Math 481/581
Homework 4

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1 Overview

In this assignment, you will use the thesis/dissertation document class and get some experience with LaTeX equations, tables, and figures.

Feel free to use the thesis/dissertation skeleton that we dissected in class as the basis for your homework. After filling in your name, department, etc. you'll only need to do the actual LaTeX typesetting. This LaTeX skeleton is available via WWW at

`http://www.math.arizona.edu/~hays/latex/diss/diss.txt`

2 Typesetting Equations

The following mathematical expressions make use of just about everything we covered in class. For the homework, typeset at least two of the following (the easiest ones come first):

Equation #1

$$i\dot{A}_j = f(|A_j|^2)(A_{j+1} + A_{j-1}) + F(|A_j|^2)A_j$$

Hint The dot on the first "A" is produced with a special accent. Also, the vertical bars are produced with the "|" charcter.

Equation #2

$$S_n = \left(\begin{array}{cc} h_n + f_n & -\phi_n \\ \chi_n & h_n - f_n \end{array} \right)$$

Hint You will need to use an `array` environment with appropriate `\left` and `\right` delimiters. The symbols ϕ and χ are generated with `\phi` and `\chi`.

Equation #3

$$\sum_{n=0}^{\infty} \frac{p_n(x)}{n!} t^n = \frac{1}{\sqrt{1+t^2}} \, \, e^{2x \tan^{-1} t}$$

Hint You can use a couple of `\,` commands to move the exponential away from the fraction on the right hand side. There is a special command to generate the tangent.

Equation #4

$$\int_{-\infty}^{\infty} \!\!\! \mbox{sech}(\pi x)\; p_m(x) p_n(x)\, dx = (n!)^2\, \delta_{mn}$$

Hint LaTeX does not define a `\sech` command; therefore, you'll need to use a `\mbox` command to make it come out in an upright roman font. You can use some `\!`'s to push the sech() under the integration limits and a `\,` or two to insert extra space after the sech() and before the δ.

Equation #5

$$\{B, C\} = -i \sum_j \left(\frac{\partial B}{\partial A_j} \frac{\partial C}{\partial A_j^*} - \frac{\partial B}{\partial A_j^*} \frac{\partial C}{\partial A_j} \right) f(|A_j|^2)$$

Hint The parentheses inside the sum are produced with `\left` and `\right` delimiters. The ∂ symbol is generated with `\partial`. Remember that you'll need to use backslashes to generate the curly braces.

Equation #6

$$\begin{aligned} X &= -\frac{i}{\Delta^2} \left[2 + \frac{p_{2N+1}}{2p_{2N+2}} + \sum_j \mu_j + (-1)^N \frac{f_n^{(N+1)}}{f_n^{(0)}} \prod_j \mu_j \right] \\ Y &= \mp \frac{i(-1)^N |\phi_n^{(N)}|^2}{2\Delta^2 p_{2N+2}} \prod_j \mu_j^* \end{aligned}$$

Hint The large brackets are produced with matching delimiters. The symbol $\mp$ is generated with `\mp`.

3 Typesetting Tables

For the homework, typeset at least one of the following tables:

Table #1

Conditions that Prevent Blowup		
ν	$N = N^*$	$N > N^*$
$1 < \nu < 2$	$\mu > 1 + \nu/2$	$\mu > \nu + 1/2$
$\nu \geq 2$	$\mu \geq \nu$	$\mu > \nu + 1/2$

Hint You'll need to use `\multicolumn` to generate the heading. The other entries in the `tabular` environment will need to be done in math mode. The symbols μ and ν are generated with `\mu` and `\nu`.

Here's a handy hack: to produce extra vertical space in the table, do something like the following between the `\begin{center}` and the `\begin{tabular}`:

```
\renewcommand{\arraystretch}{1.5}
```

This causes the height of each row to be 1.5 times greater than normal. If you don't do this, the mathematical expressions is the table are too close to the horizontal lines. When the `center` environment ends, `\arraystretch` is automagically restored to its previous value.

