

Analysis on servers tutorial

**Jonas Frey Rosborg Schaarup, Luke William
Johnston, Kristina Matthiesen Hanse**

Contents

Welcome	7
Target audiences	7
Re-use and licensing	7
Contributing	7
How the website is made	7

I

Overview

1	Syllabus	11
1.1	Learning outcome and objectives	11
2	Is this for you?	13
3	Schedule	15
3.1	Day 1	15
4	Learning design	17
4.1	Discomfort and confusion are a normal part of learning	17
4.2	Clear learning goals and a strong narrative	17
4.3	“Code-alongs” as the main activity	17
4.4	Retrieval practice with hands-on exercises	17
4.5	Linking new information with existing knowledge with discussion activities	17
4.6	Minimal use of lectures	18
4.7	Frequent breaks and variation in activities	18
4.8	Easily accessible material that is online, always	18
4.9	A safe and supportive environment	18
4.10	Using origami hats to ask for help	18
4.11	Being involved in the learning process	18

II

Pre-workshop

5	Overview	21
5.1	How to read this website	21
5.2	Summary of tasks	21
6	Installing the programs	23
6.1	Windows	23

6.2	MacOS	23
6.3	Linux (Ubuntu)	23
7	Installing R Packages	25
8	Code of conduct	27
8.1	Expected behavior	27
8.2	Unacceptable behavior	27
8.3	Consequences of unacceptable behavior	28
9	Survey	29

III	Sessions
------------	-----------------

10	Introduction to workshop	33
10.1	The Big Picture	33
11	TODO: Lesson title here	35
11.1	Learning objectives	35
11.2	TODO: Section	35
11.3	:technologist: Exercise: Title	35
11.4	:speech_balloon: Discussion activity: Title	35
11.5	:book: Reading task: Title	35
11.6	Summary	35
11.7	Survey	35
12	What next	37
	Appendices	39
A	For teachers	41
	References	43
B	Contributing	45
B.1	:bug: Issues and bugs	45
B.2	:pencil2: Adding or modifying content	45
B.3	:file_folder: Support and infrastructure files	45
C	Creative Commons Attribution 4.0 International	47
C.1	Creative Commons Attribution 4.0 International Public License	47
C.1.1	Section 1 – Definitions.	47
C.1.2	Section 2 – Scope.	48
C.1.3	Section 3 – License Conditions.	49
C.1.4	Section 4 – Sui Generis Database Rights.	49
C.1.5	Section 5 – Disclaimer of Warranties and Limitation of Liability.	50
C.1.6	Section 6 – Term and Termination.	50

C.1.7 Section 7 – Other Terms and Conditions. 50

C.1.8 Section 8 – Interpretation. 50

Welcome



This ((TODO: length)) workshop is a ((TODO: Short description of the workshop.)) It is designed for doing participatory live-typing, where the teacher demonstrates the tasks on their computer connected to a projector while learners type along on their own computer. The workshop also includes reading tasks, discussion activities, and hands-on exercises.

This website contains all of the material for the workshop, including readings, exercises, presentations, live-typing material, and images. It is structured as a book, with “chapters” as sessions, in order of appearance. We make heavy use of the website throughout the workshop where “type-along” sessions almost identically follow the material on the website (with slight modifications for time or more detailed explanations).

Check out the overview section of the workshop, starting with the [Syllabus](#).

If you plan on attending the workshop, please make sure to complete the [Pre-workshop tasks](#) to get set up and ready for the workshop. The pre-workshop tasks include a survey that you need to fill out before the workshop starts.

Do you find this workshop material useful?

If yes, please consider “starring” our [GitHub repository](#). Starring the repository will save it to your list of saved repositories, so it’s easy for you to find again later. As a plus, it helps give our project more visibility :star2:

Target audiences

This website and its content are targeted to three groups:

1. For the **learners** to use during the workshop, both to follow along and also to use as a reference after the workshop ends. A more detailed description of who the learner is can be found in [Is this for you?](#)
2. For the **teachers** to use as a guide for when they do the type-along sessions.
3. For those who are **interested in teaching**, who may not have much experience or may not know where to start, to use this website as a guide to running and teaching their own workshops.

