User's Guide:

Wiley Handbook Macro Package

Dear Author: Welcome to the Wiley Handbook Package!

You'll find using this style is very much like the standard LaTeX .cls files, with a few added features.

Click on the links above for more information on each topic.

Two important bits of advice

1. Copy, Rename, and Use the template file, `handtmpl.tex`, as the root .tex file for your book. This will give you the necessary color declarations, as well as show you how to enter all the needed and optional commands available in this style.

2. Read the Font section so that you will have the information you need to typeset your book in Garamond and Copperplate.

Files in this package, and what they do

Text list of files: `readme.txt`

Basic Style File: `handbook.cls`

Font Files: `handbook-garamond.sty`, `handbook-times.sty`

`handbook-garamond.sty` uses the fonts found in handfont.zip Works only with pdflatex

`handbook-times.sty` uses Times Roman fonts, may be used with either pdflatex or dvips

Font Zip File: `handfont.zip`

Includes all the fonts needed to typeset in Garamond and Copperplate. You can drop these files into the directory where your root .tex file is found and choose `\usepackage{handbook-garamond}`, and your font setup will be complete. Works only with pdflatex.

Template File: `handtmpl.tex`

Be sure to copy and rename this file for your book's root .tex file, since it has color definitions, and lists the necessary and optional commands.

Sample File: `handsamp.tex`

Basic sample file. Compare the commands entered with the resulting .pdf, use it to check that your fonts are working correctly.

Sample PDF: `HandSamp.pdf`

Results of handsamp.tex run with font style file: `\usepackage{handbook-garamond}`.

Documentation: `HandbookDocumentation.pdf`

PDF output is our goal

Your book must be typeset with LaTeX, and then translated to PDF by following a number of steps, depending on your LaTeX and system implementation.

The easiest way to do this is to run pdflatex on your file, directly producing a PDF file from your .tex file.

If this doesn't work on your system, you can use the older system, running dvips on your .dvi file to produce a .ps file, and then using Distiller to make the .pdf file: `.dvi ==> .ps ==> pdf`

Choosing and Using Fonts in the Handbook Style

We have three choices for the font sets used in the handbook. Each will maintain the general appearance of the style. `HandSamp.pdf` demonstrates the resulting pages produced the Garamond/Copperplate font style.

Garamond and Copperplate

The Wiley Handbook style is designed to use Garamond and Copperplate fonts.

As part of the Wiley package we include the handfont.zip file which includes these fonts, along with the .map and .fd files that you will need. You can unzip handfont.zip in the same directory (or folder) where your .tex files are found.

To test the fonts you can run pdflatex on the handsamp.tex file.

Assuming your test is successful, you can start your own book by copying and renaming handtmpl.tex to your chosen name for your root .tex file. In this file be sure that the command `\usepackage{Handbook-Garamond}` is uncommented and that there is a comment in front of the Times style file: `%\usepackage{Handbook-Times}`

This will give you the highest quality results.

Using Times Fonts

If however, for some reason you don't have pdflatex running (pdflatex is freeware, part of MikTeX, and downloadable from the web), we do have a fallback: in that case you can use the Times fonts.

You can uncomment `\usepackage{Handbook-Times}` in the handsamp.tex file, and try typesetting it to make sure that the fonts are working correctly.

Assuming you don't have problems, you can now start your document by copying and renaming handtmpl.tex to your chosen name for your root .tex file. Be sure that the command `\usepackage{Handbook-Times}` is uncommented, and that there is a comment in front of the Garamond style file: `%\usepackage{Handbook-Garamond}`.

When using the Times font set you should be able to translate the .dvi file to a .ps file with dvips, and then submit the .ps file to Distiller to make your pdf output.

Computer Modern Fonts

Third choice is to use the default font set, Computer Modern, although this is aesthetically inferior.

Front Matter

You can see an example of front matter by looking at the sample pages, `HandSamp.pdf`, and compare the pdf with handsamp.tex, the LaTeX file that was used to produce that pdf sample pages. You will also see a list of these commands in the handtmpl.tex template file.

Here is the order of the commands. All are optional except for the table of contents.

```
dedication

tableofcontents
listoffigures
listoftables

foreword

preface

acknowledgments

introduction
```

Starting the front matter

Wiley will provide the earlier title and copyright pages.

