A Format for a Good Academic Thesis

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A Thesis
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in Partial Fulfillment of the Requirements for
The Degree of Doctor of Engineering

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A Format for a Good Academic Thesis

By Assela Pathirana

Thesis Advisor: Professor E. L. Noname

An Abstract of the Thesis Presented in Partial
Fulfillment of the Requirements for the Degree of
Doctor of Engineering
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This is a skeleton system you can use to develop the structure of your graduate thesis with LaTeX. This document gives the necessary details on how to modify it to suit your needs.

You have to replace all the text between \begin{abstract} and \end{abstract} commands, with your thesis abstract. LaTeXwill place it appropriately when formatting the book.

ACKNOWLEDGMENT

When I was fed up with word and finally tried to convert my master's thesis to LaTeX, I searched the web for information. I was lucky to find the page written by a student of Univerity of Maine, on how to write a thesis from the system developed by Don Hummels. The link died sometime after that! (Perhaps the author graduated and left the university) Luckily I had a copy of the page and I posted it in my personal web site as a community service [Unknown 1998]. I should express my heartfelt thanks to the unknown author of that site, who made it easy (possible?) for me to convert my thesis to LaTeX.

Most of the material in my system was originated from that source.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1
Introduction

You don't need to know LaTeXto write your thesis with it! Just go through the skeleton files provided in this package and fill in the blanks. Compile the results and bingo! You have a beautifully formatted professional looking document.

I assume that you have already install LaTeXin your computer. If you don't already have it please download and install LaTeXas I have explained in the accompanying web pages, before proceeding further. In addition you need the free PostScript viewing program, gsview to view and print your document.

If you don't have any idea whatsoever about this 'LaTeXthing', you may want to go through the example `loving.tex`. The output document is `loving.ps` (in PostScript) or `loving.pdf` (in Adobe's Portable Document Format). While these template files themselves are designed to give you a sufficient LaTeXknowledge to get your thesis with it, first going through the above document will give you the much needed confidence to take the plunge.

1.1 organization of the book

Chapter 2 explains the structure of this system briefly. By reading it you will know where and what to change, so that these files will produce what you need.

Chapter 3 takes you through the essential elements of LaTeX. While not intended to serve as a reference, it will give you the jump start needed to make sense out of the commands and functions used in this document. If you need to use mathematical equations extensively, chapter 5 will help you. Good mathematical support is by the way, one of the major strengths of LaTeX. The basic commands needed to compile your LaTeXfile, view the output and print it are described in chapter 7. Next, in chapter 8 we go into the convenient BiBTeXsystem, that we use to manage bibliography in this thesis. Chapter 6 explains how you can do cross-referencing and citing in a LaTeXdocument.

Finally we conclude the journey in chapter 9 after giving a list of reference books that will help you to build up your LaTeXknowledge.

Chapter 2
The structure of the template

2.1 The main File

While, in principal it is possible to write a document of any number of pages in a single file, breaking large documents in to multiple files is convienient. In this template there is a seperate file for each chapter. The main file is `thesis.tex`. Basically you don't write almost anything on that file. Most of your material will be in the chapter files. Then you place a calling statement in the main file. Here is a part of the main `thesis.tex` file.

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%% Calling chapters
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
\include{introduction}
\include{structure}
\include{xref}
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%% Write each of your chapters in a seperate file
%% with extension tex. Then you have to write an \include statement
%% for each of those files here.
%% e.g. if you have a file named lit_survey.tex you have to have
%% \include{lit_survey} above to make latex read that file
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

We have a file named `introduction.tex` and to call it we write `\include{introduction}`.

2.1.1 Changing the chapter ordering

In future if you need to have the chapter in the file `xref.tex` before that in `structure.tex` simply change the order of lines:

From:	To:
\include{introduction}	\include{introduction}
\include{structure}	\include{xref}
\include{xref}	\include{structure}

2.2 Changing the names and other parameters

Open the file `thesis_info.tex`. It has a number of places where you have to enter your information. LaTeXwill automatically put these to appropriated places. For Example in

`\univ{University of Tokyo}`

replace 'University of Tokyo' with the name of your university.