Re-use and licensing

The workshop material is licensed under the [Creative Commons Attribution 4.0 License](#), so the material can be used, re-used, and modified, as long as there is attribution to this source. Check out the [For teachers](#) section for more details and tips on using this material for teaching.

Contributing

Want to contribute to this workshop? Look through our [CONTRIBUTING](#) page for contribution guidelines on how to get started.

How the website is made

The workshop material is created using [Quarto](#) to write the material and create the book format, [GitHub](#) to host the [Git](#) repository of the material, and [GitHub Actions](#) with [Netlify](#) to build and host the website. The original source material for this workshop is found on the [server-analysis-tutorial](#) GitHub repository.



Overview

1	Syllabus	11
1.1	Learning outcome and objectives	11
2	Is this for you?	13
3	Schedule	15
3.1	Day 1	15
4	Learning design	17
4.1	Discomfort and confusion are a normal part of learning	17
4.2	Clear learning goals and a strong narrative	17
4.3	“Code-alongs” as the main activity	17
4.4	Retrieval practice with hands-on exercises	17
4.5	Linking new information with existing knowledge with discussion activities	17
4.6	Minimal use of lectures	18
4.7	Frequent breaks and variation in activities	18
4.8	Easily accessible material that is online, always	18
4.9	A safe and supportive environment	18
4.10	Using origami hats to ask for help	18
4.11	Being involved in the learning process	18

1. Syllabus

TODO: Include description and overall introduction of workshop

This workshop lasts TODO: Time and is split into the following sessions, listed in the [schedule](#), which will be covered in order:

- [Introduction to the workshop](#)
- [TODO: Session title](#)
- [Concluding remarks](#)

1.1 Learning outcome and objectives

The overall aim of this workshop is to enable you to:

1. Aim one

Broken down into specific objectives for each session, we've designed the workshop to enable you to do the following:

TODO: Session title

1. Objective one

Tangibly, during the workshop you will:

- TODO: List concrete tasks and steps

2. Is this for you?

To help manage expectations and develop the material for this workshop, we make a few assumptions about *who you are* as a participant in the workshop.

We assume you can relate to one or more of the following:

- TODO: List assumptions

While we have these assumptions to help focus the content of the workshop, if you have an interest in the workshop but don't fit any of the assumptions, *you are still welcome to attend!* We welcome everyone until capacity has been reached.

In addition to the assumptions above, the workshop also has a fairly focused scope, which may also help you decide if this workshop is for you:

- TODO: List of concrete tasks we will do and not do.

3. Schedule

The workshop is structured as a series of participatory live-coding sessions interspersed with hands-on exercises and group work, using either a practice dataset or some other real-world dataset. There are some lectures given, mainly at the start and end of the workshop. The general schedule outline is shown in the below table. This is not a fixed schedule of the timings of each session—some may be shorter and others may be longer. Instead, it is meant to be an approximate guide and overview.

3.1 Day 1

Time	Session topic
------	---------------

4. Learning design

This workshop is designed using the science of learning. Learning is when new content gets incorporated into long-term storage in the brain in a way that it can be later retrieved. Some of the best ways to enable learning is to do “active learning” by engaging with the material, practicing retrieving what was just covered, repeatedly being exposed to the content, linking the new information with what you already know, and explaining it to someone else.

We use a variety of activities to target the different “pathways” of learning. A big part of learning is being engaged in the *process* of learning, not just learning the content itself. So to help you be engaged in your own learning, we want to involve you in the reasons *why* we do the things we do during this workshop.

Throughout the workshop, we use these practices to support learning.

4.1 Discomfort and confusion are a normal part of learning

Learning happens when the brain encounters something difficult or challenging. Like exercising any muscle, that feeling is usually difficult and uncomfortable. Feeling a sense of confusion is a very natural part of the learning journey. You will be confused and that is very normal. Throughout the workshop, we work towards helping you be a little less confused. We design the workshop to have times when you can work through your confusion by including different learning activities, where you can try things on your own or ask questions. We also have many helpers around to try to answer those questions you may have.