You will start your book with the table of contents. `\tableofcontents`

If you want to produce a list of figures or list of tables you will do this in the normal way:

```
\listoffigures
\listoftables
```

Preface

```
\begin{preface}
<enter text here>
```

If you use sections in the preface, use the star form so that there are no numbers

```
\section*{Preface section}
Preface text.

\prefaceauthor{<author name>}
\where{<author affiliation>
<date of preface>}
\end{preface}
```

Foreword

```
\begin{foreword}
<enter text here>
\end{foreword}
```

Acknowledgments

```
\begin{acknowledgments}
<enter text here>
\authorinitials{<enter initials here>}
\end{acknowledgments}
```

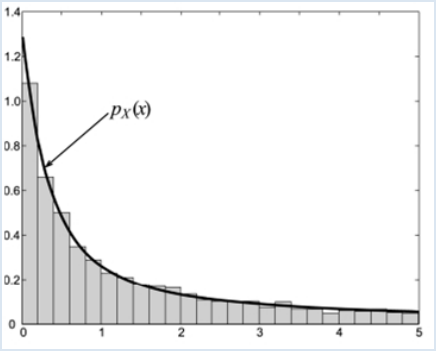
Introduction

```
\begin{introduction}
<enter text here>
\end{introduction}
```

Figures

Figures are done in the standard way in this style:

```
\begin{figure}[b]
\centerline{\includegraphics[width=.5\textwidth]{fig16-1}}
\caption[A histogram of output for a Gibbs sampler based on $n= 40$.]
{shows a histogram of output for a Gibbs sampler based on $n= 40$.
The histogram is constructed from the terminal output of the chain.}
\end{figure}
```



16.1 shows a histogram of output for a Gibbs sampler based on $n = 40$. The histogram is constructed from the terminal output of the chain.

There are a few issues that may be helpful to mention:

1) If you are using pdflatex, you must supply .pdf or .jpg files; if you are using dvips you must use .eps or .tif files. Remember that if you supply a .tif file you must specify both the height and width of the illustration in square brackets:

```
\includegraphics[height=2.25in, width=3in]{illustration.tif}
```

2) A hint to help with page makeup: You can have more than one illustration and caption in the same figure. This may help position your illustrations closer to where they are mentioned in the text. You can either put these grouped illustrations at the top or bottom of the page, or put them on their own page with `\begin{figure}[p]`

```
\begin{figure}[t]

\includegraphics[width=.8\textwidth]{samp}
\caption{First caption\label{firstfig}}

\includegraphics[width=.6\textwidth]{samp2}
\caption{Caption for second illustration}
\label{secondfig}

\includegraphics[width=.7\textwidth]{samp3}
\caption{Caption for third illustration}
\label{thirdfig}

\end{figure}
```

Tables

Tables in the Handbook Style will typeset in 9pt fonts, and will have a little extra space between lines so that they are more legible than the default LaTeX table style.

Rules for this style

1) Horizontal line (`\hline`) should be used above the table, underneath the column heads, and at the bottom of the table, and only there.

2) For each column head use `\bf`, and add `\boldmath` before any math.

3) Try to avoid vertical lines

4) Use `\centering` to make table center horizontally.

**In the sample below, notice that there is less vertical space between the first and second line of the column header, produced with `\\[-3pt]` at the end of the first line;
and, to get rid of extra horizontal space at the left and right table edges, we use `@{}`: `\begin{tabular}{@{}lcccc@{}}`.**

```
\begin{table}
\caption{Summary of Correlations Between Ice Cores and
Indices}
\centering
\begin{tabular}{@{}lcccc@{}}
\hline
&\bf Time&\bf 12-Month&\bf Pearson's&\bf Spearman \\[-3pt]
\bf Site
&\bf Span&\bf Period&\boldmath$R$&\bf Rank Order \\
\hline
GITS & 1865--1995&Feb.--Jan.&-0.316&-0.298 \\
Camp Century & 1865--1974&July--June&-0.320&-0.298 \\
Nasa-U & 1865--1994&Sept.--Aug.&-0.353&-0.342 \\
Milcent & 1865--1966&June--May&-0.410&-0.494 \\
\hline
\end{tabular}
\end{table}
```

