

The package `nicematrix`*

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Abstract

The LaTeX package `nicematrix` provides new environments similar to the classical environments `{tabular}`, `{array}` and `{matrix}` of `array` and `amsmath` but with extended features.

$$\begin{array}{c} L_1 \\ L_2 \\ \vdots \\ L_n \end{array} \begin{array}{c} C_1 \\ C_2 \cdots C_n \end{array} \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

Product	dimensions (cm)			Price
	L	l	h	
small	3	5.5	1	30
standard	5.5	8	1.5	50.5
premium	8.5	10.5	2	80
extra	8.5	10	1.5	85.5
special	12	12	0.5	70

The package `nicematrix` is entirely contained in the file `nicematrix.sty`. This file may be put in the current directory or in a `texmf` tree. However, the best is to install `nicematrix` with a TeX distribution such as MiKTeX, TeX Live or MacTeX.

Remark

If you use LaTeX via Internet with, for example, Overleaf, you can upload the file `nicematrix.sty` in the repertory of your project in order to take full advantage of the latest version de `nicematrix`.¹

This package can be used with `xelatex`, `lualatex`, `pdflatex` but also by the classical workflow `latex-dvips-ps2pdf` (or Adobe Distiller). However, the file `nicematrix.dtx` of the present documentation should be compiled with XeLaTeX.

This package requires and **loads** the packages `l3keys2e`, `array`, `amsmath`, `pgfcore` and the module `shapes` of PGF (`tikz`, which is a layer over PGF, is *not* loaded). The final user only has to load the package with `\usepackage{nicematrix}`.

The idea of `nicematrix` is to create PGF nodes under the cells and the positions of the rules of the tabular created by `array` and to use these nodes to develop new features. As usual with PGF, the coordinates of these nodes are written in the `aux` to be used on the next compilation and that's why `nicematrix` may need **several compilations**.²

Most features of `nicematrix` may be used without explicit use of PGF or Tikz (which, in fact, is not loaded by default).

A command `\NiceMatrixOptions` is provided to fix the options (the scope of the options fixed by this command is the current TeX group: they are semi-global).

*This document corresponds to the version 6.19 of `nicematrix`, at the date of 2023/05/15.

¹The latest version of the file `nicematrix.sty` may be downloaded from the SVN server of TeXLive:
<https://www.tug.org/svn/texlive/trunk/Master/texmf-dist/tex/latex/nicematrix/nicematrix.sty>

²If you use Overleaf, Overleaf will do automatically a sufficient number of compilations.

1 The environments of this package

The package `nicematrix` defines the following new environments.

<code>{NiceTabular}</code>	<code>{NiceArray}</code>	<code>{NiceMatrix}</code>
<code>{NiceTabular*}</code>	<code>{pNiceArray}</code>	<code>{pNiceMatrix}</code>
<code>{NiceTabularX}</code>	<code>{bNiceArray}</code>	<code>{bNiceMatrix}</code>
	<code>{BNiceArray}</code>	<code>{BNiceMatrix}</code>
	<code>{vNiceArray}</code>	<code>{vNiceMatrix}</code>
	<code>{VNiceArray}</code>	<code>{VNiceMatrix}</code>

The environments `{NiceArray}`, `{NiceTabular}` and `{NiceTabular*}` are similar to the environments `{array}`, `{tabular}` and `{tabular*}` of the package `array` (which is loaded by `nicematrix`).

The environments `{pNiceArray}`, `{bNiceArray}`, etc. have no equivalent in `array`.

The environments `{NiceMatrix}`, `{pNiceMatrix}`, etc. are similar to the corresponding environments of `amsmath` (which is loaded by `nicematrix`): `{matrix}`, `{pmatrix}`, etc.

The environment `{NiceTabularX}` is similar to the environment `{tabularx}` from the eponymous package.³

It's recommended to use primarily the classical environments and to use the environments of `nicematrix` only when some feature provided by these environments is used (this will save memory).

All the environments of the package `nicematrix` accept, between square brackets, an optional list of `key=value` pairs. **There must be no space before the opening bracket (`[`) of this list of options.**

2 The vertical space between the rows

It's well known that some rows of the arrays created by default with LaTeX are, by default, too close to each other. Here is a classical example.

```


$$\begin{pmatrix} \frac{1}{2} & -\frac{1}{2} \\ \frac{1}{3} & \frac{1}{4} \end{pmatrix}$$


```

Inspired by the package `cellspace` which deals with that problem, the package `nicematrix` provides two keys `cell-space-top-limit` and `cell-space-bottom-limit` similar to the parameters of `cellspace` called `\cellspacetoplimit` and `\cellspacebottomlimit`.

There is also a key `cell-space-limits` to set both parameters at once.

The initial value of these parameters is 0 pt in order to have for the environments of `nicematrix` the same behaviour as those of `array` and `amsmath`. However, a value of 1 pt would probably be a good choice and we suggest to set them with `\NiceMatrixOptions`.⁴

```

\NiceMatrixOptions{cell-space-limits = 1pt}


$$\begin{pmatrix} \frac{1}{2} & -\frac{1}{2} \\ \frac{1}{3} & \frac{1}{4} \end{pmatrix}$$


```

³In fact, it's possible to use directly the `X` columns in the environment `{NiceTabular}` (and the required width for the tabular is fixed by the key `width`): cf. p. 22

⁴One should remark that these parameters apply also to the columns of type `S` of `siunitx` whereas the package `cellspace` is not able to act on such columns of type `S`.

3 The vertical position of the arrays

The package `nicematrix` provides a option `baseline` for the vertical position of the arrays. This option takes in as value an integer which is the number of the row on which the array will be aligned.

```
$A = \begin{pNiceMatrix}[baseline=2]
\frac{1}{\sqrt{1+p^2}} & p & 1-p \\
1 & 1 & 1 \\
1 & p & 1+p
\end{pNiceMatrix}$
```

$$A = \begin{pmatrix} \frac{1}{\sqrt{1+p^2}} & p & 1-p \\ 1 & 1 & 1 \\ 1 & p & 1+p \end{pmatrix}$$

It's also possible to use the option `baseline` with one of the special values `t`, `c` or `b`. These letters may also be used absolutely like the option of the environments `{tabular}` and `{array}` of `array`. The initial value of `baseline` is `c`.

In the following example, we use the option `t` (equivalent to `baseline=t`) immediately after an `\item` of list. One should remark that the presence of a `\hline` at the beginning of the array doesn't prevent the alignment of the baseline with the baseline of the first row (with `{tabular}` or `{array}` of `array`, one must use `\firsthline`).

```
\begin{enumerate}
\item an item
\smallskip
\item \renewcommand{\arraystretch}{1.2}
$\begin{NiceArray}[t]{lcccccc}
\hline
n & 0 & 1 & 2 & 3 & 4 & 5 \\
u_n & 1 & 2 & 4 & 8 & 16 & 32
\hline
\end{NiceArray}$
\end{enumerate}
```

1. an item

2.	n	0	1	2	3	4	5
	u_n	1	2	4	8	16	32

However, it's also possible to use the tools of `booktabs`⁵: `\toprule`, `\bottomrule`, `\midrule`, etc.

```
\begin{enumerate}
\item an item
\smallskip
\item
$\begin{NiceArray}[t]{lcccccc}
\toprule
n & 0 & 1 & 2 & 3 & 4 & 5 \\
\midrule
u_n & 1 & 2 & 4 & 8 & 16 & 32
\bottomrule
\end{NiceArray}$
\end{enumerate}
```

1. an item

2.	n	0	1	2	3	4	5
	u_n	1	2	4	8	16	32

It's also possible to use the key `baseline` to align a matrix on an horizontal rule (drawn by `\hline`). In this aim, one should give the value `line-i` where *i* is the number of the row *following* the horizontal rule.

```
\NiceMatrixOptions{cell-space-limits=1pt}

$A=\begin{pNiceArray}{cc|cc}[baseline=line-3]
\dfrac{1}{A} & \dfrac{1}{B} & 0 & 0 \\
\dfrac{1}{C} & \dfrac{1}{D} & 0 & 0 \\
\hline
0 & 0 & A & B \\
0 & 0 & D & D
\end{pNiceArray}$
```

$$A = \left(\begin{array}{cc|cc} \frac{1}{A} & \frac{1}{B} & 0 & 0 \\ \frac{1}{C} & \frac{1}{D} & 0 & 0 \\ \hline 0 & 0 & A & B \\ 0 & 0 & D & D \end{array} \right)$$

⁵The extension `booktabs` is *not* loaded by `nicematrix`.

4 The blocks

4.1 General case

In the environments of `nicematrix`, it's possible to use the command `\Block` in order to place an element in the center of a rectangle of merged cells of the array.⁶

The command `\Block` must be used in the upper leftmost cell of the array with two arguments.

- The first argument is the size of the block with the syntax i - j where i is the number of rows of the block and j its number of columns.

If this argument is empty, its default value is 1-1. If the number of rows is not specified, or equal to *, the block extends until the last row (idem for the columns).

- The second argument is the content of the block. It's possible to use `\\` in that content to have a content on several lines. In `{NiceTabular}`, `{NiceTabular*}` and `{NiceTabularX}`, the content of the block is composed in text mode whereas, in the other environments, it is composed in math mode.

Here is an example of utilisation of the command `\Block` in mathematical matrices.

```
\begin{bNiceArray}{cw{c}{1cm}c|c}[margin]
\Block{3-3}{A} & & 0 \\
& & \Vdots \\
& & 0 \\
\hline
0 & \Cdots & 0 & 0
\end{bNiceArray}
```

$$\left[\begin{array}{cc|c} & & 0 \\ & & \vdots \\ & & 0 \\ \hline 0 & \cdots & 0 \end{array} \right]$$

One may wish to raise the size of the “A” placed in the block of the previous example. Since this element is composed in math mode, it's not possible to use directly a command like `\large`, `\Large` and `\LARGE`. That's why the command `\Block` provides an option between angle brackets to specify some TeX code which will be inserted before the beginning of the math mode.⁷

```
\begin{bNiceArray}{cw{c}{1cm}c|c}[margin]
\Block{3-3}<\Large>{A} & & 0 \\
& & \Vdots \\
& & 0 \\
\hline
0 & \Cdots & 0 & 0
\end{bNiceArray}
```

$$\left[\begin{array}{cc|c} & & 0 \\ & & \vdots \\ & & 0 \\ \hline 0 & \cdots & 0 \end{array} \right]$$

In fact, the command `\Block` accepts as first optional argument (between square brackets) a list of couples `key=value`. The available keys are as follows:

- the key `fill` takes in as value a color and fills the block with that color;
- the key `draw` takes in as value a color and strokes the frame of the block with that color (the default value of that key is the current color of the rules of the array);
- the key `color` takes in as value a color and apply that color the content of the block but draws also the frame of the block with that color;
- the keys `hlines`, `vlines` and `hvlines` draw all the corresponding rules in the block;⁸

⁶The spaces after a command `\Block` are deleted.

⁷This argument between angular brackets may also be used to insert a command of font such as `\bfseries` when the command `\\` is used in the content of the block.

⁸However, the rules are not drawn in the sub-blocks of the block, as always with `nicematrix`: the rules are not drawn in the blocks (cf. section 5 p. 9).

- the key `line-width` is the width of the rules (is relevant only when one of the keys `draw`, `hvlines`, `vlines` and `hlines` is used);
- the key `rounded-corners` requires rounded corners (for the frame drawn by `draw` and the shape drawn by `fill`) with a radius equal to the value of that key (the default value is 4 pt⁹);
- when the key `tikz` is used, the Tikz path corresponding of the rectangle which delimits the block is executed with Tikz¹⁰ by using as options the value of that key `tikz` (which must be a list of keys allowed for a Tikz path). For examples, cf. p. 53;
- the key `name` provides a name to the rectangular Tikz node corresponding to the block; it's possible to use that name with Tikz in the `\CodeAfter` of the environment (cf. p. 31);
- the key `respect-arraystretch` prevents the setting of `\arraystretch` to 1 at the beginning of the block (which is the behaviour by default) ;
- the key `borders` provides the ability to draw only some borders of the blocks; the value of that key is a (comma-separated) list of elements covered by `left`, `right`, `top` and `bottom`; it's possible, in fact, in the list which is the value of the key `borders`, to add an entry of the form `tikz={list}` where `list` is a list of couples `key=value` of Tikz specifying the graphical characteristics of the lines that will be drawn (for an example, see p. 57).
- By default, the rules are not drawn in the blocks (see the section about the rules: section 5 p. 9). However, if the key `transparent` is used, the rules are drawn. For an example, see section 18.1 on page 53. Caution: that key does not imply that the content of the block will be transparent!

There is also keys for the horizontal and vertical positions of the content of the block: cf. 4.5 p. 7.

One must remark that, by default, the commands `\Blocks` don't create space. There is exception only for the blocks mono-row and the blocks mono-column as explained just below.

In the following example, we have had to enlarge by hand the columns 2 and 3 (with the construction `w{c}{...}` of `array`).

```
\begin{NiceTabular}{cw{c}{2cm}w{c}{3cm}c}
rose      & tulip & daisy & dahlia \\
violet
& \Block[draw=red,fill=[RGB]{204,204,255},rounded-corners]{2-2}
      & \LARGE Some beautiful flowers
      & & marigold \\
iris & & & lis \\
arum & periwinkle & forget-me-not & hyacinth
\end{NiceTabular}
```

rose	tulip	daisy	dahlia
violet	Some beautiful flowers		marigold
iris			lis
arum	periwinkle	forget-me-not	hyacinth

4.2 The mono-column blocks

The mono-column blocks have a special behaviour.

- The natural width of the contents of these blocks is taken into account for the width of the current column.

In the columns with a fixed width (columns `w{...}{...}`, `W{...}{...}`, `p{...}`, `b{...}`, `m{...}`, `V` and `X`), the content of the block is formatted as a paragraph of that width.

⁹This value is the initial value of the *rounded corners* of Tikz.

¹⁰Tikz should be loaded (by default, `nicematrix` only loads PGF) and, if it's not, an error will be raised.

- The specification of the horizontal position provided by the type of column (c, r or l) is taken into account for the blocks (but the `\Block` may have its own specification of alignment: cf. 4.5 p. 7).
- The specifications of font specified for the column by a construction `>{...}` in the preamble of the array are taken into account for the mono-column blocks of that column (this behaviour is probably expected).

<code>\begin{NiceTabular}{@{}>{\bfseries}lr@{}} \hline</code>	
<code>\Block{2-1}{John} & 12 \\\</code>	John 12
<code>& 13 \\\ \hline</code>	13
<code>Steph & 8 \\\ \hline</code>	Steph 8
<code>\Block{3-1}{Sarah} & 18 \\\</code>	18
<code>& 17 \\\</code>	Sarah 17
<code>& 15 \\\ \hline</code>	15
<code>Ashley & 20 \\\ \hline</code>	Ashley 20
<code>Henry & 14 \\\ \hline</code>	Henry 14
<code>\Block{2-1}{Madison} & 15 \\\</code>	15
<code>& 19 \\\ \hline</code>	Madison 19
<code>\end{NiceTabular}</code>	

4.3 The mono-row blocks

For the mono-row blocks, the natural height and depth are taken into account for the height and depth of the current row (as does a standard `\multicolumn` of LaTeX).

4.4 The mono-cell blocks

A mono-cell block inherits all the properties of the mono-row blocks and mono-column blocks.

At first sight, one may think that there is no point using a mono-cell block. However, there are some good reasons to use such a block.

- It's possible to use the command `\\` in a (mono-cell) block.
- It's possible to use the option of horizontal alignment of the block in derogation of the type of column given in the preamble of the array.
- It's possible to draw a frame around the cell with the key `draw` of the command `\Block` and to fill the background with rounded corners with the keys `fill` and `rounded-corners`.¹¹
- It's possible to draw one or several borders of the cell with the key `borders`.

<code>\begin{NiceTabular}{cc}</code>	
<code>\toprule</code>	
<code>Writer & \Block[l]{year\\ of birth} \\\</code>	Writer year of birth
<code>\midrule</code>	
<code>Hugo & 1802 \\\</code>	Hugo 1802
<code>Balzac & 1799 \\\</code>	Balzac 1799
<code>\bottomrule</code>	
<code>\end{NiceTabular}</code>	

We recall that if the first mandatory argument of `\Block` is left blank, the block is mono-cell.¹²

¹¹If one simply wishes to color the background of a unique cell, there is no point using the command `\Block`: it's possible to use the command `\cellcolor` (when the key `colortbl-like` is used).

¹²One may consider that the default value of the first mandatory argument of `\Block` is 1-1.

4.5 Horizontal position of the content of the block

The command `\Block` accepts the keys `l`, `c` and `r` for the horizontal position of its content.

```
$\begin{bNiceArray}{cw{c}{1cm}c|c}[margin]
\Block[r]{3-3}<\LARGE>{A} & & 0 \\
& & \Vdots \\
& & 0 \\
\hline
0 & \Cdots & 0 & 0
\end{bNiceArray}$
```

$$\left[\begin{array}{c|c} A & \begin{smallmatrix} 0 \\ \vdots \\ 0 \end{smallmatrix} \\ \hline 0 \cdots \cdots 0 & 0 \end{array} \right]$$

By default, the horizontal position of the content of a block is computed by using the positions of the *contents* of the columns implied in that block. That's why, in the following example, the header "First group" is correctly centered despite the instruction `!\qqquad` in the preamble which has been used to increase the space between the columns (this is not the behaviour of `\multicolumn`).

```
\begin{NiceTabular}{@{}c!\qqquadccc!\qqquadccc@{}}
\toprule
Rank & \Block{1-3}{First group} & & \Block{1-3}{Second group} \\
& 1A & 1B & 1C & 2A & 2B & 2C \\
\midrule
1 & 0.657 & 0.913 & 0.733 & 0.830 & 0.387 & 0.893 \\
2 & 0.343 & 0.537 & 0.655 & 0.690 & 0.471 & 0.333 \\
3 & 0.783 & 0.885 & 0.015 & 0.306 & 0.643 & 0.263 \\
4 & 0.161 & 0.708 & 0.386 & 0.257 & 0.074 & 0.336 \\
\bottomrule
\end{NiceTabular}
```

Rank	First group			Second group		
	1A	1B	1C	2A	2B	2C
1	0.657	0.913	0.733	0.830	0.387	0.893
2	0.343	0.537	0.655	0.690	0.471	0.333
3	0.783	0.885	0.015	0.306	0.643	0.263
4	0.161	0.708	0.386	0.257	0.074	0.336

In order to have an horizontal positionning of the content of the block computed with the limits of the columns of the LaTeX array (and not with the contents of those columns), one may use the key `L`, `R` and `C` of the command `\Block`.

Here is the same example with the key `C` for the first block.

```
\begin{NiceTabular}{@{}c!\qqquadccc!\qqquadccc@{}}
\toprule
Rank & \Block[C]{1-3}{First group} & & \Block{1-3}{Second group} \\
& 1A & 1B & 1C & 2A & 2B & 2C \\
\midrule
1 & 0.657 & 0.913 & 0.733 & 0.830 & 0.387 & 0.893 \\
2 & 0.343 & 0.537 & 0.655 & 0.690 & 0.471 & 0.333 \\
3 & 0.783 & 0.885 & 0.015 & 0.306 & 0.643 & 0.263 \\
4 & 0.161 & 0.708 & 0.386 & 0.257 & 0.074 & 0.336 \\
\bottomrule
\end{NiceTabular}
```

Rank	First group			Second group		
	1A	1B	1C	2A	2B	2C
1	0.657	0.913	0.733	0.830	0.387	0.893
2	0.343	0.537	0.655	0.690	0.471	0.333
3	0.783	0.885	0.015	0.306	0.643	0.263
4	0.161	0.708	0.386	0.257	0.074	0.336

4.6 Vertical position of the content of the block

For the vertical position, the command `\Blocks` accepts the keys `v-center`¹³, `t`, `b`, `T` and `B`.

- With the key `v-center`, the content of the block is vertically centered.
- With the key `t`, the baseline of the content of the block is aligned With the baseline of the first row concerned by the block).
- with the key `b`, the baseline of the last row of the content of the block (we recall that the content of a block may contains several lines separated by `\\`) is aligned with the baseline of the last of the rows of the array involved in the block.
- With the key `T`, the content of the block is set upwards.

Modification 6.18 No vertical margin is added. However, the contents of the block is (always) composed by `nicematrix` in a `{minipage}`, a `{tabular}` or an `{array}` and, hence, there will still remain a margin (in most cases).

- With the key `B`, the content of the block is set downwards.

When no key is given, the key `v-center` applies (excepted in the mono-row blocks).

```
\NiceMatrixOptions{rules/color=[gray]{0.75}, hvlines}
```

```
\begin{NiceTabular}{ccc}
\Block[fill=red!10,t,l]{4-2}{two\\lines}
& & \Huge Un\\
& & deux \\
& & trois \\
& & \Huge quatre \\
text & text & \\
\end{NiceTabular}
```

two lines	Un	
	deux	
	trois	
	quatre	
text	text	

```
\begin{NiceTabular}{ccc}
\Block[fill=red!10,b,r]{4-2}{two\\lines}
& & \Huge Un\\
& & deux \\
& & trois \\
& & \Huge quatre \\
text & text & \\
\end{NiceTabular}
```

two lines	Un	
	deux	
	trois	
	quatre	
text	text	

```
\begin{NiceTabular}{ccc}
\Block[fill=red!10,T,l]{4-2}{two\\lines}
& & \Huge Un\\
& & deux \\
& & trois \\
& & \Huge quatre \\
text & text & \\
\end{NiceTabular}
```

two lines	Un	
	deux	
	trois	
	quatre	
text	text	

¹³That key could not have been named `c` since the key `c` is used for the horizontal alignment.


```

\begin{NiceTabular}{ccc}
\Block[fill=red!10,B,r]{4-2}{two\\lines}
& & \Huge Un\\
& & deux \\
& & trois \\
& & \Huge quatre \\
text & text & \\
\end{NiceTabular}

```

two lines	Un	
	deux	
	trois	
	quatre	
text	text	

5 The rules

The usual techniques for the rules may be used in the environments of `nicematrix` (excepted `\vline`). However, there is some small differences with the classical environments.

5.1 Some differences with the classical environments

5.1.1 The vertical rules

In the environments of `nicematrix`, the vertical rules specified by `|` in the preambles of the environments are never broken, even by an incomplete row or by a double horizontal rule specified by `\hline\hline` (there is no need to use the package `hhline`).

```

\begin{NiceTabular}{|c|c|} \hline
First & Second \\ \hline\hline
Peter & \\ \hline
Mary & George \\ \hline
\end{NiceTabular}

```

First	Second
Peter	
Mary	George

However, the vertical rules are not drawn in the blocks (created by `\Block`: cf. p. 4) nor in the corners (created by the key `corner`: cf. p. 11) nor in the potential exterior rows (created by the keys `first-row` and `last-row`: cf. p. 24).

If you use `booktabs` (which provides `\toprule`, `\midrule`, `\bottomrule`, etc.) and if you really want to add vertical rules (which is not in the spirit of `booktabs`), you should notice that the vertical rules drawn by `nicematrix` are compatible with `booktabs`.

```

$\begin{NiceArray}{|cccc|} \toprule
a & b & c & d \\ \midrule
1 & 2 & 3 & 4 \\
1 & 2 & 3 & 4 \\ \bottomrule
\end{NiceArray}$

```

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
1	2	3	4
1	2	3	4

However, it's still possible to define a specifier (named, for instance, `I`) to draw vertical rules with the standard behaviour of `array`.

```

\newcolumnntype{I}{!{\vrule}}

```

5.1.2 The command `\cline`

The horizontal and vertical rules drawn by `\hline` and the specifier “`|`” make the array larger or wider by a quantity equal to the width of the rule (with `array` and also with `nicematrix`).

