# Introduction to Quarto

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# 1 Overview

- Today, I am going to go over a software called `Quarto` that is developed by the same team that developed `R Markdown`. As you can guess for now, they are very similar with slight difference.
- In this session, I am hoping to go over:
  - What is `Quarto`, and why we should use it

  - How to use `Quarto` to generate:
    * `HTML` documents
    * `Reveal.js` slides
    * Quarto website with `GitHub Pages`

## 1.1 What is Quarto

- Quarto is an open-source scientific and technical publishing system to create dynamic content with `Python`, `R`, `Stata`, `Julia` with engines `Jupyter`, `Knitr`, and `Observable`.
- Just like `R Markdown`, `Quarto` uses `PanDoc` to convert `Markdown` to `LaTex`, `HTML`, `PDF`, `Word`, etc.
- In short: One document (`.qmd`), multiple languages, multiple outputs.

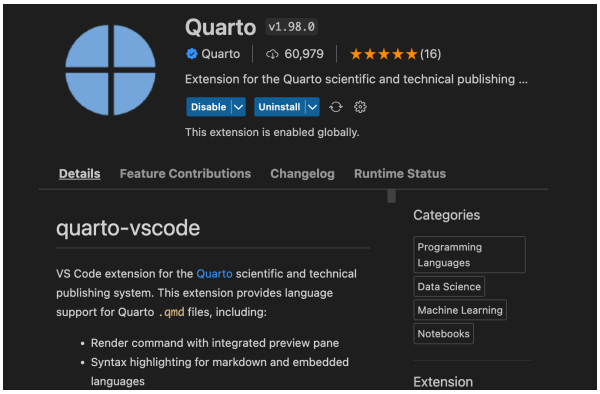
## 1.2 Why Quarto?

- To keep your code and document in one place and make it reproducible. Most importantly, to make it open-sourced and shareable.
- What if I am already using `R Markdown`, do I need to switch?
  - Based on your needs. There are many discussions on this, and I am providing some blogs and articles that you can read to make your own decision.
    * With Quarto Coming, is R Markdown Going Away? No.
    * Notes on Changing from Rmarkdown/Bookdown to Quarto

## 1.3 Install Quarto

To play with `Quarto`, you should firstly download Quarto from here, install it, and choose your favorite IDE to write `Quarto` documents. I am using `VS Code` with `Quarto` extension installed to show the demo today.

- If you are using `R Studio`, once you installed `Quarto`, you do not need any extra steps. Just restart your `R Studio` and you are good to go.
- In the `VS Code` IDE, you need to install `Quarto` extension in the `Extensions` marketplace.

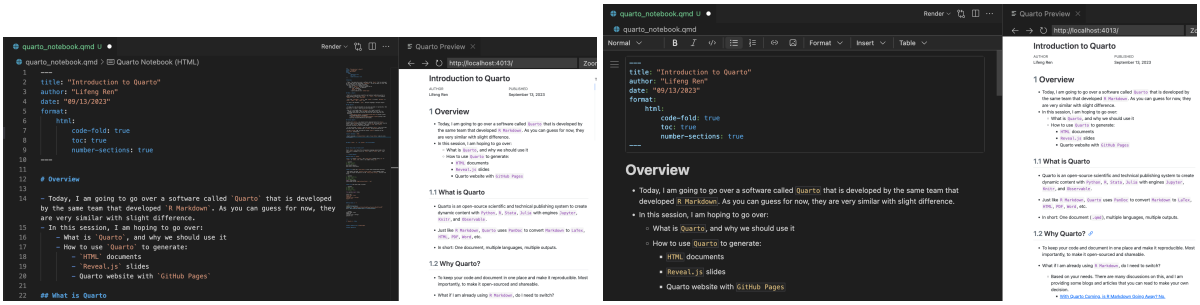



# 2 Generate your first `Quarto` document

As I mentioned above, `Quarto` can support many output formats. Today, I am going to show you how to generate `HTML` documents, `Reveal.js` slides, and `Quarto` website with `GitHub Pages`. For a full list of reference, please visit this page: https://quarto.org/docs/guide/.

