Introduction to Beamer

The files used in this section are FirstBeamer.zip, ENAR2012.zip, and IntoResearch.zip.

PowerPoint

I like PowerPoint. All of my seminars and conference presentations before the year 2013 were done using it. However, there are issues with the software:

- Equation editing – The equation editor within PowerPoint is not good enough for complex equations. If you use MathType instead, inline equations are not possible unlike in Word. Separate embedded objects containing the equations are needed when using MathType, and they have to be carefully lined up within the normal text.

- I have attended conferences where the preferred form of presentation was a PDF rather than a PowerPoint file. It is difficult to have PowerPoint construct a PDF file that has animations within it.

- If you give your presentation on someone else's computer, you need to make sure that computer has the fonts used by the PowerPoint file (including MathType's Euclid font). Alternatively, you can also embed your fonts in the PowerPoint file.

LaTeX alternatives

There are a number of document classes and style files available as described at `http://www.ctan.org/topic/presentation`. All LaTeX alternatives produce a PDF file that is used for a presentation. Thus, you give the presentation within a PDF viewer such as Adobe Acrobat Reader.

The `beamer` package is by far the most used package for presentations. Below are some specific websites for Beamer and LaTeX:

- The web page for the package: `http://www.ctan.org/pkg/beamer`. A link is given there to a 200+ page user guide.

- Wikibooks entry for the Beamer package: `http://en.wikibooks.org/wiki/LaTeX/Presentations`

- Charles Batts's "A Beamer Tutorial in Beamer" presentation: `http://www.uncg.edu/cmp/reu/presentations/Charles%20Batts%20-%20Beamer%20Tutorial.pdf`

LyX provides a nice way to use Beamer, so we are going to focus on this here. There will be a few times where using LaTeX code for the package still will be needed.

Hello World!

The purpose of this example is to give some basic familiarity with using Beamer in LyX. This is not meant to be an example of a proper presentation form! The corresponding documents for this example are located in FirstBeamer.zip.

Tour of the PDF document produced by LyX:

- Title frame:
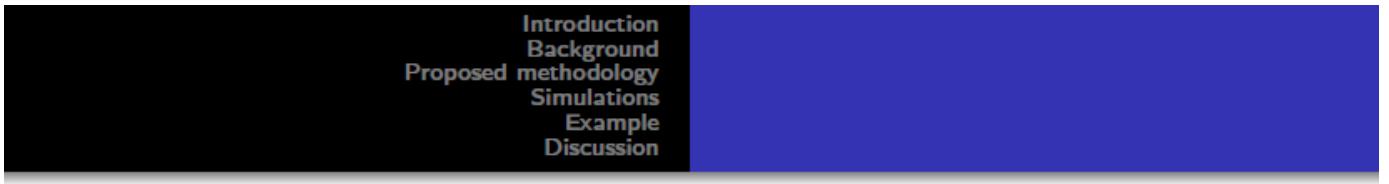
- Outline frame:

1. Introduction

2. Background
   - Notation
   - Model

3. Proposed methodology

4. Simulation study

5. Example
   - Data
   - Analysis
   - Plot

6. Discussion

Chris Bilder   Hello World!

- Model frame:

Introduction
Background
Proposed methodology
Simulations
Example
Discussion

Notation
Model

Model
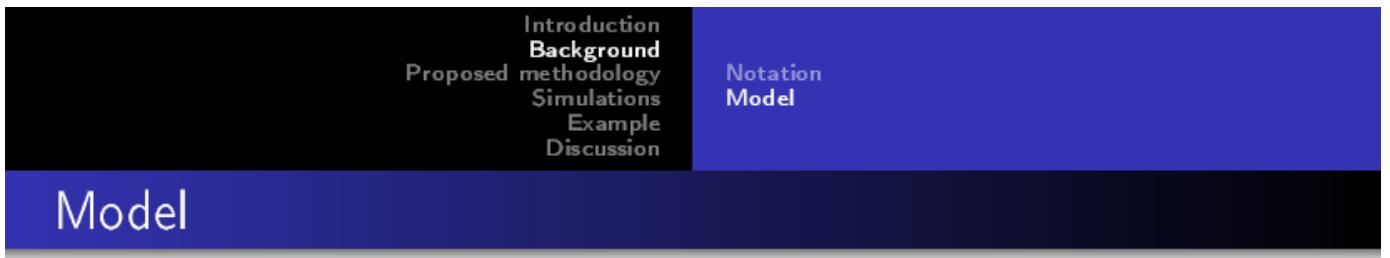
- Important equation:

$$f(y) = \frac{1}{\sigma\sqrt{2\pi}}\exp((y-\mu)^2/2\sigma^2)$$

- Another important equation:

$$f(y) = \frac{1}{\sigma\sqrt{2\pi}}e^{\frac{(y-\mu)^2}{2\sigma^2}}$$

Chris Bilder   **Hello World!**

1. Outline: This is given in the top portion of each frame due to the "theme" that I used. More on this shortly.

2. Frames and slides: In Beamer's terminology, a "frame" is what we normally think of as a slide in PowerPoint. A "slide" is a page in the PDF file. Animation (e.g., bullets being unveiled one at a time) is performed by multiple pages in the PDF. For example, pages 4 and 5 of the PDF show a bullet-by-bullet animation. These pages represent ONE frame and TWO slides.

