Latex

Editing for Mathematics

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10 06, 2017

Contents

1 Greek letters

Here a list of some of the most used Greek letters in Economics:

description	latex	result
alpha	`\alpha`	α
beta	`\beta`	β
gamma	`\gamma`	γ
theta	`\theta`	θ
sigma	`\sigma`	σ
rho	`\rho`	ρ

description	latex	result
lambda	`\lambda`	λ
phi	`\phi`	ϕ
psi	`\psi`	ψ
epsilon	`\epsilon`	ϵ

For the corresponding capital letter, we just write in the same way but with initial capital letter.

Example

description	latex	result
Gamma	`\Gamma`	Γ
Lambda	`\Lambda`	Λ
Sigma	`\Sigma`	Σ
Psi	`\Psi`	Ψ
Delta	`\Delta`	Δ
Xi	`\Xi`	Ξ
Upsilon	`\Upsilon`	Υ
Omega	`\Omega`	Ω
Theta	`\Theta`	Θ
Pi	`\Pi`	Π
Phi	`\Phi`	Φ

2 Parenthesis

We can write parenthesis and brackets just giving the input on the keyboard () or []. This does not work for braces.

Another way is to write parenthesis with the following notation:

LaTeX CODE

```
$$
\left(
\right) \\
\left[
\right]
$$
```

RESULT

$$\left(\right) \\ \left[\right]$$

that is writing `\left` *before opening the parenthesis* and `\right` *before closing the parenthesis.*

In case of braces, we should use the following notation:

LaTeX CODE

```
$$
\left\{
\right\}
$$
```

RESULT

$$\{\}$$

Note the difference with brackets that are written `\left\` and `\right\`.

Example:

LaTeX CODE

```
$$
10 \cdot
  \left\{
    5 + \left[
      3 + 2 \cdot
         \left(
            9-1\right)
        \right]
  \right\}
$$
```

RESULT

$$10 \cdot \{5 + [3 + 2 \cdot (9 - 1)]\}$$

The opportunity to write the full notation for parenthesis and brackets will be clear when dealing whit fractions.

3 Fractions

To write fractions the inputs to give are `\frac` and then *numerator and denominator written between two braces*. With an example will be clear.

Example:

LaTeX CODE

```
$$
\frac{5}{2}
$$
```

RESULT

$$\frac{5}{2}$$

Example:

LaTeX CODE

```
$$
\frac{\alpha}{1-\alpha} = \phi
$$
```

RESULT

$$\frac{\alpha}{1-\alpha} = \phi$$

4 Paranthesis & Fraction

If we write a fraction in parenthesis with the shortcut

LaTeX CODE

```
$$
( \frac{5}{2})
$$
```

RESULT

$$(\frac{5}{2})$$

the parenthesis do not fit the fraction.

If we write with full notation

LaTeX CODE

```
$$
\left(
\frac{5}{2}
\right)
$$
```

RESULT

$$\left(\frac{5}{2}\right)$$

we will have an appropriate result.

Example:

LaTeX CODE

```
$$
\frac{Y}{L} =
\left(
\frac{K}{L}, 1
\right)
$$
```

RESULT

$$\frac{Y}{L} = \left(\frac{K}{L}, 1\right)$$

5 Exponential

To write the exponential we use the symbol ^

LaTeX CODE

```
$$
2^5
$$
```

RESULT

$$2^5$$

In case of operation in the exponential, we need to *use braces after* ^

Example:

LaTeX CODE

```
$$
F(K, L) =
K^\alpha L^\beta
$$
```

RESULT

$$F(K, L) = K^\alpha L^\beta$$

Example:

LaTeX CODE

```
$$
F(K, L) =
\left[
\gamma K^\frac{\sigma - 1}{\sigma}
 + (1 - \gamma)L^\frac{\sigma - 1}{\sigma}
\right]^\frac{\sigma}{\sigma - 1}
$$
```

RESULT

$$F(K, L) = \left[\gamma K^{\frac{\sigma-1}{\sigma}} + (1-\gamma)L^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