## 2.1 Quarto Notebook

- Quarto provides a `Notebook Editor` and a `Visual Editor` mode to write the document. (DEMO)



- It can be rendered into different type of outputs. (DEMO for `HTML`, `PDF`, `Word`)
  - For now, I will keep rendering it into `HTML` format.
- Almost all syntax are the same for `R Markdown` and `Quarto` because they are based on `Markdown`. So, I won't go over the syntax a lot today. You can find more information here: https://quarto.org/docs/authoring/markdown-basics.html
- `YAML` header has some differences. Here is an example:

| RMarkdown | Quarto |
|---|---|
| output: html_document | format: html |
| output: pdf_document | format: pdf |
| output: word_document | format: docx |
| `underscore: _` (e.g.: `number_sections: true`) | `dash: -` (e.g.: `number-sections: true`) |
| Rerender all the code | Rerender only when source changes |

New Features in `Quarto`'s `YAML` header:

```yaml
execute:
  freeze: auto  # re-render only when source changes
```

- Code Chunk options are changing

#### 2.1.1 RMarkdown

````
```{r setup, include=FALSE}
```
````

#### 2.1.2 Quarto

````
```{r}
#| label: "setup"
#| include: false
```
````

### 2.2 Weave `Stata`, `R`, and `Python` into one Document

#### 2.2.1 Run Stata Code in Python and R

Since `Quarto` can choose the corresponding language engine based on the code chunk's language, we can run `Stata` code in `Python` and `R` code chunks to weave all three languages coding into one document.

#### 2.2.1.1 Run Stata in `Python`

**Step 1:** Install `pystata`, and `stata_setup` package using `pip` or `conda`, or `mamba`, etc. (Here is an example using `pip`)

```
pip install pystata
pip install stata_setup
```

**Step 2:** Point the `stata_setup` to your Stata installation directory

- Open Stata, and type `display c(sysdir_stata)` in the command window.
- Copy the output and paste it in the `stata_setup.config()` function like below.

```
import stata_setup
stata_setup.config('/Applications/Stata/', 'mp')
```

```
  ___  ____  ____  ____  ____ ®
 /__    /   ____/   /   ____/      17.0
___/   /   /___/   /   /___/       MP-Parallel Edition

 Statistics and Data Science       Copyright 1985-2021 StataCorp LLC
                                   StataCorp
                                   4905 Lakeway Drive
                                   College Station, Texas 77845 USA
                                   800-STATA-PC        https://www.stata.com
                                   979-696-4600        stata@stata.com

Stata license: Single-user 8-core , expiring  1 Jan 2025
Serial number: 501709301094
  Licensed to: Lifeng Ren
               APEC

Notes:
      1. Unicode is supported; see help unicode_advice.
      2. More than 2 billion observations are allowed; see help obs_advice.
      3. Maximum number of variables is set to 5,000; see help set_maxvar.
```

**Step 3:** Run Stata code in Python

```
from pystata import stata

stata.run('''
```

```
sysuse auto, clear
summarize
reg mpg price i.foreign
ereturn list
''')
```

```
.
. sysuse auto, clear
(1978 automobile data)

. summarize

    Variable |        Obs        Mean    Std. dev.       Min        Max
-------------+---------------------------------------------------------
        make |          0
       price |         74    6165.257    2949.496       3291      15906
         mpg |         74     21.2973    5.785503         12         41
       rep78 |         69    3.405797    .9899323          1          5
    headroom |         74    2.993243    .8459948        1.5          5
-------------+---------------------------------------------------------
       trunk |         74    13.75676    4.277404          5         23
      weight |         74    3019.459    777.1936       1760       4840
      length |         74    187.9324    22.26634        142        233
        turn |         74    39.64865    4.399354         31         51
displacement |         74    197.2973    91.83722         79        425
-------------+---------------------------------------------------------
  gear_ratio |         74    3.014865    .4562871       2.19       3.89
     foreign |         74    .2972973    .4601885          0          1

. reg mpg price i.foreign

      Source |       SS           df       MS      Number of obs   =        74
-------------+----------------------------------   F(2, 71)        =     23.01
       Model |  960.866305         2  480.433152   Prob > F        =    0.0000
    Residual |  1482.59315        71  20.8815937   R-squared       =    0.3932
-------------+----------------------------------   Adj R-squared   =    0.3761
       Total |  2443.45946        73  33.4720474   Root MSE        =    4.5696

------------------------------------------------------------------------------
         mpg | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
```

```
       price |   -.000959   .0001815    -5.28   0.000     -.001321    -.000597
             |
     foreign |
    Foreign  |   5.245271   1.163592     4.51   0.000     2.925135    7.565407
       _cons |   25.65058   1.271581    20.17   0.000     23.11512    28.18605
------------------------------------------------------------------------------

. ereturn list

scalars:
                  e(N) =  74
               e(df_m) =  2
               e(df_r) =  71
                  e(F) =  23.00749448574634
                 e(r2) =  .3932401256962295
               e(rmse) =  4.569638248831391
                e(mss) =  960.8663049714787
                e(rss) =  1482.593154487981
               e(r2_a) =  .3761482982510528
                 e(ll) =  -215.9083177127538
               e(ll_0) =  -234.3943376482347
               e(rank) =  3

macros:
            e(cmdline) : "regress mpg price i.foreign"
              e(title) : "Linear regression"
          e(marginsok) : "XB default"
                e(vce) : "ols"
            e(depvar) : "mpg"
                e(cmd) : "regress"
         e(properties) : "b V"
            e(predict) : "regres_p"
              e(model) : "ols"
          e(estat_cmd) : "regress_estat"

matrices:
                  e(b) :  1 x 4
                  e(V) :  4 x 4
               e(beta) :  1 x 3

functions:
             e(sample)
```

