oubraces.sty

Interleave \overbrace with \underbrace

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Sometimes one would like to interleave braces labelling parts of an equation, like in

$$a+b+\overbrace{c+d+\underbrace{e+f}_{z}}^{x}+\overbrace{g+h}^{y}+i+\overbrace{j}^{z}+k+l+m=\pi r^2$$

which is something that straightforward `\overbrace` and `\underbrace` cannot do.

There is a trick, which I heard from Etienne Riga, that works well for simple cases without requiring any packages or new commands, and it involves *overprinting* parts of the equation: put an overlapping `\overbrace` (or `\underbrace`) into `\rlap{$...$}`, and insert it into the equation. This does not easily handle the multiple-overlap of the example above (the overlapping gets misaligned) but can do

$$\overbrace{A+\underbrace{B}_{z}+C}^{x}$$

with `\rlap{$\overbrace{A+B}^x$}A+\underbrace{B+C}_z`.

The oubraces package provides an alternative solution (for both plain TEX and LATEX) based on visual formatting into columns, like an array or table. The formula at top is then produced by

```
\overunderbraces{&\br{2}{x}& &\br{2}{y}}%
   {a + b +&c + d +&e + f&+&g + h&+ i + j&+ k + l + m}%
   {& &\br{3}{z}}
 = \pi r^2
```

First, (on paper or imagination) write the formula and divide it into segments at the tip of each brace. In our example there are seven segments:

$$\overbrace{\left|a+b+\overbrace{c+d+\underbrace{e+f}_{z}}^{x}+\overbrace{g+h}^{y}+i+j\right|}^{\begin{array}{ccccccc}1&2&3&4&5&6&7\end{array}}+k+l+m=\pi r^2$$

although segments 1 and 7 could be omitted. We will type the main line of the formula with `&` inserted between each segment:

```
a + b +&c + d +&e + f&+&g + h&+ i + j&+ k + l + m
```

Each segment then becomes a column in an alignment, and each brace may span multiple columns. The idea is best illustrated by a LaTeX array:

```
\begin{array}[c]{ccccccc}
  & \multicolumn{2}{c}{x}& & \multicolumn{2}{c}{y}\\
  & \multicolumn{2}{c}{\downbracefill}&
                       & \multicolumn{2}{c}{\downbracefill}\\
  a + b +&c + d +&e + f&+&g + h&+ i + j&+ k + l + m\\
  & & \multicolumn{3}{c}{\upbracefill}\\
  & & \multicolumn{3}{c}{z}
\end{array} = \pi r^2
```

This doesn't work well at all, having bad braces with bad vertical and horizontal spacing. We should instead use TeX's primitive `\halign` command, and measure the size of boxes to get the correct vertical positioning of the formula's main line. Rather than type the very messy TeX commands directly with each use, it is better to make a new command:

`\overunderbraces{`*upper_braces*`}{`*main_formula*`}{`*lower_braces*`}`

We already know how to write the main line of the formula (by segmenting the formula and inserting `&` between segments), and we will also use `&` between braces. Each labelled brace will be specified in the format:

`\br{`*n*`}{`*label*`}`

where *n* is the number of segments spanned by the brace. Each top brace of our example spans two segments (with an empty segment between them) and the bottom brace spans three segments, so they are specified by:

top braces: `&\br{2}{x}&  &\br{2}{y}`
bottom braces: `& &\br{3}{z}`

Having determined all three parameters to use with `\overunderbraces`, the complete command is

```
\overunderbraces{&\br{2}{x}& &\br{2}{y}}%
   {a + b +&c + d +&e + f&+&g + h&+ i + j&+ k + l + m}%
   {& &\br{3}{z}}
 = \pi r^2
```

which produces the equation at the start of this article.