

STATS 531 project report format

1 Abstract

This is the abstract. It should briefly describe the context of the report and highlight the findings of highest interest to the target readers (other students in the class, the GSI, and the instructor).

2 About this document

This document provides a template based on the [quarto system](#) for STATS 531, building on a template document by [Shao-Ting Chiu](#). We show how [Python](#) (Perez, Granger, and Hunter 2011) or [R](#) (R Core Team 2020) code can be included.

3 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 langages). 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 template.qmd # will render to pdf
```

3.1 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

3.2 Mathematics

3.2.1 Mathematical formulae

LaTeX code is natively supported, which makes it possible to use mathematical formulae:

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

It is also possible to cross-reference an equation, see Equation 1 and Equation 2 for examples.

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

Numbering and cross-referencing makes your report easier to read and easier to peer review. That is a consideration for good scholarship

3.3 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)).

3.3.1 R

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

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

3.3.2 Python

3.4 Figures

Plots can be generated as follows and referenced. See plot Figure 1:

BROKEN. NEED A SAMPLE PLOT HERE

It is also possible to create figures from static images:



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

3.5 Tables

3.5.1 Markdown syntax

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

DEMONSTRATE IN-TEXT PYTHON REFERENCES

```
| Tables | Are | Cool |
|-----|:-----:|-----:|
| col 1 is | left-aligned | $1600 |
| col 2 is | centered | $12 |
| col 3 is | right-aligned | $1 |
: my table caption {#tbl-mylabel}
```

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

3.5.2 List-table filter

We also integrate the `list tables` filter from Pandoc, so that you may alternatively use this format , easier to write and maintain:

```
:::list-table
* - row 1, column 1
  - row 1, column 2
  - row 1, column 3
```

```

* - row 2, column 1
-
- row 2, column 3

* - row 3, column 1
- row 3, column 2
:::

• - row 1, column 1
- row 1, column 2
- row 1, column 3
• - row 2, column 1
-
- row 2, column 3
• - row 3, column 1
- row 3, column 2

```

3.5.3 Table generated from code

DEMONSTRATE THIS IN PYTHON

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

3.6 Diagrams

In addition of [quarto supported diagrams](#), we also support `tikz` diagrams. The following example¹ is rendered as follows.

For learning TiKZ, I recommend this website: [Tikz examples](#).

A simple example of a commutative diagram with `tikz`.

¹This is the new syntax for cross-references since quarto 1.4, see [Crossreferenceable elements](#)

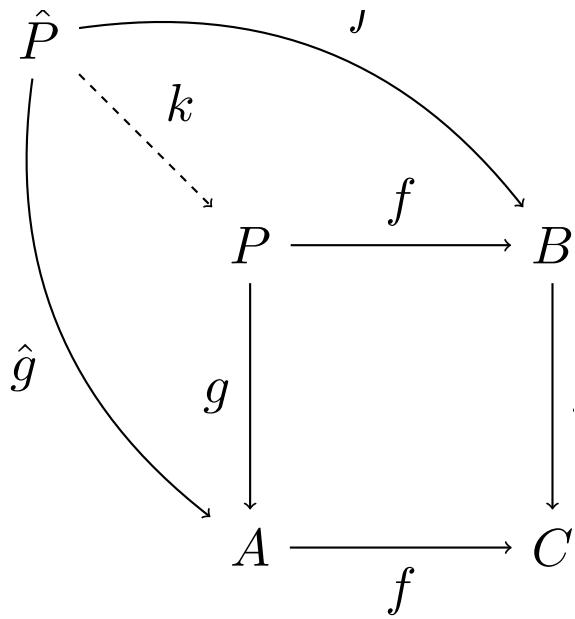


Figure 2

You may refer to it as Figure 2.

3.7 Handling references

3.7.1 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`).

3.7.2 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](#).

Bibliography

- 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>.