For historical reasons, this is not the case with the command `\cline`, as shown by the following example.

```
\setlength{\arrayrulewidth}{2pt}
\begin{tabular}{cccc} \hline
A&B&C&D \\ \cline{2-2}
A&B&C&D \\ \hline
\end{tabular}
```

A	B	C	D
A	<u>B</u>	C	D

In the environments of `nicematrix`, this situation is corrected (it's still possible to go to the standard behaviour of `\cline` with the key `standard-cline`).

```
\setlength{\arrayrulewidth}{2pt}
\begin{NiceTabular}{cccc} \hline
A&B&C&D \\ \cline{2}
A&B&C&D \\ \hline
\end{NiceTabular}
```

A	B	C	D
A	<u>B</u>	C	D

In the environments of `nicematrix`, an instruction `\cline{i}` is equivalent to `\cline{i-i}`.

5.2 The thickness and the color of the rules

The environments of `nicematrix` provide a key `rules/width` to set the width (in fact the thickness) of the rules in the current environment. In fact, this key merely sets the value of the length `\arrayrulewidth`.

It's well known that `colortbl` provides the command `\arrayrulecolor` in order to specify the color of the rules.

With `nicematrix`, it's possible to specify the color of the rules even when `colortbl` is not loaded. For sake of compatibility, the command is also named `\arrayrulecolor`. The environments of `nicematrix` also provide a key `rules/color` to fix the color of the rules in the current environment. This key sets the value locally (whereas `\arrayrulecolor` acts globally!).

```
\begin{NiceTabular}{|ccc|}[rules/color=[gray]{0.9},rules/width=1pt]
\hline
rose & tulipe & lys \\
arum & iris & violette \\
muguet & dahlia & souci \\
\hline
\end{NiceTabular}
```

rose	tulipe	lys
arum	iris	violette
muguet	dahlia	souci

5.3 The tools of `nicematrix` for the rules

Here are the tools provided by `nicematrix` for the rules.

- the keys `hlines`, `vlines`, `hvlines` and `hvlines-except-borders`;
- the specifier “|” in the preamble (for the environments with preamble);
- the command `\Hline`.

All these tools don't draw the rules in the blocks nor in the empty corners (when the key `corners` is used), nor in the exterior rows and columns.

- These blocks are:
 - the blocks created by the command `\Block`¹⁴ presented p. 4;
 - the blocks implicitly delimited by the continuous dotted lines created by `\Cdots`, `\Vdots`, etc. (cf. p. 25).
- The corners are created by the key `corners` explained below (see p. 11).
- For the exterior rows and columns, see p. 24.

¹⁴And also the command `\multicolumn` but it's recommended to use instead `\Block` in the environments of `nicematrix`.

In particular, this remark explains the difference between the standard command `\hline` and the command `\Hline` provided by `nicematrix`.

The key `\Hline` takes in an optional argument (between square brackets) which is a list of *key=value* pairs. For the description of those keys, see `custom-line` on p. 13.

5.3.1 The keys `hlines` and `vlines`

The keys `hlines` and `vlines` (which draw, of course, horizontal and vertical rules) take in as value a list of numbers which are the numbers of the rules to draw.¹⁵

In fact, for the environments with delimiters (such as `{pNiceMatrix}` or `{bNiceArray}`), the key `vlines` don't draw the exterior rules (this is certainly the expected behaviour).

```
\begin{pNiceMatrix}[vlines,rules/width=0.2pt]
1 & 2 & 3 & 4 & 5 & 6 \\
1 & 2 & 3 & 4 & 5 & 6 \\
1 & 2 & 3 & 4 & 5 & 6 \\
\end{pNiceMatrix}
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 2 & 3 & 4 & 5 & 6 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{pmatrix}$$

5.3.2 The keys `hvlines` and `hvlines-except-borders`

The key `hvlines` (no value) is the conjunction of the keys `hlines` and `vlines`.

```
\setlength{\arrayrulewidth}{1pt}
\begin{NiceTabular}{cccc}[hvlines,rules/color=blue]
rose      & tulipe & marguerite & dahlia \\
violette  & \Block[draw=red]{2-2}{\LARGE fleurs} & & souci \\
pervenche & & & lys \\
arum      & iris   & jacinthe   & muguet \\
\end{NiceTabular}
```

rose	tulipe	marguerite	dahlia
violette	fleurs		souci
pervenche			lys
arum	iris	jacinthe	muguet

It's worth noting that, when the key `rounded-corners` is used for the environment `{NiceTabular}`, the key `hvlines` draws rounded corners for the exterior frame of the tabular: cf. part 14.1, p. 41.

The key `hvlines-except-borders` is similar to the key `hvlines` but does not draw the rules on the horizontal and vertical borders of the array. For an example of use of that key, see the part “Use with `tcolorbox`”, p. 53.

5.3.3 The (empty) corners

The four `corners` of an array will be designed by `NW`, `SW`, `NE` and `SE` (*north west*, *south west*, *north east* and *south east*).

For each of these corners, we will call *empty corner* (or simply *corner*) the reunion of all the empty rectangles starting from the cell actually in the corner of the array.¹⁶

However, it's possible, for a cell without content, to require `nicematrix` to consider that cell as not empty with the key `\NotEmpty`.

¹⁵It's possible to put in that list some intervals of integers with the syntax *i-j*.

¹⁶For sake of completeness, we should also say that a cell contained in a block (even an empty cell) is not taken into account for the determination of the corners. That behaviour is natural. The precise definition of a “non-empty cell” is given below (cf. p. 51).

In the example on the right (where B is in the center of a block of size 2×2), we have colored in blue the four (empty) corners of the array.

					A	
			A	A	A	
				A		
		A	A	A	A	A
A	A	A	A	A	A	A
A	A	A	A	A	A	A
	A	A	A			
				A		
				A		

When the key `corners`¹⁷ is used, `nicematrix` computes the (empty) corners and these corners will be taken into account by the tools for drawing the rules (the rules won't be drawn in the corners).

```
\NiceMatrixOptions{cell-space-top-limit=3pt}
\begin{NiceTabular}{*{6}{c}}[corners,hvlines]
  & & & & A & \\
  & & A & A & A & \\
  & & & & A & \\
  & & & A & \\
  & & A & A & A & A & \\
A & A & A & A & A & A & A & \\
A & A & A & A & A & A & A & \\
  & A & A & A & A & \\
  & & \Block{2-2}{B} & & A & \\
  & & & & A & \\
\end{NiceTabular}
```

						A
			A	A	A	
				A		
			A	A	A	A
A	A	A	A	A	A	A
A	A	A	A	A	A	A
		A	A	A		
					A	
					A	

It's also possible to provide to the key `corners` a (comma-separated) list of corners (designed by NW, SW, NE and SE).

```
\NiceMatrixOptions{cell-space-top-limit=3pt}
\begin{NiceTabular}{*{6}{c}}[corners=NE,hvlines]
1\\
1&1\\
1&2&1\\
1&3&3&1\\
1&4&6&4&1\\
&&&&&1
\end{NiceTabular}
```

1					
1	1				
1	2	1			
1	3	3	1		
1	4	6	4	1	
					1

▷ The corners are also taken into account by the tools provided by `nicematrix` to color cells, rows and columns. These tools don't color the cells which are in the corners (cf. p. 15).

5.4 The command `\diagbox`

The command `\diagbox` (inspired by the package `diagbox`), allows, when it is used in a cell, to slash that cell diagonally downwards.

```
$\begin{NiceArray}{*{5}{c}}[hvlines]
\diagbox{x}{y} & e & a & b & c \\
e & e & a & b & c \\
a & a & e & c & b \\
b & b & c & e & a \\
c & c & b & a & e
\end{NiceArray}$
```

$x \backslash y$	<i>e</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>e</i>	<i>e</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>a</i>	<i>a</i>	<i>e</i>	<i>c</i>	<i>b</i>
<i>b</i>	<i>b</i>	<i>c</i>	<i>e</i>	<i>a</i>
<i>c</i>	<i>c</i>	<i>b</i>	<i>a</i>	<i>e</i>

It's possible to use the command `\diagbox` in a `\Block`.

¹⁷The key `corners` that we describe now has no direct link with the key `rounded-corners` described in the part 14.1, p. 41

5.5 Commands for customized rules

It's also possible to define commands and letters for customized rules with the key `custom-line` available in `\NiceMatrixOptions` and in the options of individual environments. That key takes in as argument a list of `key=value` pairs. First, there is three keys to define the tools which will be used to use that new type of rule.

- the key `command` is the name (without the backslash) of a command that will be created by `nicematrix` and that will be available for the final user in order to draw horizontal rules (similarly to `\hline`);
- the key `ccommand` is the name (without the backslash) of a command that will be created by `nicematrix` and that will be available for the final user to order to draw partial horizontal rules (similarly to `\cline`, hence the name `ccommand`): the argument of that command is a list of intervals of columns specified by the syntax `i` or `i-j`.¹⁸
- the key `letter` takes in as argument a letter¹⁹ that the user will use in the preamble of an environment with preamble (such as `\NiceTabular`) in order to specify a vertical rule.

We will now speak of the keys which describe the rule itself. Those keys may also be used in the (optional) argument of an individual command `\Hline`.

There is three possibilities.

- *First possibility*

It's possible to specify composite rules, with a color and a color for the inter-rule space (as possible with `colortbl` for instance).

- the key `multiplicity` is the number of consecutive rules that will be drawn: for instance, a value of 2 will create double rules such those created by `\hline\hline` or `||` in the preamble of an environment;
- the key `color` sets the color of the rules ;
- the key `sep-color` sets the color between two successive rules (should be used only in conjunction with `multiplicity`).

That system may be used, in particular, for the definition of commands and letters to draw rules with a specific color (and those rules will respect the blocks and corners as do all the rules of `nicematrix`).

```
\begin{NiceTabular}{lclclcl}[custom-line = {letter=I, color=blue}]
\hline
      & \Block{1-3}{dimensions} & \\
      & L & l & h & \\
\hline
Product A & 3 & 1 & 2 & \\
Product B & 1 & 3 & 4 & \\
Product C & 5 & 4 & 1 & \\
\hline
\end{NiceTabular}
```

	dimensions		
	L	l	H
Product A	3	1	2
Product B	1	3	4
Product C	5	4	1

¹⁸It's recommended to use such commands only once in a row because each use will create space between the rows corresponding to the total width of the rule.

¹⁹The following letters are forbidden: `lcrpmbVX|()[]!@<>`

- *Second possibility*

It's possible to use the key `tikz` (if Tikz is loaded). In that case, the rule is drawn directly with Tikz by using as parameters the value of the key `tikz` which must be a list of *key=value* pairs which may be applied to a Tikz path.

By default, no space is reserved for the rule that will be drawn with Tikz. It is possible to specify a reservation (horizontal for a vertical rule and vertical for an horizontal one) with the key `total-width`. That value of that key, is, in some ways, the width of the rule that will be drawn (`nicematrix` does not compute that width from the characteristics of the rule specified in `tikz`).

Here is an example with the key `dotted` of Tikz.

```
\NiceMatrixOptions
{
  custom-line =
  {
    letter = I ,
    tikz = dotted ,
    total-width = \pgflinewidth
  }
}
```

one	two	three
four	five	six
seven	eight	nine

```
\begin{NiceTabular}{cIcIc}
one & two & three \\
four & five & six \\
seven & eight & nine
\end{NiceTabular}
```

- *Third possibility : the key dotted*

As one can see, the dots of a dotted line of Tikz have the shape of a square, and not a circle. That's why the extension `nicematrix` provides in the key `custom-line` a key `dotted` which will draw rounded dots. The initial value of the key `total-width` is, in this case, equal to the diameter of the dots (but the user may change the value with the key `total-width` if needed). Those dotted rules are also used by `nicematrix` to draw continuous dotted rules between cells of the matrix with `\Cdots`, `\Vdots`, etc. (cf. p. 25).

In fact, `nicematrix` defines by default the commands `\hdottedline` and `\cdottedline` and the letter “:” for those dotted rules.²⁰

```
\NiceMatrixOptions % present in nicematrix.sty
{
  custom-line =
  {
    letter = : ,
    command = hdottedline ,
    ccommand = cdottedline ,
    dotted
  }
}
```

Thus, it's possible to use the commands `\hdottedline` and `\cdottedline` to draw horizontal dotted rules.

²⁰However, it's possible to overwrite those definitions with a `custom-line` (in order, for example, to switch to dashed lines).

```

\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 \\
\hdottedline
6 & 7 & 8 & 9 & 10 \\
\cdottedline{1,4-5}
11 & 12 & 13 & 14 & 15
\end{pNiceMatrix}

```

$$\left(\begin{array}{ccccc} 1 & 2 & 3 & 4 & 5 \\ \hdottedline 6 & 7 & 8 & 9 & 10 \\ \cdottedline 11 & 12 & 13 & 14 & 15 \end{array}\right)$$

In the environments with an explicit preamble (like `{NiceTabular}`, `{NiceArray}`, etc.), it's possible to draw a vertical dotted line with the specifier “:”.

```

\left(\begin{NiceArray}{cccc:c}
1 & 2 & 3 & 4 & 5 \\
6 & 7 & 8 & 9 & 10 \\
11 & 12 & 13 & 14 & 15
\end{NiceArray}\right)

```

$$\left(\begin{array}{ccccc} 1 & 2 & 3 & 4 & : 5 \\ 6 & 7 & 8 & 9 & : 10 \\ 11 & 12 & 13 & 14 & : 15 \end{array}\right)$$

6 The color of the rows and columns

6.1 Use of `colortbl`

We recall that the package `colortbl` can be loaded directly with `\usepackage{colortbl}` or by loading `xcolor` with the key `table`: `\usepackage[table]{xcolor}`.

Since the package `nicematrix` is based on `array`, it's possible to use `colortbl` with `nicematrix`.

However, there is two drawbacks:

- The package `colortbl` patches `array`, leading to some incompatibilities (for instance with the command `\hdotsfor`).
- The package `colortbl` constructs the array row by row, alternating colored rectangles, rules and contents of the cells. The resulting PDF is difficult to interpret by some PDF viewers and may lead to artefacts on the screen.
 - Some rules seem to disappear. This is because many PDF viewers give priority to graphical element drawn posteriorly (which is in the spirit of the “painting model” of PostScript and PDF). Concerning this problem, MuPDF (which is used, for instance, by SumatraPDF) gives better results than Adobe Reader).
 - A thin white line may appear between two cells of the same color. This phenomenon occurs when each cell is colored with its own instruction `fill` (the PostScript operator `fill` noted `f` in PDF). This is the case with `colortbl`: each cell is colored on its own, even when `\columncolor` or `\rowcolor` is used.

As for this phenomenon, Adobe Reader gives better results than MuPDF.

The package `nicematrix` provides tools to avoid those problems.

6.2 The tools of `nicematrix` in the `\CodeBefore`

The package `nicematrix` provides some tools (independent of `colortbl`) to draw the colored panels first, and, then, the content of the cells and the rules. This strategy is more conform to the “painting model” of the formats PostScript and PDF and is more suitable for the PDF viewers. However, it requires several compilations.²¹

The extension `nicematrix` provides a key `code-before` for some code that will be executed before the drawing of the tabular.

²¹If you use Overleaf, Overleaf will do automatically a sufficient number of compilations.

An alternative syntax is provided: it's possible to put the content of that `code-before` between the keywords `\CodeBefore` and `\Body` at the beginning of the environment.

```
\begin{pNiceArray}{preamble}
\CodeBefore [options]
    instructions of the code-before
\Body
    contents of the environment
\end{pNiceArray}
```

The optional argument between square brackets is a list of *key=value* pairs which will be presented progressively in this documentation.²²

New commands are available in that `\CodeBefore`: `\cellcolor`, `\rectanglecolor`, `\rowcolor`, `\columncolor`, `\rowcolors`, `\rowlistcolors`, `\chessboardcolors` and `\arraycolor`.²³

These commands don't color the cells which are in the "corners" if the key `corners` is used. That key has been described p. 11.

These commands respect the rounded corners if the key `rounded-corners` (described in the part 14.1 at the page 41) has been used.

All these commands accept an optional argument, between square brackets and in first position. That optional argument may contain two elements (separated by a comma)

- the colorimetric space (RGB, `rgb`, HTML, etc) as specified by the the extension `xcolor`;
- **New 6.18**
a specification of opacity f the form `opacity = value`.

We describe now in detail those commands.

- The command `\cellcolor` takes its name from the command `\cellcolor` of `colortbl`.
This command takes in as mandatory arguments a color and a list of cells, each of which with the format *i-j* where *i* is the number of the row and *j* the number of the column of the cell. In fact, despite its name, this command may be used to color a whole row (with the syntax *i-*) or a whole column (with the syntax *-j*).

```
\begin{NiceTabular}{ccc}[hvlines]
\CodeBefore
    \cellcolor[HTML]{FFFF88}{3-1,2-2,-3}
\Body
a & b & c \\
e & f & g \\
h & i & j \\
\end{NiceTabular}
```

a	b	c
e	f	g
h	i	j

- The command `\rectanglecolor` takes three mandatory arguments. The first is the color. The second is the upper-left cell of the rectangle and the third is the lower-right cell of the rectangle.

```
\begin{NiceTabular}{ccc}[hvlines]
\CodeBefore
    \rectanglecolor{blue!15}{2-2}{3-3}
\Body
a & b & c \\
e & f & g \\
h & i & j \\
\end{NiceTabular}
```

a	b	c
e	f	g
h	i	j

²²The available keys are `create-cell-nodes`, `sub-matrix` (and its subkeys) and `delimiters-color`.

²³Remark that, in the `\CodeBefore`, PGF/Tikz nodes of the form "(i-lj)" are also available to indicate the position to the potential rules: cf. p. 48.

- The command `\arraycolor` takes in as mandatory argument a color and color the whole tabular with that color (excepted the potential exterior rows and columns: cf. p. 24). It's only a particular case of `\rectanglecolor`.
- The command `\chessboardcolors` takes in as mandatory arguments two colors and it colors the cells of the tabular in quincunx with these colors.

```

 $\begin{pNiceMatrix}[r,margin]
\CodeBefore
\chessboardcolors{red!15}{blue!15}
\Body
1 & -1 & 1 & \\\
-1 & 1 & -1 & \\\
1 & -1 & 1 & \\
\end{pNiceMatrix}$ 

```

$$\begin{pmatrix} 1 & -1 & 1 \\ -1 & 1 & -1 \\ 1 & -1 & 1 \end{pmatrix}$$

We have used the key `r` which aligns all the columns rightwards (cf. p. 42).

- The command `\rowcolor` takes its name from the command `\rowcolor` of `colortbl`. Its first mandatory argument is the color and the second is a comma-separated list of rows or interval of rows with the form *a-b* (an interval of the form *a-* represent all the rows from the row *a* until the end).

```

 $\begin{NiceArray}{lll}[hvlines]
\CodeBefore
\rowcolor{red!15}{1,3-5,8-}
\Body
a_1 & b_1 & c_1 \\\
a_2 & b_2 & c_2 \\\
a_3 & b_3 & c_3 \\\
a_4 & b_4 & c_4 \\\
a_5 & b_5 & c_5 \\\
a_6 & b_6 & c_6 \\\
a_7 & b_7 & c_7 \\\
a_8 & b_8 & c_8 \\\
a_9 & b_9 & c_9 \\\
a_{10} & b_{10} & c_{10} \\\
\end{NiceArray}$ 

```

a_1	b_1	c_1
a_2	b_2	c_2
a_3	b_3	c_3
a_4	b_4	c_4
a_5	b_5	c_5
a_6	b_6	c_6
a_7	b_7	c_7
a_8	b_8	c_8
a_9	b_9	c_9
a_{10}	b_{10}	c_{10}

- The command `\columncolor` takes its name from the command `\columncolor` of `colortbl`. Its syntax is similar to the syntax of `\rowcolor`.
- The command `\rowcolors` (with a *s*) takes its name from the command `\rowcolors` of `colortbl`. The *s* emphasizes the fact that there is *two* colors. This command colors alternately the rows of the tabular with the two colors (provided in second and third argument), beginning with the row whose number is given in first (mandatory) argument.

In fact, the first (mandatory) argument is, more generally, a comma separated list of intervals describing the rows involved in the action of `\rowcolors` (an interval of the form *i-* describes in fact the interval of all the rows of the tabular, beginning with the row *i*).

The last argument of `\rowcolors` is an optional list of pairs *key=value* (the optional argument in the first position corresponds to the colorimetric space). The available keys are `cols`, `restart` and `respect-blocks`.

- The key `cols` describes a set of columns. The command `\rowcolors` will color only the cells of these columns. The value is a comma-separated list of intervals of the form *i-j* (where *i* or *j* may be replaced by ***).

- With the key **restart**, each interval of rows (specified by the first mandatory argument) begins with the same color.²⁴
- With the key **respect-blocks** the “rows” alternately colored may extend over several rows if they have to incorporate blocks (created with the command `\Block`: cf. p. 4).

```
\begin{NiceTabular}{clr}[hvlines]
\CodeBefore
  \rowcolors[gray]{2}{0.8}{}[cols=2-3,restart]
\Body
\Block{1-*}{Results} \\\
John & 12 \\\
Stephen & 8 \\\
Sarah & 18 \\\
Ashley & 20 \\\
Henry & 14 \\\
Madison & 15
\end{NiceTabular}
```

Results		
A	John	12
	Stephen	8
B	Sarah	18
	Ashley	20
	Henry	14
	Madison	15

```
\begin{NiceTabular}{lr}[hvlines]
\CodeBefore
  \rowcolors{1}{blue!10}{}[respect-blocks]
\Body
\Block{2-1}{John} & 12 \\\
& 13 \\\
Steph & 8 \\\
\Block{3-1}{Sarah} & 18 \\\
& 17 \\\
& 15 \\\
Ashley & 20 \\\
Henry & 14 \\\
\Block{2-1}{Madison} & 15 \\\
& 19
\end{NiceTabular}
```

John	12
	13
Steph	8
Sarah	18
	17
	15
Ashley	20
Henry	14
Madison	15
	19

- The extension `nicematrix` provides also a command `\rowlistcolors`. This command generalises the command `\rowcolors`: instead of two successive arguments for the colors, this command takes in an argument which is a (comma-separated) list of colors. In that list, the symbol `=` represent a color identical to the previous one.

```
\begin{NiceTabular}{c}
\CodeBefore
  \rowlistcolors{1}{red!15,blue!15,green!15}
\Body
Peter \\\
James \\\
Abigail \\\
Elisabeth \\\
Claudius \\\
Jane \\\
Alexandra \\\
\end{NiceTabular}
```

Peter
James
Abigail
Elisabeth
Claudius
Jane
Alexandra

It's also possible to use in the command `\rowlistcolors` a color series defined by the command `\definecolorseries` of `xcolor` (and initialized with the command `\resetcolorseries`²⁵).

²⁴Otherwise, the color of a given row relies only upon the parity of its absolute number.

²⁵For the initialization, in the following example, you have used the counter `iRow` which, when used in the `\CodeBefore`

```

\begin{NiceTabular}{c}
\CodeBefore
  \definecolorseries{BlueWhite}{rgb}{last}{blue}{white}
  \resetcolorseries{\value{iRow}}{BlueWhite}
  \rowlistcolors{1}{BlueWhite!!+}
\Body
Peter \\
James \\
Abigail \\
Elisabeth \\
Claudius \\
Jane \\
Alexandra \\
\end{NiceTabular}

```

Peter
James
Abigail
Elisabeth
Claudius
Jane
Alexandra

We recall that all the color commands we have described don't color the cells which are in the "corners". In the following example, we use the key `corners=NE` to require the determination of the corner *north east* (NE).

