A Simple Example Using LaTeX

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Abstract

This short paper illustrates basic techniques in the use of the LaTeX text formatting language, which is useful in typesetting scientific and mathematical papers. This paper can serve as a short tutorial and as a useful template for a beginning LaTeX programmer.

1 Introduction

This paper illustrates how various typesetting is accomplished in LaTeX. You are encouraged to view both the source code (`sample.tex`) and the typeset paper (`sample.dvi`).

First, notice that components of your paper such as *sections, subsections,* and *equations* are numbered automatically.

1.1 Lists

Making an itemized list is easy:

- If the LaTeX file is called `sample.tex` then output is created by executing
  `latex sample`
  This creates a file `sample.dvi`. To view or print, see documentation for your system.
- Note that leaving one or more blank lines in the input gives the start of a new paragraph. Otherwise blanks do not matter. To force a line to end, use double backslash as in the previous item as seen in `sample.tex`.
- Anything after a % is a comment that won't appear in the output.

2 Mathematical formulas

This paper supplies only a taste of how mathematical formulas are created in LaTeX. For more information, see a LaTeX manual such as [1]. As a short introduction, a few pointers are contained in this section.

Dollar signs places LaTeX into its math mode, which is where mathematical formulas and equations are created. To include an equation in a current line of text, place one dollar sign ($) before and after the equation, for example we might define $f(x) = 3e^x$. If an equation should be displayed, place two dollar signs ($$) before and after the equation. For example, we might define:

$$\sum_{j=1}^{N} j = \frac{N(N+1)}{2}.$$

If the equation should be numbered, use the following notation (see the LaTeX file):

$$e^{i\pi} = \cos(\pi) = -1. \tag{1}$$

This equation was given a label (which is optional). Hence, the equation can be referred to later as (1) rather than hardcoding such numbers into the LaTeX file. Therefore, adding new equations does not facilitate a need for the programmer to manually renumber the equations. (Note that you will have to run LaTeX twice on your `.tex` file for numbering to appear properly. The first run stores the labels in the file `sample.aux` and the second time run reads these labels at the beginning of processing.)

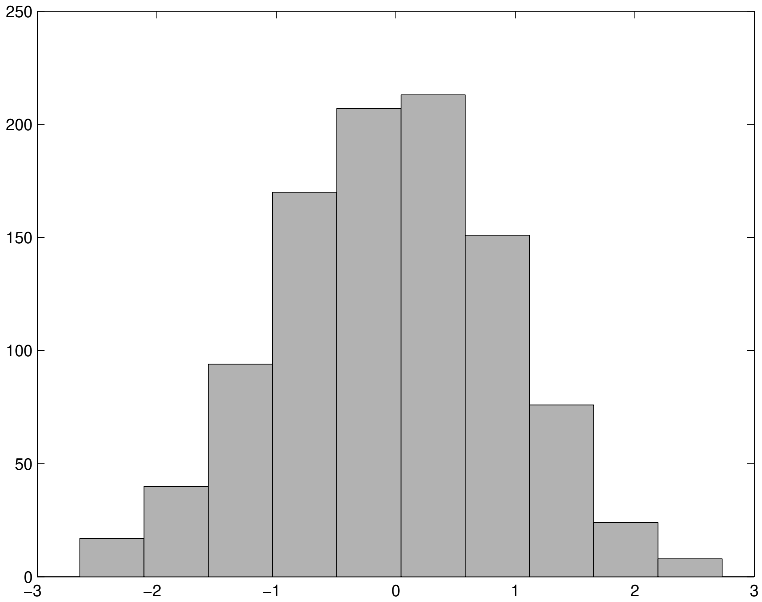

Figure 1: Histogram of 1000 normally distributed random numbers.

3 Matrices

Matrices can be made using an "array". Here's a useful definition that makes it easier to define matrices: (see the LaTeX source file)

Here's a simple matrix equation using this definition:

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} \tag{2}$$

4 Figures

Many plotting packages (e.g. matlab) allow you to produce an encapsulated postscript file (ending in `.eps`). Then the graphic can be incorporated into a paper with the following command (see the LaTeX file)

Note that the `caption` command gives the figure a number that can be referred to later as Figure 1.

The file `fig.eps` was created in matlab with the commands:

```
>> r = randn(1000,1);
>> hist(r)
>> colormap([.7 .7 .7])    % to change the color and make it print better
>> print fig.eps
```

5 Bibliography and citations

See a LaTeX manual such as [1] for complete information on the use of a bibliography and citations. The main idea is the use of a bibliographic database such as the one in `samplebib.bib`, which lists a large set of papers and books, each with a distinct label. Then the `cite` command references one of the entries in the database by its label. Hence, the citation is included in the paper; the corresponding reference is automatically included in the bibliography of the paper. To do this, you must:

1. First run `latex sample`
2. Then run `bibtex sample`
3. Then run `latex sample`

4. Then run `latex sample`

The first run of LaTeX creates a file `sample.aux` that contains information on the literature references. Running bibtex then creates another file `sample.bbl`, which is read into the next LaTeX run producing the list of literature references. Running LaTeX twice more is needed to read in the citations with proper numbering.

References

[1] M. Goossens, F. Mittelbach, and A. Samarin. *The LATEX Companion.* Addison-Wesley, 1994.