Tutorial 4: Simple tables and figures in LaTeX 2ε

Pierre Chardaire ©UEA

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Rome wasn't build in a day.

Li Proverbe au Vilain c. 1190

In this tutorial you will learn how to:

- create simple tables,
- include figures,
- cross-reference sections, tables and figures.

Note that this is a standard LaTeX tutorial. In your report you are advised to use facilities provided by the `cmpreport.cls` class file. These facilities are presented in *Tutorial 5: Producing professional-looking tables*.

1 Tables

Begin a new document and type in the following:

```
% Document for tutorial 4
\documentclass[12pt]{scrartcl}
\title{Tables and figures}
\author{John Doe}
\begin{document}
\maketitle
\end{document}
```

You can create a table with the *tabular environment*. Here is an example that you can add at the end of your document:

```
\maketitle
A simple table:
\begin{center}
\begin{tabular}{clr}
     centred  & left & right \\
     C        & L    & R     \\
     111      & 222  & 333
\end{tabular}
\end{center}
\end{document}
```

Usually you use the *tabular environment* within the *center environment*.

After processing the example you see that the table has 3 columns and 3 rows. The elements in the first, second and third columns are centred, left aligned and right aligned respectively. These properties, as well as number of columns, are specified by the parameter list `{clr}` that comes after `\begin{tabular}`. Then each line between `\begin{tabular}{clr}` and `\end{tabular}` represents a row in the table. The elements in a row are separated with the character `&`. A change of row is indicated by the return of line command `\\` at the end of the row.

You can add horizontal lines to the table using the `\hline` command:

```
\maketitle
A simple table:
\begin{center}
\begin{tabular}{clr} \hline
     centred & left & right \\ \hline\hline
     C       & L    & R     \\
     111     & 222  & 333   \\ \hline
\end{tabular}
\end{center}
\end{document}
```

The first `\hline` is used to draw the top horizontal line of the table. The last `\hline` has to be preceded by a `\\` so that the last horizontal line can be drawn after

```
\begin{center}
\begin{tabular}{|l|r|r|r|r|} \cline{2-5}
\multicolumn{1}{c}{} & \multicolumn{2}{|c|}{CPU} &
\multicolumn{2}{|c|}{Iteration} \\ \hline
Test problem & average & maximum & average & maximum \\
\hline \hline
Norwich100   &  10.1   &  121.2  &   212   &  2333   \\
London123    &   7.2   &   61.3  &    110  &  650    \\
\hline
\end{tabular}
\end{center}
```

Figure 1: Creating a more sophisticated table.

the row is completed. Also notice the effect of two consecutive `\hline` that are used to separate the header row from the rest of the table.

You can also use vertical lines. For example replace the parameter list `{clr}` with `{|c||l|r|}`; reprocess and examine the PDF. Each `|` inserted in the parameter list specifies a vertical line at a given position.

You can create a more sophisticated table as shown in figure 1. This table is obtained by using the following commands:

`\cline{2-5}` indicates that a horizontal line that span column 2 to column 5 is drawn.

`\multicolumn{2}{|c|}{CPU}` indicates that columns are grouped to form a single cell. More precisely:

- `{2}` indicates that 2 columns are grouped,
- `{|c|}` indicates that the cell formed has vertical lines on either sides and its content is centred,
- `{CPU}` specifies the content of the cell.

Notice how `\multicolumn` is used to create an empty cell, without vertical line on its left side, in the top left corner of the table.

2 Graphics

Reports often include pictures, images and graphs. LaTeX allows you to include graphics in your documents by using the `graphicx` package. Make sure the file `tree.png` that I have provided is in the same directory as tour `tex` document.