```

\begin{NiceTabular}{cccccc}[corners=NE,margin,hvlines,first-row,first-col]
\CodeBefore
  \rowlistcolors{1}{blue!15, }
\Body
  & 0 & 1 & 2 & 3 & 4 & 5 & 6 \\
0 & 1 & & & & & & \\
1 & 1 & 1 & & & & & \\
2 & 1 & 2 & 1 & & & & \\
3 & 1 & 3 & 3 & 1 & & & \\
4 & 1 & 4 & 6 & 4 & 1 & & \\
5 & 1 & 5 & 10 & 10 & 5 & 1 & \\
6 & 1 & 6 & 15 & 20 & 15 & 6 & 1 \\
\end{NiceTabular}

```

	0	1	2	3	4	5	6
0	1						
1	1	1					
2	1	2	1				
3	1	3	3	1			
4	1	4	6	4	1		
5	1	5	10	10	5	1	
6	1	6	15	20	15	6	1

One should remark that all the previous commands are compatible with the commands of `booktabs` (`\toprule`, `\midrule`, `\bottomrule`, etc). However, `booktabs` is *not* loaded by `nicematrix`.

```

\begin{NiceTabular}[c]{lSSSS}
\CodeBefore
  \rowcolor{red!15}{1-2}
  \rowcolors{3}{blue!15}{}
\Body
\toprule
\Block{2-1}{Product} &
\Block{1-3}{dimensions (cm)} & & &
\Block{2-1}{\rotate Price} \\
\cmidrule{rl}{2-4}
& L & l & h & \\
\midrule
small & 3 & 5.5 & 1 & 30 \\
standard & 5.5 & 8 & 1.5 & 50.5 \\
premium & 8.5 & 10.5 & 2 & 80 \\
extra & 8.5 & 10 & 1.5 & 85.5 \\
special & 12 & 12 & 0.5 & 70 \\
\bottomrule
\end{NiceTabular}

```

Product	dimensions (cm)			Price
	L	l	h	
small	3	5.5	1	30
standard	5.5	8	1.5	50.5
premium	8.5	10.5	2	80
extra	8.5	10	1.5	85.5
special	12	12	0.5	70

(and in the `\CodeAfter`) corresponds to the number of rows of the array: cf. p 43. That leads to an ajustement of the gradation of the colors to the size of the tabular.

We have used the type of column **S** of `siunitx`.

6.3 Color tools with the syntax of `colortbl`

It's possible to access the preceding tools with a syntax close to the syntax of `colortbl`. For that, one must use the key `colortbl-like` in the current environment.²⁶

There are three commands available (they are inspired by `colortbl` but are *independent* of `colortbl`):

- `\cellcolor` which colorizes a cell;²⁷
- `\rowcolor` which must be used in a cell and which colorizes the end of the row;
- `\columncolor` which must be used in the preamble of the environment with the same syntax as the corresponding command of `colortbl` (however, unlike the command `\columncolor` of `colortbl`, this command `\columncolor` can appear within another command, itself used in the preamble of the array).

```
\NewDocumentCommand { \Blue } { } { } { \columncolor{blue!15} }
\begin{NiceTabular}[colortbl-like]{>{\Blue}c>{\Blue}cc}
\toprule
\rowcolor{red!15}
Last name & First name & Birth day \\
\midrule
Achard & Jacques & 5 juin 1962 \\
Lefebvre & Mathilde & 23 mai 1988 \\
Vanesse & Stephany & 30 octobre 1994 \\
Dupont & Chantal & 15 janvier 1998 \\
\bottomrule
\end{NiceTabular}
```

Last name	First name	Birth day
Achard	Jacques	5 juin 1962
Lefebvre	Mathilde	23 mai 1988
Vanesse	Stephany	30 octobre 1994
Dupont	Chantal	15 janvier 1998

7 The command `\RowStyle`

The command `\RowStyle` takes in as argument some formatting intructions that will be applied to each cell on the rest of the current row.

That command also takes in as optional argument (between square brackets) a list of *key=value* pairs.

- The key `nb-rows` sets the number of rows to which the specifications of the current command will apply (with the special value `*`, it will apply to all the following rows).
- The keys `cell-space-top-limit`, `cell-space-bottom-limit` and `cell-space-limits` are available with the same meaning that the corresponding global keys (cf. p. 2).

²⁶Up to now, this key is *not* available in `\NiceMatrixOptions`.

²⁷However, this command `\cellcolor` will delete the following spaces, which does not the command `\cellcolor` of `colortbl`.

- The key `rowcolor` sets the color of the background and the key `color` sets the color of the text.²⁸
- The key `bold` enforces bold characters for the cells of the row, both in math and text mode.

```
\begin{NiceTabular}{cccc}
\hline
\RowStyle[cell-space-limits=3pt]{\rotate}
first & second & third & fourth \\
\RowStyle[nb-rows=2,rowcolor=blue!50,color=white]{\sffamily}
1 & 2 & 3 & 4 \\
I & II & III & IV
\end{NiceTabular}
```

first	second	third	fourth
1	2	3	4
I	II	III	IV

The command `\rotate` is described p. 42.

8 The width of the columns

8.1 Basic tools

In the environments with an explicit preamble (like `{NiceTabular}`, `{NiceArray}`, etc.), it's possible to fix the width of a given column with the standard letters `w`, `W`, `p`, `b` and `m` of the package `array`.

```
\begin{NiceTabular}{W{c}{2cm}cc}[hvlines]
Paris & New York & Madrid \\
Berlin & London & Roma \\
Rio & Tokyo & Oslo
\end{NiceTabular}
```

Paris	New York	Madrid
Berlin	London	Roma
Rio	Tokyo	Oslo

In the environments of `nicematrix`, it's also possible to fix the *minimal* width of all the columns (excepted the potential exterior columns: cf. p. 24) directly with the key `columns-width`.

```
$\begin{pNiceMatrix}[columns-width = 1cm]
1 & 12 & -123 \\
12 & 0 & 0 \\
4 & 1 & 2
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 12 & -123 \\ 12 & 0 & 0 \\ 4 & 1 & 2 \end{pmatrix}$$

Note that the space inserted between two columns (equal to `2 \tabcolsep` in `{NiceTabular}` and to `2 \arraycolsep` in the other environments) is not suppressed (of course, it's possible to suppress this space by setting `\tabcolsep` or `\arraycolsep` equal to 0 pt before the environment).

It's possible to give the special value `auto` to the option `columns-width`: all the columns of the array will have a width equal to the widest cell of the array.²⁹

```
$\begin{pNiceMatrix}[columns-width = auto]
1 & 12 & -123 \\
12 & 0 & 0 \\
4 & 1 & 2
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 12 & -123 \\ 12 & 0 & 0 \\ 4 & 1 & 2 \end{pmatrix}$$

²⁸The key `color` uses the command `\color` but inserts also an instruction `\leavevmode` before. This instruction prevents a extra vertical space in the cells which belong to columns of type `p`, `b`, `m`, `X` and `V` (which start in vertical mode).

²⁹The result is achieved with only one compilation (but PGF/Tikz will have written informations in the `aux` file and a message requiring a second compilation will appear).

Without surprise, it's possible to fix the minimal width of the columns of all the arrays of a current scope with the command `\NiceMatrixOptions`.

```
\NiceMatrixOptions{columns-width=10mm}
$\begin{pNiceMatrix}
a & b \\\ c & d
\end{pNiceMatrix}
=
\begin{pNiceMatrix}
1 & 1245 \\\ 345 & 2
\end{pNiceMatrix}$
```

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 1 & 1245 \\ 345 & 2 \end{pmatrix}$$

It's also possible to fix a zone where all the matrices will have their columns of the same width, equal to the widest cell of all the matrices. This construction uses the environment `{NiceMatrixBlock}` with the option `auto-columns-width`³⁰. The environment `{NiceMatrixBlock}` has no direct link with the command `\Block` presented previously in this document (cf. p. 4).

```
\begin{NiceMatrixBlock}[auto-columns-width]
$\begin{array}{c}
\begin{bNiceMatrix}
9 & 17 \\\ -2 & 5
\end{bNiceMatrix} \\\
\begin{bNiceMatrix}
1 & 1245345 \\\ 345 & 2
\end{bNiceMatrix}
\end{array}$
\end{NiceMatrixBlock}
```

$$\begin{bmatrix} 9 & 17 \\ -2 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1245345 \\ 345 & 2 \end{bmatrix}$$

8.2 The columns X

The environment `{NiceTabular}` provides `X` columns similar to those provided by the environment `{tabularx}` of the eponymous package.

The required width of the tabular may be specified with the key `width` (in `{NiceTabular}` or in `\NiceMatrixOptions`). The initial value of this parameter is `\linewidth` (and not `\textwidth`).

For sake of similarity with the environment `{tabularx}`, `nicematrix` also provides an environment `{NiceTabularX}` with a syntax similar to the syntax of `{tabularx}`, that is to say with a first mandatory argument which is the width of the tabular.³¹

As with the packages `tabu`³² and `tabularray`, the specifier `X` takes in an optional argument (between square brackets) which is a list of keys.

- It's possible to give a weight for the column by providing a positive integer directly as argument of the specifier `X`. For example, a column `X[2]` will have a width double of the width of a column `X` (which has a weight equal to 1).³³
- It's possible to specify an horizontal alignment with one of the letters `l`, `c` and `r` (which insert respectively `\raggedright`, `\centering` and `\raggedleft` followed by `\arraybackslash`).
- It's possible to specify a vertical alignment with one of the keys `t` (alias `p`), `m` and `b` (which construct respectively columns of type `p`, `m` and `b`). The default value is `t`.

```
\begin{NiceTabular}[width=9cm]{X[2,l]X[l]}[hvlines]
a rather long text which fits on several lines
& a rather long text which fits on several lines \\\
```

³⁰At this time, this is the only usage of the environment `{NiceMatrixBlock}` but it may have other usages in the future.

³¹If `tabularx` is loaded, one must use `{NiceTabularX}` (and not `{NiceTabular}`) in order to use the columns `X` (this point comes from a conflict in the definitions of the specifier `X`).

³²The extension `tabu` is now considered as deprecated.

³³The negative values of the weight, as provided by `tabu` (which is now obsolete), are *not* supported by `nicematrix`. If such a value is used, an error will be raised.

```
a shorter text & a shorter text
\end{NiceTabular}
```

a rather long text which fits on several lines	a rather long text which fits on several lines
a shorter text	a shorter text

8.3 The columns V of varwidth

Let's recall first the behaviour of the environment `{varwidth}` of the eponymous package `varwidth`. That environment is similar to the classical environment `{minipage}` but the width provided in the argument is only the *maximal* width of the created box. In the general case, the width of the box constructed by an environment `{varwidth}` is the natural width of its contents.

That point is illustrated on the following examples.

```
\fbox{%
\begin{varwidth}{8cm}
\begin{itemize}
\item first item
\item second item
\end{itemize}
\end{varwidth}}
```

- | |
|---|
| <ul style="list-style-type: none"> • first item • second item |
|---|

```
\fbox{%
\begin{minipage}{8cm}
\begin{itemize}
\item first item
\item second item
\end{itemize}
\end{minipage}}
```

- | |
|---|
| <ul style="list-style-type: none"> • first item • second item |
|---|

The package `varwidth` provides also the column type `V`. A column of type `V{<dim>}` encapsulates all its cells in a `{varwidth}` with the argument `<dim>` (and does also some tuning).

When the package `varwidth` is loaded, the columns `V` of `varwidth` are supported by `nicematrix`.

```
\begin{NiceTabular}[corners=NW,hvlines]{V{3cm}V{3cm}V{3cm}}
& some text & some very very very long text \\
some very very very long text & \\
some very very very long text & \\
\end{NiceTabular}
```

	some text	some very very very long text
some very very very long text		
some very very very long text		

Concerning `nicematrix`, one of the interests of this type of columns is that, for a cell of a column of type `V`, the PGF/Tikz node created by `nicematrix` for the content of that cell has a width adjusted to the content of the cell : cf. p. 46.

The columns `V` of `nicematrix` supports the keys `t`, `p`, `m`, `b`, `l`, `c` and `r` also supported by the columns `X`: see their description in the section 8.2, p. 22.

One should remark that the extension `varwidth` (at least in its version 0.92) has some problems: for instance, with LuaLaTeX, it does not work when the content begins with `\color`.

9 The exterior rows and columns

The options `first-row`, `last-row`, `first-col` and `last-col` allow the composition of exterior rows and columns in the environments of `nicematrix`. It's particularly interesting for the (mathematical) matrices.

A potential “first row” (exterior) has the number 0 (and not 1). Idem for the potential “first column”.

```
\begin{pNiceMatrix}[first-row,last-row,first-col,last-col,nullify-dots]
& C_1 & & \Cdots & & C_4 & & \\
L_1 & & a_{11} & & a_{12} & & a_{13} & & a_{14} & & L_1 & \\
\Vdots & & a_{21} & & a_{22} & & a_{23} & & a_{24} & & \Vdots & \\
& & a_{31} & & a_{32} & & a_{33} & & a_{34} & & & \\
L_4 & & a_{41} & & a_{42} & & a_{43} & & a_{44} & & L_4 & \\
& C_1 & & \Cdots & & C_4 & & \\
\end{pNiceMatrix}
```

$$\begin{array}{c}
 C_1 \dots\dots\dots C_4 \\
 L_1 \left(\begin{array}{cccc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) L_1 \\
 \vdots \\
 \vdots \\
 L_4 \left(\begin{array}{cccc} a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) L_4 \\
 C_1 \dots\dots\dots C_4
 \end{array}$$

The dotted lines have been drawn with the tools presented p. 25.

We have several remarks to do.

- For the environments with an explicit preamble (i.e. `{NiceTabular}`, `{NiceArray}` and its variants), no letter must be given in that preamble for the potential first column and the potential last column: they will automatically (and necessarily) be of type `r` for the first column and `l` for the last one.³⁴
- One may wonder how `nicematrix` determines the number of rows and columns which are needed for the composition of the “last row” and “last column”.
 - For the environments with explicit preamble, like `{NiceTabular}` and `{pNiceArray}`, the number of columns can obviously be computed from the preamble.
 - When the option `light-syntax` (cf. p. 44) is used, `nicematrix` has, in any case, to load the whole body of the environment (and that's why it's not possible to put verbatim material in the array with the option `light-syntax`). The analysis of this whole body gives the number of rows and the number of columns.
 - In the other cases, `nicematrix` compute the number of rows and columns during the first compilation and write the result in the `aux` file for the next run.
However, it's possible to provide the number of the last row and the number of the last column as values of the options `last-row` and `last-col`, tending to an acceleration of the whole compilation of the document. That's what we will do throughout the rest of the document.

It's possible to control the appearance of these rows and columns with options `code-for-first-row`, `code-for-last-row`, `code-for-first-col` and `code-for-last-col`. These options specify tokens that will be inserted before each cell of the corresponding row or column.

³⁴The users wishing exterior columns with another type of alignment should consider the command `\SubMatrix` available in the `\CodeAfter` (cf. p. 32).


```

\NiceMatrixOptions{code-for-first-row = \color{red},
                  code-for-first-col = \color{blue},
                  code-for-last-row = \color{green},
                  code-for-last-col = \color{magenta}}
$\begin{pNiceArray}{cc|cc}[first-row,last-row=5,first-col,last-col,nullify-dots]
    & C_1 & & \Cdots & & & C_4 & & \\
L_1 & & a_{11} & & a_{12} & & a_{13} & & a_{14} & & L_1 & \\
\Vdots & & a_{21} & & a_{22} & & a_{23} & & a_{24} & & \Vdots & \\
\hline
    & & a_{31} & & a_{32} & & a_{33} & & a_{34} & & \\
L_4 & & a_{41} & & a_{42} & & a_{43} & & a_{44} & & L_4 & \\
    & & C_1 & & \Cdots & & & & C_4 & & \\
\end{pNiceArray}$

```

$$\begin{array}{c}
\textcolor{red}{C_1} \dots \dots \dots \textcolor{red}{C_4} \\
\textcolor{blue}{L_1} \left(\begin{array}{cc|cc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) \textcolor{magenta}{L_1} \\
\vdots \\
\vdots \\
\textcolor{blue}{L_4} \left(\begin{array}{cc|cc} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{array} \right) \textcolor{magenta}{L_4} \\
\textcolor{green}{C_1} \dots \dots \dots \textcolor{green}{C_4}
\end{array}$$

Remarks

- As shown in the previous example, the horizontal and vertical rules don't extend in the exterior rows and columns. This remark also applies to the customized rules created by the key `custom-line` (cf. p. 13).
- A specification of color present in `code-for-first-row` also applies to a dotted line drawn in that exterior “first row” (excepted if a value has been given to `xdots/color`). Idem for the other exterior rows and columns.
- Logically, the potential option `columns-width` (described p. 21) doesn't apply to the “first column” and “last column”.
- For technical reasons, it's not possible to use the option of the command `\` after the “first row” or before the “last row”. The placement of the delimiters would be wrong. If you are looking for a workaround, consider the command `\SubMatrix` in the `\CodeAfter` described p. 32.

10 The continuous dotted lines

Inside the environments of the package `nicematrix`, new commands are defined: `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, and `\Iddots`. These commands are intended to be used in place of `\dots`, `\cdots`, `\vdots`, `\ddots` and `\iddots`.³⁵

Each of them must be used alone in the cell of the array and it draws a dotted line between the first non-empty cells³⁶ on both sides of the current cell. Of course, for `\Ldots` and `\Cdots`, it's an horizontal line; for `\Vdots`, it's a vertical line and for `\Ddots` and `\Iddots` diagonal ones. It's possible

³⁵The command `\iddots`, defined in `nicematrix`, is a variant of `\ddots` with dots going forward. If `mathdots` is loaded, the version of `mathdots` is used. It corresponds to the command `\adots` of `unicode-math`.

³⁶The precise definition of a “non-empty cell” is given below (cf. p. 51).

to change the color of these lines with the option `color`.³⁷

```
\begin{bNiceMatrix}
a_1      & \Cdots &      & & a_1      & \\
\Vdots   & a_2      & \Cdots & & a_2      & \\
          & \Vdots & \Ddots[color=red] & & & \\
\\
a_1      & a_2      &      & & a_n      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} a_1 & \cdots & & & a_1 \\ \vdots & a_2 & \cdots & & a_2 \\ & \vdots & \ddots[\text{color=red}] & & \\ \\ a_1 & a_2 & & & a_n \end{bmatrix}$$

In order to represent the null matrix, one can use the following codage:

```
\begin{bNiceMatrix}
0      & \Cdots & 0      & \\
\Vdots & & \Vdots & \\
0      & \Cdots & 0      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & 0 \\ \vdots & & \vdots \\ 0 & \cdots & 0 \end{bmatrix}$$

However, one may want a larger matrix. Usually, in such a case, the users of LaTeX add a new row and a new column. It's possible to use the same method with `nicematrix`:

```
\begin{bNiceMatrix}
0      & \Cdots & \Cdots & 0      & \\
\Vdots & & & \Vdots & \\
\Vdots & & & \Vdots & \\
0      & \Cdots & \Cdots & 0      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & \cdots & 0 \\ \vdots & & & \vdots \\ \vdots & & & \vdots \\ 0 & \cdots & \cdots & 0 \end{bmatrix}$$

In the first column of this example, there are two instructions `\Vdots` but, of course, only one dotted line is drawn.

In fact, in this example, it would be possible to draw the same matrix more easily with the following code:

```
\begin{bNiceMatrix}
0      & \Cdots & & 0      & \\
\Vdots & & & & \\
          & & & & \Vdots \\
0      & & & \Cdots & 0 \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & & 0 \\ \vdots & & & \vdots \\ & & & \vdots \\ 0 & & & \cdots & 0 \end{bmatrix}$$

There are also other means to change the size of the matrix. Someone might want to use the optional argument of the command `\Vdots` for the vertical dimension and a command `\hspace*` in a cell for the horizontal dimension.³⁸

However, a command `\hspace*` might interfere with the construction of the dotted lines. That's why the package `nicematrix` provides a command `\Hspace` which is a variant of `\hspace` transparent for the dotted lines of `nicematrix`.

```
\begin{bNiceMatrix}
0      & \Cdots & \Hspace*{1cm} & 0      & \\
\Vdots & & & & \Vdots \\
0      & \Cdots & & 0      & \\
\end{bNiceMatrix}
```

$$\begin{bmatrix} 0 & \cdots & \hspace*{1cm} & 0 \\ \vdots & & & \vdots \\ 0 & \cdots & & 0 \end{bmatrix}$$

³⁷It's also possible to change the color of all these dotted lines with the option `xdots/color` (`xdots` to remind that it works for `\Cdots`, `\Ldots`, `\Vdots`, etc.): cf. p. 29.

³⁸In `nicematrix`, one should use `\hspace*` and not `\hspace` for such an usage because `nicematrix` loads `array`. One may also remark that it's possible to fix the width of a column by using the environment `{NiceArray}` (or one of its variants) with a column of type `w` or `W`: see p. 21

10.1 The option nullify-dots

Consider the following matrix composed classically with the environment `{pmatrix}` of `amsmath`.

```
$A = \begin{pmatrix}
h & i & j & k & l & m \\
x & & & & & x
\end{pmatrix}$
```

$$A = \begin{pmatrix} h & i & j & k & l & m \\ x & & & & & x \end{pmatrix}$$

If we add `\ldots` instructions in the second row, the geometry of the matrix is modified.

```
$B = \begin{pmatrix}
h & i & j & k & l & m \\
x & \ldots & \ldots & \ldots & \ldots & x
\end{pmatrix}$
```

$$B = \begin{pmatrix} h & i & j & k & l & m \\ x & \dots & \dots & \dots & \dots & x \end{pmatrix}$$

By default, with `nicematrix`, if we replace `{pmatrix}` by `{pNiceMatrix}` and `\ldots` by `\Ldots`, the geometry of the matrix is not changed.

```
$C = \begin{pNiceMatrix}
h & i & j & k & l & m \\
x & \Ldots & \Ldots & \Ldots & \Ldots & x
\end{pNiceMatrix}$
```

$$C = \begin{pmatrix} h & i & j & k & l & m \\ x & \dots & \dots & \dots & \dots & x \end{pmatrix}$$

However, one may prefer the geometry of the first matrix A and would like to have such a geometry with a dotted line in the second row. It's possible by using the option `nullify-dots` (and only one instruction `\Ldots` is necessary).

