The package EASYBMAT

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Abstract

The EASYBMAT package is a macro package for writing block matrices, with equal column widths or equal rows heights or both, with various kinds of rules (lines) between rows and columns. It uses an array/tabular-like syntax.

Contents

1 Some examples with easybmat

Load the package in the usual way:

```
\documentclass{article}
.
.
\usepackage[thinlines,thiklines]{easybmat}
.
.
```

The options `thinlines`, and `thiklines` are self explanatory. EASYBMAT provides the BMAT environment which is a re-implementation of the array/tabular environment, with some limitation and some additional features. The syntax is

```
\begin{BMAT}‘(eq)’‘[ex]’‘{cc...c}’‘{cc...c}’
   a & b & ... & n \\
   ...
\end{BMAT}
```

or

```
\begin{BMAT}‘(eq,mx,my)’
            ‘[ex,MX,MY]’
            ‘{cc...c}’
            ‘{cc...c}’
   a & b & ... & n \\
   ...
\end{BMAT}
```

- `(eq)` or `(eq,mx,my)`. By `eq` you can balance the rows or the column or both, as shown in this table:

Table 1.

value of `eq`	effect
`@`	no balancing
`r`	equal rows heights
`c`	equal column widths
`b`	equal rows heights and equal column widths
`e`	equal rows heights and column widths

By `mx` and `my` you can modify the minimum size of the box in the BMAT environment. This must be a valid measure e.g. 2pt. This is useful in writing matrices an vectors.

- `[ex]` or `[ex,MX,MY]`. By "`ex`" you can specify the amount of extra space around the item in the BMAT environment. The default is `2pt`. By `MX` and `MY` you can modify the minimum size of the whole block matrix in the BMAT environment. This must be a valid measure e.g.10cm.

- The first '`{cc...c}`' is the definition of the columns and their alignment. The possible alignment for the columns are:

Table 2.

`c`	centering
`l`	flush left
`r`	flush right

- The second '`{cc...c}`' is the definition of the rows their alignment. The possible alignment for the rows are:

Table 3.

`c`	centering
`t`	flush top
`b`	flush bottom

IMPORTANT: The package can manage matrices with a maximum of 30 rows by 30 columns.

It is possible to produce rules between columns or rows as this example shows:

```
\[ \begin{BMAT}(b){|l:cr|}{|t;cb|}
     1_{j} & 1 & 1 \\
     1_{j} & 1 & \frac{111}{222} \\
     1 & 1_{j} & 1
  \end{BMAT} \qquad
  \begin{BMAT}(b){|r:cl|}{|b;ct|}
     1_{j} & 1 & 1 \\
     1_{j} & 1 & \frac{111}{222} \\
     1 & 1_{j} & 1
  \end{BMAT} \]
```

$$\left|\begin{array}{l:cr} 1_j & 1 & 1 \\ \hdashline 1_j & 1 & \frac{111}{222} \\ 1 & 1_j & 1 \end{array}\right| \qquad \left|\begin{array}{r:cl} 1_j & 1 & 1 \\ \hdashline 1_j & 1 & \frac{111}{222} \\ 1 & 1_j & 1 \end{array}\right|$$

The available rules for the rows and columns are

Table 4.

nothing	no rule
`|`	solid line
`:`	dash line
`;`	dot-dash line
`.`	dotted line
`0`	solid line with size `1/5` of normal line
`1`	solid line with size `1/4` of normal line
`2`	solid line with size `1/3` of normal line
`3`	solid line with size `1/2` of normal line
`4`	equivalent to `|`
`5`	solid line with size `2` times of normal line
`6`	solid line with size `3` times of normal line
`7`	solid line with size `4` times of normal line
`8`	solid line with size `5` times of normal line
`9`	solid line with size `6` times of normal line

The main feature of the BMAT environment is that it is reentrant as shown here:

```
\[ \begin{BMAT}{0c.c9}{|c.c|}
      1 & 2 \\ 3 &
      \begin{BMAT}{c:c}{c:c}
         a & b \\ c & d
      \end{BMAT}
   \end{BMAT} \]
```

$$\begin{BMAT}{0c.c9}{|c.c|}
1 & 2 \\ 3 &
\begin{BMAT}{c:c}{c:c}
a & b \\ c & d
\end{BMAT}
\end{BMAT}$$

IMPORTANT: The package can manage a reentrance of a maximum of `8` levels.

2 An example with balancing

Here it is showed the effect of various balancing:

```
\[ \begin{BMAT}{|c|c|c|}{|c|c|c|}
       1 & 22 & 333 \\
       \frac{1}{2} & 1 & 1 \\
       \frac{1}{\frac{1}{2}} & 1 & 1
   \end{BMAT} \quad
   \begin{BMAT}(r){|c|c|c|}{|c|c|c|}
       1 & 22 & 333 \\
       \frac{1}{2} & 1 & 1 \\
       \frac{1}{\frac{1}{2}} & 1 & 1
   \end{BMAT} \quad
   \begin{BMAT}(c){|c|c|c|}{|c|c|c|}
       1 & 22 & 333 \\
       \frac{1}{2} & 1 & 1 \\
       \frac{1}{\frac{1}{2}} & 1 & 1
   \end{BMAT} \]
```

$$\begin{BMAT}{|c|c|c|}{|c|c|c|}
1 & 22 & 333 \\
\frac{1}{2} & 1 & 1 \\
\frac{1}{\frac{1}{2}} & 1 & 1
\end{BMAT}
\quad
\begin{BMAT}(r){|c|c|c|}{|c|c|c|}
1 & 22 & 333 \\
\frac{1}{2} & 1 & 1 \\
\frac{1}{\frac{1}{2}} & 1 & 1
\end{BMAT}
\quad
\begin{BMAT}(c){|c|c|c|}{|c|c|c|}
1 & 22 & 333 \\
\frac{1}{2} & 1 & 1 \\
\frac{1}{\frac{1}{2}} & 1 & 1
\end{BMAT}$$

