LaTeX

A Document Preparation System

User's Guide and Reference Manual

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Illustrations by Duane Bibby

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To Ellen

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Contents

Preface

The first edition of this book appeared in 1985. It described LaTeX 2.09 , the first widely used version of LaTeX. Since then, I4W has become extremely popular, with many thousands of users around the world. Its functionality has grown through the efforts of many people. The time has come for a new version, LaTeX 2_ε, which is described in this edition. Hw 2E includes many of the enhancements that were made to LaTeX 2.09, as well as some new ones.

I implemented most of LaTeX 2.09 myself. was implemented by a group led by Frank Mittelbach, which included Johannes Braams, David Carlisle, Michael Downes, Alan Jeffrey, Chris Rowley, Sebastian Rahtz, and Rainer Schopf. They were assisted by many testers of the new version, and by the following organizations: the American Mathematical Society, the Open University (UK), and the Zentrum fiir Datenverarbeitung der Universitat Mainz. Lyle Ramshaw helped with the implementation of Bezier curves. My thanks to all of these people-especially Frank and Chris, with whom I have spent many enjoyable hours arguing about LaTeX.

LaTeX has been made more useful by two programs:BibTeX, written by Oren Patashnik, and MakeIndex, written by Pehong Chen and modified by Nelson Beebe.

Many people helped me write this book-often without knowing it. Advice given to me over the years by Cynthia Hibbard and Mary-Claire van Leunen has found its way onto a number of these pages. Andrei Broder was my local informant for Romanian. Helen Goldstein assisted with research on matters ranging from art to zoology.

This edition was improved by the corrections and suggestions of Marc Brown, Michel Goossens, and the implementers of LaTeX 2_ε. Stephen Harrison helped produce the final output. Errors and infelicities in the first printing were found by Rosemary Bailey, Malcolm Clark, and Ellen Gilkerson. The following people found errors in, or suggested improvements to, the previous edition: Martin Abadi, Helmer Aslaksen, Barbara Beeton, Rick Clark, John DeTreville, Mathieu Federspiel, Michael Fischer, Stephen Gildea, Andy Hisgen, Joseph Hurler, Louis E. Janus, Dave Johnson, Charles Karney, Nori Kawasaki, Steve Kelem, Mark Kent, William LeFebvre, Jerry Leichter, Hank Lewis, Stephen Peckham, Hal Perkins, Flavio Rose, Scott Simpson, David Sullivan, Matthew Swift, Walter Taylor, Joe Weening, Sam Whidden, Edgar Whipple, Chris Wilson, David Wise,

and Rusty Wright. I also received helpful comments and complaints about preliminary versions of LaTeX and of the first edition of this book from Todd Allen, Robert Amsler, David Bacon, Stephen Barnard, Per Bothner, David Braunegg, Daniel Brotsky, Chuck Buckley, Pave1 Curtis, Russell Greiner, Andrew Hanson, Michael Harrison, B. J. Herbison, Calvin W. Jackson, David Kosower, Kenneth Laws, Tim Morgan, Mark Moriconi, Stuart Reges, A. Wayne Slawson, David Smith, Michael Spivak, Mark Stickel, Gary Swanson, Mike Urban, Mark Wadsworth, and Gio Wiederhold. Assistance in the development of LaTeX2.09 was provided by David Fuchs, Richard Furuta, Marshall Henrichs, Lynn Ruggles, Richard Southall, Chris Torek, Howard Trickey, and SRI International.

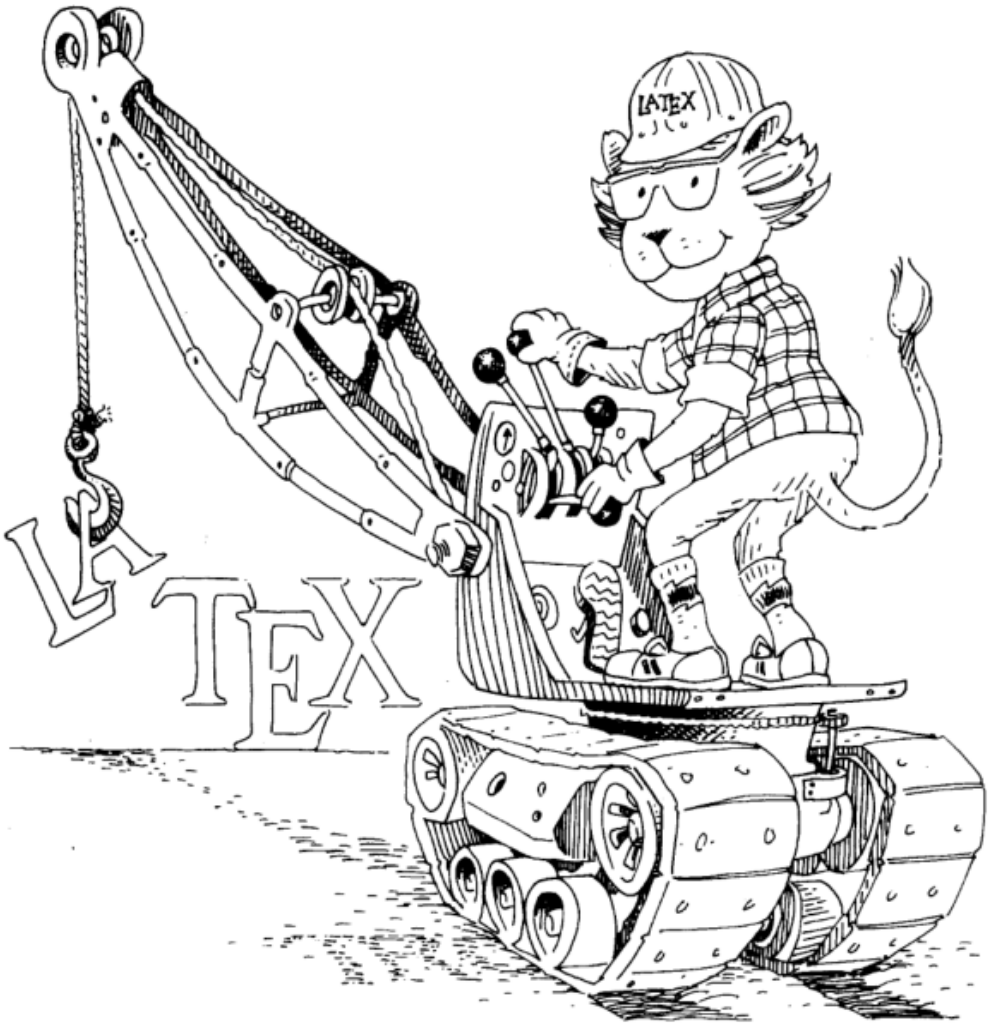
Since the introduction of version 2.09, my work on LaTeX has been supported by Digital Equipment Corporation. I want to thank Robert Taylor and all the other members of Digital's Systems Research Center for making it a fun place to work.

Finally, I want to express my special thanks to two men who made this book possible. Donald Knuth created TeX, the program on which LaTeX is based. He also answered all my questions, even the stupid ones, and was always willing to explain TeX's mysteries. Peter Gordon persuaded me to write the first edition, despite my doubts that anyone would buy a book about a typesetting system. Over the years, he has provided advice, fine dining, and friendship.

L. L.

Palo Alto, California
September 199

CHAPTER 1
Getting Acquainted



LaTeX is a system for typesetting documents. Its first widely available version, mysterjiously numbered 2.09, appeared in 1985. LaTeX is now extremely popular in the hientific and academic communities, and it is used extensively in industry. It has become a lingua frmnca of the scientific world; scientists send their papers electropically to colleagues around the world in the form of LaTeX input.

Over the years, various nonstandard enhancements were made to LaTeX 2.09 to oveqcome some of its limitations. LaTeX input that made use of these enhance ents would not work properly at all sites. A new version of LaTeX was needed to keep a Tower of Babel from rising. The current version of LaTeX, with the so newhat less mysterious number 2ε, was released in 1994. LaTeX 2_ε contains an improved method for handling different styles of type, commands for including graphics and producing colors, and many other new features.

Almost all standard LaTeX 2.09 input files will work with LaTeX 2_ε. However, to take advantage of the new features, users must learn a few new LaTeX 2_ε conventions. LaTeX 2.09 users should read Appendix D to find out what has changed. The rest of this book is about LaTeX, which, until a newer version appears, means LaTeX 2_ε.