4.2 Clear learning goals and a strong narrative

The learning goals and the narrative are tightly connected in this workshop. Learning is easier when you have a better idea of where you are going, where you are relative to the end goal, and what to expect along the way.

4.3 “Code-alongs” as the main activity

“Code-alongs” is when the teacher types on their computer that is on the projector and explains what it means as you also type along with them. The connection between using the hands and doing something tangible helps reinforce learning. It also helps the teachers to go slower as we have to both explain and type things out. This helps you learn better. “Less is more” works very well with learning.

4.4 Retrieval practice with hands-on exercises

Hands-on exercises reinforce what was just taught through retrieval practice and repetition. It gives you a chance to engage with the material and the space to try it out on your own. This helps you form a better sense of how to do it yourself.

4.5 Linking new information with existing knowledge with discussion activities

Discussion activities encourage linking what you already know and do in your work with the new information. Because humans are social beings, we also tend to learn better when there is some social aspect to it. For example, explaining something to someone else is one of the best ways to learn, as nicely expressed in the quote “while we teach, we learn” from the Roman philosopher Seneca.

4.6 Minimal use of lectures

Lectures, while extremely common, are forms of information sharing with the lowest rates of learning. In this workshop, we use reading tasks instead, so you can go at your pace, re-read things you may not understand, and take notes, all of which support learning. To help reinforce what you just read, the teacher will briefly summarise and emphasise key points after reading tasks, to repeat the main points and target another part of the brain (the auditory pathway).

4.7 Frequent breaks and variation in activities

Breaks are how your brain can recharge and refocus. The brain is only able to effectively focus on one thing at a time in 30-50 minute blocks of time. That's why we mix together code-alongs, exercises, discussions, and reading to give your brain some variation. Having an explicit break, even 5 minutes, is enough for the brain to better process and store what was covered.

4.8 Easily accessible material that is online, always

All the material is online on this website, so that it is easy for you to go back to after the workshop. This builds the repetition and retrieval practice part of learning. Our brains also get easily distracted, which is completely normal. So if you get distracted during the workshop, you can simply go to the material and get caught up with where we are. We also make sure to follow the material on the website closely, so that it is easier for you to follow along.

4.9 A safe and supportive environment

Mental safety in a supportive environment is critical for effective learning. It puts the brain into a more relaxed state that allows for optimal processing and ultimately learning. That's why we try to explicitly create that space, for example with the use of our Code of Conduct.

4.10 Using origami hats to ask for help

Asking for help can feel difficult, especially when you are learning and are unsure about something. To make it easier and feel safer, we use origami hats (or stickies) to show how everyone is doing. If you need help, you put up the "help" hat (usually orange) and a helper will come to you as soon as possible. If not, you can put up a "all good" hat (usually blue) to let us know you are following along. Since we often have several helpers, you usually won't wait long. This simple system lets you ask for help without interrupting the teacher or drawing attention, so you can keep following along while you wait. Our goal is to make getting help easier and more comfortable.

4.11 Being involved in the learning process

Now you know a bit more about the thoughts behind how we've designed this workshop to really try to support and enable your own learning! :tada: :grin:

II

Pre-workshop

5	Overview	21
5.1	How to read this website	21
5.2	Summary of tasks	21
6	Installing the programs	23
6.1	Windows	23
6.2	MacOS	23
6.3	Linux (Ubuntu)	23
7	Installing R Packages	25
8	Code of conduct	27
8.1	Expected behavior	27
8.2	Unacceptable behavior	27
8.3	Consequences of unacceptable behavior	28
9	Survey	29

5. Overview

In order to participate in this workshop, you must complete everything in this section and finish with **completing the survey (Chapter 9.)** at the end. These tasks are meant to provide everyone with the necessary setup and a shared foundation for the workshop.

