simples-matrices user guide*

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Abstract

A package to write matrices which are defined with a list of comma separated coefficients read by row.
A macro enables the definition of a named matrix, another enables the writing of a named matrix. This package provides also some shortcuts for identity matrices and null matrices.
The name of this package and of its macros are French based for there are already too many macros using the word "matrix" itself. The French "simples matrices" means "simple matrices". *Just a letter apart!*

Résumé

Une extension pour écrire des matrices en donnant les coefficients par ligne sous la forme d'une liste de valeurs séparées par des virgules.
Une macro permet de définir des matrices nommées et une autre permet d'écrire les matrices nommées. L'extension fournit également quelques raccourcis pour les matrices identité et les matrices nulles.
La documentation française pour l'utilisateur de l'extension simples-matrices est disponible sous le nom de `simples-matrices-fra`.

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In memory of my maternal grandmother Adrienne Binaut (1908-03-23 – 1997-06-08).

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The package simples-matrices requires xparse and l3keys2e used to define macros and manage key-options. It loads amsmath as well for ensuring a correct presentation of matrices.

Beware: you have to provide the suitable mathematical environment to use the macros which print a matrix. Only the unstarred version of \declarermatrice may be used outside math-mode.

1 The Macros

simples-matrices offers nine document macros.

In the main text (syntaxes and examples), the name of a macro of this package is printed in red if the macro produces some text in the document, otherwise it is printed in blue.

1.1 Main Macros

The six main document macros are the following:

\matrice `\matrice(⟨prefix⟩) < ⟨clist of key-value pairs⟩ > [⟨type⟩]{⟨clist of coefficients⟩}`

where ⟨*prefix*⟩ has the same meaning as the key **prefix** (see page 4); ⟨*clist of key-value pairs*⟩ —optional and void by default— can be used to redefined the matrix-like environment; ⟨*type*⟩ is a string of character the usage of which is explained later —see 3.1.2— and ⟨*clist of coefficients*⟩ is a clist of the coefficients of the matrix given by row order.

The French *matrice* means "matrix".

With `$\matrice{1, 2, 3, 4}$` we obtain $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$.

With `$\matrice(b)[3]{1, 2, 3, 4, 5, 6}$` we obtain $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$.

\declarermatrice `\declarermatrice(⟨prefix⟩) < ⟨clist of key-value pairs⟩ > {⟨matrix name⟩}[⟨type⟩]{⟨clist of coefficients⟩}`

\declarermatrice* `\declarermatrice*(⟨prefix⟩) < ⟨clist of key-value pairs⟩ > {⟨matrix name⟩}[⟨type⟩]{⟨clist of coefficients⟩}`

where ⟨*matrix name*⟩ is the name of the matrix to be used afterwards. The other arguments, optional or mandatory, have the same meaning than above. The starred version defines and prints the matrix. The unstarred version only defines it.

The definition is global but one can redefine an existing named matrix with the same function. **No check is done** to ensure that one is not redefining a previously defined matrix.

With the macro \declarermatrice, the first two optional arguments have no effect for they are not take into account to define the matrix (see example on page 5).

The French *déclarer une matrice* means "declare a matrix".

\lamatrice `\lamatrice(⟨prefix⟩) < ⟨clist of key-value pairs⟩ > {⟨matrix name⟩}`

prints the previously defined matrix the name of which is given by ⟨*matrix name*⟩. The two optional arguments have the meaning as before (see example on page 5).

The French *la matrice* means "the matrix".

\MatriceInterieur `\MatriceInterieur`

gives the inner part of the last printed —via \matrice or \declarermatrice*— or defined —via \declarermatrice— matrix. It can be used inside an array-like environment (see example on page 7).

The French should be *intérieur de la matrice* which means "inside of the matrix". What is implicit is the adjective "anonymous". For named matrix see below.

\LaMatriceInterieur `\LaMatriceInterieur{⟨matrix name⟩}`

gives the inner part of the matrix with name ⟨*matrix name*⟩. It can be used inside an array-like environment (see example on page 7).

Again false French but the parallel with \lamatrice should suggest that, now, the matrix has a name and we have to use it.

1.2 Setting the Keys

One can change the values of the keys of simples-matrices with

\simplesmatricessetup `\simplesmatricessetup{⟨clist of key-value pairs⟩}`

where ⟨*clist of key-value pairs*⟩ is the usual clist of key-value pairs setting one or many of the three keys of the package as presented on page 4.

To stick to established convention the name of this macro is created from the name of the package (reduced to TEX letters) followed by *setup*. I apologize for that strange linguistic mixture.

1.3 Shortcuts

There are also two *shortcut* macros:

\matid `\matid(⟨prefix⟩) < ⟨clist of key-value pairs⟩ > [⟨coefficient⟩]{⟨number of columns⟩}`

which write the identity matrix — by default — with ⟨*number of columns*⟩ columns. If ⟨*coefficient*⟩ is given, we obtain a diagonal matrix with all its coefficients equal to ⟨*coefficient*⟩.

The two first optional arguments have the same functionality as in the preceding macros.

matid stands for *matrice identité* which means "identity matrix".