6 Subscript

To write subscript use the symbol _

LaTeX CODE

```
$$
t_0
$$
```

RESULT

$$t_0$$

We use *braces in case of operation in subscript*

Example

LaTeX CODE

```
$$
y_ty_{t-j}
$$
```

RESULT

$$y_t y_{t-j}$$

7 Derivative

Example:

LaTeX CODE

```
$$
\frac{dk}{k}
$$
```

RESULT

$$\frac{dk}{k}$$

To write partial differentiation, write `\partial` in the fraction notation

Example:

LaTeX CODE

```
$$
\frac{
\partial F}{
\partial K}
r + \delta
$$
```

RESULT

$$\frac{\partial F}{\partial K} r + \delta$$

8 Summation

The code to write summation is the following: symbol of `\sum_` followed by *braces with lower bound of summation* and `^` *before the brace with the upper bound of summation.*

Example:

LaTeX CODE

```
$$
\sum_{t_0}^{\infty}
$$
```

RESULT

$$\sum_{t_0}^{\infty}$$

An example summing up what we saw until now:

LaTeX CODE

```
$$
\mathcal L =
\sum_{t=0}^{\infty}
\left(
\frac {1}{1 + \rho}
\right)^{t} u(c_t)
\frac{L_t}{H}
 + \lambda
\left[
S_0 + \sum_{t=0}^{\infty}
R_t^{-1}w_t
\left(
\frac{L_t}{H}
```

```
\right)
- \sum_{t=0}^{\infty} R_t^{-1}c_t
\left(
\frac{L_t}{H}
\right)
\right]
$$
```

RESULT

$$\mathcal{L} = \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho} \right)^t u(c_t) \frac{L_t}{H} + \lambda \left[S_0 + \sum_{t=0}^{\infty} R_t^{-1} w_t \left(\frac{L_t}{H} \right) - \sum_{t=0}^{\infty} R_t^{-1} c_t \left(\frac{L_t}{H} \right) \right]$$

9 Limit

The code for limit is written as follows:

LaTeX CODE

```
$$
\lim_{t\to\infty}
$$
```

RESULT

$$\lim_{t \to \infty}$$

Example:

LaTeX CODE

```
$$
\lim_
{t\to\infty}
R_t^{-1}S_t = 0
$$
```

RESULT

$$\lim_{t \to \infty} R_t^{-1} S_t = 0$$

Example

LaTeX CODE

```
$$
e^{
lim_{\gamma\to0}
\frac{1}{\gamma}ln
\left[
\alpha K^\gamma + (1 - \alpha)L^\gamma
\right]}
$$
```

RESULT

$$e^{lim_{\gamma \to 0} \frac{1}{\gamma} ln[\alpha K^\gamma + (1-\alpha) L^\gamma]}$$

10 Integrals

LaTeX CODE

```
$$
\int_0^\infty
$$
```

RESULT

$$\int_0^\infty$$

Example

```
$$
\int_0^\infty
  \left[
    r(t)e^{-R(t)}S(t)
    + e^{-R(t)} w(t)
    \frac{L(t)}{H}
    -e^{-R(t)}c(t)
    \frac{L(t)}{H}
  \right]
  dt
$$
```

$$\int_0^\infty \left[r(t)e^{-R(t)}S(t) + e^{-R(t)}w(t)\frac{L(t)}{H} - e^{-R(t)}c(t)\frac{L(t)}{H} \right] dt$$

11 Optimization problem

Following how we set an optimization problem:

LaTeX CODE

```
$$
\max_{x_{1}, x_{2}}
(x_{1}^{\alpha} + x_{2}^{\alpha})
^{\frac{1}{ \alpha}}
$$
```

RESULT

$$\max_{x_1,x_2}(x_1^{\alpha} + x_2^{\alpha})^{\frac{1}{\alpha}}$$

LaTeX CODE

```
$$
\text {subject to}
\quad p_{1}x_{1}+p_{2}x_{2} \leq I
$$
```

RESULT

$$\text{subject to} \quad p_1x_1 + p_2x_2 \leq I$$

LaTeX CODE

```
$$
\mathcal L
(x_1, x_2, \lambda) \equiv
$$
```

RESULT

$$\mathcal{L}(x_1, x_2, \lambda) \equiv$$

12 Matrix

The following example shows how to write a matrix.