First you must tell LaTeX to use the `graphicx` package. This is done in the preamble of your document as follows:

```
% Document for tutorial 4
\documentclass[12pt]{article}
\usepackage{graphicx}
\title{Tables and figures}
```

Then at the end of your document include the following and reprocess:

```
Example of picture inclusion:
\begin{center}
\includegraphics[width=0.5\textwidth]{tree}
\end{center}
```

The option `[width=0.5\textwidth]` indicates that the picture is scaled such that its width is half the width of a line of text in your document.

You can also create a frame around your picture by using the `\fbox` command.

```
Example of picture inclusion:
\begin{center}
\fbox{
\includegraphics[width=0.5\textwidth]{tree}
}
\end{center}
```

The graphics formats that are recognised by PDFLaTeX are PDF, PNG, JPEG, GIF and EPS[1].

[1] EPS may not work with all distributions of PDFLaTeX

3 Floating bodies

Tables and graphics are usually included in floating bodies using the `table` and `figure` environments respectively. A floating body is a component whose position is *decided* by LaTeX. Floating bodies are used for tables and graphics because such components should not be split, but a naive placement could results in partially empty pages. The placement of floats is not a simple affair. You need to understand roughly how LaTeX does it to avoid annoyance. So, *please, read section 2.12 (3 pages) of The Not So Short Introduction to LaTeX2e*. Here is an example of a floating table:

```
\begin{table}[ht]
\caption{My little table}
\begin{center}
\begin{tabular}{clr} \hline
     centred & left & right \\ \hline\hline
     C       & L    & R     \\
     111     & 222  & 333   \\ \hline
\end{tabular}
\end{center}
\end{table}
```

Include it at the end of your document. Reprocess and examine the result.

You see that to produce this floating table you have included the table you produced at the start of this tutorial in a `table` environment and added a caption with the `caption` command.

The optional parameters `[ht]` indicate that you'd like the table to be placed "here" (where the surrounding text is displayed) or if not possible at the top of a page. You can reinforce your preference by using `[!ht]`[2]

Similarly you can place your graphics inside a figure as follows:

```
\begin{figure}[ht]
\begin{center}
\fbox{\includegraphics[width=0.5\textwidth]{tree}}
\end{center}
\caption{My little figure}
\end{figure}
```

[2]Never use `[h]` on its own.

Note that table captions are usually placed above the tables whilst figure captions are placed below the figures.

You may find that in general there is too much space between caption and figure. This can be due to extra space added by the center environment. So, in figures and tables the command `\centering` is commonly used.

```
\begin{figure}[ht]
\centering
\fbox{\includegraphics[width=0.5\textwidth]{tree}}
\caption{My little figure}
\end{figure}
```

4 Referencing

LaTeX enables you to reference various elements of your document by using the following two commands:

`\label{blabla}` to create a label named `blabla`,

`\ref{blabla}` to reference the label named `blabla`.

`\label` and `\ref` are used to reference tables, figures, sections (and any level of sub-sectioning), pages (in this case we use `\pageref`) as shown in figure 2. The character ~ is used to indicate a fixed size space and also prevents a line break. The commands `\pageref{melabel}` and `\ref{melabel}` give the page number and section number respectively where `\label{melabel}` is located. `\ref{myfig}` gives the number of the figure labelled with `\label{myfig}`.

To resolve labels **you have to run PDFLaTeX twice**. In the first pass the program determines the values associated with the labels; in the second pass it replaces the references by these values[3].

Don't you l♡ve LaTeX?

[3] You could change the function of the PDFLaTeX button to make sure two passes are executed each time but this is a waste of time as most of the time you are still modifying/supplementing your document.

```
\section{A section} \label{melabel}
We will say more in section~\ref{othersec}
about figure~\ref{myfig}\ldots{}
\begin{figure}[ht]
\centering
\fbox{
\includegraphics[width=0.5\textwidth]{tree}
}
\caption{My little figure} \label{myfig}
\end{figure}

\section{Another section} \label{othersec}
As mentioned in section~\ref{melabel}
on page~\pageref{melabel}\ldots{}
```

Figure 2: This is a figure!