Chapter 3
LaTeX Basics

This chapter provides an introduction into how to structure each chapter of your thesis. It also illustrates some of the basic formatting tools (lists, numbered lists, tables, and figures).

3.1 Sections and Sub-Sections

The `\section`, `\subsection`, and `\subsubsection` commands are used to create numbered divisions within a thesis. LaTeX will create the numbers for you, so references to section numbers are handled through the use of the `\label{}` and `\ref{}` commands. For example, This is Chapter 3, and the previous chapter is Chapter 2.

See 6 to learn how to refer to a chapter, a section or a subsection from elsewhere in your document.

3.1.1 Example subsection

Here's an example of a subsection.

Example subsubsection

This is a subsubsection within that section.

Another subsubsection

Another subsubsection.

3.2 Tables and Figures

Tables and Figures are "floating" bodies, which means LaTeX will try to put them anywhere that it thinks will work. Don't fight this until you have to, when your document is virtually in its final form.

Table 3.1 is an example. Notice that the `\label{}` is contained within the table caption.

In this example, LaTeX adjusts the column width of the tables to fit the contents. You can also explicitly set the width of a table column. Check out Table 3.2.

If you want to create a table without any fancy stuff like captions, a table number, you can use `{tabular}` command. Check chapter 2 for an example. If you just use
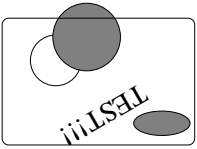
Things a table can hold	Example
Text	This is some text
Equations	$y(t) = \cos(2\pi ft)$
Graphics	

Table 3.1: This is an example table. Tables can hold many things.

Example	This is a two-column examples in which the paragraph column description is used
You can have lots of text in one of these columns, without getting a super-wide table.	This is some text
Equations still work too.	$y(t) = \cos(2\pi ft)$

Table 3.2: This table has two columns... The first is 1.5 inches wide and the second is two inches wide.

Figure 3.1: A blank figure example. For a figure to be useful, a graphic has to be shown in the space. Chapter 4 explains how to do this.

{tabular} command without the \verbtable+ command, LATEXdoes not treat it as a "floating" body and just places it exactly where you wrote it.

Figures work the same way. Figure 3.1 is a figure with three inches of blank vertical space. This could be used if a an item is to be taped into place for the final document. Examples of including graphics in figures are given in Chapter 4.

3.3 Lists

Lists may be numbered or not. Here's an example of a numbered list with references to the numbered items. Item number 1 is referenced here, and within the list.

1. Here is the first item.

2. And here is the second

3. This can go on for a long time. This item is longer than item 1. Notice how the numbers in the list can be referenced.

We don't have to number the items. Here's an example of the above list without item numbers.

- Here is the first item.

- And here is the second

- This can go on for a long time. This item is longer than item. We can't put labels on entries in a non-numbered list.

Both is numberd and bullet lists you can have any number of nested lists. Here is an example.

- Animals
    - Mammals
        1. Monkey
        2. Pig
        3. Man
    - Insects
        1. Bee
        2. Mosquito
- Trees

Chapter 4
Graphics

There are many graphics language supported by LaTeX which have varying degrees of flexibility. This chapter give examples of the inclusion of Encapsulated PostScript (EPS) files into the thesis. You can create EPS files using many free and commercial software. You can also convert the figures and graphs created by programs like Microsoft Excel to EPS.

This thesis is compiled using the `epsfig` package, assuming that `dvips` will be used to translate the document into PostScript before printing (see chapter 7).

There are many other packages which include PostScript into LaTeX documents. Most are obsolete, but may still work. As of LaTeX2e, the `epsfig` package is *the* supported way of including PostScript.

4.1 Including Encapsulated PostScript

Check out Goossens et al. [1994] for a complete description of the `\epsfig` macro. We will keep it simple here. Only a few examples.

You can scale either the width or height of the picture as illustrated in Figures 4.2 and 4.3.

Scaling the width and height creates a stretched image, as shown in Figure 4.4.

You can also clip out a portion of the image to be displayed. This is done by specifying the bounding-box lower left and upper right coordinates. A clip option is needed if the image is to be clipped. This is illustrated in Figure 4.5. If the "clip" option is not specified, the image will be translated. This is useful if the image is not originally positioned correctly. This is often the case for files with incorrect bounding-box information in the PostScript code, or for non-encapsulated PostScript. The procedure is illustrated in Figure 4.6.

