Using Beamer for Presentations

Dr. Russell L. Herman

January 31, 2014

LaTeX's Beamer class allows one to create slides for a presentation. The end result is a PDF-file which can be used without LaTeXfiles.

The simplest code for producing a slide is to begin with declaring the Beamer class, `\documentclass{beamer}`, and then in the body insert a frame environment. (Beamer uses frams instead of slides.) The following gives a plain frame:

```
\documentclass{beamer}

\begin{document}

\begin{frame}
Here we add some text.
\end{frame}

\end{document}
```

Notice that the text is vertically centered. This is the default alignment. You can change the alignment by adding [t], [b], or [c] to the frame. For example,

```
\begin{frame}[t]
Here we add some text.
\end{frame}
```

1 Introduction

On these slides one can add the usual commands for equations and itemized lists, etc. Compile the tex file and open the PDF-file. Entering **CTRL-L** will bring the file to full screen. You will seem small navigation icons along the bottom of the page.

Modifying the frame command will give the slide a title. One can insert this two ways:

```
\begin{frame}{First slide}
\end{frame}
```

or

```
\begin{frame}
\frametitle{This is a frame title}
Here we add some more text.
\end{frame}
```

Adding a second slide is simple.

```
\documentclass{beamer}

\begin{document}

\begin{frame}{First slide}
Here we add some text.
\end{frame}

\begin{frame}{Second slide}
Here we add some more text.
\end{frame}

\end{document}
```

Of course, you can add a list to a slide. Such a slide would look like

```
\begin{frame}{My Main Points}
\begin{enumerate}

\item[1.] Point One
\item[2.] Point Two
\item[3.] Point Three

\end{enumerate}
\end{frame}
```

2 Title Slide

You will want a title slide. This is done by adding to the preamble (before the `\begin{document}`):

```
\title[short title]{My Senior Project}
\subtitle[short subtitle]{subtitle if really needed \\ Advisor: Dr. So and So}
\author{My Name}
\institute{Mathematics and Statistics, UNCW}
\date{\today}
```

Then after the `\begin{document}` one can add `\titlepage`. This will produce the title slide with the information. However, it is not vertically centered. It is bettter to place the line within a frame of its own.

```
\begin{frame}
\titlepage
\end{frame}
```

3   Themes

Now we are ready to add features. First there are packages which you will probably need for mathematics, figures, links, etc. So, after the documentclass line, add

```
\usepackage{amsmath,amsfonts}    % to use ams math symbols
\usepackage{graphicx}                    % to insert images
\usepackage{url}                             % to insert urls
```

There are a variety of Beamer Themes. Try the following after the packages are loaded:

```
\usetheme{Warsaw}
```

Notice how the pages have changed.

So, you do not like blue? Try the following

```
\documentclass[red]{beamer}
```

There are many themes. You can insert a theme using the form `\usetheme{theme}` with a value for *theme*. Common values for theme are: *Hannover, Boadilla, Madrid, Pittsburgh, Rochester, Copenhagen, Warsaw, Singapore, Malmoe, Goettingen, Berkeley* or, *AnnArbor.* See sites like Beamer Matrix (`http://www.hartwork.org/beamer-theme-matrix/`) to view different themes.

You can also use change the colors by adding `\usecolortheme{color}` to the preamble. The color value could be *albatross, beaver, beetle, crane, dolphin, dove, fly, lily, orchid, seahorse, whale,* or *wolverine.*

If you want to load a Rochester theme but change to a brownish color, you can start the document with

```
\documentclass[xcolor=dvipsnames]{beamer}
\usecolortheme[named=Brown]{structure}
\usetheme{Rochester}
```

Since brown is not a typical color, one can use the xcolor list. There are many styles, colors, etc. You probably should do something simple and spend your time on the content.

4   Sections

If you place a section label between frames, then compile the file twice, you will see a navigation system between sections.

```
\section{Slide 2}
```

However, they begin to stack up and detract from the area you want for your material. So, you might change the first line to

```
\documentclass[red,compress]{beamer}
```

Inserting subsections will fill more of the navigation bar. This may, or may not, look good, depending upon the themes used. You probably do not need more than a half dozen sections.

You might want to add a Table of Contents. This frame is created automatically if you have added sections to the presentation. This frame would typically come after the title frame.

```
\begin{frame}
\frametitle{Outline}
\tableofcontents
\end{frame}
```

Note that sections and subsections are placed between frames and not inside frames. They take the form

```
\section{Calculus}
\subsection{Integration}
\subsubsection{Integration by Parts}
```

Adding a star (*) suppresses the section from the Table of Contents but not the navigation bar, if it is in your theme:

```
\section*{Calculus}
```

5 Overlays

There are times when you do not want to reveal the entire slide at once. This was done in the days of transparencies by overlaying slides. Thus, the reference to *overlays*. Most often this consists of revealing one item at a time. Here we will demonstrate this by changing the itemized items as follows and see what happens.

Start with the list

```
\begin{enumerate}

\item<1-> Point One
\item<2-> Point Two
\item<3-> Point Three

\end{enumerate}
```

Notice that `\item[1] Point One` in the usual enumerated list was replaced with `\item<1-> Point One`. Try removing the dashes and see what happens. Change the order of the numbers and see what happens. You should see that the following rules hold:

- `<3>` indicates that the item remains on the third overlay (version of this frame).

- `<3->` indicates that the item remains on the third overlay and beyond.

- `<-3>` indicates that the item remains up to the third overlay.

- `<3-5>` indicates that the item remains on the third thru fifth overlays.

- `<3-5>` indicates that the item remains on only the third and fifth overlays.

You could also use a *pause* to reveal one item at a time.

```
\begin{enumerate}
\item Point One \pause
\item Point Two \pause
\item Point Three
\end{enumerate}
```

Other things you can try are

```
\begin{enumerate}

\item<1,3> Point One
\item<2> Point Two
\item<3> Point Three

\end{enumerate}
```

This also works with bulleted items and subitems. Combining several overlays, we have

```
\begin{itemize}
\item<1-3> The first item
\begin{itemize}
\item<1-> The first subitem
\item<2-> The second subitem
\item<3-> The third subitem
\end{itemize}
\item<4-> The second item
\item<5> The third item
\end{itemize}
```

Notice how these satisfy the above rules.

One can get a bit fancy with overlays. Using the *align* environment plus `\only`, we can change bits of an equation. Here terms are added with the equation in place.

```
\begin{align*}
    \only<1>{y=ax^2}
    \only<2>{y=ax^2+bx}
    \only<3>{y=ax^2+bx+c}
\end{align*}
```

Also, one can use `\alert` to highlight parts of an equation. Here each term is highlighted as one progresses (hit ENTER).

```
\begin{frame}{Equation Overlays}
\Huge
  \begin{equation*}
      \alert<1->{f(x)} = \alert<2>{ax^2} + \alert<3>{bx} + \alert<4>{c}
  \end{equation*}
\end{frame}
```

Using the *tikz* package, one can add graphics to highlight and draw arrows to parts of equations. In the preamble, insert

```
\usepackage{tikz}
\usetikzlibrary{arrows,shapes}
\tikzstyle{every picture}+=[remember picture]
\tikzstyle{na} = [baseline=-.5ex]
```

Then, one can insert an equation and descriptors. The labels (s1) and (d1) to (d4) are nodes. These are located where the corresponding terms in the equation appear. The arrows are then drawn between these nodes in the tikzpicture environment. Adding tags like `<3->` provide the overlays, or animations.

```
\begin{itemize}
\item<2-> Function of $x$ \tikz[na] \node[coordinate] (s1) {};
\item<1->[]{%
\begin{equation}
 \tikz[baseline]{ \node[fill=blue!10,anchor=base]
  (d1) {$f(x)$}; }
= \tikz[baseline]{ \node[fill=red!10,anchor=base]
  (d2) {$ax^2$}; }
+ \tikz[baseline]{ \node[fill=green!10,anchor=base]
  (d3) {$bx$}; }
+ \tikz[baseline]{ \node[fill=yellow!15,anchor=base]
  (d4) {$c$}; }
\end{equation}}%

\item<3-> Quadratic term \tikz[na] \node[coordinate] (s2) {};
\item<4-> Linear term  \tikz[na] \node[coordinate] (s3) {};
\item<5-> Constant term  \tikz[na] \node[coordinate] (s4) {};
\end{itemize}
```

```
\begin{tikzpicture}[overlay]
\path<2->[->] (s1) edge [bend left] (d1);
\path<3->[->] (s2) edge [bend right] (d2);
\path<4->[->] (s3) edge [out=0, in=-90] (d3);
\path<5->[->] (s4) edge [out=0, in=-90] (d4);
\end{tikzpicture}
```

6   Two Columns

There are times when you might want to divide a slide into two columns and place two figures or a figure and text side by side. There are several approaches.

```
\begin{frame}{Two columns}
\begin{columns}
   \begin{column}{0.5\textwidth}

     Here we can add some text

   \end{column}

   \begin{column}{0.5\textwidth}

     or, add text on the right side.

   \end{column}
\end{columns}

\end{frame}
```

7   References

Here is a frame with references added.

```
\section{References}
\begin{frame}
\frametitle{References}

\begin{thebibliography}{99}
\bibitem{Erdos01} P. Erd\H os, \emph{A selection of problems and
results in combinatorics}, Recent trends in combinatorics (Matrahaza,
1995), Cambridge Univ. Press, Cambridge, 2001, pp. 1--6.

\bibitem{ConcreteMath}
R.L. Graham, D.E. Knuth, and O. Patashnik, \emph{Concrete
mathematics}, Addison-Wesley, Reading, MA, 1989.
```

\bibitem{Knuth92} D.E. Knuth, \emph{Two notes on notation}, Amer.
Math. Monthly \textbf{99} (1992), 403--422.

\bibitem{Simpson} H. Simpson, \emph{Proof of the Riemann
Hypothesis}, preprint (2003), available at
\url{http://www.math.drofnats.edu/riemann.ps}.

\end{thebibliography}

\end{frame}