\matnulle `\matnulle(⟨prefix⟩) < ⟨clist of key-value pairs⟩ > [⟨coefficient⟩]{⟨number of columns⟩}`

writes the null matrix with ⟨*number of columns*⟩ columns —by default— or a matrix containing with ⟨*number of columns*⟩ columns and all coefficients equal to ⟨*coefficient*⟩.

The two first optional arguments have the same functionality as in the preceding macros.

matnulle stands for *matrice nulle* which means "null matrix".

```
1 $\matid{3}$\qquad $\matid[9]{3}$
2 \par \medskip
3 $\matnulle{3}$\qquad $\matnulle[2]{3}$
```

$$\begin{pmatrix}1&0&0\\0&1&0\\0&0&1\end{pmatrix} \qquad \begin{pmatrix}9&0&0\\0&9&0\\0&0&9\end{pmatrix}$$

$$\begin{pmatrix}0&0&0\\0&0&0\\0&0&0\end{pmatrix} \qquad \begin{pmatrix}2&2&2\\2&2&2\\2&2&2\end{pmatrix}$$

2 The Package Options

The package uses key-value options. There are four keys: **envir**, **prefix**, **typeord** and **argopt**.

envir (***string***) the main and last part of the name of the environment used to print the matrix. Its initial value is `matrix`.

prefix (***string***) a string which is prefixed to `envir` to obtain the complete name of the environment. Its initial value is `p`. Therefore, by default, the environment used to print the matrix is `pmatrix` as defined by amsmath.

typeord (***string***) a string which is the ordinary —i. e. default— value of the ⟨*type*⟩ optional argument. The initial value of the key is `C`.

argopt (***token list***) for French *argument optionnel* (optional argument). That key is initially void. See page 8 for usage.

Moreover, an other key is available which is not an option of the package: **out-of-box** which is a metakey.

With `\simplesmatricessetup{out-of-box}` we obtain the same effect as with `\simplesmatricessetup{prefix=p, envir=matrix, argopt=, typeord=C}`.

3 Examples

3.1 Without any special package

That is with only amsmath loaded as done by this package.

3.1.1 Declaration and Usage

```
\declarermatrice{A}{1, 2, 300, 400}
$\declarermatrice*{B}{a, b, c, d}$
\quad $\lamatrice{A}$ \par \bigskip
$\lamatrice(V){A}$
\quad $\lamatrice(b){B}$
```

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \quad \begin{pmatrix} 1 & 2 \\ 300 & 400 \end{pmatrix}$$

$$\left\|\begin{matrix} 1 & 2 \\ 300 & 400 \end{matrix}\right\| \quad \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

On the first line of this example, the matrix `A` is defined but not printed. Then, on the second line, the matrix `B` is defined and printed. We can afterwards call the `A` or `B`-matrix with `\lamatrice`.

3.1.2 The "type" argument

The last but one — optional — argument of macros `\matrice`, `\declarermatrice` and `\declarermatrice*` defaults to `O`. In that case the value of the key `typeord` is used to determine the *type* of the matrix input, see 6.

Its value can be a number, in which case it is the number of columns, or a string —presently a one letter string— among: `C`, `D`, `I`, `J`, `S`, `T` and `x`.

`C` means square matrix for French "Carré" means "square".

```
\[
 \matrice{1, 2, 3, 4, 5, 6, 7, 8, 9}
 \quad
 \matrice[C]{1, 2, 3, 4, 5, 6, 7, 8, 9}
\]
```

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

`D` means **diagonal** matrix.

```
\[
 \matrice{1, 2, 3, 4}\quad
 \matrice[D]{1, 2, 3, 4}
\]
```

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 4 \end{pmatrix}$$

`I` means lower triangular matrix. French "Inférieur" means "lower"; `J` means lower triangular matrix with zeros on the diagonal.

```
\[
 \matrice[I]{1, 2, 3}\quad
 \matrice[J]{1, 2, 3}
\]
```

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

`S` means upper triangular matrix. French "Supérieur" means "upper"; `T` means upper triangular matrix with zeros on the diagonal.

```
\[
 \matrice[S]{1, 2, 3}\quad
 \matrice[T]{1, 2, 3}
\]
```

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

`x` means `xcas`[1]. With that value, one can copy-paste from `xcas` into the LaTeX document.

```
\[
 \matrice[x]{[[7,1,3],[1,0,3],[5,1,2]]}
\]
```

$$\begin{pmatrix} 7 & 1 & 3 \\ 1 & 0 & 3 \\ 5 & 1 & 2 \end{pmatrix}$$

A number sets up the number of columns of the matrix.

```
\[
 \matrice[2]{1, 2, 3, 4, 5, 6}
 \quad
 \matrice[3]{1, 2, 3, 4, 5, 6}
\]
```

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

3.1.3 Using the "typeord" Key

In this document, the key `typeord` has the initial value of `C`.

```
\simplesmatricessetup{typeord=3}
$\matrice{1, 2, 3, 4, 5, 6}$\quad
\simplesmatricessetup{typeord=2}
$\matrice{1, 2, 3, 4, 5, 6}$\quad
\simplesmatricessetup{typeord=C}
$\matrice{1, 2, 3, 4}$
```

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

The preceding code is but a mere illustration. In order to declare a type for one matrix it's more convenient to use the optional argument. However if one wants to write a lesson about upper triangular matrices...