Depending on your prior knowledge and skills, these tasks could take between **TIME hrs to finish**, so we suggest planning some time to complete them. While many of the tasks are mostly readings, they are important in making sure you get the most out of the workshop.

5.1 How to read this website

We try to be consistent with the way to present certain information in this website. Specifically, we follow some conventions that you should be aware of:

- Folder names always end with `/`, for example `data/` means the data folder.
- File names always end with their file extension, for example `content.md` means the file is a Markdown file.

For R-specific conventions:

- R variables are always shown as is. For instance, for the code `x <- 10`, `x` is a variable because it was assigned with 10.
- Functions always end with `()`, for instance `mean()` or `read_csv()`.
- Sometimes functions have their package name appended with `::` so that you run the code from the specific package, since we likely haven't loaded the package with `library()`. For instance, to install packages from GitHub using the `{pak}` package we use `pak::pak("user/package_name")`. You'll learn about this more later.

5.2 Summary of tasks

Here's a quick overview of the tasks you need to do. Specific details about them are found as you work through the tasks.

If you haven't already, go through the workshop overview section, including the [Syllabus](#), [Is this for you?](#), and [Learning design](#) to get an overview of what this workshop contains and the learning design behind the workshop material.

After that, please go through the the pre-workshop tasks designed to establish a shared foundation for the start of the workshop.

Complete these R-specific tasks:

1. Install a version of R, RStudio, Quarto, and Git that is as updated as possible in Chapter 6.. For some people, depending on their institution, this task can take the **longest amount of time** because you have to contact your IT to install these packages.
2. Install necessary R packages.

Do these general tasks:

1. TODO: Add more tasks
2. Read the syllabus (Chapter 1.).
3. Read the [Code of Conduct](#) (Chapter 8.).
4. Complete the pre-workshop [survey](#) (Chapter 9.): This survey is pretty quick, maybe ~10 minutes. There will be some bits from the tasks that you will need to paste into this survey.

Check each section for exact details on completing these tasks.

 Tip

You will be taken through the pre-workshop tasks in order by clicking the arrow at the bottom of each page :arrow_right:

6. Installing the programs

In order to participate in the workshop, you'll need to install these programs. You may already have some of them installed and if you did, please make sure that they are at least the minimum versions listed below. If not, you will need to update them. Updating these programs is the same as installing them, so just to be certain, please install these programs again to update them. That way you'll be less likely to encounter issues during the workshop related to version differences.

6.1 Windows

1. **Install R:** Any version above should work for the workshop. If you have used R before, you can confirm the version by running `R.version.string` in the Console.
2. **Install RStudio:** Any version above should work for the workshop. If you have installed it before, check the current version by going to the menu "Help -> About RStudio".
3. **Install Git:** Select the "Click here to download" link on that install page. Git is used throughout many sessions in the workshop. When installing, it will ask for a selecting a "Text Editor" and while we won't be using this in the workshop, Git needs to know this information so choose Notepad.

6.2 MacOS

1. **Install R:** Any version above should work for the workshop. If you have used R before, you can confirm the version by running `R.version.string` in the R Console. If you use [Homebrew](#) (which we strongly recommend installing and using), installing R is as easy as opening a Terminal and running:

```
brew install --cask r
```

2. **Install RStudio:** Any version above should work for the workshop. If you have installed RStudio before, you can check the current version by going to the menu "Help -> About RStudio". You can install it using Homebrew with:

```
brew install --cask rstudio
```

3. **Install Git:** Git is used throughout many sessions in the workshop. You can install it using Homebrew with:

```
brew install git
```

6.3 Linux (Ubuntu)

1. **Install R:** Any version above should work for the workshop. If you have used R before, you can confirm the version by running `R.version.string` in the Console. There are several commands to run to install R on Ubuntu, which is listed on the [install website](#).
2. **Install RStudio:** Any version above . If you have installed it before, check the current version by going to the menu "Help -> About RStudio".
3. **Git:** Git is used throughout many sessions in the workshop.

```
sudo apt install git
```

