Creating Presentations in LaTeX

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1 Outline of Workshop

For this workshop we will be using the LaTeX class called BEAMER to make slides and presentations.

Previous Knowledge For this workshop, no previous knowledge of BEAMER is required. However, a basic knowledge of LaTeX is required. Review previous workshop "Writing Articles in LaTeX ".

Goals To present a short tutorial of commonly used BEAMER features and create a basic presentation using BEAMER

2 Introduction

BEAMER just like any other LaTeX document contains a preamble and a text body. Thus a BEAMER presentation starts off the `\documentclass` command followed by the preamble and then the text body using the `document` envirnoment. Take note that with the beamer class, we don't have to install all the packages we do with a regular `article` document, some are automatically installed. Inside the text body, we have to create slide frames in which the necessary material can be inputted. This is done using the `frame` environment. A frame can consist of one to multiple slides, depending on the specifications.

```
\documentclass[]{beamer}

\begin{document}

\begin{frame}

\end{frame}

\end{document}
```

3 Tutorial: Euclid's Presentation

The Example that we will be using throughout this workshop is as follows:
We wish to help Professor Euclid of the University of Alexandria create a presentation on his latest discovery: There are infinitly many prime numbers! He has already written and submitted a paper to a symposium, which was accepted and now needs to create a corresponding presentation. He will have twenty minutes for a talk, including questions, and would like to use the BEAMER class to create his presentation, but has no previous knowledge of it.

3.1 Title Slide

While waiting for the presentation to start, Euclid would like to have a Title slide up on the screen. He would like to use a similar title from his paper, which was created in LaTeX using

```
\title{There Is No Largest Prime Number}
\author{Euclid of Alexandria}
```

except he would like to include a subtitle "There are Infinitely Many!", his email address "euclid@alexandria.edu", and to change the date to the symposium date. We learn that BEAMER contains a `\institute` and `\date` command, but are aware of no `\email` command so we will use the `\texttt` (typerwritter font) command instead. Thus we change the LaTeX code for the Title to:

```
\title{There Is No Largest Prime Number}
\subtitle{There are Infinitely Many!}
\author{Euclid\\ \texttt{euclid@alexandria.edu}}
\institute{University of Alexandria}
\date{Symposium Date}
```

Then the last step is to create the actual Title slide. So inside the document text body (`document` environment) we create a `frame` environment and call the `\titlepage` command

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

3.2 Creating a Simple Frame

Euclid decides that he should first explain what a prime number is. So we create the first 'real' slide of the presentation by calling the `frame` environment, giving it an individual title through the use of `\frametitle` and providing some text for the slide:

```
\begin{frame}
\frametitle{What Are Prime Numbers?}
A prime number is a number that has exactly two divisors.
\end{frame}
```

On further investigation, we learn that we can use a shortcut notation to add an individual title to a slide by just using curly brackets after we begin the enivornment.

```
\begin{frame}{What Are Prime Numbers?}
A prime number is a number that has exactly two divisors.
\end{frame}
```

While this yields exactly as what we were expecting, Euclid would like to put some emphasis on the words 'prime number'. We first try the `\emph` (emphasis/italicize) command but a more stronger result is desired.

```
\begin{frame}
\frametitle{What Are Prime Numbers?}
A \emph{prime number} is a number that has exactly two divisors.
\end{frame}
```

We learn that BEAMER offers the `\alert` command, which is used like `\emph` but makes the text a bright red color.

```
\begin{frame}
\frametitle{What Are Prime Numbers?}
A \alert{prime number} is a number that has exactly two divisors.
\end{frame}
```

After seeing this, Euclid decides that he would like to make it even clearer and use the `definition` environment, as the `amsmath` package is automattically loaded by BEAMER. He also decides that it might also be helpful to add a few examples. So we add to the frame a `example` environment that uses the `itemize` environment to bullet a few examples:

```
\begin{frame}
\frametitle{What Are Prime Numbers?}
\begin{definition}
A \alert{prime number} is a number that has exactly two divisors.
\end{definition}

\begin{example}
\begin{itemize}
\item 2 is a prime (two divisors: 1 and 2).
\item 3 is a prime (two divisors: 1 and 3).
\item 4 is not a prime (\alert{three} divisors: 1, 2, and 4).
\end{itemize}
\end{example}
\end{frame}
```

3.3 Table of Contents

Next Euclid would like to have a slide containing the table of contents for his presentation. Before doing this though we need to create some section headers using the `\section` and `\subsection` commands outside of the presentation frames:

```
\section{Motivation}
\subsection{The Basic Problem That We Studied}
\section{References}
```

with a corresponding 'Works Cited' frame near of the end of the document, because the headers won't show up in the table of contents unless at least one frame is created after each.

```
\begin{frame}
\frametitle{Works Cited}
%...
\end{frame}
```