The image may also be rotated by specifying a rotation angle in degrees. Check out Figure 4.7.
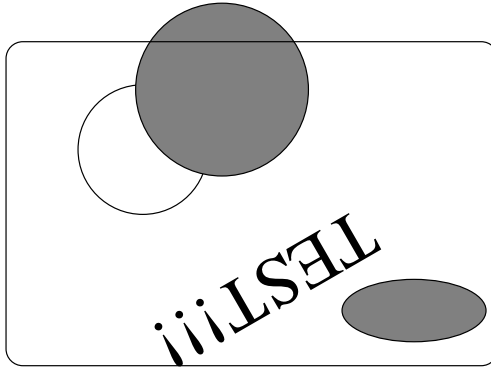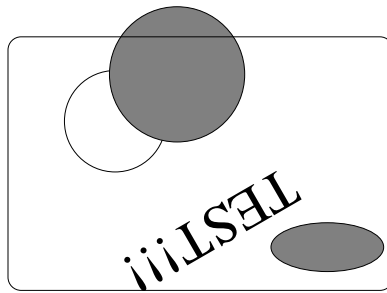
Figure 4.1: Original PostScript picture

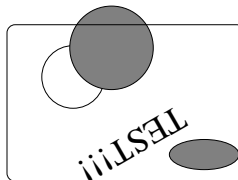Figure 4.2: Width scaling to two inches
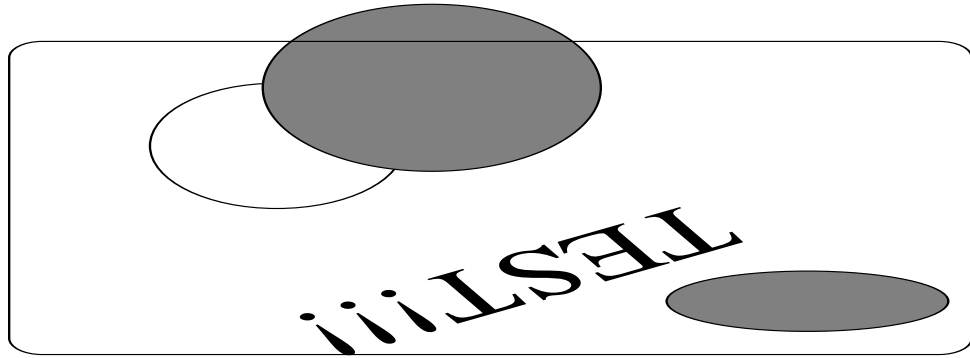

Figure 4.3: Height scaling to one inch.

Figure 4.4: Making image 5 inches by 2 inches
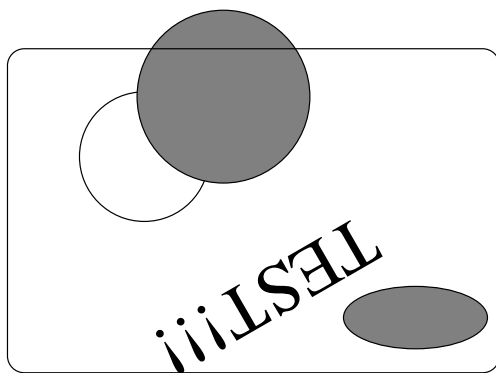

Figure 4.5: Clipping out a chunk of the picture.

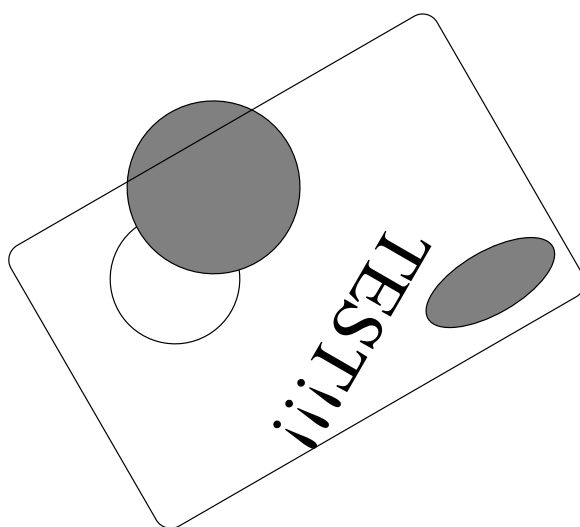Figure 4.6: Translating the picture within the figure.