```
$D = \begin{pNiceMatrix}[nullify-dots]
h & i & j & k & l & m \\
x & \Ldots & & & & x
\end{pNiceMatrix}$
```

$$D = \begin{pmatrix} h & i & j & k & l & m \\ x & \dots & & & & x \end{pmatrix}$$

The option `nullify-dots` smashes the instructions `\Ldots` (and the variants) horizontally but also vertically.

10.2 The commands `\Hdotsfor` and `\Vdotsfor`

Some people commonly use the command `\hdotsfor` of `amsmath` in order to draw horizontal dotted lines in a matrix. In the environments of `nicematrix`, one should use instead `\Hdotsfor` in order to draw dotted lines similar to the other dotted lines drawn by the package `nicematrix`.

As with the other commands of `nicematrix` (like `\Cdots`, `\Ldots`, `\Vdots`, etc.), the dotted line drawn with `\Hdotsfor` extends until the contents of the cells on both sides.

```
$\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 \\
1 & \Hdotsfor{3} & & & 5 \\
1 & 2 & 3 & 4 & 5 \\
1 & 2 & 3 & 4 & 5
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 1 & \dots & \dots & \dots & 5 \\ 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 3 & 4 & 5 \end{pmatrix}$$

However, if these cells are empty, the dotted line extends only in the cells specified by the argument of `\Hdotsfor` (by design).

```
$\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 \\
& \Hdotsfor{3} & & & \\
1 & 2 & 3 & 4 & 5 \\
1 & 2 & 3 & 4 & 5
\end{pNiceMatrix}$
```

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ & \dots & \dots & \dots & \\ 1 & 2 & 3 & 4 & 5 \\ 1 & 2 & 3 & 4 & 5 \end{pmatrix}$$

Remark: Unlike the command `\hdotsfor` of `amsmath`, the command `\Hdotsfor` may be used even when the package `colortbl`³⁹ is loaded (but you might have problem if you use `\rowcolor` on the same row as `\Hdotsfor`).

³⁹We recall that when `xcolor` is loaded with the option `table`, the package `colortbl` is loaded.

The package `nicematrix` also provides a command `\Vdotsfor` similar to `\Hdotsfor` but for the vertical dotted lines. The following example uses both `\Hdotsfor` and `\Vdotsfor`:

```
\begin{bNiceMatrix}
C[a_1,a_1] & \Cdots & C[a_1,a_n]
& \hspace*{20mm} & C[a_1,a_1^{(p)}] & \Cdots & C[a_1,a_n^{(p)}] \\
\Vdots & \Ddots & \Vdots
& \Hdotsfor{1} & \Vdots & \Ddots & \Vdots \\
C[a_n,a_1] & \Cdots & C[a_n,a_n]
& & C[a_n,a_1^{(p)}] & \Cdots & C[a_n,a_n^{(p)}] \\
\rule{0pt}{15mm}\NotEmpty & \Vdotsfor{1} & & \Ddots & & \Vdotsfor{1} \\
C[a_1^{(p)},a_1] & \Cdots & C[a_1^{(p)},a_n]
& & C[a_1^{(p)},a_1^{(p)}] & \Cdots & C[a_1^{(p)},a_n^{(p)}] \\
\Vdots & \Ddots & \Vdots
& \Hdotsfor{1} & \Vdots & \Ddots & \Vdots \\
C[a_n^{(p)},a_1] & \Cdots & C[a_n^{(p)},a_n]
& & C[a_n^{(p)},a_1^{(p)}] & \Cdots & C[a_n^{(p)},a_n^{(p)}] \\
\end{bNiceMatrix}
```

$$\left[\begin{array}{ccc} C[a_1, a_1] \cdots \cdots C[a_1, a_n] & & C[a_1, a_1^{(p)}] \cdots \cdots C[a_1, a_n^{(p)}] \\ \vdots & \ddots & \vdots \\ C[a_n, a_1] \cdots \cdots C[a_n, a_n] & \cdots \cdots & C[a_n, a_1^{(p)}] \cdots \cdots C[a_n, a_n^{(p)}] \\ \vdots & \ddots & \vdots \\ C[a_1^{(p)}, a_1] \cdots \cdots C[a_1^{(p)}, a_n] & & C[a_1^{(p)}, a_1^{(p)}] \cdots \cdots C[a_1^{(p)}, a_n^{(p)}] \\ \vdots & \ddots & \vdots \\ C[a_n^{(p)}, a_1] \cdots \cdots C[a_n^{(p)}, a_n] & \cdots \cdots & C[a_n^{(p)}, a_1^{(p)}] \cdots \cdots C[a_n^{(p)}, a_n^{(p)}] \end{array} \right]$$

10.3 How to generate the continuous dotted lines transparently

Imagine you have a document with a great number of mathematical matrices with ellipsis. You may wish to use the dotted lines of `nicematrix` without having to modify the code of each matrix. It's possible with the keys `renew-dots` and `renew-matrix`.⁴⁰

- The option `renew-dots`

With this option, the commands `\ldots`, `\cdots`, `\vdots`, `\ddots`, `\iddots`³⁵ and `\hdotsfor` are redefined within the environments provided by `nicematrix` and behave like `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor`; the command `\dots` (“automatic dots” of `amsmath`) is also redefined to behave like `\Ldots`.

- The option `renew-matrix`

With this option, the environment `{matrix}` is redefined and behave like `{NiceMatrix}`, and so on for the five variants.

Therefore, with the keys `renew-dots` and `renew-matrix`, a classical code gives directly the output of

⁴⁰The options `renew-dots`, `renew-matrix` can be fixed with the command `\NiceMatrixOptions` like the other options. However, they can also be fixed as options of the command `\usepackage`.

nicematrix.

```
\NiceMatrixOptions{renew-dots,renew-matrix}
\begin{pmatrix}
1 & & \cdots & & \cdots & & 1 & & \\
0 & & \ddots & & & & & \vdots & \\
\vdots & & \ddots & & \ddots & & \vdots & & \\
0 & & \cdots & & 0 & & & & 1
\end{pmatrix}
```

$$\begin{pmatrix} 1 & & \cdots & & \cdots & & 1 & & \\ 0 & & \ddots & & & & & \vdots & \\ \vdots & & \ddots & & \ddots & & \vdots & & \\ 0 & & \cdots & & 0 & & & & 1 \end{pmatrix}$$

10.4 The labels of the dotted lines

The commands `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` (and the command `\line` in the `\CodeAfter` which is described p. 32) accept two optional arguments specified by the tokens `_` and `^` for labels positionned below and above the line. The arguments are composed in math mode with `\scriptstyle`.

```
$\begin{bNiceMatrix}
1 & \hspace*{1cm} & & 0 \\\[8mm]
& \Ddots^{n \text{ times}} & & \\
0 & & & 1
\end{bNiceMatrix}$
```

$$\begin{bmatrix} 1 & & & 0 \\ & \ddots^{n \text{ times}} & & \\ 0 & & & 1 \end{bmatrix}$$

10.5 Customisation of the dotted lines

The dotted lines drawn by `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots`, `\Hdotsfor` and `\Vdotsfor` (and by the command `\line` in the `\CodeAfter` which is described p. 32) may be customized by the following options (specified between square brackets after the command):

- `color`;
- `radius`;
- `shorten-start`, `shorten-end` and `shorten`;
- `inter`;
- `line-style`.

These options may also be fixed with `\NiceMatrixOptions`, as options of `\CodeAfter` or at the level of a given environment but, in those cases, they must be prefixed by `xdots` (*xdots* to remind that it works for `\Cdots`, `\Ldots`, `\Vdots`, etc.), and, thus have for names:

- `xdots/color`;
- `xdots/radius`;
- `xdots/shorten-start`, `xdots/shorten-end` and `xdots/shorten`;
- `xdots/inter`;
- `xdots/line-style`.

For the clarity of the explanations, we will use those names.

The option `xdots/color`

The option `xdots/color` fixes the color of the dotted line. However, one should remark that the dotted lines drawn in the exterior rows and columns have a special treatment: cf. p. 24.

The option `xdots/radius`

The option `radius` fixes the radius of the dots. The initial value is 0.53 pt.

The option `xdots/shorten`

The keys `xdots/shorten-start` and `xdots/shorten-end` fix the margin at the extremities of the line. The key `xdots/shorten` fixes both parameters. The initial value is 0.3 em (it is recommended to use a unit of length dependent of the current font).

The option `xdots/inter`

The option `xdots/inter` fixes the length between the dots. The initial value is 0.45 em (it is recommended to use a unit of length dependent of the current font).

The option `xdots/line-style`

It should be pointed that, by default, the lines drawn by Tikz with the parameter `dotted` are composed of square dots (and not rounded ones).⁴¹

```
\tikz \draw [dotted] (0,0) -- (5,0) ;
```

In order to provide lines with rounded dots in the style of those provided by `\ldots` (at least with the *Computer Modern* fonts), the package `nicematrix` embeds its own system to draw a dotted line (and this system uses PGF and not Tikz). This style is called `standard` and that's the initial value of the parameter `xdots/line-style`.

However (when Tikz is loaded) it's possible to use for `xdots/line-style` any style provided by Tikz, that is to say any sequence of options provided by Tikz for the Tikz paths (with the exception of “color”, “shorten >” and “shorten <”).

Here is for example a tridiagonal matrix with the style `loosely dotted`:

```
$\begin{pNiceMatrix}[nullify-dots,xdots/line-style=loosely dotted]
a      & b      & 0      & & & \Cdots & 0      & \\
b      & a      & b      & & & \Ddots & & \Vdots \\
0      & b      & a      & & & \Ddots & & \\
      & & \Ddots & & \Ddots & & \Ddots & \\
\Vdots & & & & & & & 0      \\
0      & \Cdots & & & 0      & b      & a      & \\
\end{pNiceMatrix}$
```

$$\begin{pmatrix} a & b & 0 & \cdots & 0 \\ b & a & b & \ddots & \\ 0 & b & a & \ddots & \\ \vdots & \ddots & \ddots & \ddots & \vdots \\ 0 & \cdots & 0 & b & a \end{pmatrix}$$

10.6 The dotted lines and the rules

The dotted lines determine virtual blocks which have the same behaviour regarding the rules (the rules specified by the specifier `|` in the preamble, by the command `\Hline`, by the keys `hlines`, `vlines`, `hvlines` and `hvlines-except-borders` and by the tools created by `custom-line` are not drawn within the blocks).⁴²

```
$\begin{bNiceMatrix}[margin,hvlines]
\Block{3-3}<\LARGE>\{A\} & & & 0 \\
& \hspace*{1cm} & & \Vdots \\
& & & 0 \\
0 & \Cdots & 0 & 0 \\
\end{bNiceMatrix}$
```

$$\left[\begin{array}{ccc|c} & & & 0 \\ & & & \vdots \\ & & & 0 \\ \hline 0 & \cdots & 0 & 0 \end{array} \right]$$

⁴¹The first reason of this behaviour is that the PDF format includes a description for dashed lines. The lines specified with this descriptor are displayed very efficiently by the PDF readers. It's easy, starting from these dashed lines, to create a line composed by square dots whereas a line of rounded dots needs a specification of each dot in the PDF file. Nevertheless, you can have a look at the following page to see how to have dotted rules with rounded dots in Tikz:

<https://tex.stackexchange.com/questions/52848/tikz-line-with-large-dots>

⁴²On the other side, the command `\line` in the `\CodeAfter` (cf. p. 32) does *not* create block.

11 Delimiters in the preamble of the environment

In the environments with preamble (`{NiceArray}`, `{pNiceArray}`, etc.), it's possible to put vertical delimiters directly in the preamble of the environment.⁴³

The opening delimiters should be prefixed by the keyword `\left` and the closing delimiters by the keyword `\right`. It's not mandatory to use `\left` and `\right` pair-wise.

All the vertical extensible delimiters of LaTeX are allowed.

Here is a example which uses the delimiters `\lgroup` and `\rgroup`.

```
\begin{NiceArray}{\left\lgroup ccc\right\rgroup l}
1 & 2 & 3 &
4 & 1 & 6 &
7 & 8 & 9 & \scriptstyle L_3 \gets L_3 + L_1 + L_2
\end{NiceArray}
```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 1 & 6 \\ 7 & 8 & 9 \end{pmatrix}_{L_3 \leftarrow L_3 + L_1 + L_2}$$

For this example, it would also have been possible to use the environment `{NiceArrayWithDelims}` (cf. the section 14.10, p. 44) and the key `last-col` (cf. p. 24).

There is a particular case: for the delimiters `(`, `[` and `\{` (and the corresponding closing delimiters), the prefixes `\left` et `\right` are optional.⁴⁴

When there are two successive delimiters (necessarily a closing one following by an opening one for another submatrix), a space equal to `\enskip` is automatically inserted.

```
\begin{pNiceArray}{(c)(c)(c)}
a_{11} & a_{12} & & a_{13} \\
a_{21} & \displaystyle \int_0^1 \frac{1}{x^2+1} dx & a_{23} \\
a_{31} & a_{32} & a_{33}
\end{pNiceArray}
```

$$\begin{pmatrix} a_{11} \\ a_{21} \\ a_{31} \end{pmatrix} \begin{pmatrix} a_{12} & \int_0^1 \frac{1}{x^2+1} dx \\ a_{32} \end{pmatrix} \begin{pmatrix} a_{13} \\ a_{23} \\ a_{33} \end{pmatrix}$$

For more complex constructions, in particular with delimiters spanning only a *subset* of the rows of the array, one should consider the command `\SubMatrix` available in the `\CodeAfter`. See the section 12.2, p. 32.

12 The `\CodeAfter`

The option `code-after` may be used to give some code that will be executed *after* the construction of the matrix.⁴⁵

For the legibility of the code, an alternative syntax is provided: it's possible to give the instructions of the `code-after` at the end of the environment, after the keyword `\CodeAfter`. Although `\CodeAfter` is a keyword, it takes in an optional argument (between square brackets).⁴⁶

⁴³This syntax is inspired by the extension `blkarray`.

⁴⁴For the delimiters `[` and `]`, the prefixes remain mandatory when there is a conflict of notation with the square brackets for the options of some descriptors of columns.

⁴⁵There is also a key `code-before` described p. 16.

⁴⁶Here are the keys accepted in that argument: `delimiters/color`, `rules` and its sub-keys and `sub-matrix` (linked to the command `\SubMatrix`) and its sub-keys.

The experienced users may, for instance, use the PGF/Tikz nodes created by `nicematrix` in the `\CodeAfter`. These nodes are described further beginning on p. 45.

Moreover, several special commands are available in the `\CodeAfter`: `\line`, `\SubMatrix`, `\OverBrace` and `\UnderBrace`. We will now present these commands.

12.1 The command `\line` in the `\CodeAfter`

The command `\line` draws directly dotted lines between cells or blocks. It takes in two arguments for the cells or blocks to link. Both argument may be:

- a specification of cell of the form i - j where i is the number of the row and j is the number of the column;
- the name of a block (created by the command `\Block` with the key `name` of that command).

The options available for the customisation of the dotted lines created by `\Cdots`, `\Vdots`, etc. are also available for this command (cf. p. 29).

This command may be used, for example, to draw a dotted line between two adjacent cells.

```
\NiceMatrixOptions{xdots/shorten = 0.6 em}
\begin{pNiceMatrix}
I      & 0      & \Cdots & 0      & \\
0      & I      & \Ddots & \Vdots & \\
\Vdots & \Ddots & I      & 0      & \\
0      & \Cdots & 0      & I      & \\
\CodeAfter \line{2-2}{3-3}
\end{pNiceMatrix}
```

$$\begin{pmatrix} I & 0 & \cdots & 0 \\ 0 & I & \ddots & \vdots \\ \vdots & \ddots & I & 0 \\ 0 & \cdots & 0 & I \end{pmatrix}$$

It can also be used to draw a diagonal line not parallel to the other diagonal lines (by default, the dotted lines drawn by `\Ddots` are “parallelized”: cf. p. 51).

```
\begin{bNiceMatrix}
1      & \Cdots & & 1      & 2      & \Cdots & & 2      & \\
0      & \Ddots & & \Vdots & \Vdots & \hspace*{2.5cm} & & \Vdots & \\
\Vdots & \Ddots & & & & & & & \\
0      & \Cdots & 0 & 1      & 2      & \Cdots & & 2      & \\
\CodeAfter \line[shorten=6pt]{1-5}{4-7}
\end{bNiceMatrix}
```

$$\left[\begin{array}{cccccc} 1 & \cdots & 1 & 2 & \cdots & 2 \\ 0 & \ddots & & \vdots & & \vdots \\ \vdots & & & & & \\ 0 & \cdots & 0 & 1 & 2 & \cdots & 2 \end{array} \right]$$

12.2 The command `\SubMatrix` in the `\CodeAfter` (and the `\CodeBefore`)

The command `\SubMatrix` provides a way to put delimiters on a portion of the array considered as a submatrix. The command `\SubMatrix` takes in five arguments:

- the first argument is the left delimiter, which may be any extensible delimiter provided by LaTeX : `(`, `[`, `\{`, `\langle`, `\lgroup`, `\lfloor`, etc. but also the null delimiter `.`;
- the second argument is the upper-left corner of the submatrix with the syntax i - j where i the number of row and j the number of column;
- the third argument is the lower-right corner with the same syntax;
- the fourth argument is the right delimiter;

- the last argument, which is optional, is a list of *key=value* pairs.⁴⁷

One should remark that the command `\SubMatrix` draws the delimiters *after* the construction of the array: no space is inserted by the command `\SubMatrix` itself. That's why, in the following example, we have used the key `margin` and you have added by hand some space between the third and fourth column with `@{\hspace{1.5em}}` in the preamble of the array.

```
\[\begin{NiceArray}{ccc@{\hspace{1.5em}}c}[cell-space-limits=2pt,margin]
1 & & & & x \\
\dfrac{1}{4} & \dfrac{1}{2} & \dfrac{1}{4} & y \\
1 & 2 & 3 & z \\
\CodeAfter
\SubMatrix({1-1}{3-3})
\SubMatrix({1-4}{3-4})
\end{NiceArray}\]
```

$$\begin{pmatrix} 1 & 1 & 1 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 1 & 2 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

Eventually, in this example, it would probably have been easier to put the delimiters directly in the preamble of `{NiceArray}` (see section 11, p. 31) with the following construction.

```
$\begin{NiceArray}{(ccc)(c)}[cell-space-limits=2pt]
1 & & & x \\
\dfrac{1}{4} & \dfrac{1}{2} & \dfrac{1}{4} & y \\
1 & 2 & 3 & z \\
\end{NiceArray}$
```

$$\begin{pmatrix} 1 & 1 & 1 \\ \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ 1 & 2 & 3 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

In fact, the command `\SubMatrix` also takes in two optional arguments specified by the traditional symbols `^` and `_` for material in superscript and subscript.

```
$\begin{bNiceMatrix}[right-margin=1em]
1 & 1 & 1 \\
1 & a & b \\
1 & c & d \\
\CodeAfter
\SubMatrix[{2-2}{3-3}]^T
\end{bNiceMatrix}$
```

$$\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & b \\ 1 & c & d \end{bmatrix}^T$$

The options of the command `\SubMatrix` are as follows:

- `left-xshift` and `right-xshift` shift horizontally the delimiters (there exists also the key `xshift` which fixes both parameters);
- `extra-height` adds a quantity to the total height of the delimiters (height `\ht` + depth `\dp`);
- `delimiters/color` fixes the color of the delimiters (also available in `\NiceMatrixOptions`, in the environments with delimiters and as option of the keyword `\CodeAfter`);
- `slim` is a boolean key: when that key is in force, the horizontal position of the delimiters is computed by using only the contents of the cells of the submatrix whereas, in the general case, the position is computed by taking into account the cells of the whole columns implied in the submatrix (see example below). ;
- `vlines` contents a list of numbers of vertical rules that will be drawn in the sub-matrix (if this key is used without value, all the vertical rules of the sub-matrix are drawn);
- `hlines` is similar to `vlines` but for the horizontal rules;
- `hvlines`, which must be used without value, draws all the vertical and horizontal rules;
- `code` insert code, especially TikZ code, after the construction of the submatrix. That key is detailed below.

⁴⁷There is no optional argument between square brackets in first position because a square bracket just after `\SubMatrix` must be interpreted as the first (mandatory) argument of the command `\SubMatrix`: that bracket is the left delimiter of the sub-matrix to construct (eg.: `\SubMatrix[{2-2}{4-7}]`).

One should remark that the keys add their rules after the construction of the main matrix: no space is added between the rows and the columns of the array for theses rules.

All these keys are also available in `\NiceMatrixOptions`, at the level of the environments of `nicematrix` or as option of the command `\CodeAfter` with the prefix `sub-matrix` which means that their names are therefore `sub-matrix/left-xshift`, `sub-matrix/right-xshift`, `sub-matrix/xshift`, etc.

```


$$\begin{NiceArray}{cc@{\hspace{5mm}}l}[cell-space-limits=2pt]
& & \frac{1}{2} \\\
& & \frac{1}{4} \\\[1mm]
a & b & \frac{1}{2}a + \frac{1}{4}b \\\
c & d & \frac{1}{2}c + \frac{1}{4}d \\\
\CodeAfter
& \SubMatrix({1-3}{2-3}) \\
& \SubMatrix({3-1}{4-2}) \\
& \SubMatrix({3-3}{4-3}) \\
\end{NiceArray}$$


```

Here is the same example with the key `slim` used for one of the submatrices.

```


$$\begin{NiceArray}{cc@{\hspace{5mm}}l}[cell-space-limits=2pt]
& & \frac{1}{2} \\\
& & \frac{1}{4} \\\[1mm]
a & b & \frac{1}{2}a + \frac{1}{4}b \\\
c & d & \frac{1}{2}c + \frac{1}{4}d \\\
\CodeAfter
& \SubMatrix({1-3}{2-3})[slim] \\
& \SubMatrix({3-1}{4-2}) \\
& \SubMatrix({3-3}{4-3}) \\
\end{NiceArray}$$


```

There is also a key `name` which gives a name to the submatrix created by `\SubMatrix`. That name is used to create PGF/Tikz nodes: cf p. 49.

Despite its name, the command `\SubMatrix` may also be used within a `{NiceTabular}`. Here is an example (which uses `\bottomrule` and `\toprule` of `booktabs`).

```

\begin{NiceTabular}{{}ll{}}
\toprule
Part A & the first part \\\
\Block[2-1]{Part B} & a first sub-part \\\
& a second sub-part \\\
\bottomrule
\CodeAfter
& \SubMatrix{\{}{2-2}{3-2}{.}
\end{NiceTabular}

```

The command `\SubMatrix` is, in fact, also available in the `\CodeBefore`. By using `\SubMatrix` in the `\CodeBefore`, the delimiters drawn by those commands `\SubMatrix` are taken into account to limit the continuous dotted lines (drawn by `\Cdots`, `\Vdots`, etc.) which have an open extremity. For an example, see voir 18.9 p. 63.

