CSCE 222 Discrete Structures for Computing

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Example LaTeX source for creating a truth table and aligning derivation steps

For example, to draw the truth table for $p \wedge q$ and $p \oplus q$ as below

p	q	$p \wedge q$	$p \oplus q$
T	T	T	F
T	F	F	T
F	T	F	T
F	F	F	F

the LaTeX source looks like this:

```
\begin{displaymath}
\begin{array}{|c c||c|c|}
% |c c|c|c| means that there are four columns in the table where
% a vertical bar '|' will be printed on the left and right borders,
% and between the third and the fourth columns.  I put double
% vertical bars '||' between the second and the third columns to
% separate the possible value combinations for the variables
% (the first two columns) and the resulting values of the operations
% on those values (the last two columns). Note that between the
% first two columns there is no bar.
%
% The letter 'c' means the value will be centered within the column.
% If you want the value to be left-aligned, then you give letter 'l'
% instead, and to have it right-aligned, give letter 'r'.
%
p & q & p \land q & p \oplus q\\ % Use & to separate the columns
\hline  % Put a horizontal line between the table header and the rest.
T & T & T & F\\
T & F & F & T\\
F & T & F & T\\
F & F & F & F\\
\end{array}
\end{displaymath}
```

To align derivation steps, we can use the align or align* environment. The align environment puts a label at the end of each line whereas align* does not. Also note that the align environment is already a math environment, i.e., within the align environment, you do not enclose math symbols within the dollar signs. For example, to show the derivation of the logical equivalence $\neg(p \rightarrow q) \equiv p \land \neg q$ in the last page of lecture slides propositional.pdf, you can do as below.

$$\begin{aligned}
\neg(p \rightarrow q) &\equiv \neg(\neg p \lor q) && \text{previous result: } p \rightarrow q \equiv \neg p \lor q \\
&\equiv \neg(\neg p) \land \neg q && \text{de Morgan's Law} \\
&\equiv p \land \neg q && \text{double negation law}
\end{aligned}$$

for which, the LaTeX source looks like this:

```
\begin{align*}
% Each line of derivation must end with two backslashes \\ (newline
% symbol in LaTeX).
% In each line, there must be one ampersand & symbol preceding the
% symbol that you want to align. In this example, the symbol to be
% aligned is the equivalence symbol \equiv, thus we put the & symbol
% right before the \equiv symbol.
% The \quad command puts some space there.
% \mbox{ } is to display a text within the math environment. It is used
% when you need to put explanations within the math mode.
%
\neg(p\rightarrow q)
&\equiv \neg(\neg p\lor q) \quad \mbox{ previous result: }
                           p\rightarrow q\equiv \neg p\lor q\\
&\equiv \neg(\neg p) \land \neg q \quad \mbox{ de Morgan's Law}\\
&\equiv p\land \neg q \quad \mbox{ double negation law}
\end{align*}
```