Figure 4.7: 30 degree rotation of the image.

Chapter 5
Typesetting Math

Using LaTeX to typeset equation is easy, but takes some time to learn. This chapter gives some examples of different types of equations.

5.1 Types of Equations

Equations which appear within the text are delimited by dollar signs, so that `$y(t) = \cos(2 \pi f t)$` becomes $y(t) = \cos(2\pi f t)$. Equations with numbers use the `equation` environment, as in

$$y(t) = \cos(2\pi f t). \tag{5.1}$$

Note the punctuation at the end of equation (5.1), since it completes the above sentence.

Arrays of equations may be created using the `eqnarray` environment:

$$
\begin{aligned}
z(t) &= x(t) + y(t) & (5.2)\\
&= x(t) + \cos(2\pi f t). & (5.3)
\end{aligned}
$$

You can avoid numbering each element of an equation array by using the `\nonumber` keyword. For example

$$
\begin{aligned}
z(t) &= x(t) + y(t)\\
&= x(t) + \cos(2\pi f t). & (5.4)
\end{aligned}
$$

To avoid numbering any of the equations, use the `eqnarray*` environment as follows:

$$
\begin{aligned}
z(t) &= x(t) + y(t)\\
&= x(t) + \cos(2\pi f t).
\end{aligned}
$$

This is also the method of getting a single un-numbered equation.

$$y(t) = \cos(2\pi f t).$$

5.2 Equations Which Hold Arrays

Many equations hold arrays of numbers or other equations. Use the `array` environment to typeset these. It works about the same way as the `tabular` environment used earlier for tables.

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & x^2 \end{bmatrix}. \tag{5.5}$$

The same construct may be used to create complicated equations:

$$z(t) = \begin{cases} 0 & t < 0, \\ \cos(2\pi ft) & 0 \le t < 1, \\ 1/(1+t^2) & t \ge 1 \end{cases} \tag{5.6}$$

5.3 Other Examples

Here's an equation with an integral:

$$x(L) = \int_{-\infty}^{2L} y(t)\cos(t)dt. \tag{5.7}$$

Summations work the same way.

$$g(t) = \sum_{i=0}^{\infty} c_i e^{j2\pi f_0 t}. \tag{5.8}$$

Finally, here's a fraction:

$$H(\omega) = \frac{1}{1+j\omega}. \tag{5.9}$$

Chapter 6
Cross-referencing and Citing

6.1   cross-referencing

To cross reference any item in your thesis, just put `\label{}` statement with a unique name in the curly brackets.

For example see the following :

```
\chapter{Cross-referencing and Citing}
\label{ch:xref}
```

I have put the `\label{ch:xref}` statement immediately below the name of the chapter. Now let's see how we can refer it somewhere else in the document. Shown below is a place where I have referred it in chapter 1:

```
\chapter{Cross-referencing and Citing}
Chapter \ref{ch:struct} explains the structure ...
```

In the final document this cross referencing appers like:
Chapter 2 explains the structure ...

The `\ref{foo}` command will show the number of the chapter, section or subsection where you placed the command `\label{foo}`.

Note that if additional chapters, sections or subsections were added, the symbolic references would still point to the desired location, even though the chapter numbers would change. The `\pageref{}` command can be used to get the page number of a label, so you can say things like "Check out Table 3.1 on page 5."