   Notice in the PDF file how the page numbering is done:

   4 | (5 of 14)

   The frame number is first. The actual page number (slide number) in the PDF file is second.

There is a way to print only completed frames (e.g., do not print page 4, but print page 5) for handouts. This will be demonstrated shortly.

3. Full screen mode: When you want to give the presentation, select VIEW > FULL SCREEN MODE in Adobe Acrobat Reader. Press the <ESC> key to exit the full screen mode.

4. Advancing frames or slides: You can advance slides by left clicking the mouse, pressing the <ENTER> key, or pressing the <PAGE DOWN> key. You can go backwards by right clicking.

   At the bottom of the PDF, there are other tools:

   that help you navigate through the slides. You can simply click on them to select.

Tour of the LyX document:

LyX: C:\chris\unl\Dropbox\NEW\STAT850\LyX\Beamer\FirstBeamer\FirstBeamerLyX2.1.1.lyx (changed)

File Edit View Insert Navigate Document Tools Help

Section

Hello World!

Chris Bilder

Department of Statistics

Note
The left arrow is a "Ragged line break" - INSERT > FORMATTING > RAGGED LINE BREAK. Without it, both lines will not appear in the PDF. Can also do a CNTRL ENTER; http://www.personal.ceu.hu/tex/breaking.htm

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www.chrisbilder...