All these programs are required for the workshop, even Git. Git, which is a software program to formally manage versions of files, is used because of its popularity and the amount of documentation available for

it. Check out the online book [Happy Git with R](#), especially the “Why Git” section, for an understanding on why we are teaching Git. Windows users tend to have more trouble with installing Git than macOS or Linux users. See the section on [Installing Git for Windows](#) for help. We also maintain a list of common issues that participants experience in our [FAQ](#) section of our guides website.

i Note

Some pictures may show a Git pane in RStudio, but you may not see it. If you haven’t created or opened an RStudio R Project (which is taught in the introductory workshop), the Git pane *does not* show up. It only shows up in R Projects that use Git to track file changes.

i Note

A note to those who have or use work laptops with restrictive administrative privileges: You may encounter problems installing software due to administrative reasons (e.g. you don’t have permission to install things). Even if you have issues installing or updating the latest version of R or RStudio, you will likely be able to continue with the workshop as long as you have the minimum version listed above for R and for RStudio. If you have versions of R and RStudio that are older than that, you may need to ask your IT department to update your software if you can’t do this yourself. Unfortunately, Git is not a commonly used software for some organizations, so you may not have it installed and you *will* need to ask IT to install it. We *require* it for the workshop, so please make sure to give IT enough time to be able to install it for you prior to the workshop.

Once R, RStudio, and Git have been installed, open RStudio. *If you encounter any troubles during these pre-workshop tasks*, try as best as you can to complete the task and then let us know about the issues in the pre-workshop survey. If you continue having problems, indicate on the survey that you need help and we can try to book a quick video call to fix the problem. Otherwise, you can come to the workshop 15-20 minutes earlier to get help.

If you’re unable to complete the setup procedure due to unfixable technical issues, you can use Posit Cloud (to use RStudio on the cloud) as a final solution in order to participate in the workshop. For help setting up Posit Cloud for this workshop, refer to the [Posit Cloud setup guide](#).

7. Installing R Packages

We will be using specific R packages for the workshop, so you will need to install them. To make it easier, we've created a custom R package called `r3` that will install all the necessary packages for you for this workshop. Run these two functions in the Console by copying and pasting them to install our custom `r3` package as well as the `{tidyverse}` package.

```
install.packages(  
  "r3",  
  repos = c("https://rostoools.r-universe.dev", "https://cloud.r-project.org")  
)  
install.packages("tidyverse")
```

💡 Tip

Installing packages is tricky, especially on some work laptops, and doesn't always work as expected. Here are some other methods to try if you have trouble installing the packages with the code above.

For Windows users, you may have to install [RTools](#) to use either the `{pak}` or `{remotes}` method. The version of RTools you install must match the version of R that you have installed. For example, if you have R version 4.4, you need to install RTools 4.4.

First, try installing the `r3` package directly from GitHub with `{pak}`:

```
install.packages("pak")  
pak::pak("rostoools/r3")
```

If that doesn't work, try with `{remotes}`:

```
install.packages("remotes")  
remotes::install_github("rostoools/r3")
```

If you encounter any errors with either of these functions, try to restart R by going to “Sessions -> Restart R” and re-run them again. If that also doesn't work, try to complete the other tasks as best you can, complete the survey, and let us know you have a problem in the survey. We'll email you at least a week before the workshop starts to try to help you get it working.

💡 Tip

When you see a command like `something::something()`, for example with `pak::pak()`, you would “read” this as:

R, can you please use the `pak()` function from the `{pak}` package.

The normal way of doing this would be to load the package with `library(pak)` and then running the command `(pak())`. But by using the `::`, we tell R to directly use a function from a package, without needing to load the package and all of its other functions too. We use this trick because we only want to use the `pak()` command from the `{pak}` package and not have to load all the other functions as well. In this workshop we will be using `::` often.

8. Code of conduct

Learning happens when we feel safe and supported. Since we want you to learn during this workshop, we want you to feel safe and supported. We also want all learners to have an enjoyable and fulfilling experience while participating in this workshop. So we expect all learners to show respect, kindness, and courtesy to other learners throughout the whole workshop and to help create a positive and safe learning environment.