Each of your figures, tables, equations should have a label statement so that you can refer to them elsewhere in the docuement. Here is a figure with a label statement.

```
\begin{figure}
\epsfig{file = ./figures/graph1.eps, width=.50\textwidth}
\caption{
It is very easy to convert your figures drawn in
Microsoft office to EPS. Just copy and paste to Illustrator
and save as EPS.
   \label{fig:mschart}
}
```

```
\end{figure}
```

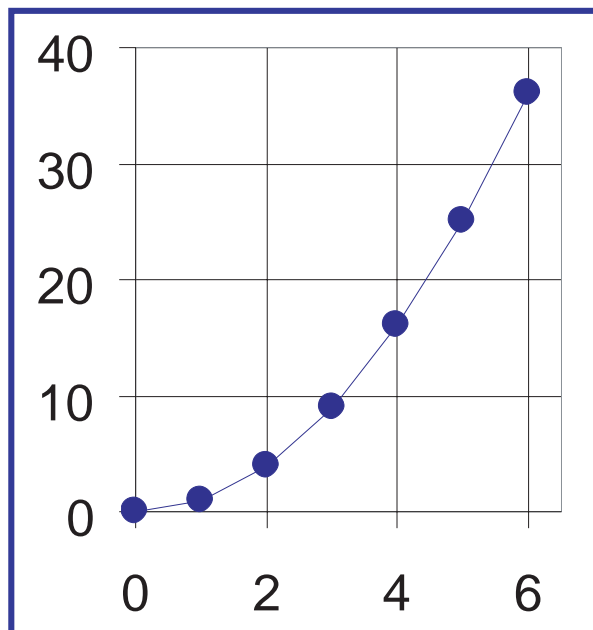You can refer to that figure by `{fig:mschart}` in the document.

Figure 6.1: It is very easy to convert your figures drawn in Microsoft office to EPS. Just copy and paste to Illustrator and save as EPS.).

Example:

I put figure 6.1 here to show you how you can cite a figure.

6.1.1 Getting References to Work

LaTeX pulls the section number information out of ".aux" files which were created on the *previous* run of LaTeX. Usually, if section labels have changed, it is necessary to re-compile the file *twice* to get the correct numbers into the symbolic references.

If the references don't look right, try recompiling.

6.2 Citations

Read {loving.pdf} or {loving.ps} to learn how to prepare a {.bib} file using LaTeX. Here I assume you have a {.bib} file with all your references in it.

An entry in the bib file will look something like this:

```
@book{jane,
author={J. Hahn},
title={{\LaTeX} for everyone: A reference guide and
tutorial for typesetting documents
```

```
using a computer},
publisher={Prentice Hall, New Jersey},
year={1993}
}
```

There are several styles for citing this type of entry. I will give just two:

1. If you need to refer to this as Hahn [1993] then use `\shortciteN{jane}`

2. To cite both name and year in brackets like,[Hahn 1993], use `\shortcite{jane}`

Chapter 7
How to Run

This chapter explains how to run your template to obtain an output. You need to have the following software installed to do it properly:

- Properly installed LaTeX system like MikTeX.

- gsView (GhostView) and GhostScript – available free from
  `http://www.ghostscript.com/`

- To print your pages, you may need a printer that supports PostScript.

If you have everything ready, go to the command prompt and type:

`latex thesis <Return>`

If you use BiBTeXyou may have to run LaTeX several times to get all the references correct. For details see chapter 8.

To have a look at the output

`yap thesis`

Yap command will invoke the a previewer (Yap = Yet Another Previewer) which can display .dvi files generated by `latex` command. You may have to do this compile-look-correct sequence a number of times while you are writing.

Finally how to print. Perhaps the easiest way to print a LaTeX document from a PC is using gsview. The following command can produce a PostScript (.ps) file which you can read from gsview.

`dvips thesis <Return>`

Then just start the gsview program and open the file thesis.ps from the menu. You can print your thesis from here.

In fact, gsview program is responsible for placing EPS graphics in your figures. This happens when you do `dvips thesis`. Even yap relies on gsview to render the graphics in documents. So, without getting gsview (and GhostScript) installed, you may not be able to get your graphics seen either on the screen or on printed-paper.

Chapter 8
Using BibTeX

It is possible to typeset the references for your thesis by hand, and if you do not have many references, this may in fact be the easiest path to follow. The procedure is described in [Lamport and Bibby 1994]. For more complicated documents, BibTeX is a powerful tool for typesetting the bibliography of your thesis. For example, note the differences between citations of articles [Pathirana et al. 2001], books [Kopka and Daly 1999], tech reports [Ample 2001], manuals [Name 2001], and conference proceedings [Pathirana et al. 2000]. Each type of citation has its own rules governing what font is used for titles, journal names, etc. BibTeX handles these details for you, and organizes your citations into an accurate bibliography. This chapter (hopefully) gives enough information for you to take advantage of this tool. A more complete description of BibTeX is given in [Goossens et al. 1994].