The second one is a bit trickier.
Table #2

Periodic Table of the Conversion Polynomials				
	From NO	From NSO	From ANO	From SO
To NO	$\exp xt$	$\exp x(e^t-1)$	$\frac{1}{1-t}\exp\frac{xt}{1-t}$ **1.**	$\frac{2}{2-t}\exp\frac{2xt}{2-t}$ **2.**
To NSO	$(1+t)^x$	$\exp xt$	$\frac{1}{1-t}\left(\frac{1}{1-t}\right)^x$	$\frac{2}{2-t}\left(\frac{2+t}{2-t}\right)^x$
To ANO	$\frac{1}{1+t}\exp\frac{xt}{1+t}$ **3.**	$e^t\exp x(1-e^{-t})$	$\exp xt$	$\frac{2-t}{2+t}\exp\frac{2xt}{2+t}$ **4.**
To SO	$\frac{2}{2+t}\exp\frac{2xt}{2+t}$ **5.**	$\frac{2}{e^t+1}\exp\left(2x\tanh\frac{t}{2}\right)$	$\frac{1}{1-t}\exp\frac{2xt}{2-t}$	$\exp xt$

1. $n!L_n(-x)$
2. $\frac{n!}{2^n}L_n(-2x)$
3. $(-1)^n n!L_n(x)$
4. $\frac{(-1)^n(n-1)!}{2^{n-1}}[nL_n(2x)+L_{n-1}(2x)]$
5. $\left(-\frac{1}{2}\right)^n L_n(2x)$

Hint This one is done in a `tabular` environment. The list underneath is an `enumerate` environment. One annoying thing about LaTeX is that you cannot put footnotes inside a table (see below).

As above, you'll need to change `\arraystretch` to something like 1.8 so that the vertical spacing looks good. Generating the "footnote" numbers in the table is a pain. I defined the following macro to do it:

```
\newcommand{\fn}[1]{\ensuremath{{}^{\mbox{\scriptsize\textbf{\  #1.}}}}}
```

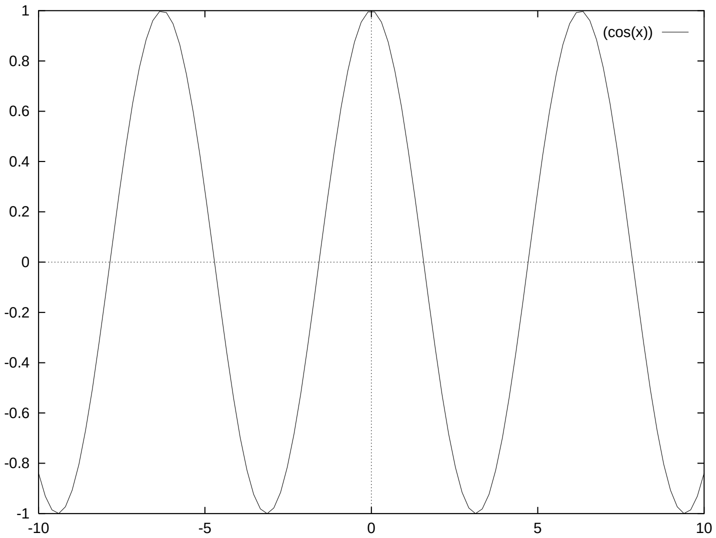
In the table itself, you'd say `\fn{1}` to generate the "1.", etc. The only new thing here is `\scriptsize` which causes the font size to decrease to the size normally used for sub- and superscripts.

4 Including a Figure

Finally, use the `graphics` package to include the PostScript figure available from

`http://www.math.arizona.edu/~hays/latex/fig.ps`

into your LaTeX file.



You will need to rotate and rescale the figure so that it appears right side up and fits on the page (I set the width to four inches to achieve this).

5 Submitting Your Completed Assignment

Email your LaTeX files to Prof. Restrepo at

`restrepo@math.arizona.edu`

You do not need to include the PostScript figure, or the document class source code itself — you only need to include the LaTeX files that you create.