LaTeX is available for just about any computer made today. The versions that rup on these different systems are essentially the same; an input file created according to the directions in this book should produce the same output with any of them. However, how you actually run LaTeX depends upon the computer system. Moreover, some new features may not be available on all systems when LaTeX 2_ε is first released. For each computer system, there is a short companion to this book, titled something like *Local Guide to LaTeX for the McKludge PC*, containing information specific to that system. I will call it simply the *Local Guide*. It is distributed with the LaTeX software.

Thete is another companion to this book, *The LaTeX Companion* by Goossens, Mittelbach, and Samarin[1]. This companion is an in-depth guide to LaTeX and to its *packages*-standard enhancements that can be used at any site to provide additional features. The LaTeX Companion is the place to look if you can't find what you need in this book. It describes more than a hundred packages.

1.1 How to Avoid Reading This Book

Many people would rather learn about a program at their computer than by reading a book. There is a small sample LaTeX input file named `small2e.tex` that shdws how to prepare your own input files for typesetting simple documents. Before reading any further, you might want to examine `small2e.tex` with a text editor and modify it to make an input file for a document of your own, then run LaTeX on this file and see what it produces. The Local Guide will tell you how to find `small2e.tex` and run LaTeX your computer; it may also contain information about text editors. Be careful not to destroy the original version of `small2e.tex`; you'll probably want to look at it again.

The file `small2e.tex` is only forty lines long, and it shows how to produce

only very simple documents. There is a longer file named `small2e.tex` that contains more information. If `small2e.tex` doesn't tell you how to do something, you can try looking at `small2e.tex`.

If you prefer to learn more about a program before you use it, read on. Almost everything in the sample input files is explained in the first two chapters of this book.

1.2 How to Read This Book

While `sample2e.tex` illustrates many of LaTeX's features, it is still only about two hundred lines long, and there is a lot that it doesn't explain. Eventually, you will want to typeset a document that requires more sophisticated formatting than you can obtain by imitating the two sample input files. You will then have to look in this book for the necessary information. You can read the section containing the information you need without having to read everything that precedes it. However, all the later chapters assume you have read Chapters 1 and 2. For example, suppose you want to set one paragraph of a document in small type. Looking up "type size7" in the index or browsing through the table of contents will lead you to Section 6.7.1, which talks about "declarations" and their "scope"-simple concepts that are explained in Chapter 2. It will take just a minute or two to learn what to do if you've already read Chapter 2; it could be quite frustrating if you haven't. So, it's best to read the first two chapters now, before you need them.

LaTeX's input is a file containing the document's text together with commands that describe the document's structure; its output is a file of typesetting instructions. Another program must be run to convert these instructions into printed output. With a high-resolution printer, LaTeX can generate book-quality typesetting.

This book tells you how to prepare a LaTeXinput file. The current chapter discusses the philosophy underlying LaTeX; here is a brief sketch of what's in the remaining chapters and appendices:

Chapter 2 explains what you should know to handle most simple documents and to read the rest of the book. Section 2.5 contains a summary of everything in the chapter; it serves as a short reference manual.

Chapter 3 describes logical structures for handling a variety of formatting problems. Section 3.4 explains how to define your own commands, which can save typing when you write the document and retyping when you change it. It's a good idea to read the introduction-up to the beginning of Section 3.1-before reading any other part of the chapter.

Chapter 4 contains features especially useful for large documents, including automatic cross-referencing and commands for splitting a large file into smaller pieces. Section 4.7 discusses sending your document electronically.

Chapter 5 is about making books, slides, and letters (the kind you send by post).

Chapter 6 describes the visual formatting of the text. It has information about changing the style of your document, explains how to correct bad line and page breaks, and tells how to do your own formatting of structures not explicitly handled by LaTeX.

Chapter 7 discusses pictures–drawing them yourself and inserting ones prepared with other programs–and color.

Chapter 8 explains how to deal with errors. This is where you should look when LaTeX prints an error message that you don't understand.

Appendix A describes how to use the *MakeIndex* program to make an index.

Appendix B describes how to make a bibliographic database for use with BibTeX, a separate program that provides an automatic bibliography feature for LaTeX

Appendix C is a reference manual that compactly describes all LaTeX's features, including many advanced ones not described in the main text. If a command introduced in the earlier chapters seems to lack some necessary capabilities, check its description here to see if it has them. This appendix is a convenient place to refresh your memory of how something works.