[1] Free computer algebra system, see here: https://www-fourier.univ-grenoble-alpes.fr/~parisse/giac.html.

3.1.4 Using the \(La)MatriceInterieur Macros

```
1  \declarermatrice{B}[4]{
2   \hline ein, zwei, drei, vier,
3   \hline unos, dos, tres, cuatro,
4   \hline unu, du, tri, kvar}%
5  \declarermatrice{A}[3]{
6   one, two, three,
7   un, deux, trois,
8   uno, due, tre}%
9  \begin{tabular}{*{3}{l}}
10   \MatriceInterieur
11 \end{tabular}
12 \par \bigskip *** \par \bigskip
13 \begin{tabular}{*{3}{l}}
14   \LaMatriceInterieur{A}
15 \end{tabular}
16 \par \bigskip
17 \begin{tabular}{|*{4}{l|}}
18   \LaMatriceInterieur{B}\hline
19 \end{tabular}
```

one	two	three
un	deux	trois
uno	due	tre

***

one	two	three
un	deux	trois
uno	due	tre

ein	zwei	drei	vier
unos	dos	tres	cuatro
unu	du	tri	kvar

On lines 10 and 14 we use the same *internal* because the A-matrix is the last defined before line 10.

3.2 Changing the Look

We can load other packages which deal with matrices such as mathtools, delarray or nicematrix. In that case we can change the look of our matrices thanks to the option-key **envir**, **prefix** and **argopt**.

This document loads the three packages mathtools, delarray and nicematrix in order to give the following examples.

3.2.1 With mathtools

As already stated above there are two ways to use the option-keys: through **\simplesmatricessetup** or through the optional argument < ⟨*clist of pairs of key-value*⟩ > . I show both.

```
1 \simplesmatricessetup{
2   envir=matrix*, prefix=p, argopt=[r]}
3 $\matrice{1, 2, 30, 40}$ \quad
4 \simplesmatricessetup{out-of-box}
5 $\matrice{1, 2, 30, 40}$
6 \par \medskip
7 $\matrice(b)<envir=matrix*,argopt=[l]>
    {1, 2, 30, 40}$
```

$$\begin{pmatrix} 1 & 2 \\ 30 & 40 \end{pmatrix} \quad \begin{pmatrix} 1 & 2 \\ 30 & 40 \end{pmatrix}$$

$$\begin{bmatrix} 1 & 2 \\ 30 & 40 \end{bmatrix}$$

3.2.2 With delarray

```
\simplesmatricessetup{
  envir=array, prefix=,
  argopt=[c][{l r}\}}
$\matrice{1, 2, 30, 40}$ \quad
$\matid()<envir=array,
  argopt={[c][{@{}c c c@{}}\}}>{3}$
```

$$\left[\begin{array}{cc} 1 & 2 \\ 30 & 40 \end{array}\right\} \quad \left[\begin{array}{ccc} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{array}\right\}$$

3.2.3 With nicematrix

```
$\matrice<prefix=b, envir=NiceArray,
argopt={ {cc||rl} }>{1, 2, 3, 4, 5, 6,
  7, 8, 9, 10, 11, 12, 13, 14, 15, 16}$
```

$$\left[\begin{array}{cc||rl} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{array}\right]$$

In that case we need to double the curly braces around the column descriptors of the array environment because the first level is stripped off by LaTeX when valuating the key.

In the following example, for the second matrix, it is not necessary to surround the value of argopt with an extra pair of curly braces (see line 6) —even if it is not dangerous (see line 10)— for the presence of [margin] prevents LaTeX to strip off the curly braces.

```
1  $\matrice<prefix=b, envir=NiceArray,
2  argopt={{l c r}}>{1, 2, 3, 40, 50, 60,
3    700, 800, 900}$
4  \par \medskip
5  $\matrice<prefix=b, envir=NiceArray,
6  argopt={l c r}[margin]>{1, 2, 3,
7    40, 50, 60, 700, 800, 900}$
8  \par \medskip
9  $\matrice<prefix=b, envir=NiceArray,
10 argopt={{l c r}[margin]}>{1, 2, 3,
11   40, 50, 60, 700, 800, 900}$
```

$$\left[\begin{array}{lll} 1 & 2 & 3 \\ 40 & 50 & 60 \\ 700 & 800 & 900 \end{array}\right]$$

$$\left[\begin{array}{lll} 1 & 2 & 3 \\ 40 & 50 & 60 \\ 700 & 800 & 900 \end{array}\right]$$

$$\left[\begin{array}{lll} 1 & 2 & 3 \\ 40 & 50 & 60 \\ 700 & 800 & 900 \end{array}\right]$$

4 Thanks

Many thanks to Denis Bitouzé for his remarks about the initial state of this documentation. Thanks to him, some colours have appeared on these pages.

Le TeXnicien de Surface scripsit.
