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### Abstract

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*Keywords:* key1, key2, key3

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# 1 Introduction

## 1.1 About this document

This document provides a template based on the [quarto system](#) for contributions to **Computo** (Computo Team (2021)). We show how Python (Perez, Granger, and Hunter 2011) or R (R Core Team 2020) code can be included.

## 1.2 Advice for writing your manuscript

First make sure that you are able to build your manuscript as a regular notebook on your system.

# 2 Formatting

This section covers basic formatting guidelines. [Quarto](#) is a versatile formatting system for authoring HTML based on markdown, integrating LaTeX and various code block interpreted either via Jupyter or Knitr (and thus deal with Python, R and many other languages). It relies on the [Pandoc Markdown](#) markup language.

To render/compile a document, run `quarto render`. A document will be generated that includes both content as well as the output of any embedded code chunks within the document:

```
quarto render content.qmd # will render to html
```

## 2.1 Basic markdown formatting

**Bold text** or *italic*

- This is a list
- With more elements
- It isn't numbered.

But we can also do a numbered list

1. This is my first item
2. This is my second item
3. This is my third item

## 2.2 Mathematics

### 2.2.1 Mathematical formulae

[LaTeX](#) code is natively supported<sup>2</sup>, which makes it possible to use mathematical formulae:  
will render

$$f(x_1, \dots, x_n; \mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{1}{2\sigma^2} \sum_{i=1}^n (x_i - \mu)^2\right)$$

It is also possible to cross-reference an equation, see [Equation 1](#):

---

<sup>2</sup>We use [katex](#) for this purpose.

$$\begin{aligned}
 D_{x_N} &= \frac{1}{2} \begin{bmatrix} x_L^\top & x_N^\top \end{bmatrix} \begin{bmatrix} L_L & B \\ B^\top & L_N \end{bmatrix} \begin{bmatrix} x_L \\ x_N \end{bmatrix} \\
 &= \frac{1}{2} (x_L^\top L_L x_L + 2x_N^\top B^\top x_L + x_N^\top L_N x_N),
 \end{aligned} \tag{1}$$

### 2.2.2 Theorems and other amsthm-like environments

Quarto includes a nice support for theorems, with predefined prefix labels for theorems, lemmas, proposition, etc. see [this page](#). Here is a simple example:

**Theorem 2.1** (Strong law of large numbers). *The sample average converges almost surely to the expected value:*

$$\bar{X}_n \xrightarrow{a.s.} \mu \quad \text{when } n \rightarrow \infty.$$

See Theorem [2.1](#).

## 2.3 Code

Quarto uses either Jupyter or knitr to render code chunks. This can be triggered in the yaml header, e.g., for Jupyter (should be installed on your computer) use

```
---
title: "My Document"
author "Jane Doe"
jupyter: python3
---
```

For knitr (R + knitr must be installed on your computer)

```
---
title: "My Document"
author "Jane Doe"
---
```

You can use Jupyter for Python code and more. And R + Knitr for if you want to mix R with Python (via the package reticulate Ushey, Allaire, and Tang (2020)).

### 2.3.1 R

R code (R Core Team 2020) chunks may be embedded as follows:

```
x <- rnorm(10)
```

### 2.3.2 Python

```
---
title: "My Document"
author "Jane Doe"
jupyter: python3
---
```

```
import matplotlib.pyplot as plt
import numpy as np

fig, ax = plt.subplots()
ax.plot(np.arange(10))
```

## 2.4 Figures

Plots can be generated as follows:

```
library("ggplot2")
p <- ggplot(mpg, aes(displ, hwy)) +
  geom_point() +
  geom_smooth()
p
```



It is also possible to create figures from static images:



Figure 1: SFdS logo (c.a. 2021)

## 2.5 Tables

Tables (with label: @tbl-mylabel renders Table 1) can be generated with markdown as follows

Table 1: my table caption

Tables	Are	Cool
col 1 is	left-aligned	\$1600
col 2 is	centered	\$12
col 3 is	right-aligned	\$1

Table can also be generated by some code, for instance with knitr here:

```
knitr::kable(summary(cars), caption = "Table caption.")
```

Table 2: Table caption.

speed	dist
Min. : 4.0	Min. : 2.00
1st Qu.:12.0	1st Qu.: 26.00
Median :15.0	Median : 36.00
Mean :15.4	Mean : 42.98
3rd Qu.:19.0	3rd Qu.: 56.00
Max. :25.0	Max. :120.00

## 2.6 Handling references

### 2.6.1 Bibliographic references

References are displayed as footnotes using [BibTeX](#), e.g. [ @computo ] will be displayed as (Computo Team 2021), where `computo` is the bibtex key for this specific entry. The bibliographic information is automatically retrieved from the `.bib` file specified in the header of this document (here: `references.bib`).

### 2.6.2 Other cross-references

As already (partially) seen, Quarto includes a mechanism similar to the bibliographic references for sections, equations, theorems, figures, lists, etc. Have a look at [this page](#).

 For more information

[Check our mock version of the t-SNE paper](#) for a full and advanced example using the Jupyter kernel.

[The template available in the Computo Quarto extension](#) uses advanced features and the KnitR kernel (interactive plots and pseudocode).

## References

- Computo Team. 2021. “Computo: Reproducible Computational/Algorithmic Contributions in Statistics and Machine Learning.” *Computo*.
- Perez, Fernando, Brian E Granger, and John D Hunter. 2011. “Python: An Ecosystem for Scientific Computing.” *Computing in Science & Engineering* 13 (2): 13–21.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.  
Ushey, Kevin, JJ Allaire, and Yuan Tang. 2020. *Reticulate: Interface to Python*. <https://github.com/rstudio/reticulate>.

## Session information

```
sessionInfo()
```

```
R version 4.2.3 (2023-03-15)
Platform: x86_64-conda-linux-gnu (64-bit)
Running under: Ubuntu 22.04.2 LTS

Matrix products: default
BLAS/LAPACK: /home/runner/micromamba-root/envs/computorbuild/lib/libopenblaspr0.3.23.so

locale:
 [1] LC_CTYPE=C.UTF-8      LC_NUMERIC=C           LC_TIME=C.UTF-8
 [4] LC_COLLATE=C.UTF-8    LC_MONETARY=C.UTF-8    LC_MESSAGES=C.UTF-8
 [7] LC_PAPER=C.UTF-8      LC_NAME=C              LC_ADDRESS=C
[10] LC_TELEPHONE=C        LC_MEASUREMENT=C.UTF-8 LC_IDENTIFICATION=C

attached base packages:
[1] stats      graphics  grDevices  utils      datasets  methods   base

other attached packages:
[1] ggplot2_3.4.2

loaded via a namespace (and not attached):
 [1] Rcpp_1.0.10      compiler_4.2.3    pillar_1.9.0      tools_4.2.3
 [5] digest_0.6.31    nlme_3.1-162      jsonlite_1.8.5    evaluate_0.21
 [9] lifecycle_1.0.3  tibble_3.2.1      gtable_0.3.3      lattice_0.21-8
[13] mgcv_1.8-42      pkgconfig_2.0.3   png_0.1-8         rlang_1.1.1
[17] Matrix_1.5-4.1   cli_3.6.1         rstudioapi_0.14   yaml_2.3.7
[21] xfun_0.39        fastmap_1.1.1     withr_2.5.0       dplyr_1.1.2
[25] knitr_1.43       generics_0.1.3    vctrs_0.6.2       grid_4.2.3
[29] tidyselect_1.2.0 reticulate_1.26    glue_1.6.2        R6_2.5.1
[33] fansi_1.0.4      rmarkdown_2.22    farver_2.1.1      magrittr_2.0.3
[37] splines_4.2.3    scales_1.2.1      htmltools_0.5.5   colorspace_2.1-0
[41] labeling_0.4.2   utf8_1.2.3        munsell_0.5.0
```