While most people and (sub-)cultures have an implicit, assumed set of practices and expectations for behaviour, we believe strongly in effective and clear communication. This includes making what is normally implicit expectations to instead be explicit expectations.

Teachers and helpers will uphold and embody this code in all spaces and activities of the workshop, and we expect you as the learner to do the same. In fact, by participating in this workshop, you indicate that you agree to follow these explicit expectations. We have this code of conduct to communicate to you that we really value and want to nurture a space that encourages and enhances learning. Otherwise, why would we have a workshop if you can't or aren't able to effectively learn anything from it! :zany_face:

8.1 Expected behavior

We want a welcoming, supportive, safe, and fun environment not only for ourselves as teachers and helpers, but also for all learners, regardless of background and identity. This means that we do not tolerate behaviour that is disrespectful to any of our teachers, helpers, or learners (see below for unacceptable behaviour).

We encourage the following kinds of behaviours in all interactions during this workshop that will foster a positive and professional learning environment:

- Show kindness, courtesy, and respect towards other workshop members.
- All interactions should be professional regardless of platform: either online or in-person.
- Be aware of your words by using welcoming and inclusive language. Words matter, a lot!
- Be respectful to different viewpoints and experiences.
- Gracefully accept constructive criticism.
- Focus on what is best for everyone in the workshop.

8.2 Unacceptable behavior

While we assume you will not do these behaviours, we want to clearly communicate what unacceptable behaviour is. It is any behaviour, as actions or words, that excludes, intimidates, or causes discomfort to others. We do not tolerate discrimination or harassment based on characteristics that include, though are not limited to, gender identity and expression, sexual orientation, disability, physical appearance, body size, citizenship, nationality, ethnic or social origin, pregnancy, familial status, veteran status, genetic information, religion or belief (or lack thereof), membership of a national minority, property, age, education, socio-economic status, technical choices, and experience level. We of course also don't tolerate verbally or physically violent behaviour towards others.

Examples of unacceptable behavior includes:

- Written or verbal comments that exclude people on the basis of membership of any specific group.
- The display of sexual or violent images.
- Unwelcome sexual attention, advances, and/or physical contact.
- Sustained disruption of workshop sessions or communications.
- Insults or put downs.
- Sexist, racist, homophobic, transphobic, ableist, or exclusionary jokes.

8.3 Consequences of unacceptable behavior

Learners who are asked, either in person or online, to stop any inappropriate behavior are expected to comply immediately. If a learner engages in behaviour that violates this code of conduct, the organizers, teachers, or helpers may take any action they deem appropriate, including warning the offender or removing them from the workshop.

If you feel in any way unsafe or mistreated, you may contact us privately—all communication is confidential.

Thank you for helping make this a welcoming, friendly workshop for all :smile:

Note

Acknowledgements: Large portions of this code of conduct were taken and modified from other codes of conduct, specifically [Software Carpentry](#) and [UofTCoders](#).

9. Survey

We have a [Code of Conduct](#). If you haven't read it, **read it now**. The survey involves a question about Conduct. We want to make sure this workshop is a supportive and safe environment for learning, so this Code of Conduct is quite important.

If you haven't read the sections under "Workshop overview" and "Pre-workshop tasks", **please read them now**.

You're almost done. Please fill out the pre-workshop survey to finish this section:

[Pre-workshop survey](#) :tada:

See you at the workshop! :wave:

III

Sessions

10	Introduction to workshop	33
10.1	The Big Picture	33
11	TODO: Lesson title here	35
11.1	Learning objectives	35
11.2	TODO: Section	35
11.3	:technologist: Exercise: Title	35
11.4	:speech_balloon: Discussion activity: Title	35
11.5	:book: Reading task: Title	35
11.6	Summary	35
11.7	Survey	35
12	What next	37

10. Introduction to workshop

Introduction slides

Teacher note

The slides contain speaking notes that you can view by pressing 'S' on the keyboard.

