&&  
&&&  
\end{matrix}
```

The resulting empty 4×4 matrix is shown on the right.

A Matrix with data

Alignment characters (&) *separate* cells.

```
\begin{matrix}
a_{00}&&a_{01}&&a_{02}&&a_{03} \\
a_{10}&&a_{11}&&a_{12}&&a_{13} \\
a_{20}&&a_{21}&&a_{22}&&a_{23} \\
a_{30}&&a_{31}&&a_{32}&&a_{33}
\end{matrix}
```

- To have n cells in a row, use $n - 1$ alignment characters.
- The last line doesn't need the double backslash

Matrix Environments

- matrix - no special formatting $\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$
- pmatrix - parentheses $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
- bmatrix - bracketed matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- Bmatrix - braced matrix $\begin{Bmatrix} 1 & 0 \\ 0 & 1 \end{Bmatrix}$
- vmatrix - vertical bars $\begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$
- Vmatrix - two vertical bars $\begin{Vmatrix} 1 & 0 \\ 0 & 1 \end{Vmatrix}$
- smallmatrix - a small matrix $\begin{smallmatrix} 1 & 0 \\ 0 & 1 \end{smallmatrix}$ which flows in text.

Matrices can hold most math-related objects

$$\begin{pmatrix} 2 + x & m_p^2 & \sin \theta & \frac{e^x + e^{-x}}{2} \\ & \begin{bmatrix} a & b \\ c & d \end{bmatrix} & \delta_{n,m} = \begin{cases} 1 & n = m \\ 0 & n \neq m \end{cases} & \begin{matrix} a \\ a & d \\ b \end{matrix} \end{pmatrix}$$

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Structure

Begin statement - unlike `matrix`, takes a required argument.

```
\begin{array}{ccc}
```

Content with alignment characters

```
1&1&1&1\\
```

```
1&2&3&4\\
```

```
1&3&6&10\\
```

```
1&4&10&20
```

End statement

```
\end{array}
```

The Difference

Arrays in math mode, tabulars in text.

```
\[ \begin{array} {ccc}
x(t)&y(t)&r(t) \\
\sin(t)&\cos(t)&1 \\
t+1&t-1&\sqrt{t^2+2} \\
\end{array} \]
```

$$\begin{array}{ccc}
 x(t) & y(t) & r(t) \\
 \sin(t) & \cos(t) & 1 \\
 t+1 & t-1 & \sqrt{t^2+2}
 \end{array}$$

```
\begin{tabular} {ccc}
$x(t)$&$y(t)$&$r(t)$ \\
$\sin(t)$&$\cos(t)$&1 \\
$t+1$&$t-1$&$\sqrt{t^2+2}$ \\
\end{tabular}
```

$$\begin{tabular}{ccc}
 x(t) & y(t) & r(t) \\
 \sin(t) & \cos(t) & 1 \\
 t+1 & t-1 & \sqrt{t^2+2}
 \end{tabular}$$

The Difference

Arrays in math mode, tabulars in text.

<code>\[\begin{array}{lc}</code>		
<code>\mathrm{Item}&\mathrm{Qty.} \\</code>	Item	Qty.
<code>\mathrm{Lightsaber}&2 \\</code>	Lightsaber	2
<code>\mathrm{Robe}&1 \\</code>	Robe	1
<code>\end{array} \\</code>		
<code>\begin{tabular}{lc}</code>	Item	Qty.
<code>Item&Qty. \\</code>	Lightsaber	2
<code>Lightsaber&2 \\</code>	Robe	1
<code>Robe&1 \\</code>		
<code>\end{tabular}</code>		

To use normal text in math mode, use `\mathrm{}`.

Spacing and Alignments

Normally available alignments

- $p\{\}$ - specified width, e.g., $p\{0.5in\}$
- l - left justified
- c - centered
- r - right justified (m,b available in array package)

n	$\phi(n)$	p_n	K_n
1	1	2	2
2	1	3	6
3	2	5	12
4	3	7	24
8	21	19	240
24	46368	89	196560

Text Wrapping

LaTeX doesn't automatically wrap lines in tables.

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Use fixed width columns (p) to enable line wrapping.

In an array, \LaTeX makes fixed width columns automatically not math mode.

```
\[\begin{array}{p{1in}|c|b{2in}}
```

```
There is too much text in this line&x&  
but not this one.\[
```

```
&x^2&\[
```

```
\end{array}\]
```

There is too much text in this line	x	but not this one.
	x^2	

Vertical Lines

Vertical and horizontal lines are declared differently in arrays and tabulars.

Vertical lines are declared in the required command with `—` between columns.

```
\begin{tabular}{|c||c|||c}
```

```
1&2&3\\
```

```
4&5&6\\
```

```
\end{tabular}
```

1	2	3
4	5	6

Horizontal Lines

Horizontal lines are declared where they appear with `\hline`.

```
\begin{tabular}{|c||c|||c}\hline  
1&2&3\\\hline  
4&5&6\\\hline  
\end{tabular}
```

1	2	3
4	5	6
7	8	10

Multiple Identical Columns

Sometimes you don't want to count out five columns. Multiply anything by the number of desired repetitions.

```
\begin{tabular}{|l|*{5}{c}|*{2}{r}}
a&b&c&d&e&f&g&h&i&j&1&2\\
k&l&m&n&o&p&q&r&s&t&3&4
\end{tabular}
```

a	b	c	d	e	f	g	h	i	j	1	2
k	l	m	n	o	p	q	r	s	t	3	4

Multi Columns

```
\begin{tabular}{cc}  
\multicolumn{2}{c}{x}\\  
f(x)&g(x)\\  
\end{tabular}
```

$$\begin{array}{cc} & x \\ f(x) & g(x) \end{array}$$

Multi Rows

Use the `\multirow` package.

```
\begin{tabular}{cc}  
\multirow{2}{*}{x}&f(x)\\  
&g(x)\\  
\end{tabular}
```

$$\begin{array}{cc} x & f(x) \\ & g(x) \end{array}$$

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Tables are enclosures for tabulars which act much like figures.

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Table : A tabular in a table.