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Macros

MACROS FOR TWO-COLUMN FORMAT

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In Appendix E of the TeXbook, Don Knuth presents the macros that were used for two-column formatting in Appendix I, the index. For their intended purposes they seem to have worked well enough, but there are a couple of circumstances under which they may fail. I discovered the first of these while trying to adapt the macros to another context, and in the process of working out a fix, Don came across the other.

The first problem can arise when switching from single-column to double-column mode near the end of a page, and then back to single-column mode “too soon” on the next page. Referring to page 417 of The TeXbook, the \begindoublecolumns macro operates by first saving the current \box255 in \partialpage, changing the output routine to \doublecolumnone, changing \hsizeto \colwidth, and changing \vsizeto \bigcolheight, which is a bit more than twice the original \vsizet. This allows a very tall column to accumulate, after which, when \doublecolumnone is invoked, \vsplits is used to extract columns of the correct height.

When \enddoublecolumns occurs, the output routine \balancecolumns uses a \loop in an attempt to split the current \box255 into two columns of equal height. Then \pagesofar packages these boxes side by side and contributes the result (along with the \partialpage, if any) to the current vertical list, and normal processing resumes.

The problem is that the alteration of \vsizet by \begindoublecolumns doesn’t take the height of \partialpage into account. This can allow \box255 to grow too large, creating a situation that \balancecolumns can’t handle. Consider a case where \begindoublecolumns has occured on a given page and more than enough material has accumulated in the main vertical list to fill the remainder of the page, if split equally. Since \begindoublecolumns has set \vsizet for a full double-column page, this might not be enough material to cause the output routine to be invoked. If \enddoublecolumns occurs at this point, \balancecolumns will split the entire \box255 into two equal parts, and the resulting columns won’t fit onto the page along with \partialpage. The result is that \partialpage gets put onto the current page as a badly underfull \vbox, and the two columns get held over for the next page. You get something like this:

Instead of this:

Of course, this situation never occurs in Appendix I because before \enddoublecolumns finally occurs, several full-size double-column pages have intervened, so that \partialpage is empty.
The cure is to set a value of \vsize which ensures that the \doublecolumnout output routine gets "triggered" at the right time. In the modified versions of the macros below, the changes have been marked by \%%n for easy reference. The \savesize register is used to hold the original \vsize, so it can be restored by \enddoublecolumns. In \begindoublecolumns, the new line \%%5 adjusts \vsize to compensate for \partialpage, and line \%%8 resets it to \bigcolheight, since a fresh page will start after \doublecolumnout operates.

A second problem with the macros in Appendix E is that under certain circumstances it is possible for \balancecolumns to be invoked twice in a row. Note that the final act of \balancecolumns, after splitting \box255, is to invoke \pagesofar, which contributes its results to the current vertical list. It is possible for the resulting list to be big enough to trigger the output routine, which at this point is still \balancecolumns. Since \box255 no longer contains a "column" to be split, the results will tend to be chaotic. In this kind of situation it is likely that the page cannot be properly balanced, so the best thing to do is warn the user and go on. This is accomplished by changing the output routine inside \balancecolumns to simply produce an error message. This happens in line \%%9, and then line \%%6 is required to restore normal output in \enddoublecolumns.

Note that \colwidth and \bigcolheight here replace the TeXbook values of 14pc and 89pc respectively, and that \dimen0 replaces \dimen8.