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```
%Uncommented this code if you want the outline to be displayed with before each new
section. I often see people use this style, but I not convinced that it is necessary.
%\AtBeginSubsection[]{
%  \frame<beamer>{
%    \frametitle{Outline}
%    \tableofcontents[currentsection,currentsubsection]
%  }
%}
```

Frame
Frame Title

Table of Contents

Section 1 Introduction Note This is used in the outline

Frame Introduction Note This shows the title of the frame
Frame Title

This frame describes why my new statistical method is soooo important.

Section 2 Background

Subsection 2.1 Notation Note This is used in the outline

Frame Notation
Frame Title

- Suppose Y_i for $i = 1,...,n$ is a random sample from a normal population with mean μ and variance σ^2.

1. The previous screen capture was done using LyX 2.1.6 so newer versions may have a few different stylistic aspects.

2. Document class: The document class needs to be set to "Beamer" under Presentations (not "Beamer Article")
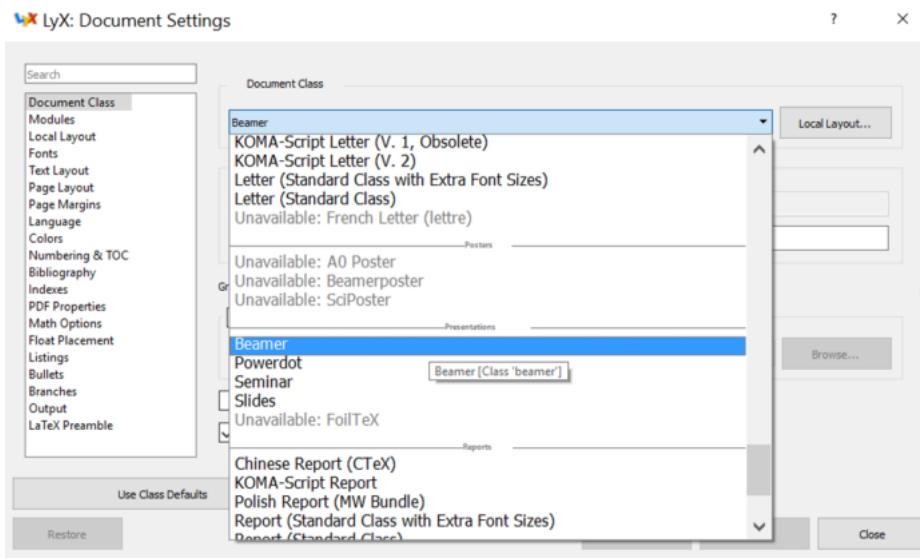
   This will enable you to access a number of environments:
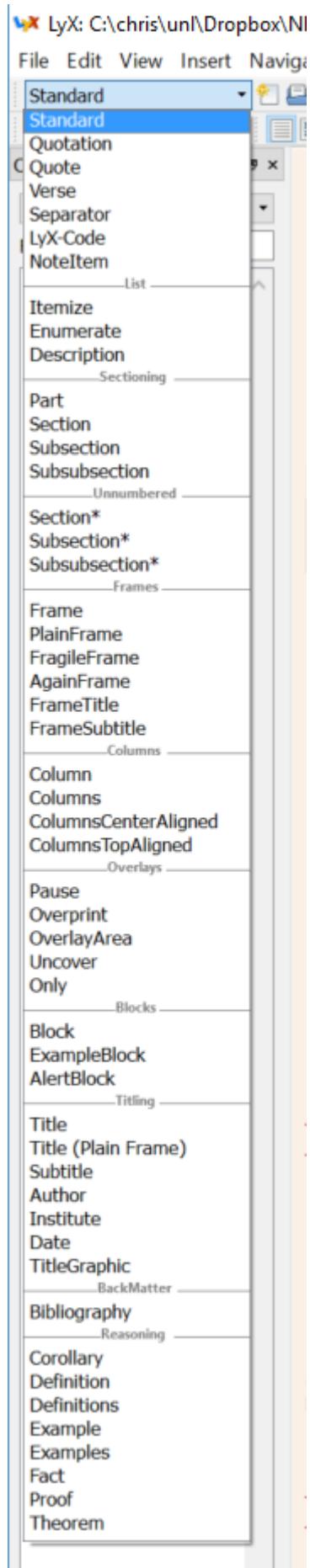
3. Preamble: This is where you can select a theme for the presentation. Themes are pre-constructed sets of colors, fonts, and other items that control how your presentation looks. There are many themes available!

   Section 15 of the Beamer user guide shows a number of themes and gives information about how to control specific options within them. Another resource to see themes is `http://deic.uab.es/~iblanes/beamer_gallery`.

   I chose the "warsaw" theme because this is commonly used by statisticians. I simply put

   ```
   \usetheme{Warsaw}
   ```

   in my preamble to make this specification.