10.1 The Big Picture

TODO: Add text highlighting the bigger picture of why we teach this.

11. TODO: Lesson title here

11.1 Learning objectives

The learning objectives for this session are:

1. Objective one

11.2 TODO: Section

i Reading task: ~4 minutes

TODO: Reading text

11.3 :technologist: Exercise: Title

Time: ~NUM minutes.

Text

{{< text_snippet sticky_up >}}

11.4 :speech_balloon: Discussion activity: Title

Time: ~Num minutes.

Text

11.5 :book: Reading task: Title

Time: ~Num minutes.

Text

{{< text_snippet sticky_up >}}

11.6 Summary

- TODO: List of summary items

11.7 Survey

Feedback survey! :tada:

12. What next

Slides

Teacher note

The slides contain speaking notes that you can view by pressing 'S' on the keyboard.

Appendices

A. For teachers

A more general guide to teaching or helping is found on the [Guides](#) website. This page has information relevant specifically to this workshop.

- For created teams, assign one teacher or helper to each group to help them specifically during the final group project.

References

B. Contributing

Check out the [Contributing Guide](#) for more details on how to contribute. For guidelines on how to be a helper or teacher, check out the [For teachers](#) page. As always, make sure to adhere to the [Code of Conduct](#).

B.1 :bug: Issues and bugs

The easiest way to contribute is to report issues or bugs that you might find while using or reading the workshop material. You can do this by creating a new issue on our GitHub repository.

B.2 :pencil2: Adding or modifying content

To contribute to the workshop, you first need to install [uv](#) and [justfile](#). We use uv and justfile to manage our project, such as to run checks and build the workshop website. Both the uv and justfile websites have a more detailed guide on using uv, but below are some simple instructions to get you started.

It's easiest to [install uv](#) first and then install justfile using uv. Then, to install justfile, run:

```
uv tool install rust-just
```

We keep all our development workflows in the [justfile](#), so you can explore it to see what commands are available. To see a list of commands available, run:

```
just
```

As you contribute, make sure your changes will pass our checks by opening a terminal so that the working directory is the root of this workshop's parent/root folder and running:

```
just run-all
```

When committing changes, please try to follow [Conventional Commits](#) as Git messages. Using this convention allows us to be able to automatically create a release based on the commit message by using [Cocogitto](#). If you don't use Conventional Commits when making a commit, we will revise the pull request title to follow that format. That's because we use squash merges when merging pull requests, so all other commits in the pull request will be squashed into one commit.

B.3 :file_folder: Support and infrastructure files

- `.copier-answers.yml`: Contains the answers you gave when copying the project from the template. **You should not modify this file directly.**
- `.gitignore`: This ignore file tells Git which files to not track. Unless you know what you are doing, it's best to not touch this file.
- `_quarto.yml`: Quarto configuration file for the website, including settings for the website, such as the theme, navigation, and other options.
- `_metadata.yml`: Quarto metadata file for the website, including information about the project, such as the titles and GitHub names.
- `.pre-commit-config.yaml`: [Pre-commit](#) configuration file for managing and running checks before each commit.
- `.config/`: Contains configuration files for various tools used in the project, such as:
 - `typos.toml`: [typos](#) spell checker configuration file.
 - `lychee.toml`: [Lychee](#) URL checker configuration file.
 - `rumdl.toml` and `panache.toml`: [rumdl](#) and [Panache](#) configuration file for formatting Markdown files in the project.
- `.zenodo.json`: Structured citation metadata for your project when archived on [Zenodo](#). This is used to add the metadata to Zenodo when a GitHub release has been uploaded to Zenodo.
- `justfile`: [just](#) configuration file for scripting project tasks.

- `.editorconfig`: Editor configuration file for [EditorConfig](#) to maintain consistent coding styles across different editors and IDEs.
- `CONTRIBUTING.md`: Guidelines for contributing to the project.
- `.github/`: Contains GitHub-specific files, such as issue and pull request templates, workflows, [dependabot](#) configuration, pull request templates, and a [CODEOWNERS](#) file.

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