16.1 Summary of Correlations Between Ice Cores and Indices

Site	Time Span	12-Month Period	Pearson's *R*	Spearman Rank Order
GITS	1865–1995	Feb.–Jan.	-0.316	-0.298
Camp Century	1865–1974	July–June	-0.320	-0.298
Nasa-U	1865–1994	Sept.–Aug.	-0.353	-0.342
Milcent	1865–1966	June–May	-0.410	-0.494

Example

The example environment is made with
`\example{<Title of Example>}{<Text of Example>}`
Here we see the commands used and the results:

```
\example{Gibbs sampling for a normal distribution}
{Suppose that $XN (M-5)$ for some mean vector $$ and covariance matrix $S$.
Note that, the Gibbs sampler may not be the most efficient method of
generating samples from a multivariate normal distribution. This example
serves to illustrate more general principles, where Gibbs sampling is used to
generate samples from non-standard distributions.
\begin{equation}
E[f (X)] = f(x)p(x)\, dx
\end{equation}
A standard result from
multivariate normality is that the distribution of any selection of
components within X conditioned on the remaining components is also normal.
}
```

Which produces...

EXAMPLE 0.1 Gibbs sampling for a normal distribution

Suppose that $XN(M-5)$ for some mean vector and covariance matrix S. Note that, the Gibbs sampler may not be the most efficient method of generating samples from a multivariate normal distribution. This example serves to illustrate more general principles, where Gibbs sampling is used to generate samples from non-standard distributions.

$$E[f(X)] = f(x)p(x)\,dx \tag{1}$$

A standard result from multivariate normality is that the distribution of any selection of components within X conditioned on the remaining components is also normal.

If you have difficulty making up pages when using many examples, you can enter them in a 'float' environment:

```
\begin{figure}[t]
\example{title}{contents}
\end{figure}
```

Steps

Steps are made with
\begin{steps}
\step{<num>}...
\end{steps}

Here is an example of code and results:

```
\begin{steps}
\step{0} (Initialization) Choose the length of the .burn-in. period $M$ and an
arbitrary initial state $X0$. Set $k = 0$.

\step{1} Generate a candidate point $W$ according to the proposal distribution
$q(|Xk)$.

\step{2} Generate a point $U$ from a $U(0, 1)$ distribution.
Set $Xk+1 = W if U =
(Xk, W)$ from (16.3). Otherwise set $Xk+1 = Xk$.

\step{3} Repeat Steps 1 and 2 until $XM$ is available. Terminate .burn-in.
process and proceed to step 4 with $Xk = XM$.
\end{steps}
```

Which produces...

Step 0. (Initialization) Choose the length of the .burn-in. period M and an arbitrary initial state $X0$. Set $k = 0$.

Step 1. Generate a candidate point W according to the proposal distribution $q(|Xk)$.

Step 2. Generate a point U from a $U(0, 1)$ distribution. Set $Xk + 1 = WifU = (Xk, W)$ from (16.3). Otherwise set $Xk + 1 = Xk$.

Step 3. Repeat Steps 1 and 2 until XM is available. Terminate .burn-in. process and proceed to step 4 with $Xk = XM$.

Key Terms

The Key terms environment is set up and used in this way:

\begin{keyterms}
\term{<term>} Term description...
\end{keyterms}

Easily done, and with nice results:

```
\begin{keyterms}

\term{Burn-in Period} The first M iterations in a Markov chain.

\term{Proposal Distribution}
sometimes called an instrumental distribution or a candidate- generating, the
proposal distribution may be chosen arbitrarily, although there may be
efficiency advantages to one form over another in some applications.
The proposal distribution satisfies the key condition for density functions.
\end{keyterms}
```

KEY TERMS

Burn-in Period: The first M iterations in a Markov chain.

Proposal Distribution: sometimes called an instrumental distribution or a candidate- generating, the proposal distribution may be chosen arbitrarily, although there may be efficiency advantages to one form over another in some applications. The proposal distribution satisfies the key condition for density functions.

Exercises and Answers

Cross-referencing labels will work in both exercises and answers.