Now that we have a basic outline, we create the table of contents as a frame using the `\tableofcontents` command:

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

Euclid also wishes that he could have a frame singly devoted to the section header throughout the presentation. We learn that this can be added throughout the document by using the shortcut `\frame` environment command with the `\sectionpage` command:

```
\frame{\sectionpage}
```

4 Creating Simple Overlays

Although a bit colorful, the presentation looks quite nice. However, Euclid would like to change the one main frame 'What Are Prime Numbers?' to show the three example items one after another instead of right away, which should draw the audience's attention to the item at hand. To achieve this, we add the `\pause` command after the first and second example.

```
\begin{frame}
\frametitle{What Are Prime Numbers?}
\begin{definition}
A \alert{prime number} is a number that has exactly two divisors.
\end{definition}

\begin{example}
\begin{itemize}
\item 2 is a prime (two divisors: 1 and 2).
\pause
\item 3 is a prime (two divisors: 1 and 3).
\pause
\item 4 is not a prime (\alert{three} divisors: 1, 2, and 4).
\end{itemize}
\end{example}
\end{frame}
```

5 Using Overlays

Now that Euclid is satisfied with the overlay of 'What Are Prime Numbers?', he wishes to create a new frame with his main arguments put in a 'Results' section. For this frame, he wants prove his theorem using the `enumeration` environment, in which he wants the points to be uncovered one-by-one, except for the fourth item which he desires to be shown at the same time as the first.

Looking into the overlay specifications a bit more, we discover that we can tell BEAMER when to show items by adding pointed brackets in a list type environment; e.g. `<1->` means "from slide 1 on". We also learn that these specifications can be expanded to ranges, in which the starting or ending of a range can be left open; e.g. `<-3,5-6,8->` means "all slides, expect fro slides 4 and 7". Thus we create the slide:

```
\section{Results}
\frame{Results}

\begin{frame}
\frametitle{There Is No Largest Prime Number}
\framesubtitle{The proof uses \textit{reductio ad absurdum}.}

\begin{theorem}
There is no largest prime number.
\end{theorem}
\begin{proof}
\begin{enumerate}
\item<1-> Suppose $p$ were the largest prime number.
\item<2-> Let $q$ be the product of the first $p$ numbers.
\item<3-> Then $q+1$ is not divisible by any of them.
\item<1-> Thus $q+1$ is also prime and greater than $p$. \qedhere
\end{enumerate}
\end{proof}
\uncover<4->{The proof used \textit{reductio ad absurdum}.}
\end{frame}
```

We also learned that the `\item` command is not the only command that allows overlay specifications. One can also use the `\uncover` and `\only` commands, which hid the argument until specified but still occupies space on the slides.

5.1 Structuring a Frame

On the next frame, Euclid wants to contrast solved and open problems on prime numbers with corresponding titles, but to do this a new environment needs to be created, since none exist that fits Euclid's specifications. We look into this and find that we can use the `block` environment, which will allow us to give an arbitrary title:

```
\begin{frame}
\frametitle{What's Still To Do?}
\begin{block}{Answered Questions}
How many primes are there?
\end{block}
\begin{block}{Open Questions}
Is every even number the sum of two primes?
\end{block}
\end{frame}
```

On later analysis, Euclid decides that he would like these two blocks to be split into two columns, with "Answered Questions" on the left and "Open Questions" on the right, and have one uncovered after another. For this, we decide to use the `columns` environment just like we would in a LaTeX article and the `\pause` command.

```
\begin{frame}
\frametitle{What's Still To Do?}

\begin{columns}
\column{.5\textwidth}
\begin{block}{Answered Questions}
How many primes are there?
\end{block}

\pause
\column{.5\textwidth}
\begin{block}{Open Questions}
Is every even number the sum of two primes?
\end{block}
\end{columns}
\end{frame}
```

5.2 Themes

Now that Euclid has his presentation slides, he wants to see if a different theme would be visually more attractive. Exploring BEAMER, we find that we can change the theme of the presentation through the command `\usetheme`, which takes certain cities (cities that tend to have well-known workshops or conferences) as a condition in curly braces. So we try out several of these and notice that some very substantially from others; e.g. block environments have a visual color blocked behind them, some have table of contents on the side others the top, etc.

We also learn that we can change the color contrast for any given theme with the `\usecolortheme` command. Just like the themes there are numerous color themes already built-in to beamer. A list with visual slides for numerous themes and color themes can be found at Beamer Theme Matrix or Beamer Gallery.