Note that `\bmatrix` stands for *bracket matrix* while `\pmatrix` stands for *parenthesized matrix*. Other kinds of matrix are available.

Moreover, `\vdots` stands for *vertical dots* while `\ddots` for *diagonal dots*. `\cdots` stands for *central dots*, used also as multiplication sign.

LaTeX Code

```
$$
A =
\begin{bmatrix}
  a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\
  a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\
  \vdots & \vdots & \vdots & \vdots & \vdots\\
  a_{m1} & a_{m2} & a_{m3} & \dots & a_{mn} \\
\end{bmatrix}
\ne
B =
\begin{pmatrix}
 b_{11} & b_{12} & b_{13} & \cdots & b_{1n} \\
 b_{21} & \ddots & b_{23} & \cdots & b_{2n} \\
 ...&...&... & \ddots &... \\
 b_{m1} & b_{m2} & b_{m3} & \dots & b_{mn} \\
\end{pmatrix}
$$
```

RESULT

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \dots & a_{mn} \end{bmatrix} \neq B = \begin{pmatrix} b_{11} & b_{12} & b_{13} & \cdots & b_{1n} \\ b_{21} & \ddots & b_{23} & \cdots & b_{2n} \\ ... & ... & ... & \ddots & ... \\ b_{m1} & b_{m2} & b_{m3} & \dots & b_{mn} \end{pmatrix}$$

Another example with matrix

LaTeX Code

```
$$
PAQ=\left[
  \begin{array}{c|c}
    I_{d\times d} & O_{d\times(n-d)}\\
    \hline O_{(m-d)\times d} & O_{(m-d)\times(n-d)}
  \end{array}
```

```
\right]
$$
```

RESULT

$$PAQ = \left[\begin{array}{c|c} I_{d\times d} & O_{d\times(n-d)} \\ \hline O_{(m-d)\times d} & O_{(m-d)\times(n-d)} \end{array}\right]$$

13 Equalities and Inequalities

desription	latex	result
Equality or assignment	`=`	$=$
Inequality	`\neq`	$\neq$
Less than	`<`	$<$
Less than or equal to	`\leq`	$\leq$
Greater than	`>`	$>$
Greater than or equal to	`\geq`	$\geq$
Approximately equal to	`\simeq`	$\simeq$
Identical to	`\equiv`	$\equiv$

14 Subset and Functions

desription	latex	result
A is included in B	`A \subset B`	$A \subset B$
A includes B	`A \supset B`	$A \supset B$
A intersection B	`A \cap B`	$A \cap B$
A union B	`A \cup B`	$A \cup B$
x is in A	`x \in A`	$x \in A$
A contains x	`A \ni x`	$A \ni x$
x is not in A	`x \notin A`	$x \notin A$
for some x	`\exists x`	$\exists x$
for any x	`\forall x`	$\forall x$
tends to / maps into	`\to`	$\to$
gets	`\gets`	$\leftarrow$
A implies B	`A \implies B`	$A \implies B$

15 Mathematical fonts

desription	latex	result
Set of complex numbers	`\mathbb{C}`	$\mathbb{C}$
Set of rational numbert	`\mathbb{Q}`	$\mathbb{Q}$
Set of real numbers	`\mathbb{R}`	$\mathbb{R}$
Expected value of a random variable	`\mathbb{E}`	$\mathbb{E}$
Lagrangian	`\mathcal{L}`	$\mathcal{L}$
Hamiltonian	`\mathcal{H}`	$\mathcal{H}$

16 Others

LaTeX Code

```
$$
\mathrm{sgn}:S_{n}\to\{-1,1\}
$$
```

RESULT

$$\mathrm{sgn}:S_{n}\to\{-1,1\}$$

LaTeX Code

```
$$
  \mathrm{sgn}(\sigma)=\begin{cases}
  -1 & \mbox{if }\sigma\mbox{ is odd}\\
  +1 & \mbox{if }\sigma\mbox{ is even}.
  \end{cases}
$$
```

RESULT

$$\mathrm{sgn}(\sigma)=\begin{cases}
-1 & \mbox{if }\sigma\mbox{ is odd}\\
+1 & \mbox{if }\sigma\mbox{ is even}.
\end{cases}$$