3 Some example with minimal size setting

It is possible to specify the minimal size of the item inside a "BMAT" environment, as shown here

```
\[ \left[
   \begin{BMAT}(@,50pt,20pt){c.c}{c.c}
      1 & 22 \\ \frac{1}{2} & 1
   \end{BMAT}
   \right] \]
```

$$\left[\begin{BMAT}(@,50pt,20pt){c.c}{c.c} 1 & 22 \\ \frac{1}{2} & 1 \end{BMAT}\right]$$

It is possible to specify the total minimal size of a "BMAT" environment, as shown here

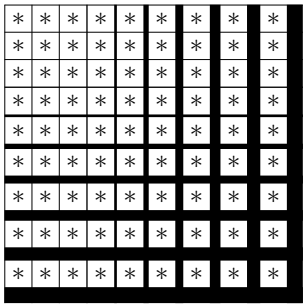
```
\[ \left[
   \begin{BMAT}(e)[2pt,3cm,3cm]{c.c}{c.c}
      1 & 22 \\ \frac{1}{2} & 1
   \end{BMAT}
   \right] \times \left[
   \begin{BMAT}(e)[2pt,0pt,3cm]{c}{c.c}
     x \\ y
   \end{BMAT}
   \right] = \left[
   \begin{BMAT}(e)[2pt,1cm,3cm]{c}{c.c}i
      2 \\ \frac{3}{2}
   \end{BMAT} \right] \]
```

$$\left[\begin{BMAT}(e)[2pt,3cm,3cm]{c.c}{c.c} 1 & 22 \\ \frac{1}{2} & 1 \end{BMAT}\right] \times \left[\begin{BMAT}(e)[2pt,0pt,3cm]{c}{c.c} x \\ y \end{BMAT}\right] = \left[\begin{BMAT}(e)[2pt,1cm,3cm]{c}{c.c} i2 \\ \frac{3}{2} \end{BMAT}\right]$$

4 An example with various size rules

This example shows the use of various size rule in BMAT environment:

```
\[ \begin{BMAT}(e,10pt,10pt){0c1c2c3c4c5c6c7c8c9}
                             {0c1c2c3c4c5c6c7c8c9}
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \\
   * & * & * & * & * & * & * & * & * & * & * & * \end{BMAT} \]
```



5 The \addpath command

Is is possible to add paths to the "BMAT" environment. The syntax is the following

```
\begin{BMAT} ..... {...}{...}
   ..... \\
   ..... \\
   ..... \\
   \addpath{('x','y','rule')'path'}
   .
   .
   \addpath{('x','y','rule')'path'}
\end{BMAT}
```

where

"x' and 'y' are the integer coordinate of the starting point. The left down corner is at coordinate $x = 0$, $y = 0$.

rule is the code of a valid rule as described in table 4.

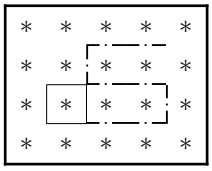
path is a string describing the path. Each letter of the string is a movement coded as follows:

Table 5.

letter	direction
`l`	left movement and drawing
`r`	right movement and drawing
`u`	up movement and drawing
`d`	down movement and drawing

The following example shows the use of `\addpath`,

```
\[ \begin{BMAT}[5pt]{|ccccc|}{|cccc|}
      * & * & * & * & * \\
      * & * & * & * & * \\
      * & * & * & * & * \\
      * & * & * & * & *
      \addpath{(1,1,0)ruld}
      \addpath{(4,3,;)lldrrdll}
   \end{BMAT} \]
```



This is another example

```
\[ \left(\begin{BMAT}[5pt]{cccccc}{cccccc}
      1 & *  & *   & *    & *     & * \\
      0 & 11 & *   & *    & *     & * \\
      0 & 0  & 111 & *    & *     & * \\
      0 & 0  & 0   & 1111 & *     & * \\
      0 & 0  & 0   & 0    & 11111 & * \\
      0 & 0  & 0   & 0    & 0     & 11111
      \addpath{(0,5,.)rdrdrdrdrd}
   \end{BMAT}\right) \]
```

$$\left(\begin{array}{cccccc} 1 & * & * & * & * & * \\ 0 & 11 & * & * & * & * \\ 0 & 0 & 111 & * & * & * \\ 0 & 0 & 0 & 1111 & * & * \\ 0 & 0 & 0 & 0 & 11111 & * \\ 0 & 0 & 0 & 0 & 0 & 11111 \end{array}\right)$$

6 An example with reentrance

This final example shows a slightly more complex (reentrant) definition in which the BMAT environment is used:

```
\def\rec(#1){\expandafter\recurse#1-\end}
\def\recurse#1#2\end{%
 \if\noexpand#1-\def\next##1##2{}%
 \else\let\next=\recursea\fi%
 \expandafter\next{#1}{#2}%
}%
\def\recursea#1#2{%
  \bgroup
    \begin{BMAT}[0pt]{l:c:r}{t;c;b}
       \rec(#2) &      #1  & \rec(#2) \\
             #1 & \rec(#2) & #1       \\
       \rec(#2) &      #1  & \rec(#2)
    \end{BMAT}
  \egroup
}
\[ \recurse\clubsuit\diamondsuit\heartsuit\end \]
```

It produces the following output: