THE PLAIN TRUTH: DISPLAYLINES, IALIGN

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This column continues the attempt, begun in the last issue, to illustrate the reasons for various changes to plain.tex. This issue's installment covers various changes made to macros controlling alignment.

Displayed Lines of Equations
The \displaylines macro lets you display any number of formulas in any way you want, without any alignment between formulas. Its original definition looked like this:

\def\displaylines#1\display\halign{\hbox to\displaywidth{$\hfill\displaystyle##\hfill$}\crcr #1\crcr}

The first change never actually got into print in an errata list, being posted and rescinded almost immediately, but it may have been included in some distributions of version 1.1, or picked up via the Arpanet by unsuspecting users. This change consisted in putting braces around the aligned argument ##. These braces were added to be consistent with similar syntax in the definitions of \eqalign, \eqalignno and \leqalignno, but there is a significant difference—the eqalign macros were designed to produce only certain explicit structures, and \displaylines is provided to handle the nonstandard cases, where pieces may have to be moved around by hand. The following use of \displaylines is common:

{\rlap{($\ast$)}\hfill a+b=c\hfill}

Without braces—\displaystyle###:

(*)

\begin{align*}
  a + b &= c \\
\end{align*}

With braces—\displaystyle{###}:

\begin{align*}
  {\rlap{($\ast$)}\hfill a+b=c\hfill}
\end{align*}

The \hfill instructions, intended to overpower occurrences of \hfill in the definition, lose their effect within braces.

Another bug in \displaylines was flushed out with the aid of this expression:

(\text{underbrace}x+y\text{)}(n)=0

This behaves nicely in a simple display, $$$. But with the "uncorrected" plain, the result of \displaylines{...} was unexpected:

\begin{align*}
  (m) & x+y(n) = 0 \\
\end{align*}

(Look closely at the baseline.) The explanation hinges on the complicated expansion of \everycr in the expansion of \display (it appears in The \TeXbook on page 362 and won’t be repeated here); \everycr needs to be reset, and that was the nature of the fix to plain:

\def\@align{\tabskip=Opt \everycr{}}
\def\displaylines#1\display\halign{\hbox to\displaywidth{$\hfill\displaystyle##\hfill$}\crcr #1\crcr}
\def\*eqalignno{\@align\hfill\displaystyle##\hfill\crcr #1\crcr}

\eqalignno and \leqalignno were changed in a similar manner, by inserting \align before every instance of \displaystyle in their definitions. The \tabskip=Opt in \@align locally resets \tabskip= centering in \*eqalignno in case an alignment occurs in the argument.
Initialized Alignment

The \ialign macro provides an \halign for which \tabskip is initially zero. Its need for initialization similar to \displaylines had been discovered earlier. The original definition looked like this:

\def\ialign{\tabskip=Opt \halign}

The correction was:

\def\ialign
{\everycr{}\tabskip=Opt \halign}

\ialign occurs internally in many plain macros, including ones dealing with alignment using tabs, accent placement, placement of arrows or braces above or below expressions, construction of “composite” characters from separate symbols (e.g. \(\Rightarrow\) from \(\sim\) and \(=\)), matrices, and displays aligned on equal signs.

To be continued...