4. Title frame: Use the title, author, institute, and date environments here for the corresponding relevant information. Because I wanted my "institute" information to extend over more than one line, I needed to use a "ragged line break". If I had put an end of paragraph symbol after each line instead, LyX would only put the last line in the PDF. This is a result of the corresponding LaTeX code which only recognizes one `\institute{}` statement. The actual LaTeX code is then

   ```
   \institute{{\normalsize Department of Statistics
   } \\ {\normalsize University of Nebraska--Lincoln}
   \\ {\normalsize \url{www.chrisbilder.com}}}
   ```

   If you do not include the date, it will automatically be included for you as today's date.

5. Frame: Again, a frame is like what is referred to as a slide in a PowerPoint file. The title frame is automatically inserted, so you do not need to state it is a frame. In order to insert a regular frame, select the Frame environment. After **Frame** you can give the frame a title. This will appear as the title

then in the corresponding PDF. For example, this is what the top of the introduction frame looks like:
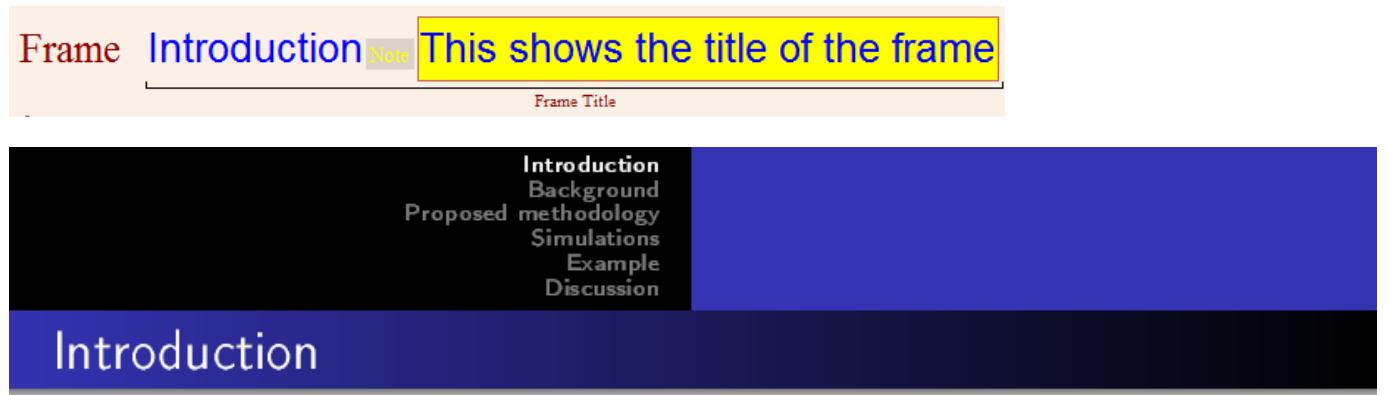
6. The content in the frame needs to be indented:
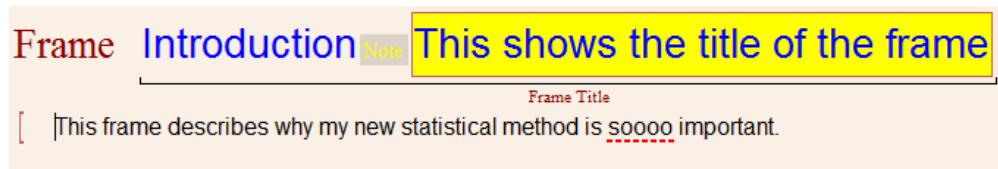
7. Starting a new frame is somewhat awkward with recent changes to LyX that are supposed to integrate Beamer better into it. To start a new frame, go to the end of a current frame and make sure there is no indentation. Select <Enter> so that an end-of-frame marker is inserted. Select the Frame environment to start the new frame. If **Frame** does not appear, you have not inserted a new frame correctly!

Another way to insert the end-of-frame marker is by being within a frame and selecting EDIT > START NEW PARENT ENVIRONMENT (FRAME):
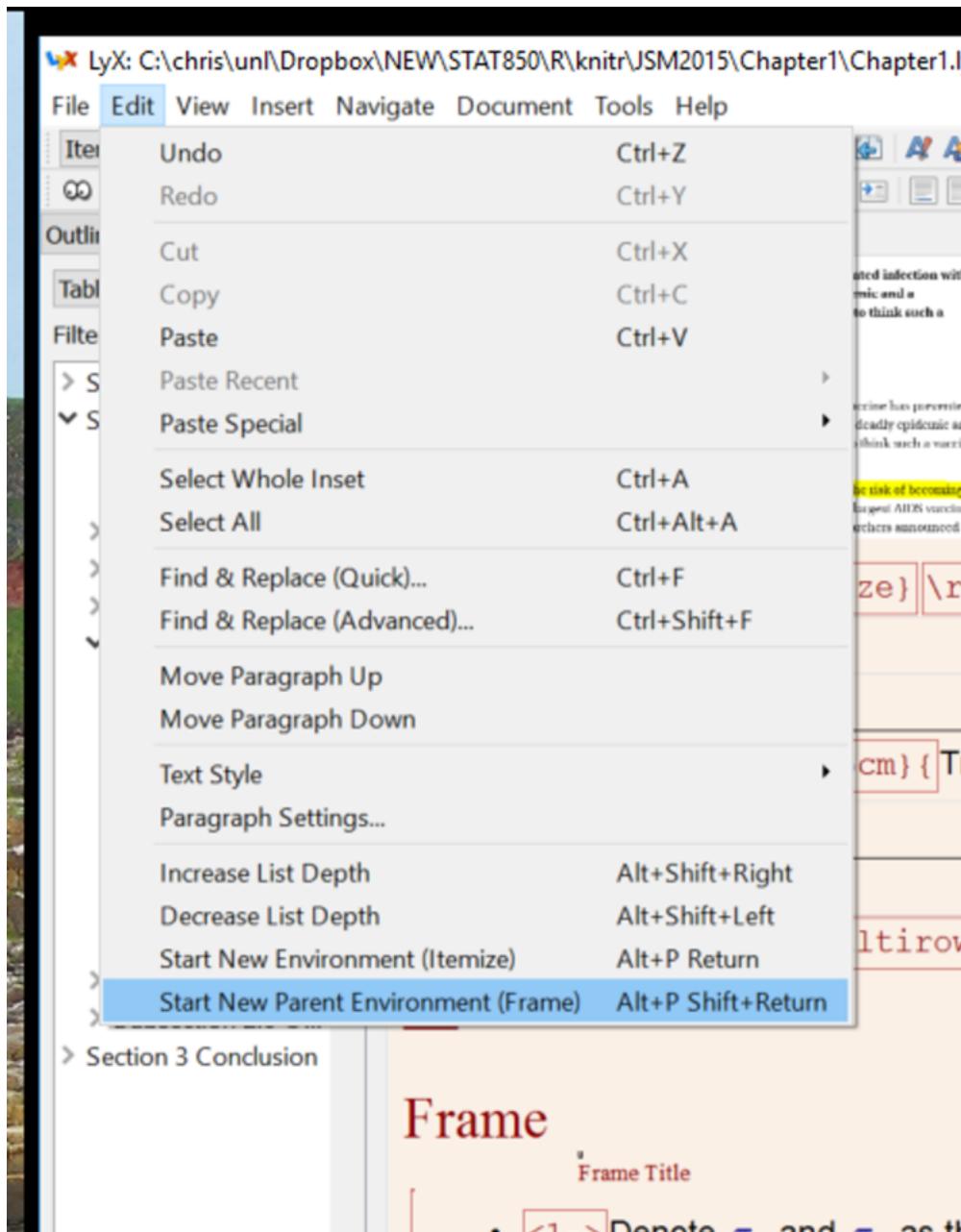
Note that this option under EDIT will NOT appear if you are outside of a frame.

Without the end-of-frame marker, LyX may produce a PDF. I have found that this end-of-frame marker is always needed whenever multiple frames are within the same section or subsection, as occurs in Section 2.1 of the example document.

8. Outline (table of contents): While I do not think these are generally necessary for a presentation, you can insert an outline like in a regular LyX document (select INSERT > LIST / TOC > TABLE OF CONTENTS).

The outline is based on titles given by the section and sub-section environments in the document. Also, notice how frames are WITHIN corresponding sections.

Take note of the LaTeX comment in the LyX file about displaying an outline before each section in a PDF. I sometimes see this done in presentations.

9. Short titles: When a title of a section is long, you can display a shorter title in the outline at the top of each page. At the end of a section, select INSERT > SHORT TITLE and you will obtain a box to enter the shorter title. Of course, only one short title can be given per section or sub-section.

10. Pause and the general overlay environments: You can insert an animation by selecting the pause environment.

Note that this will also put an extra space between what is above and below the pause:

- Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.

- Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.
- Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.

which can make a slide look odd if there are other bullets at the same level.

Because of this side-effect, I recommend using a general overlay environment. Below is an example from the next frame:

A general LATEX code box is inserted at the beginning of the animated line. The "<1->" means to show this particular bullet for slide 1 and higher within the frame. The "<2->" means to show the corresponding bullets from slide 2 and higher. Below is the corresponding completed frame:

- Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.

- Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.

- Suppose Y_i for $i = 1, \ldots, n$ is a random sample from a normal population with mean μ and variance σ^2.

Notice that all bullets are the same distance apart.

You can also change the order of what appears and when it appears by simply changing the numbers. I recommend examining Section 9.2 of the Beamer user guide and Section 8 of Charles Batt's Beamer presentation for more information.

11. Tables and figures: These are inserted in the same manner as before; however, it does not make sense for them to be floating (insert them without the floating part).

12. Cross-referencing: This does not work, but one rarely would want to do this in a presentation.

13. Exporting LaTeX code from LyX: This is done the same way as before (FILE > EXPORT > LaTeX (PLAIN)). Note that you need to compile the exported .tex file TWICE in order to get the top outline on each frame!

14. Program listing box: To exhibit R code/output (without `knitr`), the best way to do this is through a program listings box (see LyX lecture notes). Unfortunately, code/output will not appear correctly when in a regular frame. Instead, put the program listings box in a fragile frame. Also, please see how I included the following options for listings:
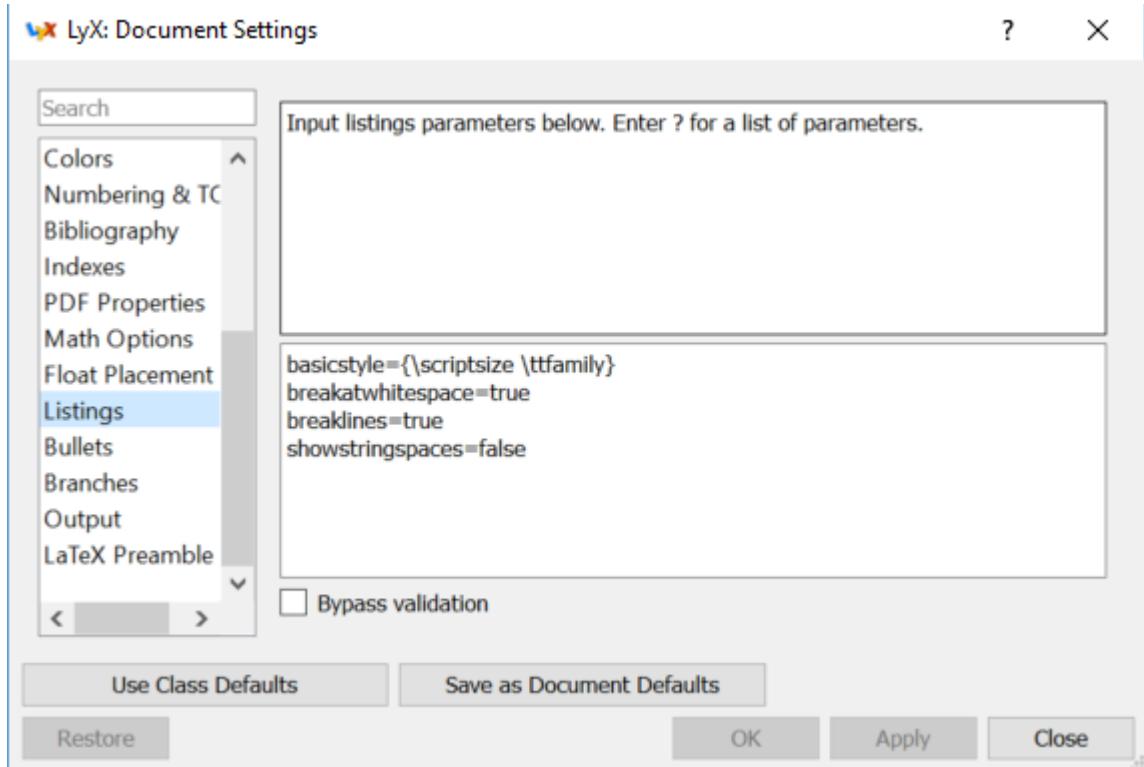
15. Writing on a slide during a presentation: If you have a pen-enabled computer, you can write on each slide using a program like PDF Annotator. I prefer to do this rather than using a laser pointer

16. The `knitr` package can be used to embed R code and output within a presentation. This will be discussed in the `knitr` section of the course.

Creating handouts

Handouts are PDF files with completed frames (end of the animation for a frame). They can be created by first specifying the "handout" option for the document class:
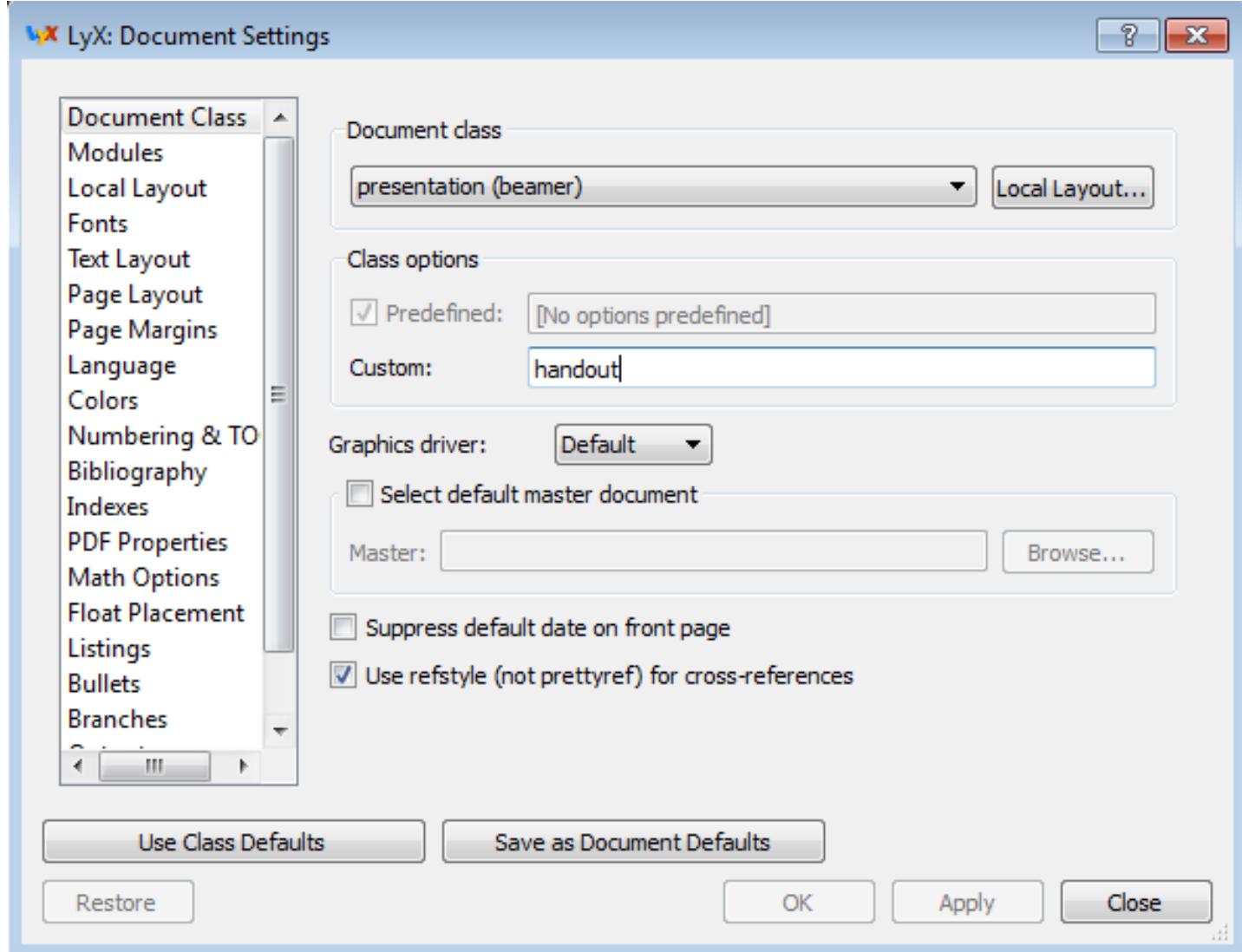
In terms of LaTeX code, the option is included in the following manner:

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

Once the PDF is created, you can print the number of pages desired per sheet of paper by the PDF viewer's print settings.

LaTeX code in the preamble can also automatically create the desired number of completed frames per page. For example,

```
\usepackage{pgfpages}
```

```
\pgfpagesuselayout{4 on 1}[letterpaper, border shrink=
landscape]
```

creates four completed frames per page in the PDF. This code uses the `pgfpages` package to create this printing result. Other packages appear to exist which will do this too (e.g., pdfpages).

Resources for LyX

- Beamer user manual in LyX: Help > Specific Manuals > Beamer Presentations

- LyX's web pages for Beamer: `http://wiki.lyx.org/Examples/Beamer` and `http://wiki.lyx.org/Tips/Beamer`.

- Chris Bourke's (lecturer in CSE at UNL) web page at `http://chrisbourke.unl.edu` contains a UNL template for Beamer.

ENAR meetings presentation example

I gave an invited presentation at the ENAR 2012 meetings using PowerPoint. I have re-typed most of it now into LyX. This will show you some of the finer points of using Beamer with LyX along with offering some comparisons with PowerPoint. Note that there are some parts (large equations, large tables) that I did not include in the LyX file and also there were some places where I had to modify the bullet and animation structures a little. A video of the PowerPoint presentation is available through `http://www.chrisbilder.com/CV` if you are interested!

Comments about the Beamer presentation:

1. Document class: Of course, I used the Beamer document class. I included the "t" option so that each slide had its text start at the top of it. I also include the "red" option to change the default blue color for bars and bullets to red.

2. Preamble: I used the Darmstadt theme. Other themes are commented out in the preamble. I recommend trying some of them to see how they change the document.

The code

