Introduction to LaTeX

December 5, 2006

1 Introduction

TeX looks more difficult than it is. It is almost as easy as π. See how easy it is to make special symbols such as α, β, γ, δ, $\sin x$, $\hbar$, λ, ... We also can make subscripts A_x, A_{xy} and superscripts, e^x, e^{x^2}, and e^{a^b}. We will use LaTeX, which is based on TeX and has many higher-level commands (macros) for formatting, making tables, etc. More information can be found in Ref. [1].

We just made a new paragraph. Extra lines and spaces make no difference. Note that all formulas are enclosed by $ and occur in *math mode*.

The default font is Computer Modern. It includes *italics*, **boldface**, *slanted*, and `monospaced` fonts.

2 Equations

Let us see how easy it is to write equations.

$$\Delta = \sum_{i=1}^{N} w_i (x_i - \bar{x})^2. \tag{1}$$

It is a good idea to number equations, but we can have a equation without a number by writing

$$P(x) = \frac{x-a}{b-a},$$

and

$$g = \frac{1}{2}\sqrt{2\pi}.$$

We can give an equation a label so that we can refer to it later.

$$E = -J \sum_{i=1}^{N} s_i s_{i+1}, \tag{2}$$

Equation (2) expresses the energy of a configuration of spins in the Ising model.[1]

We can define our own macros to save typing. For example, suppose that we introduce the macros:

```
\newcommand{\lb}{{\langle}}
\newcommand{\rb}{{\rangle}}
```

Then we can write the average value of x as

```
\begin{equation}
\lb x \rb = 3
\end{equation}
```

The result is

$$\lb x \rb = 3. \tag{3}$$

Examples of more complicated equations:

$$I = \int_{-\infty}^{\infty} f(x)\, dx. \tag{4}$$

We can do some fine tuning by adding small amounts of horizontal spacing:

```
\, small space        \! negative space
```

as is done in Eq. (4).

We also can align several equations:

$$a = b \tag{5}$$
$$c = d, \tag{6}$$

or number them as subequations:

$$a = b \tag{7a}$$
$$c = d. \tag{7b}$$

We can also have different cases:

$$m(T) = \begin{cases} 0 & T > T_c \\ \left(1 - [\sinh 2\beta J]^{-4}\right)^{1/8} & T < T_c \end{cases} \tag{8}$$

[1]It is necessary to process (typeset) a file twice to get the counters correct.

write matrices

$$\begin{aligned}\mathbf{T} &= \begin{pmatrix} T_{++} & T_{+-} \\ T_{-+} & T_{--} \end{pmatrix}, \\ &= \begin{pmatrix} e^{\beta(J+B)} & e^{-\beta J} \\ e^{-\beta J} & e^{\beta(J-B)} \end{pmatrix}. \end{aligned} \tag{9}$$

and

$$\sum_i \vec{A} \cdot \vec{B} = -P \int \mathbf{r} \cdot \hat{\mathbf{n}} \, dA = P \int \vec{\nabla} \cdot \mathbf{r} \, dV. \tag{10}$$

3 Tables

Tables are a little more difficult. TeX automatically calculates the width of the columns.

lattice	d	q	T_{mf}/T_c
square	2	4	1.763
triangular	2	6	1.648
diamond	3	4	1.479
simple cubic	3	6	1.330
bcc	3	8	1.260
fcc	3	12	1.225

Table 1: Comparison of the mean-field predictions for the critical temperature of the Ising model with exact results and the best known estimates for different spatial dimensions d and lattice symmetries.

4 Lists

Some example of formatted lists include the following:

1. bread
2. cheese

- Tom
- Dick

5 Special Symbols

5.1 Common Greek letters

These commands may be used only in math mode. Only the most common letters are included here.

$\alpha, \beta, \gamma, \Gamma, \delta, \Delta, \epsilon, \zeta, \eta, \theta, \Theta, \kappa, \lambda, \Lambda, \mu, \nu, \xi, \Xi, \pi, \Pi, \rho, \sigma, \tau, \phi, \Phi, \chi, \psi, \Psi, \omega, \Omega$

5.2 Special symbols

The derivative is defined as

$$\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} \tag{11}$$

$$f(x) \to y \quad \text{as} \quad x \to x_0 \tag{12}$$

$$f(x) \underset{x \to x_0}{\longrightarrow} y \tag{13}$$

Order of magnitude:

$$\log_{10} f \simeq n \tag{14}$$

$$f(x) \sim 10^n \tag{15}$$

Approximate equality:

$$f(x) \simeq g(x) \tag{16}$$

LaTeX is simple if we keep everything in proportion:

$$f(x) \propto x^3. \tag{17}$$

Finally we can skip some space by using commands such as

`\bigskip` `\medskip` `\smallskip` `\vspace{1pc}`

The space can be negative.

6 Use of Color

We can change colors for emphasis, but who is going pay for the ink?

References

[1] Helmut Kopka and Patrick W. Daly, *A Guide to LaTeX: Document Preparation for Beginners and Advanced Users*, fourth edition, Addison-Wesley (2004).

[2] Some useful links are given at .

Updated 5 December 2006.