

STATS 531 project report format

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). Usually, the abstract is 150-300 words.

1 Introduction

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

2 Methods

2.1 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
```

2.2 Basic markdown

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

2.3 Mathematics

2.3.1 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 Results

A reproducible document should not contain hard-coded results. Instead, it should run code to generate these results from data. 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"
---
```

Use R and Knitr for if you want to mix R with Python (via the package reticulate Ushey, Allaire, and Tang (2020)). Here, we use Python, starting with a sample Python chunk:

```
import numpy as np
np.random.seed(0)
x = np.random.normal(size=10)
```

Variables can be accessed in text chunks, for example, the mean of the variable x is 0.738.

3.1 Figures

```
import matplotlib.pyplot as plt
plt.figure(figsize=(8,3))
plt.plot(range(10),x)
plt.tight_layout(); plt.show()
```

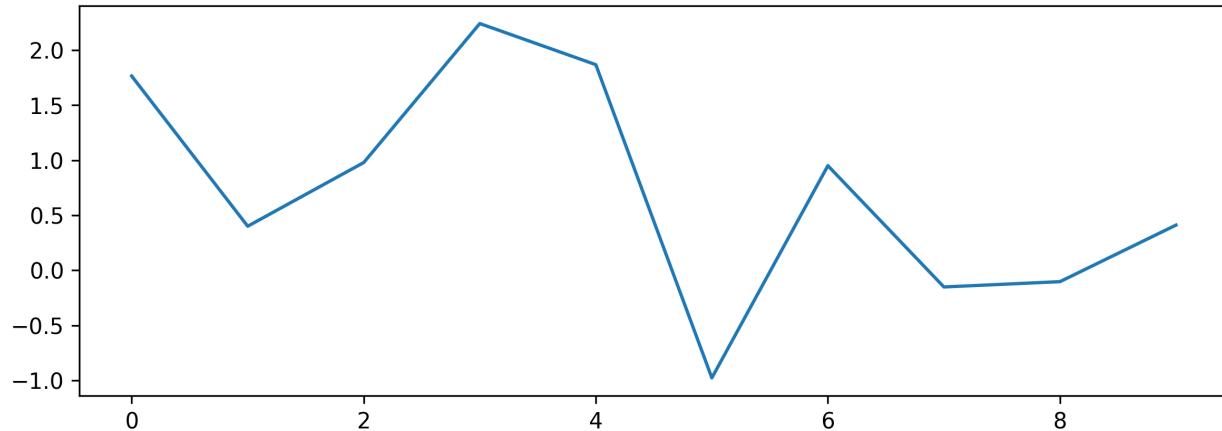


Figure 1: A time plot of x

Plots can be generated and referenced as shown. See plot Figure 1. Usually, we set `echo: false` in the code chunk to suppress the code in the report. The qmd source should be available for those who want to check the code.

3.2 Tables

3.2.1 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

3.2.2 List-table filter

We also integrate the `list-table` 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
```

3.2.3 Table generated from code

DEMONSTRATE THIS IN PYTHON

Table can also be generated by some code

3.3 Handling references

3.3.1 Bibliographic references

References are displayed using `BibTeX`, e.g. `[@computo]` will be displayed as (Computo Team 2021), where `computo` is the bibtex key for this specific entry. `@computo` gives an unparenthesized reference

to Computo Team (2021). The bibliographic information is automatically retrieved from the `.bib` file specified in the header of this document (here: `references.bib`). Some BibTeX entries relevant to STATS 531 are already in `references.bib`, including Huang and Petukhina (2022), Ionides (2026), Shumway and Stoffer (2017).

3.3.2 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](#).

Acknowledgments

This template builds on a template document by [Shao-Ting Chiu](#). AI was used for debugging via Google AI overview. Vscode with the Quarto extension was used for editing.

Bibliography

- Computo Team. 2021. “Computo: Reproducible Computational/Algorithmic Contributions in Statistics and Machine Learning.” *Computo*.
- Huang, Changquan, and Alla Petukhina. 2022. *Applied Time Series Analysis and Forecasting with Python*. Springer.
- Ionides, Edward. 2026. “Notes for STATS 531, Modeling and Analysis of Time Series Data.” <https://ionides.github.io/531w26/>.
- 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/>.
- Shumway, Robert H, and David S Stoffer. 2017. *Time Series Analysis and Its Applications: With R Examples*. 4th ed. Springer.
- Ushey, Kevin, JJ Allaire, and Yuan Tang. 2020. *Reticulate: Interface to Python*. <https://github.com/rstudio/reticulate>.

4 Supplementary material

You can put additional analysis here, or other relevant material. You should not assume the reader will read the supplement systematically. Material in the supplement should support claims made in the body of the report, and should be referenced in the report. The strongest and most critical evidence should be in the body of the report, not in the supplement.