Appendix D describes the differences between the current version of LaTeX and the original version, LaTeX 2.09.

Appendix E is for the reader who knows TeX, the program on which LaTeX built, and wants to use TeX commands that are not described in this book.

When you face a formatting problem, the best place to look for a solution is in the table of contents. Browsing through it will give you a good idea of what B W has to offer. If the table of contents doesn't work, look in the index; I have tried to make it friendly and informative.

Each section of Chapters 3-7 is reasonably self-contained, assurning only that you have read Chapter 2. Where additional knowledge is required, explicit cross-references are given. Appendix C is also self-contained, but a command's description may be hard to understand without first reading the corresponding description in the earlier chapters.

The descriptions of most commands include examples of their use. In this book, examples are formatted in two columns, as follows:

The left column shows the printed output; the right column contains the input that produced it.	`The left column shows the printed output; the right column contains the input that produced it.`

Note the special typewriter type style in the right column. It indicates what you type-either text that you put in the input file or something like a file name that you type as part of a command to the computer.

Since the sample output is printed in a narrower column, and with smaller type, than LaTeX normally uses, it won't look exactly like the output you'd get from that input. The convention of the output appearing to the left of the corresponding input is generally also used when commands and their output are listed in tables.

1.3 The Game of the Name

1.4 Turning Typing into Typograph

1.5 Why LaTeX

1.6 Turning Ideas into Input

1.7 Trying It Out

Hello world

CHAPTER 2
Getting Started

2.1 Preparing an Input File

The input to LaTeX is a text file. I assume that you know how to use a text editor to create such a file, so I will tell you only what should go into your input file, not how to get it there. A good text editor can be customized by the user to make it easier to prepare LaTeX input files. Consult the Local Guide to find out how to customize the text editors on your computer.

On most computers, file names have two parts separated by a period, like `sample2e.tex`. I will call the first part its first name and the second part its *extension*, so `sample2e` is the first name of `sample2e.tex`, and `tex` is its extension. Your input file's first name can be any name allowed by your computer system, but its extension should be `tex`.

Let's examine the characters that can appear in input file. First, there are the upper- and lowercase letters and the ten digits `0 ... 9`. Don't confuse the uppercase letter `O`(oh) with the digit `0`(zero), or the letter `l`(the lowercase el) with the digit `1`(one). Next, there are the following sixteen punctuation characters:

```
. : ; , ? ! ‘ ’ ( ) [ ] - / * @
```

Note that there are two different quote symbols: ‘ and ’ . You may think of ’ as an ordinary "single quote" and ‘ as a funny symbol, perhaps displayed like ` on your screen. The *Local Guide* should tell where to find ‘ and ’ on your keyboard, if they're not obvious. The characters `(` and `)` are ordinary parentheses, while `[` and `]` are called square brackets, or simply brackets.

The ten special characters

```
# $ % & _ { } ~ ^ \
```

are used only in LaTeX commands. Check the *Local Guide* for help in finding them on your keyboard. The character \ is called *backslash*, and should not be confused with the more familiar /, as in 1/2. Most LaTeX commands begin with a \ character, so you will soon become very familiar with it. The `{` and `}` characters are called *curly braces* or simply *braces*