8.1 The BibTeX database: references.bib

Each citation that is used in your thesis must have an entry in the BibTeX database file, which is "references.bib" for this thesis template. Enter your own references following the examples given in that file. The first part of each database entry is a symbolic name, which will be used to create the citation. The `\shortcite` command is used to add a citaion to a given database entry. For example, `\shortcite{exproc}` will become "[Pathirana et al. 2000]", since this article has the symbolic name "exproc" in the database file. BibTeX figures out which files within the database you are citing, and creates the typeset bibliography for you.

8.2 About 'Chicago' style

The citation and reference style 'Chicago' is used in this template. Table 8.1 gives a list of different styles of citations you can use in your document.

8.3 Creating the List of References

Because of the interaction between LaTeX and BibTeX, a more complicated procedure is needed to create the complete bibliography, and get the references right within the LaTeX document. The following procedure should work.

1. Compile the LaTeXdocument using the usual command

Command	Single Author	Two Authors	Three or More Authors
Commonly used			
\shortciteN{key}	Hahn [1993]	Kopka and Daly [1999]	Goossens et al. [1994]
\shortcite{key}	[Hahn 1993]	[Kopka and Daly 1999]	[Goossens et al. 1994]
Rarely needed			
\cite{key}	[Hahn 1993]	[Kopka and Daly 1999]	[Goossens, Mittelbach, and Samarin 1994]
\citeNP{key}	Hahn 1993	Kopka and Daly 1999	Goossens, Mittelbach, and Samarin 1994
\citeA{key}	[Hahn]	[Kopka and Daly]	[Goossens, Mittelbach, and Samarin]
\citeANP{key}	Hahn	Kopka and Daly	Goossens, Mittelbach, and Samarin
\citeN{key}	Hahn [1993]	Kopka and Daly [1999]	Goossens, Mittelbach, and Samarin [1994]
\shortciteNP{key}	Hahn 1993	Kopka and Daly 1999	Goossens et al. 1994
\shortciteA{key}	[Hahn]	[Kopka and Daly]	[Goossens et al.]
\shortciteANP{key}	Hahn	Kopka and Daly	Goossens et al.
\citeyear{key}	[1993]	[1999]	[1994]
\citeyearNP{key}	1993	1999	1994

Table 8.1: Different citation styles and how they will show citations for references with different number of authors.

```
latex thesis.tex
```

This creates files which BibTeX needs to determine what to include in the list of references.

2. Run BibTeX to compile the bibliography.

```
bibtex thesis
```

This creates a file which LaTeX will include to produce the bibliography.

3. Compile the LaTeXdocument again using the usual command

```
latex thesis.tex
```

This line will include the BibTeX bibliography in the resulting document. However, since citation numbers are obtained from the previous compilation of LaTeX, the citation numbers will probably not be correct.

4. Recompile the file to get the citation numbers correct.

```
latex thesis.tex
```

Chapter 9
Conclusion

The objective of this article was not to teach you how to use LaTeX. That is an impossible task to do within a few pages of text. Further there are a large number of good books and articles on the subject: Lamport and Bibby [1994],Kopka and Daly [1999], Goossens et al. [1994] to name a few.

If you are seriously going in to the task of writing your thesis in LaTeXit will be a good investment to buy one or a few of these books. With a good reference handy, you will be able to develop this skeleton file in to a professional looking document, with minimum effort. So Good Luck !!

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Pathirana, A., S. Herath, and K. Musiake (2001, February). Scaling rainfall series with a multifractal model. *Annual Journal of Hydraulic Engineering 45*, xxx–yyy.

Unknown (1998, Oct). My LATEX adventures... On the Web.

APPENDIX A
Sample Appendix File

This is an example of an appendix. Put anything that you want here.

APPENDIX B
Sample Appendix File

This is an example of an appendix. Put anything that you want here.