\textbf{\LaTeX\ 2e Examples}

A \LaTeX\ 2e file will begin with the key word \texttt{\documentclass}, followed by optional arguments between square brackets, and the type of document in braces. An example is

\begin{verbatim}
\documentclass[10pt]{report}
\end{verbatim}

Alternatives to \texttt{[10pt]}, which specifies a ten point font, include \texttt{[11pt]} and \texttt{[12pt]}. Alternatives to \texttt{\{report\}} include \texttt{\{article\}}, \texttt{\{book\}}, and \texttt{\{letter\}}.

After this line comes a preamble where format options such as margin widths may be set. See one of the documents from class for an example.

The file should then contain a line that says \texttt{\begin{document}}, followed by the body of the document and ending with the line \texttt{\end{document}}.

Regular text is put in normally. You should include blank lines between paragraphs. Spacing and line breaks do not matter within a paragraph. One or more space is treated as a single space, and single line breaks are equivalent to a single space. Two or more consecutive line breaks separate paragraphs.

Mathematical notation is formatted in mathematical mode. I prefer placing text between $'$s and between $$'s for displayed formulas, although there are other ways to do this. Expressions that belong together are placed between braces.

Here are a few examples to get you started.

1. \textbf{Greek Letters}.
   Greek letters are specified by using a \texttt{\textbackslash} followed by the name of the letter.

   \begin{verbatim}
   The binomial random variable $X$ has mean $\mu = np$ and standard deviation $\sigma = \sqrt{np(1-p)}$.
   \end{verbatim}

   is created with this text.

   \begin{verbatim}
   The binomial random variable $X$ has mean $\mu = np$ and standard deviation $\sigma = \sqrt{np(1-p)}$.
   \end{verbatim}

2. \textbf{Superscripts and subscripts}.
   Subscripts are made with the underscore \texttt{_} and superscripts or powers with the carat \texttt{^}.

   \begin{verbatim}
   The random variables $X_1, X_2, \ldots, X_{100}$ each have the same distribution as $Y^2$.
   \end{verbatim}

   is created with the code

   \begin{verbatim}
   The random variables $X_1, X_2, \ldots, X_{100}$ each have the same distribution as $Y^2$.
   \end{verbatim}

3. \textbf{Sums and Integrals}.
   Sums and integrals are created with the \texttt{\sum} and \texttt{\int} codes. Use subscripts and superscripts to add limits to the sums and integrals.

   \begin{verbatim}
   The expected value of a discrete random variable $X$ with pmf $p(x)$ is $\sum_{x: p(x) > 0} x p(x)$. The expected value of a continuous random variable $Y$ with pdf $f(y)$ is $\int_{-\infty}^{\infty} y f(y) \, dy$.
   \end{verbatim}

   is created with this text.

   \begin{verbatim}
   The expected value of a discrete random variable $X$ with pmf $p(x)$ is $\sum_{x: p(x) > 0} x p(x)$.
   The expected value of a continuous random variable $Y$ with pdf $f(y)$ is $\int_{-\infty}^{\infty} y f(y) \, dy$.
   \end{verbatim}
Sums and integrals look different when displayed as formulas because they are larger and place the limits differently.

\[ E[X] = \sum_{k=0}^{n} \binom{n}{k} p^k (1-p)^{n-k} = np \]

is created with the text

$$
E[X] = \sum_{k=0}^{n} \binom{n}{k} p^k (1-p)^{n-k} = np
$$

This example also shows how to make binomial coefficients with the \texttt{choose} command between curly braces.

4. **Aligned equations.**

It is common in presenting a derivation to place several equations together with the equal signs aligned. This may be done in the \texttt{eqnarray*} environment. The symbol to be aligned comes between \texttt{&}'s and lines are ended with \\

\[
E(X) = \sum_{k=1}^{\infty} (1-p)^{k-1} p \\
= p \sum_{k=1}^{\infty} (1-p)^{k-1} \\
= p \left( \frac{1}{1 - (1-p)} \right) \\
= 1
\]

is created with

\begin{eqnarray*}
E(X) & \& = \sum_{k=1}^{\infty} (1-p)^{k-1} p \\
& \& = p \sum_{k=1}^{\infty} (1-p)^{k-1} \\
& \& = p \left( \frac{1}{1 - (1-p)} \right) \\
& \& = 1
\end{eqnarray*}

This example also shows how to make large fractions with \texttt{over} between braces and automatically sized parentheses with \texttt{left} (and \texttt{right}).

5. **Tables.**

Tables are created in the \texttt{tabular} environment. Separate table entries are separated by \texttt{&} and lines are ended with \\

The required argument determines how each column is aligned (1, c, or r) and can place lines between columns. The command \texttt{\hline} places a horizontal line. The \texttt{\multicolumn} command puts an entry over several columns. Tables contain regular text, and mathematical expressions should be placed between dollar signs.

\[
\begin{array}{l|c|c|c|c}
\hline
k & p(k) & 0 & 1 & 2 & 3 \\
\hline
0 & 0.2 & 0.4 & 0.1 & 0.3 \\
\end{array}
\]

is created with

\begin{center}
\begin{tabular}{r|c|c|c|c}
\hline
\multicolumn{5}{c}{A discrete pmf} \\
\hline
k & p(k) & 0 & 1 & 2 & 3 \\
\hline
0 & 0.2 & 0.4 & 0.1 & 0.3 \\
\end{tabular}
\end{center}