The key `code` of the command `\SubMatrix` allows the insertion of code after the construction of the submatrix. It's meant to be used to insert TikZ instructions because, in the TikZ instructions inserted by that code, the nodes of the form `i-j` and `i-lj` are interpreted with `i` and `j` as numbers of row and columns *relative to the submatrix*.⁴⁸

⁴⁸Be careful: the syntax `j|-i` is *not* allowed.

```

 $\begin{NiceArray}{ccc@{}w{c}{5mm}@{}ccc}$ 
& & & -1 & 1 & 2 & \\\
& & & 0 & 3 & 4 & \\\
& & & 0 & 0 & 5 & \\\
1 & 2 & 3 & -1 & 7 & 25 & \\\
0 & 4 & 5 & 0 & 12 & 41 & \\\
0 & 0 & 6 & 0 & 0 & 30 & \\
\CodeAfter
\NewDocumentCommand{\MyDraw}{\tikz \draw [blue] (2-|1) -| (3-|2) -| (4-|3) ;}
\SubMatrix({1-5}{3-7})[code = \MyDraw]
\SubMatrix({4-1}{6-3})[code = \MyDraw]
\SubMatrix({4-5}{6-7})[code = \MyDraw]
\end{NiceArray}$

```

$$\begin{pmatrix} 1 & 2 & 3 \\ 0 & 4 & 5 \\ 0 & 0 & 6 \end{pmatrix}
 \begin{pmatrix} -1 & 1 & 2 \\ 0 & 3 & 4 \\ 0 & 0 & 5 \end{pmatrix}
 \begin{pmatrix} -1 & 7 & 25 \\ 0 & 12 & 41 \\ 0 & 0 & 30 \end{pmatrix}$$

As we see, the drawing done by our command `\MyDraw` is *relative* to the submatrix to which it is applied.

12.3 The commands `\OverBrace` and `\UnderBrace` in the `\CodeAfter`

The commands `\OverBrace` and `\UnderBrace` provide a way to put horizontal braces on a part of the array. These commands take in three arguments:

- the first argument is the upper-left corner of the submatrix with the syntax $i-j$ where i the number of row and j the number of column;
- the second argument is the lower-right corner with the same syntax;
- the third argument is the label of the brace that will be put by `nicematrix` (with PGF) above the brace (for the command `\OverBrace`) or under the brace (for `\UnderBrace`).

```

\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 & 6 & \\\
11 & 12 & 13 & 14 & 15 & 16 & \\\
\CodeAfter
\OverBrace{1-1}{2-3}{A}
\OverBrace{1-4}{2-6}{B}
\end{pNiceMatrix}

```

$$\begin{pmatrix} \overbrace{1 \ 2 \ 3}^A & \overbrace{4 \ 5 \ 6}^B \\ 11 & 12 & 13 & 14 & 15 & 16 \end{pmatrix}$$

Caution : There is no vertical space reserved for those braces.⁴⁹

In fact, the commands `\OverBrace` and `\UnderBrace` take in an optional argument (in first position and between square brackets) for a list of `key=value` pairs. The available keys are:

- `left-shorten` and `right-shorten` which do not take in value; when the key `left-shorten` is used, the abscissa of the left extremity of the brace is computed with the contents of the cells of the involved sub-array, otherwise, the position of the potential vertical rule is used (idem for `right-shorten`).
- `shorten`, which is the conjunction of the keys `left-shorten` and `right-shorten`;

⁴⁹See: <https://tex.stackexchange.com/questions/685755>

- `yshift`, which shifts vertically the brace (and its label);
- `color`, which sets the color of the brace (and its label).

```

\begin{pNiceMatrix}
1 & 2 & 3 & 4 & 5 & 6 & \\
11 & 12 & 13 & 14 & 15 & 16 & \\
\CodeAfter
  \OverBrace[shorten,yshift=3pt]{1-1}{2-3}{A}
  \OverBrace[shorten,yshift=3pt]{1-4}{2-6}{B}
\end{pNiceMatrix}

```

$$\begin{array}{cccccc}
 & \overbrace{\hspace{1.5cm}}^A & & \overbrace{\hspace{1.5cm}}^B & & \\
 \left(\begin{array}{cccccc}
 1 & 2 & 3 & 4 & 5 & 6 \\
 11 & 12 & 13 & 14 & 15 & 16
 \end{array} \right)
 \end{array}$$

13 Captions and notes in the tabulars

13.1 Caption of a tabular

The environment `{NiceTabular}` provides the keys `caption`, `short-caption` and `label` which may be used when the tabular is inserted in a floating environment (typically the environment `{table}`). With the key `caption`, the caption, when it is long, is wrapped at the width of the tabular (excepted the potential exterior columns specified by `first-col` and `last-col`: cf. 9, p. 24), without the use of the package `threeparttable` or the package `floatrow`.

By default, the caption is composed below the tabular. With the key `caption-above`, available in `\NiceMatrixOptions`, the caption will be composed above the tabular.

The key `short-caption` corresponds to the optional argument of the classical command `\caption` and the key `label` corresponds, of course, to the command `\label`.

See table 1, p. 38, for an example of use the keys `caption` and `label`.

These functionalities are compatible with the extension `caption`.

13.2 The footnotes

The package `nicematrix` allows, by using `footnote` or `footnotehyper`, the extraction of the notes inserted by `\Footnote` in the environments of `nicematrix` and their composition in the foot of the page with the other notes of the document.

If `nicematrix` is loaded with the option `footnote` (with `\usepackage[footnote]{nicematrix}` or with `\PassOptionsToPackage`), the package `footnote` is loaded (if it is not yet loaded) and it is used to extract the footnotes.

If `nicematrix` is loaded with the option `footnotehyper`, the package `footnotehyper` is loaded (if it is not yet loaded) and it is used to extract footnotes.

Caution: The packages `footnote` and `footnotehyper` are incompatible. The package `footnotehyper` is the successor of the package `footnote` and should be used preferently. The package `footnote` has some drawbacks, in particular: it must be loaded after the package `xcolor` and it is not perfectly compatible with `hyperref`.

13.3 The notes of tabular

The package `nicematrix` also provides a command `\tabularnote` which gives the ability to specify notes that will be composed at the end of the array with a width of line equal to the width of the array (excepted the potential exterior columns specified by `first-col` and `last-col`: cf. 9, p. 24). With no surprise, that command is available only in the environments `{NiceTabular}`, `{NiceTabular*}` and `{NiceTabularX}`.

In fact, this command is available only if the extension `enumitem` has been loaded (before or after `nicematrix`). Indeed, the notes are composed at the end of the array with a type of list provided by the package `enumitem`.

```

\begin{NiceTabular}{@{}llr@{}}
\toprule \RowStyle{\bfseries}
Last name & First name & Birth day \\
\midrule
Achard\tabularnote{Achard is an old family of the Poitou.}
& Jacques & 5 juin 1962 \\
Lefebvre\tabularnote{The name Lefebvre is an alteration of the name Lefebure.}
& Mathilde & 23 mai 1988 \\
Vanesse & Stephany & 30 octobre 1994 \\
Dupont & Chantal & 15 janvier 1998 \\
\bottomrule
\end{NiceTabular}

```

Last name	First name	Birth day
Achard ^a	Jacques	June 5, 2005
Lefebvre ^b	Mathilde	January 23, 1975
Vanesse	Stephany	October 30, 1994
Dupont	Chantal	January 15, 1998

^a Achard is an old family of the Poitou.

^b The name Lefebvre is an alteration of the name Lefebure.

- If you have several successive commands `\tabularnote{...}` with no space at all between them, the labels of the corresponding notes are composed together, separated by commas (this is similar to the option `multiple` of `footmisc` for the footnotes).
- If a command `\tabularnote{...}` is exactly at the end of a cell (with no space at all after), the label of the note is composed in an overlapping position (towards the right). This structure may provide a better alignment of the cells of a given column.
- If the key `notes/para` is used, the notes are composed at the end of the array in a single paragraph (as with the key `para` of `threeparttable`).
- There is a key `tabularnote` which provides a way to insert some text in the zone of the notes before the numbered tabular notes.

An alternative syntax is available with the environment `{TabularNote}`. That environment should be used at the end of the environment `{NiceTabular}` (but *before* a potential instruction `\CodeAfter`).

- If the package `booktabs` has been loaded (before or after `nicematrix`), the key `notes/bottomrule` draws a `\bottomrule` of `booktabs` *after* the notes.
- The command `\tabularnote` may be used *before* the environment of `nicematrix`. Thus, it's possible to use it on the title inserted by `\caption` in an environment `{table}` of LaTeX (or in a command `\captionof` of the package `caption`). It's also possible, as expected, to use the command `\tabularnote` in the caption provided by the *key* `caption` of the environment `{NiceTabular}`.

If several commands `\tabularnote` are used in a tabular with the same argument, only one note is inserted at the end of the tabular (but all the labels are composed, of course). It's possible to control that feature with the key `notes/detect-duplicates`.⁵⁰

- It's possible to create a reference to a tabular note created by `\tabularnote` (with the usual command `\label` used after the `\tabularnote`).

⁵⁰For technical reasons, the final user is not allowed to put several commands `\tabularnote` with exactly the same argument in the caption of the tabular.

- **New 6.19** The command `\tabularnote` has an optional argument (between square brackets) to change the symbol of the reference of the note.

Example: `\tabularnote[\star]{A footnote...}`

For an illustration of some of those remarks, see table 1, p. 38. This table has been composed with the following code (the package `caption` has been loaded in this document).

```
\begin{table}
\centering
\NiceMatrixOptions{caption-above}
\begin{NiceTabular}{@{}llc@{}}
[
  caption = A tabular whose caption has been specified by the key
    \texttt{caption}\tabularnote[$\star$]{It's possible to put a tabular note in the caption} ,
  label = t:tabularnote ,
  tabularnote = Some text before the notes. ,
  notes/bottomrule
]
\toprule
Last name & First name & Length of life \\
\midrule
Churchill & Wiston & 91\\
Nightingale\tabularnote{Considered as the first nurse of history}%
\tabularnote{Nicknamed ``the Lady with the Lamp''.}
& Florence\tabularnote{This note is shared by two references.} & 90 \\
Schoelcher & Victor & 89\tabularnote{The label of the note is overlapping.}\\
Touchet & Marie\tabularnote{This note is shared by two references.} & 89 \\
Wallis & John & 87 \\
\bottomrule
\end{NiceTabular}
\end{table}
```

Table 1: A tabular whose caption has been specified by the key `caption`*

Last name	First name	Length of life
Churchill	Wiston	91
Nightingale ^{a,b}	Florence ^c	90
Schoelcher	Victor	89 ^d
Touchet	Marie ^c	89
Wallis	John	87

Some text before the notes.

* It's possible to put a tabular note in the caption

^a Considered as the first nurse of history.

^b Nicknamed “the Lady with the Lamp”.

^c This note is shared by two references.

^d The label of the note is overlapping.

13.4 Customisation of the tabular notes

The tabular notes can be customized with a set of keys available in `\NiceMatrixOptions`. The name of these keys is prefixed by `notes`.

- `notes/para`
- `notes/bottomrule`

- `notes/style`
- `notes/label-in-tabular`
- `notes/label-in-list`
- `notes/enumitem-keys`
- `notes/enumitem-keys-para`
- `notes/code-before`

For sake of commodity, it is also possible to set these keys in `\NiceMatrixOptions` via a key `notes` which takes in as value a list of pairs `key=value` where the name of the keys need no longer be prefixed by `notes`:

```
\NiceMatrixOptions
{
  notes =
  {
    bottomrule ,
    style = ... ,
    label-in-tabular = ... ,
    enumitem-keys =
    {
      labelsep = ... ,
      align = ... ,
      ...
    }
  }
}
```

We detail these keys.

- The key `notes/para` requires the composition of the notes (at the end of the tabular) in a single paragraph.

Initial value: `false`

That key is also available within a given environment.

- The key `notes/bottomrule` adds a `\bottomrule` of `booktabs` *after* the notes. Of course, that rule is drawn only if there is really notes in the tabular. The package `booktabs` must have been loaded (before or after the package `nicematrix`). If it is not, an error is raised.

Initial value: `false`

That key is also available within a given environment.

- The key `notes/style` is a command whose argument is specified by `#1` and which gives the style of numerotation of the notes. That style will be used by `\ref` when referencing a tabular note marked with a command `\label`. The labels formatted by that style are used, separated by commas, when the user puts several consecutive commands `\tabularnote`. The marker `#1` is meant to be the name of a LaTeX counter.

Initial value: `\textit{\alph{#1}}`

Another possible value should be a mere `\arabic{#1}`

- The key `notes/label-in-tabular` is a command whose argument is specified by `#1` which is used when formatting the label of a note in the tabular. Internally, this number of note has already been formatted by `notes/style` before sent to that command.

Initial value: `#1`

In French, it's a tradition of putting a small space before the label of note. That tuning could be achieved by the following code:

```
\NiceMatrixOptions{notes/label-in-tabular = \,\textsuperscript{#1}}
```

- The key `notes/label-in-list` is a command whose argument is specified by `#1` which is used when formatting the label in the list of notes at the end of the tabular. Internally, this number of note has already been formatted by `notes/style` before sent to that command.

Initial value: `#1`

In French, the labels of notes are not composed in upper position when composing the notes. Such behaviour could be achieved by:

```
\NiceMatrixOptions{notes/label-in-list = #1.\nobreak\hspace{0.25em}}
```

The command `\nobreak` is for the event that the option `para` is used.

- The notes are composed at the end of the tabular by using internally a style of list of `enumitem`. This style of list is defined as follows (with, of course, keys of `enumitem`):

```
noitemsep , leftmargin = * , align = left , labelsep = 0pt
```

The specification `align = left` in that style requires a composition of the label leftwards in the box affected to that label. With that tuning, the notes are composed flush left, which is pleasant when composing tabulars in the spirit of `booktabs` (see for example the table 1, p. 38).

The key `notes/enumitem-keys` specifies a list of pairs `key=value` (following the specifications of `enumitem`) to customize that style of list (it uses internally the command `\setlist*` of `enumitem`).

- The key `notes/enumitem-keys-para` is similar to the previous one but corresponds to the type of list used when the option `para` is in force. Of course, when the option `para` is used, a list of type `inline` (as called by `enumitem`) is used and the pairs `key=value` should correspond to such a list of type `inline`.

Initially, the style of list is defined by: `afterlabel = \nobreak, itemjoin = \quad`

- The key `notes/code-before` is a token list inserted by `nicematrix` just before the composition of the notes at the end of the tabular.

Initial value: *empty*

For example, if one wishes to compose all the notes in gray and `\footnotesize`, he should use that key:

```
\NiceMatrixOptions{notes/code-before = \footnotesize \color{gray}}
```

It's also possible to add `\raggedright` or `\RaggedRight` in that key (`\RaggedRight` is a command of `ragged2e`).

- The key `notes/detect-duplicates` activates the detection of the commands `\tabularnotes` with the same argument.

Initial value : `true`

For an example of customisation of the tabular notes, see p. 54.

13.5 Use of `{NiceTabular}` with `threeparttable`

If you wish to use an environment `{NiceTabular}`, `{NiceTabular*}` or `{NiceTabularX}` in an environment `{threeparttable}` of the eponymous package, you have to patch `{threeparttable}` with the following code (with a version of LaTeX at least 2020/10/01).

```
\makeatletter
\AddToHook{env/threeparttable/begin}
{ \TPT@hookin{NiceTabular}\TPT@hookin{NiceTabular*}\TPT@hookin{NiceTabularX} }
\makeatother
```

Nevertheless, the use of `threeparttable` in conjunction with `nicematrix` seems rather point-less because of the functionalities provided by `nicematrix` (see the key `caption` in the section 13.1, p. 36).

14 Other features

14.1 The key rounded-corners of {NiceTabular}

New 6.18

The key `rounded-corners` that we will describe now has no direct link with the key `corners` (which is used to specify “empty corners”) described in the part 5.3.3, p. 11.

The environment `{NiceTabular}` provides a key `rounded-corners` which specify that the tabular should have rounded corners with a radius equal to the value of that key (the default value is 4 pt⁵¹). More precisely, that key has two effects that we describe now.

- All the commands for coloring the cells, columns and rows (in the `\CodeBefore` but also directly in the array when the key `colortbl-like` is used) will respect those rounded corners.
- When the key `hvlines` is used, the exterior rules will be drawn with rounded corners.

```
\begin{NiceTabular}
[hvlines,rounded-corners]
{ccc}
\CodeBefore
\rowcolor{red!15}{1}
\Body
Last name & First name & Profession \\
Arvy & Jacques & Physicist \\
Jalon & Amandine & Physicist
\end{NiceTabular}
```

Last name	First name	Profession
Arvy	Jacques	Physicist
Jalon	Amandine	Physicist

14.2 Command \ShowCellNames

The command `\ShowCellNames`, which may be used in the `\CodeBefore` and in the `\CodeAfter` displays the name (with the form *i-j*) of each cell. When used in the `\CodeAfter`, that command applies a semi-transparent white rectangle to fade the array (caution: some PDF readers don’t support transparency).

```
\begin{NiceTabular}{ccc}[hvlines,cell-space-limits=3pt]
\Block{2-2}{ } & & & test \\
& & & blabla \\
& & & some text & nothing
\CodeAfter \ShowCellNames
\end{NiceTabular}
```

1-1	1-2	1-3
2-1	2-2	2-3
3-1	3-2	3-3

14.3 Use of the column type S of siunitx

If the package `siunitx` is loaded (before or after `nicematrix`), it’s possible to use the `S` column type of `siunitx` in the environments of `nicematrix`. The implementation doesn’t use explicitly any private macro of `siunitx`.

```
$\begin{pNiceArray}{Scw{c}{1cm}c}[nullify-dots,first-row]
{C_1} & & \Cdots & & C_n \\
2.3 & & 0 & & \Cdots & & 0 \\
12.4 & & \Vdots & & & & \Vdots \\
1.45 & & & & & & \\
7.2 & & 0 & & \Cdots & & 0
\end{pNiceArray}$
```

$$\begin{pmatrix} C_1 & \dots & C_n \\ 2.3 & 0 & \dots & 0 \\ 12.4 & \vdots & & \vdots \\ 1.45 & \vdots & & \vdots \\ 7.2 & 0 & \dots & 0 \end{pmatrix}$$

On the other hand, the `d` columns of the package `dcolumn` are not supported by `nicematrix`.

⁵¹This value is the initial value of the *rounded corners* of Tikz.

14.4 Default column type in {NiceMatrix}

The environments without preamble (`{NiceMatrix}`, `{pNiceMatrix}`, `{bNiceMatrix}`, etc.) and the commande `\pAutoNiceMatrix` (and its variants) provide an option `columns-type` to specify the type of column which will be used (the initial value is, of course, `c`).

The keys `l` and `r` are shortcuts for `columns-type=l` and `columns-type=r`.

```


$$\begin{bNiceMatrix}[r] \\ \cos x & - \sin x \\ \sin x & \cos x \end{bNiceMatrix}$$


```

The key `columns-type` is available in `\NiceMatrixOptions` but with the prefix `matrix`, which means that its name is, within `\NiceMatrixOptions` : `matrix/columns-type`.

14.5 The command \rotate

The package `nicematrix` provides a command `\rotate`. When used in the beginning of a cell, this command composes the contents of the cell after a rotation of 90° in the direct sens.

In the following command, we use that command in the `code-for-first-row`.⁵²

```

\NiceMatrixOptions%
{code-for-first-row = \scriptstyle \rotate \text{image of },
 code-for-last-col = \scriptstyle }
$A = \begin{pNiceMatrix}[first-row,last-col=4]
e_1 & e_2 & e_3 & \\
1 & 2 & 3 & e_1 \\
4 & 5 & 6 & e_2 \\
7 & 8 & 9 & e_3 \\
\end{pNiceMatrix}$

```

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \begin{matrix} e_1 \\ e_2 \\ e_3 \end{matrix}$$

If the command `\rotate` is used in the “last row” (exterior to the matrix), the corresponding elements are aligned upwards as shown below.

```

\NiceMatrixOptions%
{code-for-last-row = \scriptstyle \rotate ,
 code-for-last-col = \scriptstyle }
$A = \begin{pNiceMatrix}[last-row=4,last-col=4]
1 & 2 & 3 & e_1 \\
4 & 5 & 6 & e_2 \\
7 & 8 & 9 & e_3 \\
\text{image of } & e_1 & e_2 & e_3 \\
\end{pNiceMatrix}$

```

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \begin{matrix} e_1 \\ e_2 \\ e_3 \end{matrix}$$

14.6 The option small

With the option `small`, the environments of the package `nicematrix` are composed in a way similar to the environment `{smallmatrix}` of the package `amsmath` (and the environments `{psmallmatrix}`, `{bsmallmatrix}`, etc. of the package `mathtools`).

```


$$\begin{smallmatrix} c & c & c & c & c \\ 1 & -2 & 3 & 4 & 5 \\ 0 & 3 & 2 & 1 & 2 \\ 0 & 1 & 1 & 2 & 3 \end{smallmatrix}$$


```

⁵²It can also be used in `\RowStyle` (cf. p. 20.)

$$\left[\begin{array}{cccc|c} 1 & -2 & 3 & 4 & 5 \\ 0 & 3 & 2 & 1 & 2 \\ 0 & 1 & 1 & 2 & 3 \end{array} \right] \begin{array}{l} L_2 \leftarrow 2L_1 - L_2 \\ L_3 \leftarrow L_1 + L_3 \end{array}$$

One should note that the environment `\NiceMatrix` with the option `small` is not composed *exactly* as the environment `\smallmatrix`. Indeed, all the environments of `nicematrix` are constructed upon `\array` (of the package `array`) whereas the environment `\smallmatrix` is constructed directly with an `\halign` of TeX.

In fact, the option `small` corresponds to the following tuning:

- the cells of the array are composed with `\scriptstyle`;
- `\arraystretch` is set to 0.47;
- `\arraycolsep` is set to 1.45 pt;
- the characteristics of the dotted lines are also modified.

When the key `small` is in force, some functionalities of `nicematrix` are no longer available: for example, it's no longer possible to put vertical delimiters directly in the preamble of an environment with preamble (cf. section 11, p. 31).

14.7 The counters `iRow` and `jCol`

In the cells of the array, it's possible to use the LaTeX counters `iRow` and `jCol` which represent the number of the current row and the number of the current column⁵³. Of course, the user must not change the value of these counters which are used internally by `nicematrix`.

In the `\CodeBefore` (cf. p. 16) and in the `\CodeAfter` (cf. p. 31), `iRow` represents the total number of rows (excepted the potential exterior rows) and `jCol` represents the total number of columns (excepted the potential exterior columns).

```
$\begin{pNiceMatrix}% don't forget the %
  [first-row,
   first-col,
   code-for-first-row = \mathbf{\alphajCol} ,
   code-for-first-col = \mathbf{\arabic{iRow}} ]
& & & & \\
& 1 & 2 & 3 & 4 \\
& 5 & 6 & 7 & 8 \\
& 9 & 10 & 11 & 12
\end{pNiceMatrix}$
```

$$\begin{array}{c} \mathbf{a} \quad \mathbf{b} \quad \mathbf{c} \quad \mathbf{d} \\ \mathbf{1} \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{pmatrix} \\ \mathbf{2} \\ \mathbf{3} \end{array}$$

If LaTeX counters called `iRow` and `jCol` are defined in the document by packages other than `nicematrix` (or by the final user), they are shadowed in the environments of `nicematrix`.

The package `nicematrix` also provides commands in order to compose automatically matrices from a general pattern. These commands are `\AutoNiceMatrix`, `\pAutoNiceMatrix`, `\bAutoNiceMatrix`, `\vAutoNiceMatrix`, `\VAutoNiceMatrix` and `\BAutoNiceMatrix`.

These commands take in two mandatory arguments. The first is the format of the matrix, with the syntax `n-p` where `n` is the number of rows and `p` the number of columns. The second argument is the pattern (it's a list of tokens which are inserted in each cell of the constructed matrix).

```
$C = \pAutoNiceMatrix{3-3}{C_{\arabic{iRow},\arabic{jCol}}}$
```

$$C = \begin{pmatrix} C_{1,1} & C_{1,2} & C_{1,3} \\ C_{2,1} & C_{2,2} & C_{2,3} \\ C_{3,1} & C_{3,2} & C_{3,3} \end{pmatrix}$$

⁵³We recall that the exterior “first row” (if it exists) has the number 0 and that the exterior “first column” (if it exists) has also the number 0.