5.2.1 UVA Colors

As this is a UVA Workshop, we tend to want to use the UVA orange and blue instead of defaults for our slides. So for the preamable of the beamer document we have the following code where we set the color theme to either the blue or orange and then can use any main theme we desire:

- To use our own colors we have to use the option `xcolor` in the declaration of the beamer document.
- As we are changing the `structure` using the color theme, only colors that are controlled by the beamer (no packages) will have the color changed; e.g. the `example` environment since it belongs to the `amsmath` package will not change color. One would have to change that using a different command line.

```
\documentclass[xcolor=dvipsnames]{beamer}

\definecolor{uvaorange}{RGB}{252, 175, 23}
\definecolor{uvablue}{RGB}{0, 85, 150}

%\usecolortheme[named=uvaorange]{structure}
\usecolortheme[named=uvablue]{structure}

%\usetheme{Warsaw}
\usetheme{Berkeley}
```

6 Other Frame Attributes

6.1 Splitting a Frame

If we have too much material for one frame, we can use the `\allowframebreaks` option in the frame declaration to split the material up among more than one frame automatically (determined by BEAMER) or manually by the command `\framebreak`

- This option does not work with the `\pause` command. We would have to choose between the two.

```
\begin{frame}[allowframebreaks]{Title}
%....
\framebreak
%....
\end{frame}
```

6.2 Repeating Slides

If we wanted to repeat a frame we made earlier later in the presentation, we can use the `label` option in the frame declaration on any slide, and then use the `\againframe` command with the corresponding label of the frame we want to repeat.

```
\begin{frame}[label=example1]{Title}
%....
\end{frame}

\againframe{example1}
```

6.3 Equations and Figures

Just like in LaTeX articles, mathematical equations and figures/tables can be added to BEAMER slides, although keep in mind that the default page size of frames in BEAMER is different from article size in LaTeX

- The default page size in a BEAMER presentation is 12.8cm x 9.6cm, with some variability depending on the theme.

```
\begin{frame}{Thank You for Coming}
\begin{figure}
\centering
\includegraphics[width=10cm]{StatLabLogo.jpg}
\caption{Test}
\end{figure}
\end{frame}
```

6.4 Hyperlinks

Another common LaTeX attribute that is often used in BEAMER is the `hyperref` package, so that we can have url links in the presentation. One can use the commands `\url` to input just a url into the slide (no external link) or `\href` to input a hyperlink in BEAMER without loading the packages since BEAMER automatically loads it.

```
\begin{frame}{Other Helpful Sources}
To explore Beamer more check out
\begin{itemize}
\item \href{http://texdoc.net/texmf-dist/doc/latex/beamer/doc/beameruserguide.pdf}{Beamer User Guide}
\item \href{http://en.wikibooks.org/wiki/LaTeX}{LaTeX Wiki}
\end[itemize}
\end{frame}
```

6.5 Verbatim Environment

We can also add verbatim text, useful when presenting code, in BEAMER through the `verbatim` environment. (There are several other things that allow code to be inputted like `knitr` and `RSweave` that we could use as well).

- For BEAMER we have to include the `fragile` option to the frame environment in order for this to work without getting an error

```
\begin{frame}[fragile]{An Algorithm For Finding Prime Numbers.}
\begin{verbatim}

int main (void)
{
     std::vector<bool> is_prime (100,true);
    for(int i=2; i<100; i++)
        if(is_prime[i])
            {
                std::cout << i << " ";
                for (int j=i; j<100; is_prime[j]=false, j+=1);
            }
        return 0;
}

\end{verbatim}
\end{frame}
```

6.6 Font Size

BEAMER attempts to size the frame material to fit the slide, but sometimes the text still runs off the frame or we want the text to be larger. So we can use different size environments to manually fit the material to fit the frame at a desired size. The different size environments are

- tiny
- scriptsize
- footnotesize
- small
- normal
- large
- Large
- LARGE
- huge
- Huge

These environments are especially helpful with the `verbatim` environment.

```
\begin{frame}[fragile]{An Algorithm For Finding Prime Numbers.}
\begin{footnotesize}

int main (void)
{
     std::vector<bool> is_prime (100,true);
    for(int i=2; i<100; i++)
        if(is_prime[i])
            {
                std::cout << i << " ";
                for (int j=i; j<100; is_prime[j]=false, j+=1);
            }
        return 0;
}

\end{footnotesize}
\end{frame}
```

7 Works Cited

Materials were made using
http://texdoc.net/texmf-dist/doc/latex/beamer/doc/beameruserguide.pdf