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Ignorable Inpu

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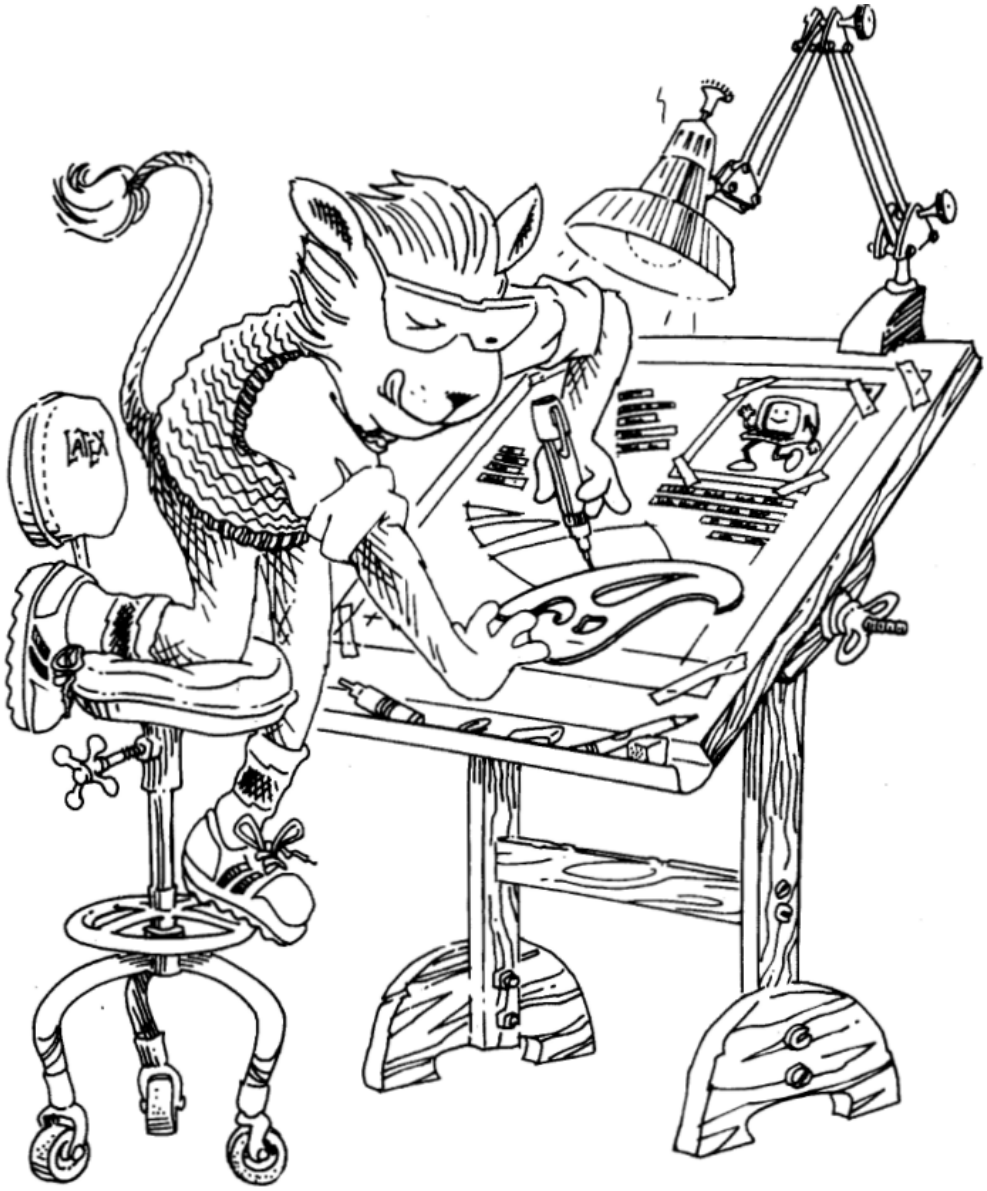

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Using MakeIndex

A.1 How to Use MakeIndex

Makelndex is a program for making an index from information generated by `\index` commands in your document.Section A.2 below explains what `\index` commands to use to produce the index entries you want.To use MakeIndex, you must also put the following commands in your document:

- `\usepackage{makeindx}` in the

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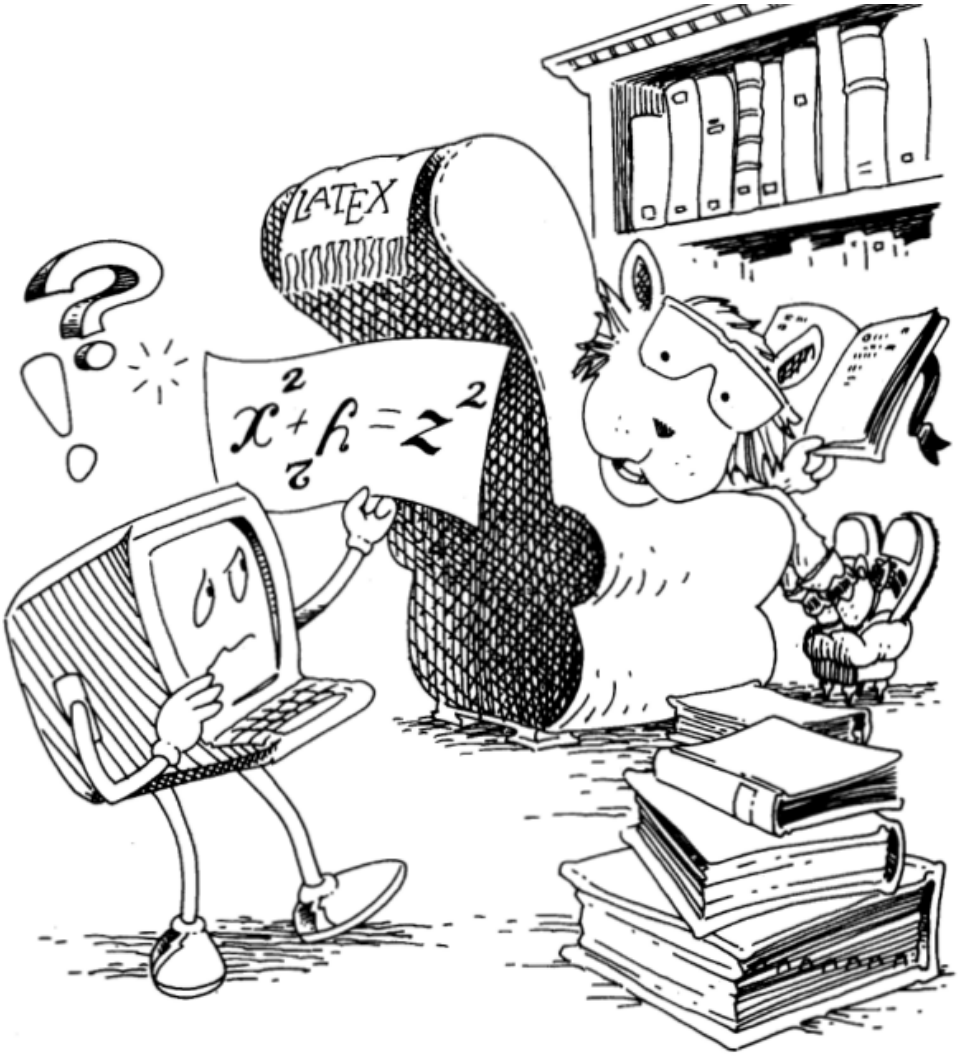

C.1 Commands and Environments

C.1.1 Commands and Environments
C.1.2 Command Names and Arguments
C.1.3 Environments
C.1.4 Fragile Commands
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`\symbol{num}`
Chooses the symbol with number *num* from the current font. Octal (base 8) and hexadecimal (base 16) numbers are preceded by ' and ", respectively. Robust

Appendix D
What's New

This appendix lists most of the differences between LaTeX 2.09, the original version of LaTeX, and the current version, LaTeX 2$_\varepsilon$.

Document Styles and Style Options

Documents prepared for LaTeX 2$_\varepsilon$ begin with a `\documentclass` command (Section 2.2.2). LaTeX 2$_\varepsilon$ realizes it is processing a LaTeX 2.09 input file and enters *compatibility mode* when it encounters a LaTeX 2.09 `\documentstyle` command. Most LaTeX 2.09 input files will work with LaTeX 2$_\varepsilon$. However, an error may occur if LaTeX 2$_\varepsilon$ reads an auxiliary file produced by LaTeX 2.09, so it's a good idea to delete such files before running LaTeX 2$_\varepsilon$.

The document styles of LaTeX 2.09 have become document classes. SliTeX has been eliminated; slides are produced using the `slides` document class. Standard document-style options that controlled formatting, such as `twoside`, have become document-class options, and are specified as optional arguments to the `\documentclass` command. Other document-style options have become packages, loaded with the `\usepackage` command (Section 2.2.2). Most nonstandard document-style options will work as LaTeX 2$_\varepsilon$ packages.

Appendix E
Using Plain TEX Commands

LaTeX is implemented as a TeX "macro package"-a series of predefined TeX commands.Plain TeX is the standard version of TeX,consisting of "raw" TeX plus the plain macro package. You can use Plain TeX commands to do some things that you can't with standard LaTeX commands.However,before using Plain TeX, check the LaTeX Companion to see if there is a package that does what you want.

Bibliography

[1] Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The LaTeX Companion*. Reading, Massachusetts: Addison-Wesley, 1994.

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