14.8 The key `light-syntax`

The option `light-syntax` (inspired by the package `spalign`) allows the user to compose the arrays with a lighter syntax, which gives a better legibility of the TeX source.

When this option is used, one should use the semicolon for the end of a row and spaces or tabulations to separate the columns. However, as usual in the TeX world, the spaces after a control sequence are discarded and the elements between curly braces are considered as a whole.

```
$\begin{bNiceMatrix}[light-syntax,first-row,first-col]
{} a          b          ;
a 2\cos a      {\cos a + \cos b} ;
b \cos a+\cos b { 2 \cos b }
\end{bNiceMatrix}$
```

$$\begin{matrix} & a & b \\ a & \begin{bmatrix} 2 \cos a & \cos a + \cos b \end{bmatrix} \\ b & \begin{bmatrix} \cos a + \cos b & 2 \cos b \end{bmatrix} \end{matrix}$$

It's possible to change the character used to mark the end of rows with the option `end-of-row`. As said before, the initial value is a semicolon.

When the option `light-syntax` is used, it is not possible to put verbatim material (for example with the command `\verb`) in the cells of the array.⁵⁴

14.9 Color of the delimiters

For the environments with delimiters (`{pNiceArray}`, `{pNiceMatrix}`, etc.), it's possible to change the color of the delimiters with the key `delimiters/color`.

```
$\begin{bNiceMatrix}[delimiters/color=red]
1 & 2 \\\
3 & 4
\end{bNiceMatrix}$
```

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

This color also applies to the delimiters drawn by the command `\SubMatrix` (cf. p. 32) and for the delimiters directly specified in the preamble of the environments with preamble (cf. p. 31).

14.10 The environment `{NiceArrayWithDelims}`

In fact, the environment `{pNiceArray}` and its variants are based upon a more general environment, called `{NiceArrayWithDelims}`. The first two mandatory arguments of this environment are the left and right delimiters used in the construction of the matrix.

It's possible to use `{NiceArrayWithDelims}` if we want to use atypical or asymmetrical delimiters.

```
$\begin{NiceArrayWithDelims}
{\downarrow}{\uparrow}{ccc}[margin]
1 & 2 & 3 \\\
4 & 5 & 6 \\\
7 & 8 & 9
\end{NiceArrayWithDelims}$
```

$$\begin{array}{ccc} \downarrow & \begin{array}{ccc} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{array} & \uparrow \end{array}$$

14.11 The command `\OnlyMainNiceMatrix`

The command `\OnlyMainNiceMatrix` executes its argument only when it is in the main part of the array, that is to say when it is not in one of the exterior rows. If it is used outside an environment of `nicematrix`, that command is no-op.

For an example of utilisation, see tex.stackexchange.com/questions/488566

⁵⁴The reason is that, when the option `light-syntax` is used, the whole content of the environment is loaded as a TeX argument to be analyzed. The environment doesn't behave in that case as a standard environment of LaTeX which only put TeX commands before and after the content.

15 Use of Tikz with nicematrix

15.1 The nodes corresponding to the contents of the cells

The package `nicematrix` creates a PGF/Tikz node⁵⁵ for each (non-empty) cell of the considered array. These nodes are used to draw the dotted lines between the cells of the matrix (inter alia).

Caution : By default, no node is created in a empty cell.

However, it's possible to impose the creation of a node with the command `\NotEmpty`.⁵⁶

The nodes of a document must have distinct names. That's why the names of the nodes created by `nicematrix` contains the number of the current environment. Indeed, the environments of `nicematrix` are numbered by a internal global counter.

In the environment with the number n , the node of the row i and column j has for name `nm-n-i-j`.

The command `\NiceMatrixLastEnv` provides the number of the last environment of `nicematrix` (for LaTeX, it's a "fully expandable" command and not a counter).

However, it's advisable to use instead the key `name`. This key gives a name to the current environment. When the environment has a name, the nodes are accessible with the name "`name-i-j`" where `name` is the name given to the array and i and j the numbers of row and column. It's possible to use these nodes with PGF but the final user will probably prefer to use Tikz (which is a convenient layer upon PGF). However, one should remind that `nicematrix` doesn't load Tikz by default. In the following examples, we assume that Tikz has been loaded.

```

 $\begin{pNiceMatrix}[name=mymatrix]
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9
\end{pNiceMatrix}$ 
 $\tikz[remember picture,overlay]
\draw (mymatrix-2-2) circle (2mm) ;$ 

```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & \textcircled{5} & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

Don't forget the options `remember picture` and `overlay`.

In the `\CodeAfter`, the things are easier : one must refer to the nodes with the form $i-j$ (we don't have to indicate the environment which is of course the current environment).

```

 $\begin{pNiceMatrix}
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9
\end{pNiceMatrix}$ 
 $\CodeAfter
\tikz \draw (2-2) circle (2mm) ;$ 
 $\end{pNiceMatrix}$ 

```

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & \textcircled{5} & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

The nodes of the last column (excepted the potential "last column" specified by `last-col`⁵⁷) may also be indicated by `i-last`. Similarly, the nodes of the last row may be indicated by `last-j`.

In the following example, we have underlined all the nodes of the matrix.

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

⁵⁵We recall that Tikz is a layer over PGF. The extension `nicematrix` loads PGF but does not load Tikz. We speak of PGF/Tikz nodes to emphase the fact that the PGF nodes created by `nicematrix` may be used with PGF but also with Tikz. The final user will probably prefer to use Tikz rather than PGF.

⁵⁶One should note that, with that command, the cell is considered as non-empty, which has consequences for the continuous dotted lines (cf. p. 25) and the computation of the "corners" (cf. p. 11).

⁵⁷For the exterior columns, cf. part 9, p. 24.

New 6.17 Since those nodes are PGF nodes, one won't be surprised to learn that they are drawn by using a specific PGF style. That style is called `nicematrix/cell-node` and its definition in the source file `nicematrix.sty` is as follows:

```
\pgfset
{
  nicematrix / cell-node /.style =
  {
    inner sep = 0 pt ,
    minimum width = 0 pt
  }
}
```

The final user may modify that style by changing the values of the keys `text/rotate`, `inner xsep`, `inner ysep`, `inner sep`, `outer xsep`, `outer ysep`, `outer sep`, `minimum width`, `minimum height` and `minimum size`.

For an example of utilisation, see part 18.10, p. 64.

15.1.1 The key `pgf-node-code`

New 6.17 For the experienced users, `nicematrix` provides the key `pgf-node-code` which corresponds to some PGF node that will be executed at the creation, by PGF, of the nodes corresponding to the cells of the array. More precisely, the value given to the key `pgf-node-code` will be passed in the fifth argument of the command `\pgfnode`. That value should contain at least an instruction such as `\pgfusepath`, `\pgfusepathqstroke`, `\pgfusepathqfill`, etc.

15.1.2 The columns `V` of `varwidth`

When the extension `varwidth` is loaded, the columns of the type `V` defined by `varwidth` are supported by `nicematrix`. It may be interesting to notice that, for a cell of a column of type `V`, the PGF/Tikz node created by `nicematrix` for the content of that cell has a width adjusted to the content of the cell. This is in contrast to the case of the columns of type `p`, `m` or `b` for which the nodes have always a width equal to the width of the column. In the following example, the command `\lipsum` is provided by the eponymous package.

```
\begin{NiceTabular}{V{10cm}}
\bfseries \large
Titre \\\
\lipsum[1][1-4]
\CodeAfter
\tikz \draw [rounded corners] (1-1) -| (last-|2) -- (last-|1) |- (1-1) ;
\end{NiceTabular}
```

Titre

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna.

We have used the nodes corresponding to the position of the potential rules, which are described below (cf. p. 48).

15.2 The “medium nodes” and the “large nodes”

In fact, the package `nicematrix` can create “extra nodes”: the “medium nodes” and the “large nodes”. The first ones are created with the option `create-medium-nodes` and the second ones with the option `create-large-nodes`.⁵⁸

⁵⁸There is also an option `create-extra-nodes` which is an alias for the conjunction of `create-medium-nodes` and `create-large-nodes`.

These nodes are not used by `nicematrix` by default, and that’s why they are not created by default.

The names of the “medium nodes” are constructed by adding the suffix “-medium” to the names of the “normal nodes”. In the following example, we have underlined the “medium nodes”. We consider that this example is self-explanatory.

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

The names of the “large nodes” are constructed by adding the suffix “-large” to the names of the “normal nodes”. In the following example, we have underlined the “large nodes”. We consider that this example is self-explanatory.⁵⁹

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

The “large nodes” of the first column and last column may appear too small for some usage. That’s why it’s possible to use the options `left-margin` and `right-margin` to add space on both sides of the array and also space in the “large nodes” of the first column and last column. In the following example, we have used the options `left-margin` and `right-margin`.⁶⁰

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

It’s also possible to add more space on both side of the array with the options `extra-left-margin` and `extra-right-margin`. These margins are not incorporated in the “large nodes”. It’s possible to fix both values with the option `extra-margin` and, in the following example, we use `extra-margin` with the value 3 pt.

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix}$$

Be careful : These nodes are reconstructed from the contents of the contents cells of the array. Usually, they do not correspond to the cells delimited by the rules (if we consider that these rules are drawn).

Here is an array composed with the following code:

```
\large
\begin{NiceTabular}{\wl{2cm}ll}[hvlines]
fraise & amande & abricot \\
prune & pêche & poire \\
noix & noisette & brugnion
\end{NiceTabular}
```

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnion

Here, we have colored all the cells of the array with `\chessboardcolors`.

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnion

⁵⁹There is no “large nodes” created in the exterior rows and columns (for these rows and columns, cf. p. 24).

⁶⁰The options `left-margin` and `right-margin` take dimensions as values but, if no value is given, the default value is used, which is `\arraycolsep` (by default: 5 pt). There is also an option `margin` to fix both `left-margin` and `right-margin` to the same value.

Here are the “large nodes” of this array (without use of `margin` nor `extra-margin`).

fraise	amande	abricot
prune	pêche	poire
noix	noisette	brugnon

The nodes we have described are not available by default in the `\CodeBefore` (described p. 16). It’s possible to have these nodes available in the `\CodeBefore` by using the key `create-cell-nodes` of the keyword `\CodeBefore` (in that case, the nodes are created first before the construction of the array by using informations written on the `aux` file and created a second time during the construction of the array itself).

Here is an example which uses these nodes in the `\CodeAfter`.

```
\begin{NiceArray}{c@{\;}c@{\;}c@{\;}c}[create-medium-nodes]
  u_1 & - & u_0 & = & r & \\
  u_2 & - & u_1 & = & r & \\
  u_3 & - & u_2 & = & r & \\
  u_4 & - & u_3 & = & r & \\
  \phantom{u_5} & & \phantom{u_4} & & \smash{\vdots} & \\
  u_n & - & u_{n-1} & = & r & \\
\hline
  u_n & - & u_0 & = & nr & \\
\CodeAfter
  \tikz[very thick, red, opacity=0.4, name suffix = -medium]
  \draw (1-1.north west) -- (2-3.south east)
  (2-1.north west) -- (3-3.south east)
  (3-1.north west) -- (4-3.south east)
  (4-1.north west) -- (5-3.south east)
  (5-1.north west) -- (6-3.south east) ;
\end{NiceArray}
```

$$\begin{array}{rcl}
 u_1 - u_0 & = & r \\
 u_2 - u_1 & = & r \\
 u_3 - u_2 & = & r \\
 u_4 - u_3 & = & r \\
 & \vdots & \\
 u_n - u_{n-1} & = & r \\
 \hline
 u_n - u_0 & = & nr
 \end{array}$$

15.3 The nodes which indicate the position of the rules

The package `nicematrix` creates a PGF/Tikz node merely called i (with the classical prefix) at the intersection of the horizontal rule of number i and the vertical rule of number i (more specifically the potential position of those rules because maybe there are not actually drawn). The last node has also an alias called `last`. There is also a node called $i.5$ midway between the node i and the node $i + 1$. These nodes are available in the `\CodeBefore` and the `\CodeAfter`.

	$\bullet^{1.5}$	tulipe	lys
arum		$\bullet^{2.5}$	violette mauve
muguet			$\bullet^{3.5}$

If we use Tikz (we remind that `nicematrix` does not load Tikz by default, by only PGF, which is a sub-layer of Tikz), we can access, in the `\CodeAfter` but also in the `\CodeBefore`, to the intersection of the (potential) horizontal rule i and the (potential) vertical rule j with the syntax $(i-j)$.


```

\begin{NiceMatrix}
\CodeBefore
\tikz \draw [fill=red!15] (7-|4) |- (8-|5) |- (9-|6) |- cycle ;
\Body
1 \\\
1 & 1 \\\
1 & 2 & 1 \\\
1 & 3 & 3 & 1 \\\
1 & 4 & 6 & 4 & 1 \\\
1 & 5 & 10 & 10 & 5 & 1 \\\
1 & 6 & 15 & 20 & 15 & 6 & 1 \\\
1 & 7 & 21 & 35 & 35 & 21 & 7 & 1 \\\
1 & 8 & 28 & 56 & 70 & 56 & 28 & 8 & 1
\end{NiceMatrix}

```

```

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 21 35 35 21 7 1
1 8 28 56 70 56 28 8 1

```

The nodes of the form $i.5$ may be used, for example to cross a row of a matrix (if Tikz is loaded).

```

$\begin{pNiceArray}{ccc|c}
2 & 1 & 3 & 0 \\\
3 & 3 & 1 & 0 \\\
3 & 3 & 1 & 0
\CodeAfter
\tikz \draw [red] (3.5-|1) -- (3.5-|last) ;
\end{pNiceArray}$

```

$$\begin{pmatrix} 2 & 1 & 3 & | & 0 \\ 3 & 3 & 1 & | & 0 \\ \hline 3 & 3 & 1 & | & 0 \end{pmatrix}$$

15.4 The nodes corresponding to the command `\SubMatrix`

The command `\SubMatrix` available in the `\CodeAfter` has been described p. 32.

If a command `\SubMatrix` has been used with the key `name` with an expression such as `name=MyName` three PGF/Tikz nodes are created with the names `MyName-left`, `MyName` and `MyName-right`.

The nodes `MyName-left` and `MyName-right` correspond to the delimiters left and right and the node `MyName` correspond to the submatrix itself.

In the following example, we have highlighted these nodes (the submatrix itself has been created with `\SubMatrix\{{2-2}\{3-3}\}`).

$$\begin{pmatrix} 121 & 23 & 345 & 345 \\ 45 & \left\{ \begin{array}{cc} 346 & 863 \\ 38458 & 34 \end{array} \right\} & 444 \\ 3462 & 7 & 78 & 309 \\ 34 & 7 & 78 & 309 \end{pmatrix}$$

16 API for the developpers

The package `nicematrix` provides two variables which are internal but public⁶¹:

⁶¹According to the LaTeX3 conventions, each variable with name beginning with `\g_nicematrix` ou `\l_nicematrix` is public and each variable with name beginning with `\g__nicematrix` or `\l__nicematrix` is private.

- `\g_nicematrix_code_before_tl` ;
- `\g_nicematrix_code_after_tl`.

These variables contain the code of what we have called the “code-before” (usually specified at the beginning of the environment with the syntax using the keywords `\CodeBefore` and `\Body`) and the “code-after” (usually specified at the end of the environment after the keyword `\CodeAfter`). The developer can use them to add code from a cell of the array (the affectation must be global, allowing to exit the cell, which is a TeX group).

One should remark that the use of `\g_nicematrix_code_before_tl` needs one compilation more (because the instructions are written on the aux file to be used during the next run).

Example : We want to write a command `\crossbox` to draw a cross in the current cell. This command will take in an optional argument between square brackets for a list of pairs *key-value* which will be given to Tikz before the drawing.

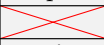
It’s possible to program such command `\crossbox` as follows, explicitly using the public variable `\g_nicematrix_code_before_tl`.

```
\ExplSyntaxOn
\cs_new_protected:Nn \__pantigny_crossbox:nnn
{
  \tikz \draw [ #3 ]
    ( #1 -| \int_eval:n { #2 + 1 } ) -- ( \int_eval:n { #1 + 1 } -| #2 )
    ( #1 -| #2 ) -- ( \int_eval:n { #1 + 1 } -| \int_eval:n { #2 + 1 } ) ;
}

\NewDocumentCommand \crossbox { ! 0 { } }
{
  \tl_gput_right:Nx \g_nicematrix_code_before_tl
  {
    \__pantigny_crossbox:nnn
    { \int_use:c { c@iRow } }
    { \int_use:c { c@jCol } }
    { \exp_not:n { #1 } }
  }
}
\ExplSyntaxOff
```

Here is an example of utilisation:

```
\begin{NiceTabular}{ccc}[hvlines]
\CodeBefore
  \arraycolor{gray!10}
\Body
merlan & requin & cabillaud \\
baleine & \crossbox[red] & morue \\
mante & raie & poule
\end{NiceTabular}
```

merlan	requin	cabillaud
baleine		morue
mante	raie	poule

17 Technical remarks

First remark: the package `underscore` must be loaded before `nicematrix`. If it is loaded after, an error will be raised.

17.1 Diagonal lines

By default, all the diagonal lines⁶² of a same array are “parallelized”. That means that the first diagonal line is drawn and, then, the other lines are drawn parallel to the first one (by rotation around the left-most extremity of the line). That’s why the position of the instructions `\Ddots` in the array can have a marked effect on the final result.

In the following examples, the first `\Ddots` instruction is written in color:

Example with parallelization (default):

```
$A = \begin{pNiceMatrix}
1      & \Cdots &      & 1      & \\
a+b    & \Ddots &      & \Vdots & \\
\Vdots & \Ddots &      &        & \\
a+b    & \Cdots & a+b  & 1      & \\
\end{pNiceMatrix}$
```

$$A = \begin{pmatrix} 1 & \cdots & \cdots & \cdots & 1 \\ a+b & \ddots & & & \\ \vdots & \ddots & & & \\ \vdots & & & & \\ a+b & \cdots & \cdots & a+b & 1 \end{pmatrix}$$

```
$A = \begin{pNiceMatrix}
1      & \Cdots &      & 1      & \\
a+b    &      &      & \Vdots & \\
\Vdots & \Ddots & \Ddots &        & \\
a+b    & \Cdots & a+b  & 1      & \\
\end{pNiceMatrix}$
```

$$A = \begin{pmatrix} 1 & \cdots & \cdots & \cdots & 1 \\ a+b & & & & \\ \vdots & \ddots & & & \\ \vdots & & & & \\ a+b & \cdots & \cdots & a+b & 1 \end{pmatrix}$$

It’s possible to turn off the parallelization with the option `parallelize-diags` set to `false`:

The same example without parallelization:

$$A = \begin{pmatrix} 1 & \cdots & \cdots & \cdots & 1 \\ a+b & \ddots & & & \\ \vdots & \ddots & & & \\ \vdots & & & & \\ a+b & \cdots & \cdots & a+b & 1 \end{pmatrix}$$

It’s possible to specify the instruction `\Ddots` which will be drawn first (and which will be used to draw the other diagonal dotted lines when the parallelization is in force) with the key `draw-first`: `\Ddots[draw-first]`.

17.2 The “empty” cells

An instruction like `\Ldots`, `\Cdots`, etc. tries to determine the first non-empty cell on both sides. When the key `corners` is used (cf. p. 11), `nicematrix` computes corners consisting of empty cells. However, an “empty cell” is not necessarily a cell with no TeX content (that is to say a cell with no token between the two ampersands `&`). The precise rules are as follow.

- An implicit cell is empty. For example, in the following matrix:

```
\begin{pmatrix}
a & b \\
c & \\
\end{pmatrix}
```

the last cell (second row and second column) is empty.

- For the columns of type `p`, `m`, `b`, `V`⁶³ and `X`⁶⁴, the cell is empty if (and only if) its content in the TeX code is empty (there is only spaces between the ampersands `&`).

⁶²We speak of the lines created by `\Ddots` and not the lines created by a command `\line` in the `\CodeAfter`.

⁶³The columns of type `V` are provided by `varwidth`: cf. p. 23.

⁶⁴See p. 22

- For the columns of type `c`, `l`, `r` and `w{\dots}{\dots}`, the cell is empty if (and only if) its TeX output has a width equal to zero.
- A cell containing the command `\NotEmpty` is not empty (and a PGF/Tikz node is created in that cell).
- A cell with only a command `\Hspace` (or `\Hspace*`) is empty. This command `\Hspace` is a command defined by the package `nicematrix` with the same meaning as `\hspace` except that the cell where it is used is considered as empty. This command can be used to fix the width of some columns of the matrix without interfering with `nicematrix`.

17.3 The option `exterior-arraycolsep`

The environment `{array}` inserts an horizontal space equal to `\arraycolsep` before and after each column. In particular, there is a space equal to `\arraycolsep` before and after the array. This feature of the environment `{array}` was probably not a good idea⁶⁵. The environment `{matrix}` of `amsmath` and its variants (`{pmatrix}`, `{vmatrix}`, etc.) of `amsmath` prefer to delete these spaces with explicit instructions `\hskip -\arraycolsep`⁶⁶. The package `nicematrix` does the same in all its environments, `{NiceArray}` included. However, if the user wants the environment `{NiceArray}` behaving by default like the environment `{array}` of `array` (for example, when adapting an existing document) it's possible to control this behaviour with the option `exterior-arraycolsep`, set by the command `\NiceMatrixOptions`. With this option, exterior spaces of length `\arraycolsep` will be inserted in the environments `{NiceArray}` (the other environments of `nicematrix` are not affected).

17.4 Incompatibilities

The package `nicematrix` is not compatible with the class `ieeeaccess` (because that class is not compatible with PGF/Tikz).⁶⁷

In order to use `nicematrix` with the class `aastex631` (of the *American Astronomical Society*), you have to add the following lines in the preamble of your document :

```
\BeforeBegin{NiceTabular}{\let\begin\BeginEnvironment\let\end\EndEnvironment}
\BeforeBegin{NiceArray}{\let\begin\BeginEnvironment}
\BeforeBegin{NiceMatrix}{\let\begin\BeginEnvironment}
```

In order to use `nicematrix` with the class `sn-jnl` (of *Springer Nature*), `pgf` must be loaded before the `\documentclass` with `\RequirePackage`:

```
\RequirePackage{pgf}
\documentclass{sn-jnl}
```

The package `nicematrix` is not fully compatible with the packages and classes of Lua_{TeX}-ja: the detection of the empty corners (cf. may be wrong in some circumstances).

The package `nicematrix` is not fully compatible with the package `arydshln` (because this package redefines many internals of `array`). By any means, in the context of `nicematrix`, it's recommended to draw dashed rules with the tools provided by `nicematrix`, by creating a customized line style with `custom-line`: cf. p. 13.

The columns `d` of `dcolumn` are not supported (but it's possible to use the columns `S` of `siunitx`).

⁶⁵In the documentation of `amsmath`, we can read: *The extra space of `\arraycolsep` that `array` adds on each side is a waste so we remove it [in `{matrix}`] (perhaps we should instead remove it from `array` in general, but that's a harder task).*

⁶⁶And not by inserting `@{}` on both sides of the preamble of the array. As a consequence, the length of the `\hline` is not modified and may appear too long, in particular when using square brackets.