Exercises

Exercises are made with

`\begin{exercises}`
`\exer{<number>}` text of exercise

`\subexer{<letter>}`

`\end{exercises}`,

as we see in the example below:

```
\begin{exercises}

\exer{16.1}Discuss why the ergodic average of a given number of samples in typical
applications of the M-H (and other) algorithms will have greater
variability than a corresponding average of the same number of
independent samples of f (X).\label{exer}

\exer{16.2}\subexer{a}Based on 50 independent replications of the M-H
algorithm in Example 16.1 with the uniform proposal distribution depicted in
Figure 16.1, test whether the mean of the terminal estimate is statistically
indistinguishable from the true value of 0.

\subexer{b}Second subexercise.
\end{exercises}
```

Which produces...

EXERCISES

16.1 Discuss why the ergodic average of a given number of samples in typical applications of the M-H (and other) algorithms will have greater variability than a corresponding average of the same number of independent samples of f (X).

16.2 (a) Based on 50 independent replications of the M-H algorithm in Example 16.1 with the uniform proposal distribution depicted in Figure 16.1, test whether the mean of the terminal estimate is statistically indistinguishable from the true value of 0.

(b) Second subexercise.

Answers

Answers to Selected Exercises are made similarly:

```
\begin{answers}
\answer{<number>}text of exercise
\subanswer{<letter>}
\end{answers}
```

As we see in the example below:

```
\begin{answers}

\answer{16.3} Let $X$ be the current state value and $W$ be the candidate
point. The candidate point $W$ is accepted with probability $(X,W)$. This
probability is random as it depends on $X$ and $W$. For convenience, let $p
(x, w) = p(w)q(x)/[p(x)q(w)]$ (so $(x,w) = min\{p (x, w), 1\}$ according to
(16.3)). \label{answer}

\subanswer{a}
After several steps involving the re-expression of the integrals above
(Reader should show these steps), it is found that $E [(X, W)] = 2$,
$p(x,w)$ $=1$,
$p(x)q(w)$ $dxdw$. The result to be proved then follows in several more steps
(reader to show) by invoking the given inequality $p(x) = Cq(x)$ (Incidentally,
the form of M-H where $q(w|x)  q(w)$ is sometimes called the independent
M-H sampler.)\label{subanswer}

\end{answers}
```

Which produces...

ANSWERS

16.3 Let X be the current state value and W be the candidate point. The candidate point W is accepted with probability (X, W). This probability is random as it depends on X and W. For convenience, let $p(x, w) = p(w)q(x)/[p(x)q(w)]$ (so $(x, w) = min\{p(x, w), 1\}$ according to (16.3)).

(a) After several steps involving the re-expression of the integrals above (Reader should show these steps), it is found that $E[(X, W)] = 2$, $p(x, w) = 1$, $p(x)q(w)\, dxdw$. The result to be proved then follows in several more steps (reader to show) by invoking the given inequality $p(x) = Cq(x)$ (Incidentally, the form of M-H where $q(w|x)q(w)$ is sometimes called the independent M-H sampler.)

Chapter References

References at the end of the chapter are entered as plain text, with a blank line between every entry.

```
\begin{references}
Besag, J., Green, P., Higdon, D., and Mengersen, K. (1995),
{\it Bayesian Computation
and Stochastic Systems}, Statistical Science, vol. 10, pp. 3–66.

Cappé, O. and Robert, C. P. (2000), {\it
Markov Chain Monte Carlo: 10 Years and Still
Running!}, Journal of the American Statistical Association, vol. 95, pp.
1282–1286.

...
\end{references}
```

Which produces...

REFERENCES

Besag, J., Green, P., Higdon, D., and Mengersen, K. (1995), *Bayesian Computation and Stochastic Systems*, Statistical Science, vol. 10, pp. 3-66.

Cappé, O. and Robert, C. P. (2000), *Markov Chain Monte Carlo: 10 Years and Still Running!*, Journal of the American Statistical Association, vol. 95, pp. 1282-1286.

...

BibTeX

BibTeX is one of the reasons why authors choose to use LaTeX. It allows the use of a bibliography database, automating the production of bibliography entries and making the entries more accurate.

The Handbook style uses the standard method of producing a bibliography using BibTeX. The instructions that follow are offered in an effort to be helpful, but you can follow instructions in any of the LaTeX reference guides instead, if you wish.