.

#### 2.2.1.2 Run Stata in R

```
library(Statamarkdown)
```

```
Stata found at /Applications/Stata/StataMP.app/Contents/MacOS/StataMP
```

```
The 'stata' engine is ready to use.
```

```
stataexe <- "/Applications/Stata/StataMP.app/Contents/MacOS/StataMP"
knitr::opts_chunk$set(engine.path=list(stata=stataexe))
```

```
sysuse auto, clear
summarize
reg mpg price i.foreign
ereturn list
```

```
(1978 automobile data)

    Variable |        Obs        Mean    Std. dev.       Min        Max
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```
matrices:
                  e(b) :  1 x 4
                  e(V) :  4 x 4
               e(beta) :  1 x 3

functions:
             e(sample)
```

# 3 `Reveal.js` slides

I normally has a document first and then copy and paste it into a new `Quarto` document to generate `Reveal.js` slides. But you can also just change a few things in the `YAML` header to generate `Reveal.js` slides.

The key thing we need to modify is the `format` in the `YAML` header. Here is an example:

```yaml
---
title: "Introduction to Quarto"
author: "Lifeng Ren"
date: "09-13-2023"
format:
    revealjs: # revealjs slides
        theme: default # default, beige, sky, night, serif, simple, solarized
        chalkboard: true # add a chalkboard to the slides
        scrollable: true # make the slides scrollable: this is useful for long slides (or
---
```

## 3.1 Key Features

In the `Revealjs` slides, a new section will be generated for a new slide. And We can use `#`

- Incremental Lists

```
## Slide 1
::: {.incremental}
-   Item 1
-   Item 2
:::
```

- Multiple Columns

```
:::: {.columns}

::: {.column width="40%"}
Left column
:::

::: {.column width="60%"}
Right column
:::

::::
```

- Code Highlight

Suppose we would like to highlight the following code

- `ax.plot(theta, r)`
- `x.grid(True)`

We could use the following code to highlight the code in a presentation

````
```{.python code-line-numbers="7,9"}
import numpy as np
import matplotlib.pyplot as plt

r = np.arange(0, 2, 0.01)
theta = 2 * np.pi * r
fig, ax = plt.subplots(subplot_kw={'projection': 'polar'})
ax.plot(theta, r)
ax.set_rticks([0.5, 1, 1.5, 2])
x.grid(True)
plt.show()
```
````

# 4 Quarto website with `GitHub Pages`

## 4.1 Personal Website

In order to generate a personal website hosted by GitHub, we need to do the following things:

- A github account

- Create a new repository with the name of `username.github.io` (e.g.: `lfr00154.github.io`)
  - If you already have your personal website and you can add create a repository with a different name and link this repository to your personal website. For example, I would use `quarto_demosite` as the repository name.
- Create a new `Quarto` website project.
  - In the `_quarto.yml` file, add `output-dir: docs` under the `project` section.
  - Render this file and there shall be a local static website shown on your IDE/browser.
- Go to GitHub and upload the whole project to the repository you just created.

# 5 Useful Resources