⁶⁷See <https://tex.stackexchange.com/questions/528975/error-loading-tikz-in-ieeeaccess-class>

18 Examples

18.1 Utilisation of the key “tikz” of the command \Block

The key `tikz` of the command `\Block` is available only when Tikz is loaded.⁶⁸
For the following example, we also need the Tikz library `patterns`.

```
\usetikzlibrary{patterns}

\ttfamily \small
\begin{NiceTabular}{X[m]X[m]X[m]}[hvlines,cell-space-limits=3pt]
  \Block[tikz={pattern=grid,pattern color=lightgray}]{ }
    {pattern = grid,\ \ pattern color = lightgray}
& \Block[tikz={pattern = north west lines,pattern color=blue}]{ }
    {pattern = north west lines,\ \ pattern color = blue}
& \Block[tikz={outer color = red!50, inner color=white }]{2-1}
    {outer color = red!50,\ \ inner color = white} \ \
  \Block[tikz={pattern = sixpointed stars, pattern color = blue!15}]{ }
    {pattern = sixpointed stars,\ \ pattern color = blue!15}
& \Block[tikz={left color = blue!50}]{ }
    {left color = blue!50} \ \
\end{NiceTabular}
```

pattern = grid, pattern color = lightgray	pattern = north west lines, pattern color = blue	outer color = red!50, inner color = white
pattern = sixpointed stars, pattern color = blue!15	left color = blue!50	

In the following example, we use the key `tikz` to hatch a row of the tabular. Remark that you use the key `transparent` of the command `\Block` in order to have the rules drawn in the block.⁶⁹

```
\begin{NiceTabular}{ccc}[hvlines]
\CodeBefore
  \columncolor[RGB]{169,208,142}{2}
\Body
one & two & three \ \
\Block[transparent, tikz={pattern = north west lines, pattern color = gray}]{1-*}{ }
four & five & six \ \
seven & eight & nine
```

one	two	three
four	five	six
seven	eight	nine

18.2 Use with tcolorbox

Here is an example of use of `{NiceTabular}` within a command `\tcbox` of `tcolorbox`. We have used the key `hvlines-except-borders` in order all the rules excepted on the borders (which are, of course, added by `tcolorbox`)

⁶⁸By default, `nicematrix` only loads PGF, which is a sub-layer of Tikz.

⁶⁹By default, the rules are not drawn in the blocks created by the command `\Block`: cf. section 5 p. 9

```

\tcbset
{
  colframe = blue!50!black ,
  colback = white ,
  colupper = red!50!black ,
  fonttitle = \bfseries ,
  nobeforeafter ,
  center title
}

\tcbox
[
  left = 0mm ,
  right = 0mm ,
  top = 0mm ,
  bottom = 0mm ,
  boxsep = 0mm ,
  toptitle = 0.5mm ,
  bottomtitle = 0.5mm ,
  title = My table
]
{
  \renewcommand{\arraystretch}{1.2}% <-- the % is mandatory here
  \begin{NiceTabular}{rcl}[hvlines-except-borders,rules/color=blue!50!black]
  \CodeBefore
    \rowcolor{red!15}{1}
  \Body
    One & Two & Three \\
    Men & Mice & Lions \\
    Upper & Middle & Lower
  \end{NiceTabular}
}

```

My table		
One	Two	Three
Men	Mice	Lions
Upper	Middle	Lower

That example shows the use of `nicematrix` in conjunction with `tcolorbox`. If one wishes a tabular with an exterior frame with rounded corners, it's not necessary to use `tcolorbox`: it's possible to use the command `\Block` with the key `rounded-corners`.

```

\begin{NiceTabular}{rcl}[hvlines-except-borders]
\Block[draw,transparent,rounded-corners]{*-*}{
  One & Two & Three \\
  Men & Mice & Lions \\
  Upper & Middle & Lower
}
\end{NiceTabular}

```

One	Two	Three
Men	Mice	Lions
Upper	Middle	Lower

We have used the key `transparent` to have the rules specified by `hvlines-except-borders` drawn in the blocks (by default, the rules are not drawn in the blocks).

18.3 Notes in the tabulars

The tools provided by `nicematrix` for the composition of the tabular notes have been presented in the section 13 p. 36.

Let's consider that we wish to number the notes of a tabular with stars.⁷⁰

First, we write a command `\stars` similar the well-known commands `\arabic`, `\alph`, `\Alph`, etc. which produces a number of stars equal to its argument⁷¹.

```
\ExplSyntaxOn
\NewDocumentCommand \stars { m }
  { \prg_replicate:nn { \value { #1 } } { $ \star $ } }
\ExplSyntaxOff
```

Of course, we change the style of the labels with the key `notes/style`. However, it would be interesting to change also some parameters in the type of list used to compose the notes at the end of the tabular. First, we required a composition flush right for the labels with the setting `align=right`. Moreover, we want the labels to be composed on a width equal to the width of the widest label. The widest label is, of course, the label with the greatest number of stars. We know that number: it is equal to `\value{tabularnote}` (because `tabularnote` is the LaTeX counter used by `\tabularnote` and, therefore, at the end of the tabular, its value is equal to the total number of tabular notes). We use the key `widest*` of `enumitem` in order to require a width equal to that value: `widest*=\value{tabularnote}`.

```
\NiceMatrixOptions
{
  notes =
  {
    style = \stars{#1} ,
    enumitem-keys =
    {
      widest* = \value{tabularnote} ,
      align = right
    }
  }
}

\begin{NiceTabular}{{}}llr{{}}
\toprule \RowStyle{\bfseries}
Last name & First name & Birth day \\
\midrule
Achard\tabularnote{Achard is an old family of the Poitou.}
& Jacques & 5 juin 1962 \\
Lefebvre\tabularnote{The name Lefebvre is an alteration of the name Lefebure.}
& Mathilde & 23 mai 1988 \\
Vanesse & Stephany & 30 octobre 1994 \\
Dupont & Chantal & 15 janvier 1998 \\
\bottomrule
\end{NiceTabular}
```

Last name	First name	Birth day
Achard*	Jacques	June 5, 2005
Lefebvre**	Mathilde	January 23, 1975
Vanesse	Stephany	October 30, 1994
Dupont	Chantal	January 15, 1998

*Achard is an old family of the Poitou.

**The name Lefebvre is an alteration of the name Lefebure.

⁷⁰Of course, it's realistic only when there is very few notes in the tabular.

⁷¹In fact: the value of its argument.

18.4 Dotted lines

An example with the resultant of two polynomials:

```
\setlength{\extrarowheight}{1mm}
\[\begin{vNiceArray}{ccccccc}[columns-width=6mm]
a_0 & & & & b_0 & & \\
a_1 & & \Ddots & & b_1 & & \Ddots \\
\vdots & & \Ddots & & \vdots & & \Ddots b_0 \\
a_p & & & a_0 & & & b_1 \\
& & \Ddots & a_1 & & b_q & \vdots \\
& & & \vdots & & & \\
& & & & a_p & & \\
& & & & & & b_q
\end{vNiceArray}\]
```

$$\left| \begin{array}{ccccccc} a_0 & & & & b_0 & & \\ a_1 & & \cdots & & b_1 & & \cdots \\ \vdots & & \cdots & & \vdots & & \cdots b_0 \\ a_p & & & a_0 & & & b_1 \\ & & \cdots & a_1 & & b_q & \vdots \\ & & & \vdots & & & \\ & & & a_p & & & \\ & & & & & & b_q \end{array} \right|$$

An example for a linear system:

```
\begin{pNiceArray}{*6c|c}[nullify-dots,last-col,code-for-last-col=\scriptstyle]
1 & 1 & 1 & \Cdots & 1 & 0 & \\
0 & 1 & 0 & \Cdots & 0 & & L_2 \gets L_2-L_1 \\
0 & 0 & 1 & \Ddots & \vdots & & L_3 \gets L_3-L_1 \\
& & & \Ddots & & \vdots & \\
\vdots & & & \Ddots & 0 & & \\
0 & & & \Cdots & 0 & 1 & L_n \gets L_n-L_1
\end{pNiceArray}
```

$$\left(\begin{array}{ccccccc|c} 1 & 1 & 1 & \cdots & 1 & 0 & \\ 0 & 1 & 0 & \cdots & 0 & & L_2 \leftarrow L_2 - L_1 \\ 0 & 0 & 1 & \cdots & \vdots & & L_3 \leftarrow L_3 - L_1 \\ \vdots & & & \ddots & & \vdots & \\ 0 & \cdots & \cdots & 0 & 1 & & L_n \leftarrow L_n - L_1 \end{array} \right)$$

18.5 Dotted lines which are no longer dotted

The option `line-style` controls the style of the lines drawn by `\Ldots`, `\Cdots`, etc. Thus, it's possible with these commands to draw lines which are not longer dotted.

```
\NiceMatrixOptions{code-for-first-row = \scriptstyle,code-for-first-col = \scriptstyle }
\setcounter{MaxMatrixCols}{12}
\newcommand{\blue}{\color{blue}}
\[\begin{pNiceMatrix}[last-row,last-col,nullify-dots,xdots/line-style={dashed,blue}]
1 & & \vdots & & & \vdots
\end{pNiceMatrix}\]
```



```

& \Ddots[line-style=standard] \\
& & 1 \\
\Cdots[color=blue,line-style=dashed]& & & \blue 0 &
\Cdots & & & \blue 1 & & & \Cdots & \blue \leftarrow i \\
& & & & 1 \\
& & & \Vdots & & \Ddots[line-style=standard] & & \Vdots \\
& & & & & & 1 \\
\Cdots & & & \blue 1 & \Cdots & & \Cdots & \blue 0 & & & \Cdots & \blue \leftarrow j \\
& & & & & & & & & & 1 \\
& & & & & & & \Ddots[line-style=standard] \\
& & & \Vdots & & & \Vdots & & & 1 \\
& & & \blue \overset{\uparrow}{i} & & & \blue \overset{\uparrow}{j} \\
\end{pNiceMatrix}\]

```

$$\begin{pmatrix}
 1 & \cdots & & & \\
 & 1 & & & \\
 \cdots & & 0 & \cdots & 1 \\
 & & & 1 & \\
 \cdots & & & & 1 \\
 & & 1 & \cdots & 0 \\
 & & & & \cdots & 1 \\
 & & & & & 1
 \end{pmatrix}
 \begin{matrix}
 \\
 \\
 \leftarrow i \\
 \\
 \\
 \leftarrow j \\
 \\
 \uparrow i \\
 \uparrow j
 \end{matrix}$$

In fact, it's even possible to draw solid lines with the commands `\Cdots`, `\Vdots`, etc.⁷²

```

\NiceMatrixOptions
{nullify-dots,code-for-first-col = \color{blue},code-for-first-row=\color{blue}}
$\begin{pNiceMatrix}[first-row,first-col]
& & \Ldots[line-style={solid,<->},shorten=0pt]^{\text{ columns}} \\
& 1 & 1 & 1 & \Ldots & 1 \\
& 1 & 1 & 1 & & 1 \\
\Vdots[line-style={solid,<->}]_{\text{ rows}} & 1 & 1 & 1 & & 1 \\
& 1 & 1 & 1 & & 1 \\
& 1 & 1 & 1 & \Ldots & 1
\end{pNiceMatrix}$

```

$$\begin{matrix}
 \xleftarrow{n \text{ columns}} \\
 \uparrow n \text{ rows} \\
 \begin{pmatrix}
 1 & 1 & 1 & \dots & 1 \\
 1 & 1 & 1 & & 1 \\
 1 & 1 & 1 & & 1 \\
 1 & 1 & 1 & & 1 \\
 1 & 1 & 1 & \dots & 1
 \end{pmatrix}
 \end{matrix}$$

18.6 Dashed rules

In the following example, we use the command `\Block` to draw dashed rules. For that example, Tikz should be loaded (by `\usepackage{tikz}`).

```

\begin{pNiceMatrix}
\Block[borders={bottom,right,tikz=dashed}]{2-2}{}

```

⁷²In this document, the Tikz library `arrows.meta` has been loaded, which impacts the shape of the arrow tips.

```

1 & 2 & 0 & 0 & 0 & 0 & 0 \\
4 & 5 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & \Block[borders={bottom,top,right,left,tikz=dashed}]{2-2}{
      7 & 1 & 0 & 0 & 0 \\
0 & 0 & -1 & 2 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & \Block[borders={left,top,tikz=dashed}]{2-2}{
      3 & 4 & \\
0 & 0 & 0 & 0 & 0 & 1 & 4
\end{pNiceMatrix}

```

$$\left(\begin{array}{ccc|ccc} 1 & 2 & 0 & 0 & 0 & 0 \\ 4 & 5 & 0 & 0 & 0 & 0 \\ \hline 0 & 0 & 7 & 1 & 0 & 0 \\ 0 & 0 & -1 & 2 & 0 & 0 \\ \hline 0 & 0 & 0 & 0 & 3 & 4 \\ 0 & 0 & 0 & 0 & 1 & 4 \end{array}\right)$$

18.7 Stacks of matrices

We often need to compose mathematical matrices on top on each other (for example for the resolution of linear systems).

In order to have the columns aligned one above the other, it's possible to fix a width for all the columns. That's what is done in the following example with the environment `{NiceMatrixBlock}` and its option `auto-columns-width`.

```

\begin{NiceMatrixBlock}[auto-columns-width]
\NiceMatrixOptions
{
  light-syntax,
  last-col, code-for-last-col = \color{blue} \scriptstyle,
}
\setlength{\extrarowheight}{1mm}

$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 {} ;
3 -18 12 1 4 ;
-3 -46 29 -2 -15 ;
9 10 -5 4 7
\end{pNiceArray}$

\smallskip
$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 ;
0 64 -41 1 19 { L_2 \gets L_1-4L_2 } ;
0 -192 123 -3 -57 { L_3 \gets L_1+4L_3 } ;
0 -64 41 -1 -19 { L_4 \gets 3L_1-4L_4 } ;
\end{pNiceArray}$

\smallskip
$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 ;
0 64 -41 1 19 ;
0 0 0 0 0 { L_3 \gets 3 L_2 + L_3 }
\end{pNiceArray}$

\smallskip
$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 {} ;
0 64 -41 1 19 ;
\end{pNiceArray}$

```

`\end{NiceMatrixBlock}`

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{array}\right)$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{array}\right) \begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right) L_3 \leftarrow 3L_2 + L_3$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{array}\right)$$

However, one can see that the last matrix is not perfectly aligned with others. That's why, in LaTeX, the parenthesis have not exactly the same width (smaller parenthesis are a bit slimer).

In order to solve that problem, it's possible to require the delimiters to be composed with the maximal width, thanks to the boolean key `delimiters/max-width`.

```
\begin{NiceMatrixBlock}[auto-columns-width]
\NiceMatrixOptions
{
  delimiters/max-width,
  light-syntax,
  last-col, code-for-last-col = \color{blue}\scriptstyle,
}
\setlength{\extrarowheight}{1mm}

$\begin{pNiceArray}{rrrr|r}
12 -8 7 5 3 {} ;
3 -18 12 1 4 ;
-3 -46 29 -2 -15 ;
9 10 -5 4 7
\end{pNiceArray}$

...
\end{NiceMatrixBlock}
```

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{array}\right)$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{array}\right) \begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)_{L_3 \leftarrow 3L_2 + L_3}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{array}\right)$$

If you wish an alignment of the different matrices without the same width for all the columns, you can construct a unique array and place the parenthesis with commands `\SubMatrix` in the `\CodeAfter`. Of course, that array can't be broken by a page break.

```
\setlength{\extrarowheight}{1mm}
\[\begin{NiceMatrix}[ r, last-col=6, code-for-last-col = \scriptstyle \color{blue} ]
12 & -8 & & 7 & 5 & 3 \\
3 & -18 & & 12 & 1 & 4 \\
-3 & -46 & & 29 & -2 & -15 \\
9 & 10 & & -5 & 4 & 7 \\
12 & -8 & & 7 & 5 & 3 \\
0 & 64 & & -41 & 1 & 19 & \scriptstyle L_1-4L_2 \\
0 & -192 & 123 & -3 & -57 & L_3 & \scriptstyle L_1+4L_3 \\
0 & -64 & 41 & -1 & -19 & L_4 & \scriptstyle 3L_1-4L_4 \\
12 & -8 & & 7 & 5 & 3 \\
0 & 64 & & -41 & 1 & 19 \\
0 & 0 & & 0 & 0 & L_3 & \scriptstyle 3L_2+L_3 \\
12 & -8 & & 7 & 5 & 3 \\
0 & 64 & & -41 & 1 & 19 \\
\CodeAfter [sub-matrix/vlines=4]
\SubMatrix({1-1}{4-5})
\SubMatrix({5-1}{8-5})
\SubMatrix({9-1}{11-5})
\SubMatrix({12-1}{13-5})
\end{NiceMatrix}\]
```

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{array}\right)$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{array}\right)_{\begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)_{L_3 \leftarrow 3L_2 + L_3}$$

$$\left(\begin{array}{cccc|c} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{array}\right)$$

In this tabular, the instructions `\SubMatrix` are executed after the composition of the tabular and, thus, the vertical rules are drawn without adding space between the columns.

In fact, it's possible, with the key `vlines-in-sub-matrix`, to choice a letter in the preamble of the array to specify vertical rules which will be drawn in the `\SubMatrix` only (by adding space between the columns).

```

\setlength{\extrarowheight}{1mm}
\[\begin{NiceArray}
[
  \vlines-in-sub-matrix=I,
  last-col,
  code-for-last-col = \scriptstyle \color{blue}
]
{rrrrIr}
12 & -8 & 7 & 5 & 3 & \backslash\backslash
3 & -18 & 12 & 1 & 4 & \backslash\backslash
-3 & -46 & 29 & -2 & -15 & \backslash\backslash
9 & 10 & -5 & 4 & 7 & \backslash\backslash[1mm]
12 & -8 & 7 & 5 & 3 & \backslash\backslash
0 & 64 & -41 & 1 & 19 & \backslash\text{gets} L_1-4L_2 \backslash\backslash
0 & -192 & 123 & -3 & -57 & \backslash\text{gets} L_1+4L_3 \backslash\backslash
0 & -64 & 41 & -1 & -19 & \backslash\text{gets} 3L_1-4L_4 \backslash\backslash[1mm]
12 & -8 & 7 & 5 & 3 & \backslash\backslash
0 & 64 & -41 & 1 & 19 & \backslash\backslash
0 & 0 & 0 & 0 & 0 & \backslash\text{gets} 3L_2+L_3 \backslash\backslash[1mm]
12 & -8 & 7 & 5 & 3 & \backslash\backslash
0 & 64 & -41 & 1 & 19 & \backslash\backslash
\CodeAfter
\SubMatrix({1-1}{4-5})
\SubMatrix({5-1}{8-5})
\SubMatrix({9-1}{11-5})
\SubMatrix({12-1}{13-5})
\end{NiceArray}\]

```

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 3 & -18 & 12 & 1 & 4 \\ -3 & -46 & 29 & -2 & -15 \\ 9 & 10 & -5 & 4 & 7 \end{pmatrix}$$

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & -192 & 123 & -3 & -57 \\ 0 & -64 & 41 & -1 & -19 \end{pmatrix}
\begin{array}{l} L_2 \leftarrow L_1 - 4L_2 \\ L_3 \leftarrow L_1 + 4L_3 \\ L_4 \leftarrow 3L_1 - 4L_4 \end{array}$$

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}
\begin{array}{l} L_3 \leftarrow 3L_2 + L_3 \end{array}$$

$$\begin{pmatrix} 12 & -8 & 7 & 5 & 3 \\ 0 & 64 & -41 & 1 & 19 \end{pmatrix}$$

18.8 How to highlight cells of a matrix

In order to highlight a cell of a matrix, it's possible to “draw” that cell with the key `draw` of the command `\Block` (this is one of the uses of a mono-cell block⁷³).

```

$\begin{pNiceArray}{>{\strut}cccc}[margin,rules/color=blue]
\Block[draw]{a_{11}} & a_{12} & a_{13} & a_{14} \backslash\backslash

```

⁷³We recall that, if the first mandatory argument of the command `\Block` is left empty, that means that the block is a mono-cell block

```

a_{21} & \Block[draw]{a_{22}} & a_{23} & a_{24} \\
a_{31} & a_{32} & \Block[draw]{a_{33}} & a_{34} \\
a_{41} & a_{42} & a_{43} & \Block[draw]{a_{44}} \\
\end{pNiceArray}$

```

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{pmatrix}$$

We should remark that the rules we have drawn are drawn *after* the construction of the array and thus, they don't spread the cells of the array. We recall that, on the other side, the commands `\hline` and `\Hline`, the specifier “|” and the options `hlines`, `vlines`, `hvlines` and `hvlines-except-borders` spread the cells.⁷⁴

It's possible to color a row with `\rowcolor` in the `code-before` (or with `\rowcolor` in the first cell of the row if the key `colortbl-like` is used—even when `colortbl` is not loaded).

```

\begin{pNiceArray}{>{\strut}cccc}[margin, extra-margin=2pt,colortbl-like]
\rowcolor{red!15}A_{11} & A_{12} & A_{13} & A_{14} \\
A_{21} & \rowcolor{red!15}A_{22} & A_{23} & A_{24} \\
A_{31} & A_{32} & \rowcolor{red!15}A_{33} & A_{34} \\
A_{41} & A_{42} & A_{43} & \rowcolor{red!15}A_{44} \\
\end{pNiceArray}

```

$$\begin{pmatrix} A_{11} & A_{12} & A_{13} & A_{14} \\ A_{21} & A_{22} & A_{23} & A_{24} \\ A_{31} & A_{32} & A_{33} & A_{34} \\ A_{41} & A_{42} & A_{43} & A_{44} \end{pmatrix}$$

However, it's not possible to do a fine tuning. That's why we describe now a method to highlight a row of the matrix.

That example and the following ones require Tikz (by default, `nicematrix` only loads PGF, which is a sub-layer of Tikz) and the Tikz library `fit`. The following lines in the preamble of your document do the job:

```

\usepackage{tikz}
\usetikzlibrary{fit}

```

We create a rectangular Tikz node which encompasses the nodes of the second row by using the tools of the Tikz library `fit`. Those nodes are not available by default in the `\CodeBefore` (for efficiency). We have to require their creation with the key `create-cell-nodes` of the keyword `\CodeBefore`.

```

\tikzset{highlight/.style={rectangle,
                             fill=red!15,
                             rounded corners = 0.5 mm,
                             inner sep=1pt,
                             fit=#1}}

$\begin{bNiceMatrix}
\CodeBefore [create-cell-nodes]
\tikz \node [highlight = (2-1) (2-3)] {} ;
\Body

```

⁷⁴For the command `\cline`, see the remark p. 9.

```

0 & \Cdots & 0 \\
1 & \Cdots & 1 \\
0 & \Cdots & 0 \\
\end{bNiceMatrix}$

```

$$\begin{bmatrix} 0 \cdots \cdots 0 \\ 1 \cdots \cdots 1 \\ 0 \cdots \cdots 0 \end{bmatrix}$$

We consider now the following matrix. If we want to highlight each row of this matrix, we can use the previous technique three times.

```

\[\begin{pNiceArray}{ccc}[last-col, margin = 2pt]
\CodeBefore [create-cell-nodes]
\begin{tikzpicture}
\node [highlight = (1-1) (1-3)] {} ;
\node [highlight = (2-1) (2-3)] {} ;
\node [highlight = (3-1) (3-3)] {} ;
\end{tikzpicture}
\Body
a & a + b & a + b + c & L_1 \\
a & a & a + b & L_2 \\
a & a & a & L_3
\end{pNiceArray}\]

```

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix} \begin{matrix} L_1 \\ L_2 \\ L_3 \end{matrix}$$

The result may seem disappointing. We can improve it by using the “medium nodes” instead of the “normal nodes”.

```

\[\begin{pNiceArray}{ccc}[last-col, margin = 2pt, create-medium-nodes]
\CodeBefore [create-cell-nodes]
\begin{tikzpicture} [name suffix = -medium]
\node [highlight = (1-1) (1-3)] {} ;
\node [highlight = (2-1) (2-3)] {} ;
\node [highlight = (3-1) (3-3)] {} ;
\end{tikzpicture}
\Body
a & a + b & a + b + c & L_1 \\
a & a & a + b & L_2 \\
a & a & a & L_3
\end{pNiceArray}\]

```

$$\begin{pmatrix} a & a+b & a+b+c \\ a & a & a+b \\ a & a & a \end{pmatrix} \begin{matrix} L_1 \\ L_2 \\ L_3 \end{matrix}$$

18.9 Utilisation of `\SubMatrix` in the `\CodeBefore`

In the following example, we illustrate the mathematical product of two matrices. The whole figure is an environment `{NiceArray}` and the three pairs of parenthesis have been added with `\SubMatrix` in the `\CodeBefore`.