Using BibTeX for your Bibliography

BibTeX is a separate program which can be used with LaTeX to produce a database file and build a bibliography.

Follow these steps:

1. **Make a xxx.bib file, with 'xxx' being any file name you choose. This is the database file including all the references. The form that these entries should take is described in the LaTeX book.**

2. **In your .tex file enter `\bibliographystyle{plain}`**
   Next you must write `\bibliography{xxx}`, with 'xxx' being the name of the .bib database file that you have written. You can also use more than one .bib file, in which case you must separate the filenames with a comma: `\bibliography{xxx,yyy}`.

3. **Write either `\cite{<label>}` or `\nocite{<label>}` for each reference that you want to appear in the bibliography. `\cite{}` will produce a printed citation, `\nocite{}` will not print, but in either case he citation will appear in the finished bibliography.**

4. **Run Latex on the .tex document, producing the usual .aux file.**

5. **Run BibTex on the .tex document, producing a .bbl file,**

6. **And, finally, run LaTeX on the .tex file, and Voila! your bibliography will appear where you have written `\bibliography{<mybibfile>}`.**

See the example bibliography in the sample file, `handsamp.pdf`, and look in handsamp.tex to see how the bibliography commands were entered in the text.

Index

As with the BibTeX commands, indexing with this style uses the standard LaTeX indexing commands. You can read more about indexing in any of the LaTeX reference books. Here is a quick summary:

1. **Before `\begin{document}` write**

   ```
   \usepackage{makeidx}
   \makeindex
   ```

   `\makeindex` will open the file where the index information will be entered.

2. **In the body of your document, write in `\index{term}` to have "term" appear in the index. For a subentry, write the primary entry followed by an exclamation mark, i.e., `\index{trees!pointy}`. For a subsub entry, follow a similar sequence: `\index{trees!pointy!green}`.**

3. **When you run LaTeX on the file it will produce an .idx file. If you run each chapter separately you will have to combine all the separate .idx files into one file.**

4. **To alphabetize the index, you use the separate program, makeindx. How to call this program depends on your implementation of LaTeX, but it is possible to do so in a DOS box, using `makeindx filename.idx`. This will produce filename.ind. You may open this file and edit it if you want to do so.**

5. **To print the index at the end of your book, type in:**

   ```
   \printindex
   ```

   which will bring in the new filename.ind, formatted in two columns.

You may want to edit the `.ind` file to add letters between each section starting with a particular letter.

```
\begin{theindex}

\iletter{a}
  \item access cards, 35
  \item acquisition, 14
  \item AFIS, 5, 116, 169

  \indexspace
\iletter{b}
  \item behavior, 146, 186
  \item big brother, 10, 230
  \item binning, 140
```

Which produces...

A

access cards, 35
acquisition, 14
AFIS, 5, 116, 169

B

behavior, 146, 186
big brother, 10, 230
binning, 140

Draft Mode

If you enter the command `\draft` before `\begin{document}`, you will get double spaced text, and a time stamp on the running foot. Very convenient for copyediting.

15.1 Introduction/Purpose of the Chapter

The previous two chapters considered the interface of simulation and optimization. This chapter on Markov chain Monte Carlo (MCMC) continues the study of simulation-related methods, but with a different focus. MCMC is a powerful means for generating random samples that can be used in computing statistical estimates, numerical integrals, and marginal and joint probabilities. The approach is especially useful in statistical applications where one is forming an estimate based on a multivariate probability distribution or density function that would be hopeless to obtain analytically. In particular, MCMC provides a means for generating samples from joint distributions based on easier sampling from conditional distributions. The approach has had a large impact on the theory and practice of statistical modeling. In fact, MCMC sometimes applies in problems where it is hard to imagine any other approach working.

15.2 Vignette/Historical Notes

Markov chain Monte Carlo (MCMC) is a powerful means for generating random samples that can be used in computing statistical estimates and in computing marginal and conditional probabilities. MCMC methods rely on a dependent (Markov) sequence with a limiting distribution corresponding to a distribution interest.

Markov chain Monte Carlo (MCMC) is a powerful means for generating random samples that can be used in computing statistical estimates and in computing marginal and conditional probabilities.