```
\useoutertheme[subsection = false]{miniframes}
```

removed an extra bar that would appear toward the top of a frame to indicate the subsection title. See what happens if the code was commented over to better understand its effect. Depending on your own style, this extra title bar may or may not be helpful to include. For example, one could use it to serve the role of a main bullet for the entire frame.

The use of `\useoutertheme{}` and `\useinnertheme{}` will be discussed more later.

3. Title page: I included the usual title page at the beginning. In order to get the superscript 1 and 2, I used INSERT > FORMATTING > SUPERSCRIPT rather than an equation.

A nice frame to have open at the end of the presentation is another title page. To have a duplicate title page be located there, simply insert a LaTeX code box with `\maketitle` inside of it on a new frame without a title.

4. Frames: I decided not to include any titles with frames to avoid the printing of title bars on frames.

5. Subsections: While I included subsections with names, they are not included by name anywhere in the PDF. I used names with them for my own reference and in case I wanted to change the theme later, which may then include the subsection names.

Subsections NEED to be given if you want to see the open circles in the outline at the top of each page. These circles correspond to each frame within a section. For example, examine the Application section. The first frame is in Section

5.1, and it is indicated by

Application
●○○○○

The filled-in white circle indicates that this frame is the first frame out of 5 in the corresponding section. The next frame is in Section 5.2, and it is indicated by

Application
○●○○○

Notice there are three frames within this section as indicated by the three circles with a bolder outline.

6. Figures: Two figures are included in the document (INSERT > GRAPHICS). The picture quality is not the best. If I were doing an actual presentation with the PDF file, I would probably try to improve the quality (I do not think it is a LyX or Beamer issue).

7. Animations: There are many examples of using the general overlay environment! For example, examine the frame below to see how I did the animation at different bullet levels:

- <1-> Test for multiple diseases at the same time ¶
  - <2-> American Red Cross (Stramer et al. 2004; ARC 2012) ¶
    * <3-> ≈ 6 million blood donations per year ¶
    * <3-> HIV, hepatitis B, and hepatitis C ¶
    * <3-> Groups of size 16 ¶
- <4-> Nebraska Public Health Laboratory ¶
  - Chlamydia and gonorrhea screening ¶
  - ≈ 25,000 individuals per year ¶
  - GenProbe Aptima Combo 2 assay ¶
- <5-> Only Hughes-Oliver and Rosenberger (2000) address multiple-disease problem in group testing ¶
  - Estimate overall prevalence ¶
  - Perfect diagnostic tests ¶

Comments:

- Despite the "Nebraska Public Health Laboratory" bullet being after the <3->, I needed to put a <4-> with it. Otherwise, it would appear with the "Test for multiple . . ." bullet, which is at its same level.
- By default, all sub-bullets to a bullet–like the three sub-bullets under "Nebraska Public Health Laboratory"–will be animated with the higher level bullet.
- Another way that some people do animation is to show all bullets (including the corresponding text) in a very light color. As bullets are discussed one-by-one, the bullet returns to a normal color. For example, this is what it would like in my PDF "if" it was done:
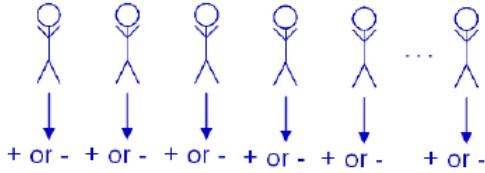
I am not convinced that this type of animation is necessary, but I have seen it done multiple times for presentations. This type of unveiling can be done in LyX by putting `\setbeamercovered{transparent}` in the preamble.

8. Large equations: Section 3.3 has a large equation that would go beyond the right side of the slide if it was only one line. I split the equation up into three lines similar to what was shown earlier in the LyX notes. Also, I reduced the overall size of the equation by highlighting it, clicking on text style , and selecting "small" from the SIZE drop down menu. Finally, I also used one-sided brackets by selecting in the math toolbar. Below is the end result:

- Estimating the working correlation matrix $\mathbf{R}(\boldsymbol{\alpha})$¶

    – Want to estimate $Corr(\ddot{Y}_{ijk}, \ddot{Y}_{ij'k}) = \alpha_{jj'}$, but $\ddot{Y}_{ijk}$ is not observed¶

    – One can show that ¶

$$Cov(Z_{jk}, Z_{j'k}) = (\delta_j + \eta_j - 1)(\delta_{j'} + \eta_{j'} - 1) \times$$

$$\left[\prod_{i=1}^{I_k} \left\{ \alpha_{jj'} \sqrt{Var(\ddot{Y}_{ijk})Var(\ddot{Y}_{ij'k})} + (1 - \breve{p}_{ijk})(1 - \breve{p}_{ij'k}) \right\} - \right.$$

$$\left. \prod_{i=1}^{I_k} (1 - \breve{p}_{ijk})(1 - \breve{p}_{ij'k}) \right] ¶$$

Notice the use of the pause environment. I was unable to get the desired effect with the general overlay environment.

9. Showing one row at a time: Sometimes you want to explain one row at a time in a table. You can unveil each row in this manner by putting `\pause` in a LaTeX code box in the last cell of a corresponding row. Please see the table in the simulations section for an example.

10. Removing all headers and footers from one frame: This can be helpful when you have a large table or figure. Rather than using the Frame environment, use the PlainFrame environment. See Section 4 for an example.

11. Inner themes: There are additional sub-themes that control how items like title pages, figures, and itemize (bullet) environments appear. For example, to use a rectangle for bullets (rather than the default), include `\useinnertheme{rectangles}` in the preamble. Please see Chapter 16 in the Beamer user guide for more information.

12. Outer themes: There are additional sub-themes that control how items like headers and footers appear. For exam-

ple, we saw the effect of `\useoutertheme[subsection = false]{miniframes}` earlier. Please see Chapter 16 in the Beamer user guide for more information.

13. Problems compiling: I often had an error occur when compiling my document. Below is the window that appeared:
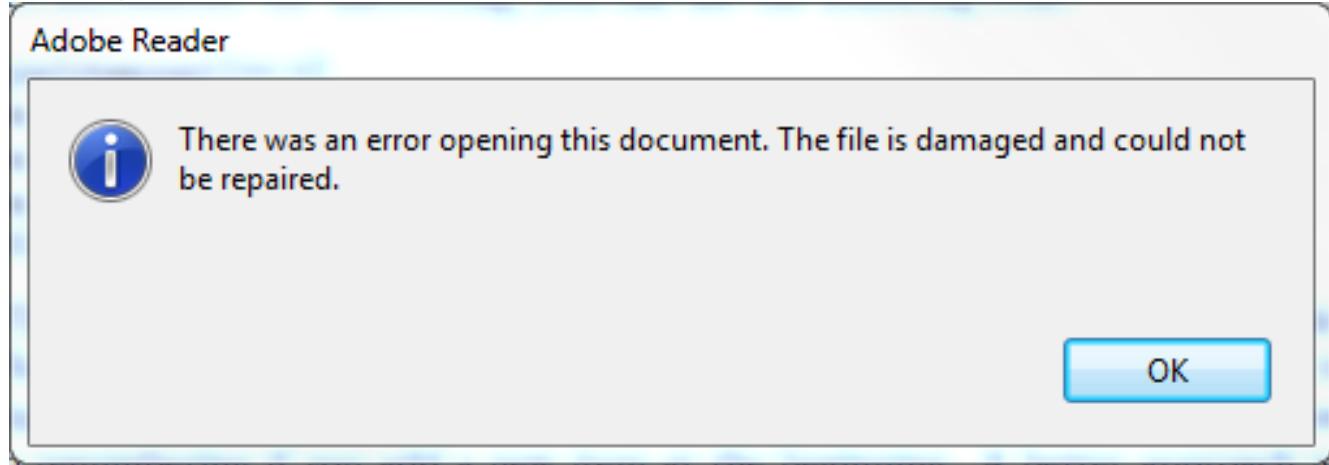
After clicking on OK, I would select the view button ∞ in LYX and the PDF would appear.

Overall, I think Beamer and LYX did a good job with my presentation. If I were constructing the document for an actual presentation rather than trying to reproduce my PowerPoint document, I would probably change some frame organization aspects and change some of the animations.

Introduction to research presentation

At the beginning of each academic year, the Department of Statistics often has each faculty member give a very short introduction to their research during a seminar. I have included my own presentation in the course materials. This presentation purposely stripped out various outline guides due to the shortness of the presentation. However, I have included in the lower right corner of each slide information about the frame number and the total number of frames. This is a great tool to use anytime when giving a presentation. Please see the preamble for the LATEX code used

to produce this information.

Final comments

- The beamer-structured-simple-outline.lyx file on the LyX's Beamer example page (`http://wiki.lyx.org/Examples/Beamer`) discusses some items that I did not include in my own examples. These items include: Slide 10, Block environment; Slide 13, Example environment, Slide 16, Theorem environment; and Slide 18, Multiple columns.

- Section 16.3 of the Beamer user guide discusses how to create your own theme. I have not tried it.

- Projectors now often accept 16:9 aspect ratios in addition to 4:3. When I attended the International Statistical Institute conference a few years ago, we were even asked to use 16:9. To make this change, use the `aspectratio = 169` option with the document class. This option is set in the same manner as the handout option earlier.

- Sometimes you may want to animate one line at a time in a multiline equation (e.g., suppose you were showing a proof). You can get this done by inserting `\onslide` commands within the LyX equation. For example, below is a screen capture from a LyX file (not available from my website) showing the process:

Frame

Frame Title

- <1->BIG derivation is next!

\begin{footnotesize}

$$L(\pi_1,\ldots,\pi_n|y_1,\ldots,y_n) = P(Y_1=y_1)\times\cdots\times P(Y_n=y_n)$$
$$\text{\textbackslash onslide} <2-> \quad = \prod_{i=1}^{n} P(Y_i=y_i)$$
$$\text{\textbackslash onslide} <3-> \quad = \prod_{i=1}^{n} \pi_i^{y_i}(1-\pi_i)^{1-y_i}$$

\end{footnotesize}

- <4->Wow!

Also, often the equations are larger than needed for frames. I included the use of the footnotesize environment here as an example of how one can reduce their size.