\textbf{LATEX Commands with Arguments}
CSC 341, “Automata, Formal Languages, and Computational Complexity”
Department of Computer Science · Grinnell College
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Some of the LATEX commands that you will use in preparing documents for CSC 341 take arguments and build expressions around them or have side effects on the state of the virtual typesetter.

A LATEX command can have as many as nine arguments. For certain commands, the first argument is optional; LATEX supplies a default value for the corresponding parameter, which you can override by enclosing a different value in square brackets. All other arguments are required, and the user encloses them curly braces.

For example, the $\sqrt{ab}$ command takes one argument, which is required, and directs the virtual typesetter to set that argument with a radical sign $\sqrt{}$ in front of it and a horizontal line on top of it:

\begin{verbatim}
Desired output \ LATEX input
\sqrt{ab} \ \texttt{\sqrt{ab}}
\end{verbatim}

Similar commands direct the virtual typesetter to set a one-character argument with some typographical decoration on top of it:

\begin{verbatim}
Desired output \ LATEX input
\bar{z} \ \texttt{\bar{z}}
\hat{z} \ \texttt{\hat{z}}
\tilde{z} \ \texttt{\tilde{z}}
\end{verbatim}

Because the typesetter has to manage the spacing somewhat differently, there are separate commands for cases in which the typographical decoration is supposed to extend over an entire expression:

\begin{verbatim}
Desired output \ LATEX input
\overline{\phi \land \psi} \ \texttt{\overline{\phi \land \psi}}
\widehat{k + 2} \ \texttt{\widehat{k + 2}}
\overbrace{w + x + y + z} \ \texttt{\overbrace{w + x + y + z}}
\end{verbatim}

The $\frac{\texttt{n}}{\texttt{n + 1}}$ command builds a fraction from its arguments, typesetting each one and then placing a horizontal line between them, equal in width to the wider of the two subexpressions. Fractions are typeset at a smaller size when they are surrounded by text than when they are inside a displayed mathematical expression.

\begin{verbatim}
Desired output (text) \ LATEX input
\frac{n}{n + 1} \ \texttt{\frac{n}{n + 1}}
\end{verbatim}

\begin{verbatim}
Desired output (display) \ LATEX input
\frac{n}{n + 1} \ \texttt{\frac{n}{n + 1}}
\end{verbatim}

The $\stackrel{\texttt{*}}{\Rightarrow}$ command builds a compound symbol expressing a binary mathematical relation by setting a smaller version of its first argument on top of its second argument:

\begin{verbatim}
Desired output \ LATEX input
S \Rightarrow aabb \ S \ \texttt{\Rightarrow} \ \texttt{aabb}
\end{verbatim}
\LaTeX{} reserves the underscore and circumflex characters (’\_’ and ’\^’) for use as binary typesetting operators. Each one sets the expression that precedes it normally and the expression that follows it at a reduced size, and then attaches the latter to the former as a subscript or superscript:

\begin{center}
<table>
<thead>
<tr>
<th>Desired output</th>
<th>\LaTeX{} input</th>
</tr>
</thead>
<tbody>
<tr>
<td>(x_0)</td>
<td>(x_0)</td>
</tr>
<tr>
<td>(n^{k+1})</td>
<td>(n^{k + 1})</td>
</tr>
</tbody>
</table>
\end{center}

Be careful to use braces for grouping whenever your subscript or superscript consists of more than one character. If you leave the braces out of the second example above, the result is ’\(n^{k + 1}\)’, which is not the same thing as ’\(n^{k+1}\)’. Note that the braces do not show up in the typeset output. If you actually want to see braces — in a set-constructor, for instance — use the command symbols ’\{’ and ’\}’.

\begin{center}
<table>
<thead>
<tr>
<th>Desired output</th>
<th>\LaTeX{} input</th>
</tr>
</thead>
<tbody>
<tr>
<td>({j \mid j^2 \leq 5})</td>
<td>({j \mid j^2 \leq 5})</td>
</tr>
</tbody>
</table>
\end{center}