ESS 575 LaTeX Cheat Sheet

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LaTeX, pronounced lay-tech (to rhyme with Bertolt Brecht) is the preeminent software for preparing scientific documents of all kinds, books, manuscripts, dissertations. It is particularly well suited for displaying mathematics. Here are some LaTeX expressions used frequently in the work in this class. Remember that LaTeX must be enclosed in $ ... $ for an inline equation or $$ ... $$ for a display equation centered on its own line in R Markdown.

1 Some useful syntax

	LaTeX	Output
Greek letters	\alpha, \beta, \gamma, \tau, etc	α,β,γ,τ
raise to power or superscript	a^b	a^b
subscript	x_i x_{ij}	x_i x_{ij}
products	\prod_{i=1}^n	$\prod_{i=1}^{n}$
sums	\sum_{i=1}^n	$\sum_{i=1}^{n}$
definite integral	\int_a^b	$\int_a^b$
proportionate to	\propto	$\propto$
distributed as	\sim	$\sim$
conditional on	\mid	$\mid$
fractions	\frac{a}{b}	$\frac{a}{b}$
math bold font	\mathbf{a}	$\mathbf{a}$
Greek bold font	\boldsymbol{\alpha}	$\boldsymbol{\alpha}$
text font	\text{normal}	normal
make a conditional symbol bigger	\biggm|	$\biggm\|$
expanding parentheses, in this case, enclosing a fraction	\left \frac{a^z}{b}\right	$\left \frac{a^z}{b}\right$
expanding brackets, in this case for a distribution	\left[y_i \biggm| \frac {\mu^2}{\sigma^2},\frac{\mu}{\sigma^2}\right]	$\left[y_i \biggm\| \frac {\mu^2}{\sigma^2},\frac{\mu}{\sigma^2}\right]$

2 Multiline equations

You will write many expressions showing the proportionality between posterior and joint distributions because these expressions form the foundation of all modern Bayesian analysis. These expressions will often extend across multiple lines. Here is an example using, in LaTeX terminology, an *equation array* environment:

$$\begin{eqnarray} [\beta_0,\beta_1, \sigma^2 \mid \mathbf{y}] &\sim &\prod_{i=1}^n[y_i\mid \beta_0,\beta_1,\sigma^2] \\
& & \times [\beta_0][\beta_1][\sigma^2] \end{eqnarray}$$

which might benefit from some explanation. Each line of an equation array consists of of three parts: 1) the part of the left hand side of a relation, 2) the relation itself, and 3) the part on the right hand side of a relation. In this example the first part of line one is `[\beta_0,\beta_1, \sigma^2 \mid \mathbf{y}]`, the second part is the proportional relation, which is designated by `&` on each side: `&\sim &`, and the third part is `\prod_{i=1}^n[y_i\mid \beta_0,\beta_1,\sigma^2]`.

The `\\` means skip to the next line. The first part is left blank (i.e., there is nothing to the left of `& &`, and the second part is left blank because there is nothing between `& &`. The third part (on the second line) is `\times [\beta_0][\beta_1][\sigma^2] \end{eqnarray}`, which is neatly aligned with the third part on line one. Additional lines can be added using `\\` at the ends of lines.

Some LaTeX users prefer the *align* and *split* environments to write aligned, multi-line equations, which I illustrate with a somewhat more simple example. R Markdown code for a multiline equation split and aligned at the equals sign is

```
$$\begin{equation} \begin{split} A & = \frac{\pi r^2}{\\
& = \frac{1}{2} \pi r^2 \end{split} \end{equation}$$
```

which produces:

$$\begin{equation} \begin{split} A & = \frac{\pi r^2}{2} \\ & = \frac{1}{2} \pi r^2 \end{split} \end{equation} \tag{3}$$