Diagram illustrating the contraction of two tensors:

- Tensor L_i (left): A 3D tensor with indices i_1, i_k, i_n highlighted in red.
- Tensor C_j (right): A 3D tensor with indices $1_j, k_j, n_j$ highlighted in red.
- The contraction is indicated by a curved line connecting the i_k index of L_i to the k_j index of C_j .

```

\tikzset{highlight/.style={rectangle,
                                fill=red!15,
                                rounded corners = 0.5 mm,
                                inner sep=1pt,
                                fit=#1}}

\[\begin{NiceArray}{*{6}{c}}@{\hspace{6mm}}*{5}{c}}[nullify-dots]
\CodeBefore [create-cell-nodes]
  \SubMatrix({2-7}{6-last})
  \SubMatrix({7-2}{last-6})
  \SubMatrix({7-7}{last-last})
\begin{tikzpicture}
  \node [highlight = (9-2) (9-6)] { } ;
  \node [highlight = (2-9) (6-9)] { } ;
\end{tikzpicture}
\Body
& & & & & & & \color{blue}\scriptstyle C_j \\
& & & & & b_{11} & \Cdots & b_{1j} & \Cdots & b_{1n} \\
& & & & & \Vdots & & \Vdots & & \Vdots \\
& & & & & & & b_{kj} \\
& & & & & & & \Vdots \\
& & & & & b_{n1} & \Cdots & b_{nj} & \Cdots & b_{nn} \\
& a_{11} & \Cdots & & a_{1n} \\
& \Vdots & & & \Vdots & & & \Vdots \\
\color{blue}\scriptstyle L_i
& a_{i1} & \Cdots & a_{ik} & \Cdots & a_{in} & \Cdots & c_{ij} \\
& \Vdots & & & \Vdots \\
& a_{n1} & \Cdots & & a_{nn} \\
\CodeAfter
\tikz \draw [gray,shorten > = 1mm, shorten < = 1mm] (9-4.north) to [bend left] (4-9.west) ;
\end{NiceArray}\]

```

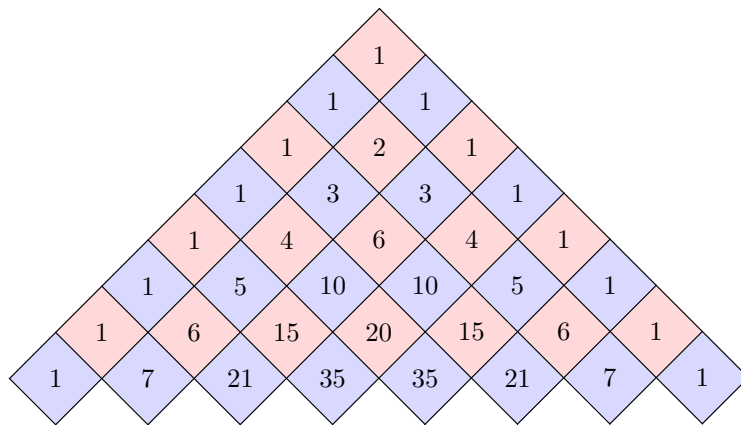
18.10 A triangular tabular

In the following example, we use the style PGF/TikZ `nicematrix/cell-node` to rotate the contents of the cells (and, then, we compensate that rotation by a rotation of the whole tabular with the command `\adjustbox` of the eponymous package, which must be loaded previously).

```
\pgfset
{
    nicematrix/cell-node/.append style =
        { text/rotate = 45, minimum size = 6 mm }
```



```
\adjustbox{rotate = -45, set depth = 6mm + 1.414 \arrayrulewidth}{
\begin{NiceTabular} [ hvlines, corners=SE, baseline = line-9 ] { ccccccc }
\CodeBefore
\chessboardcolors{red!15}{blue!15}
\Body
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & \\\
1 & 2 & 3 & 4 & 5 & 6 & 7 & \\\
1 & 3 & 6 & 10 & 15 & 21 & \\\
1 & 4 & 10 & 20 & 35 & \\\
1 & 5 & 15 & 35 & \\\
1 & 6 & 21 & \\\
1 & 7 & \\\
1
\end{NiceTabular}}
```



19 History

The successive versions of the file `nicematrix.sty` provided by TeXLive are available on the SVN server of TeXLive:

<https://www.tug.org/svn/texlive/trunk/Master/texmf-dist/tex/latex/nicematrix/nicematrix.sty>

Changes between version 6.18 and 6.19

The command `\tabularnote` now supports an optional argument (between square brackets) to change the symbol of the reference of the note.

Changes between version 6.17 and 6.18

New key `opacity` in the commands to color cells, rows and columns.

New key `rounded-corners` for a whole tabular.

Changes between version 6.16 and 6.17

New PGF/Tikz style `nicematrix/cell-node`.

New key `pgf-node-code`

Changes between version 6.15 and 6.16

It's now possible to put any LaTeX extensible delimiter (`\lgroup`, `\langle`, etc.) in the preamble of an environment with preamble (such as `{NiceArray}`) by prefixing them by `\left` and `\right`.

New key `code` for the command `\SubMatrix` in the `\CodeAfter`.

Changes between version 6.14 and 6.15

New key `transparent` for the command `\Block` (with that key, the rules are drawn within the block).

Changes between version 6.13 and 6.14

New keys for the command `\Block` for the vertical position of the content of that block.

Changes between version 6.12 and 6.13

New environment `{TabularNote}` in `{NiceTabular}` with the same semantic as the key `tabularnote` (for legibility).

The command `\Hline` now accepts options (between square brackets).

Changes between version 6.11 and 6.12

New keys `caption`, `short-caption` and `label` in the environment `{NiceTabular}`.

In `{NiceTabular}`, a caption specified by the key `caption` is wrapped to the width of the tabular.

Correction of a bug: it's now possible to use `\OverBrace` and `\UnderBrace` with `unicode-math` (with XeLaTeX or LuaLaTeX).

Changes between version 6.10 and 6.11

New key `matrix/columns-type` to specify the type of columns of the matrices.

New key `ccommand` in `custom-line` and new command `\cdottedline`.

Changes between version 6.9 and 6.10

New keys `xdots/shorten-start` and `xdots/shorten-end`.

It's possible to use `\line` in the `\CodeAfter` between two blocks (and not only two cells).

Changes between version 6.8 and 6.9

New keys `xdots/radius` and `xdots/inter` for customisation of the continuous dotted lines.

New command `\ShowCellNames` available in the `\CodeBefore` and in the `\CodeAfter`.

Changes between version 6.7 and 6.8

In the notes of a tabular (with the command `\tabularnote`), the duplicates are now detected: when several commands `\tabularnote` are used with the same argument, only one note is created at the end of the tabular (but all the labels are present, of course).

Changes between version 6.6 and 6.7

Key `color` for `\OverBrace` and `\UnderBrace` in the `\CodeAfter`

Key `tikz` in the key borders of a command `\Block`

Changes between version 6.5 and 6.6

Keys `tikz` and `width` in `custom-line`.

Changes between versions 6.4 and 6.5

Key `custom-line` in `\NiceMatrixOptions`.

Key `respect-arraystretch`.

Changes between versions 6.3 and 6.4

New commands `\UnderBrace` and `\OverBrace` in the `\CodeAfter`.

Correction of a bug of the key `baseline` (cf. question 623258 on TeX StackExchange).

Correction of a bug with the columns `V` of `varwidth`.

Correction of a bug: the use of `\hdottedline` and `:` in the preamble of the array (of another letter specified by `letter-for-dotted-lines`) was incompatible with the key `xdots/line-style`.

Changes between versions 6.2 and 6.3

Keys `nb-rows`, `rowcolor` and `bold` for the command `\RowStyle`

Key `name` for the command `\Block`.

Support for the columns `V` of `varwidth`.

Changes between versions 6.1 and 6.2

Better compatibility with the classes `revtex4-1` and `revtex4-2`.

Key `vlines-in-sub-matrix`.

Changes between versions 6.0 and 6.1

Better computation of the widths of the `X` columns.

Key `\color` for the command `\RowStyle`.

Changes between versions 5.19 and 6.0

Columns `X` and environment `{NiceTabularX}`.

Command `\rowlistcolors` available in the `\CodeBefore`.

In columns with fixed width, the blocks are composed as paragraphs (wrapping of the lines).

The key `define-L-C-R` has been deleted.

Changes between versions 5.18 and 5.19

New key `tikz` for the command `\Block`.

Changes between versions 5.17 and 5.18

New command `\RowStyle`

Changes between versions 5.16 and 5.17

The key `define-L-C-R` (only available at load-time) now raises a (non fatal) error.

Keys `L`, `C` and `R` for the command `\Block`.

Key `hvlines-except-borders`.

It's now possible to use a key `l`, `r` or `c` with the command `\pAutoNiceMatrix` (and the similar ones).

Changes between versions 5.15 and 5.16

It's now possible to use the cells corresponding to the contents of the nodes (of the form `i-j`) in the `\CodeBefore` when the key `create-cell-nodes` of that `\CodeBefore` is used. The medium and the large nodes are also available if the corresponding keys are used.

Changes between versions 5.14 and 5.15

Key `hvlines` for the command `\Block`.

The commands provided by `nicematrix` to color cells, rows and columns don't color the cells which are in the "corners" (when the key `corner` is used).

It's now possible to specify delimiters for submatrices in the preamble of an environment.

The version 5.15b is compatible with the version 3.0+ of `siunitx` (previous versions were not).

Changes between versions 5.13 and 5.14

Nodes of the form `(1.5)`, `(2.5)`, `(3.5)`, etc.

Keys `t` and `b` for the command `\Block`.

Key `corners`.

Changes between versions 5.12 and 5.13

New command `\arraycolor` in the `\CodeBefore` (with its key `except-corners`).

New key `borders` for the command `\Block`.

New command `\Hline` (for horizontal rules not drawn in the blocks).

The keys `vlines` and `hlines` takes in as value a (comma-separated) list of numbers (for the rules to draw).

Changes between versions 5.11 and 5.12

Keywords `\CodeBefore` and `\Body` (alternative syntax to the key `code-before`).

New key `delimiters/max-width`.

New keys `hlines`, `vlines` and `hvlines` for the command `\SubMatrix` in the `\CodeAfter`.

New key `rounded-corners` for the command `\Block`.

Changes between versions 5.10 and 5.11

It's now possible, in the `code-before` and in the `\CodeAfter`, to use the syntax `|(i-|j)` for the Tikz node at the intersection of the (potential) horizontal rule number i and the (potential) vertical rule number j .

Changes between versions 5.9 and 5.10

New command `\SubMatrix` available in the `\CodeAfter`.

It's possible to provide options (between brackets) to the keyword `\CodeAfter`.

Changes between versions 5.8 and 5.9

Correction of a bug: in the previous versions, it was not possible to use the key `line-style` for the continuous dotted lines when the Tikz library `babel` was loaded.

New key `cell-space-limits`.

Changes between versions 5.7 and 5.8

Keys `cols` and `restart` of the command `\rowcolors` in the `code-before`.

Modification of the behaviour of `\` in the columns of type `p`, `m` or `b` (for a behaviour similar to the environments of `array`).

Better error messages for the command `\Block`.

Changes between versions 5.6 and 5.7

New key `delimiters-color`

Keys `fill`, `draw` and `line-width` for the command `\Block`.

Changes between versions 5.5 and 5.6

Different behaviour for the mono-row blocks.

New command `\NotEmpty`.

Changes between versions 5.4 and 5.5

The user must never put `\omit` before `\CodeAfter`.

Correction of a bug: the tabular notes `\tabularnotes` were not composed when present in a block (except a mono-column block).

Changes between versions 5.3 and 5.4

Key `tabularnote`.

Different behaviour for the mono-column blocks.

Changes between versions 5.2 and 5.3

Keys `c`, `r` and `l` for the command `\Block`.

It's possible to use the key `draw-first` with `\Ddots` and `\Iddots` to specify which dotted line will be drawn first (the other lines will be drawn parallel to that one if parallelization is activated).

Changes between versions 5.1 and 5.2

The vertical rules specified by `|` or `||` in the preamble respect the blocks.

Key `respect-blocks` for `\rowcolors` (with a *s*) in the `code-before`.

The variable `\g_nicematrix_code_before_tl` is now public.

The key `baseline` may take in as value an expression of the form *line-i* to align the `\hline` in the row *i*.

The key `hvlines-except-corners` may take in as value a list of corners (eg: NW,SE).

Changes between versions 5.0 and 5.1

The vertical rules specified by `|` in the preamble are not broken by `\hline\hline` (and other).

Environment `{NiceTabular*}`

Command `\Vdotsfor` similar to `\Hdotsfor`

The variable `\g_nicematrix_code_after_tl` is now public.

Changes between versions 4.4 and 5.0

Use of the standard column types `l`, `c` and `r` instead of `L`, `C` and `R`.

It's now possible to use the command `\diagbox` in a `\Block`.

Command `\tabularnote`

Changes between versions 4.3 and 4.4

New key `hvlines-except-corners` (now deprecated).

Changes between versions 4.2 and 4.3

The horizontal centering of the content of a `\Block` is correct even when an instruction such as `!\qqquad` is used in the preamble of the array.

It's now possible to use the command `\Block` in the “last row”.

Changes between versions 4.1 and 4.2

It's now possible to write `\begin{pNiceMatrix}a&b\\c&d\end{pNiceMatrix}`² with the expected result.

Changes between versions 4.0 and 4.1

New keys `cell-space-top-limit` and `cell-space-bottom-limit`

New command `\diagbox`

The key `hvlone` don't draw rules in the blocks (commands `\Block`) and in the virtual blocks corresponding to the dotted lines.

Changes between versions 3.15 and 4.0

New environment `{NiceTabular}`

Commands to color cells, rows and columns with a perfect result in the PDF.

Changes between versions 3.14 and 3.15

It's possible to put labels on the dotted lines drawn by `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, `\Iddots`, `\Hdotsfor` and the command `\line` in the code-after with the tokens `_` and `^`.

The option `baseline` is now available in all the environments of `nicematrix`. Before, it was available only in `{NiceArray}`.

New keyword `\CodeAfter` (in the environments of `nicematrix`).

Changes between versions 3.13 and 3.14

Correction of a bug (question 60761504 on [stackoverflow](https://stackoverflow.com)).

Better error messages when the user uses `&` or `\\` when `light-syntax` is in force.

Changes between versions 3.12 and 3.13

The behaviour of the command `\rotate` is improved when used in the “last row”.

The option `dotted-lines-margin` has been renamed in `xdots/shorten` and the options `xdots/color` and `xdots/line-style` have been added for a complete customisation of the dotted lines.

In the environments without preamble (`{NiceMatrix}`, `{pNiceMatrix}`, etc.), it's possible to use the options `l` (=L) or `r` (=R) to specify the type of the columns.

The code of `nicematrix` no longer uses Tikz but only PGF. By default, Tikz is *not* loaded by `nicematrix`.

Changes between versions 3.11 and 3.12

Command `\rotate` in the cells of the array.

Options `vlines`, `hlines` and `hvlines`.

Option `baseline` pour `{NiceArray}` (not for the other environments).

The name of the Tikz nodes created by the command `\Block` has changed: when the command has been issued in the cell $i-j$, the name is $i-j$ -block and, if the creation of the “medium nodes” is required, a node $i-j$ -block-medium is created.

If the user tries to use more columns than allowed by its environment, an error is raised by `nicematrix` (instead of a low-level error).

The package must be loaded with the option `obsolete-environments` if we want to use the deprecated environments.

Changes between versions 3.10 and 3.11

Correction of a bug linked to `first-row` and `last-row`.

Changes between version 3.9 and 3.10

New option `light-syntax` (and `end-of-row`).

New option `dotted-lines-margin` for fine tuning of the dotted lines.

Changes between version 3.8 and 3.9

New commands `\NiceMatrixLastEnv` and `\OnlyMainNiceMatrix`.

New options `create-medium-nodes` and `create-large-nodes`.

Changes between version 3.7 and 3.8

New programmation for the command `\Block` when the block has only one row. With this programmation, the vertical rules drawn by the specifier “|” at the end of the block is actually drawn. In previous versions, they were not because the block of one row was constructed with `\multicolumn`. An error is raised when an obsolete environment is used.

Changes between version 3.6 and 3.7

The four “corners” of the matrix are correctly protected against the four codes: `code-for-first-col`, `code-for-last-col`, `code-for-first-row` and `code-for-last-row`.

New command `\pAutoNiceMatrix` and its variants (suggestion of Christophe Bal).

Changes between version 3.5 and 3.6

LaTeX counters `iRow` and `jCol` available in the cells of the array.

Addition of `\normalbaselines` before the construction of the array: in environments like `{align}` of `amsmath` the value of `\baselineskip` is changed and if the options `first-row` and `last-row` were used in an environment of `nicematrix`, the position of the delimiters was wrong.

A warning is written in the `.log` file if an obsolete environment is used.

There is no longer artificial errors `Duplicate-name` in the environments of `amsmath`.

Changes between version 3.4 and 3.5

Correction on a bug on the two previous versions where the `code-after` was not executed.

Changes between version 3.3 and 3.4

Following a discussion on TeX StackExchange⁷⁵, optimization of Tikz externalization is disabled in the environments of `nicematrix` when the class `standalone` or the package `standalone` is used.

Changes between version 3.2 and 3.3

The options `first-row`, `last-row`, `first-col` and `last-col` are now available in the environments `{NiceMatrix}`, `{pNiceMatrix}`, `{bNiceMatrix}`, etc.

The option `columns-width=auto` doesn't need any more a second compilation.

Changes between version 3.1 and 3.2 (and 3.2a)

Option `small`.

Changes between version 3.0 and 3.1

Command `\Block` to draw block matrices.

Error message when the user gives an incorrect value for `last-row`.

The vertical rules in the matrices (drawn by “|”) are now compatible with the color fixed by `colortbl`.

Correction of a bug: it was not possible to use the colon “:” in the preamble of an array when `pdflatex` was used with `french-babel` (because `french-babel` activates the colon in the beginning of the document).

Changes between version 2.3 and 3.0

Modification of `\Hdotsfor`. Now `\Hdotsfor` erases the `\vlines` (of “|”) as `\hdotsfor` does.

Composition of exterior rows and columns on the four sides of the matrix (and not only on two sides) with the options `first-row`, `last-row`, `first-col` and `last-col`.

⁷⁵cf. tex.stackexchange.com/questions/510841/nicematrix-and-tikz-external-optimize

Changes between version 2.2.1 and 2.3

Compatibility with the column type `S` of `siunitx`.
Option `hlines`.

Changes between version 2.2 and 2.2.1

Improvement of the vertical dotted lines drawn by the specifier “:” in the preamble.
Modification of the position of the dotted lines drawn by `\hdottedline`.

Changes between version 2.1.5 and 2.2

Possibility to draw horizontal dotted lines to separate rows with the command `\hdottedline` (similar to the classical command `\hline` and the command `\hdashline` of `arydshln`).
Possibility to draw vertical dotted lines to separate columns with the specifier “:” in the preamble (similar to the classical specifier “|” and the specifier “:” of `arydshln`).

Changes between version 2.1.4 and 2.1.5

Compatibility with the classes `revtex4-1` and `revtex4-2`.
Option `allow-duplicate-names`.

Changes between version 2.1.3 and 2.1.4

Replacement of some options `0 { }` in commands and environments defined with `xparse` by `! 0 { }` (because a recent version of `xparse` introduced the specifier `!` and modified the default behaviour of the last optional arguments).
See www.texdev.net/2018/04/21/xparse-optional-arguments-at-the-end

Changes between version 2.1.2 and 2.1.3

When searching the end of a dotted line from a command like `\Cdots` issued in the “main matrix” (not in the exterior column), the cells in the exterior column are considered as outside the matrix. That means that it’s possible to do the following matrix with only a `\Cdots` command (and a single `\Vdots`).

$$\begin{pmatrix} & C_j & \\ 0 & \vdots & 0 \\ & \ddots & \dots \\ 0 & & 0 \end{pmatrix} L_i$$

Changes between version 2.1 and 2.1.1

Small corrections: for example, the option `code-for-first-row` is now available in the command `\NiceMatrixOptions`.
Following a discussion on TeX StackExchange⁷⁶, Tikz externalization is now deactivated in the environments of the package `nicematrix`.⁷⁷

⁷⁶cf. tex.stackexchange.com/questions/450841/tikz-externalize-and-nicematrix-package

⁷⁷Before this version, there was an error when using `nicematrix` with Tikz externalization. In any case, it’s not possible to externalize the Tikz elements constructed by `nicematrix` because they use the options `overlay` and `remember picture`.

Changes between version 2.0 and 2.1

New implementation of the environment `{pNiceArrayRC}`. With this new implementation, there is no restriction on the width of the columns.

The package `nicematrix` no longer loads `mathtools` but only `amsmath`.

Creation of “medium nodes” and “large nodes”.

Changes between version 1.4 and 2.0

The versions 1.0 to 1.4 of `nicematrix` were focused on the continuous dotted lines whereas the version 2.0 of `nicematrix` provides different features to improve the typesetting of mathematical matrices.

Changes between version 1.3 and 1.4

The column types `w` and `W` can now be used in the environments `{NiceArray}`, `{pNiceArrayC}` and its variants with the same meaning as in the package `array`.

New option `columns-width` to fix the same width for all the columns of the array.

Changes between version 1.2 and 1.3

New environment `{pNiceArrayC}` and its variants.

Correction of a bug in the definition of `{BNiceMatrix}`, `{vNiceMatrix}` and `{VNiceMatrix}` (in fact, it was a typo).

Options are now available locally in `{pNiceMatrix}` and its variants.

The names of the options are changed. The old names were names in “camel style”.

Changes between versions 1.1 and 1.2

New environment `{NiceArray}` with column types `L`, `C` and `R`.

Changes between versions 1.0 and 1.1

The dotted lines are no longer drawn with Tikz nodes but with Tikz circles (for efficiency).

Modification of the code which is now twice faster.

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