MY472 – Week 1: Introduction

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Course website: lse-my472.github.io

What is this course about?

The 80/20 rule of data science:
80% data manipulation, 20% data analysis

It is about the 80%

Course outline

1. Introduction to data
2. The shape of data
3. Data visualisation
4. Textual data
5. HTML, CSS, and scraping static pages
6. (*Reading week*)
7. XML, RSS, and scraping non-static pages
8. Working with APIs
9. Creating and managing databases
10. Interacting with online databases
11. Cloud computing

Plan for today

- Administration and logistics
- On the history of data and databases
- R and RStudio
- Git/Github for version control

Course philosophy

How to learn the techniques in this course?

- Lecture approach: not ideal for learning how to code
- You can only learn by doing

→ We will cover each concept three times during each week

1. Introduction to the topic in lecture
2. Guided coding session in lecture and lab
3. Course assignments

- We will move relatively fast

Materials

Course website: `https://lse-my472.github.io/`

- Mixed set of readings, very specific to each week
  - Often freely available online, otherwise, available for purchase (often in electronic versions)
  - Some books are (freely) available online and in print, and the online version may be more recent

Course meetings

- Weekly lectures
- Ten one-hour classes ("labs") *starting this week*
  - Group 1: Thursdays 13:00–14:00 (CKK.2.13)
  - Group 3: Thursdays 14:00–15:00 (CKK.2.18)
  - Group 2: Thursdays 17:00–18:00 (CKK.1.09)
- No lecture/class in Week 6
- Office hours (book via StudentHub)

Assessment

- 1 practise problem set
  - Opportunity to practise format and style of response
  - Due Thursday 12 October, 16:00
- 2 further problem sets will be assessed (50% in total)
  - Submitted via Moodle
  - Only "knitted" R-markdown assignments in HTML accepted
  - Due 2 November and 7 December 2023, 16:00
- Take-home assessment (50% in total)
  - A collaborative project undertaken over winter holidays
  - Deadline: 10 January 2024, 16:00

A note on collaboration

- All assignments are individual unless we instruct you otherwise
- **Strictly no discussion and collaboration with others allowed in any individual assignment**
- You can use online resources but always give credit in comments if you borrow code/solutions
- Any forbidden discussion/collaboration or not cited code/solutions/papers/resources are considered plagiarism

ChatGPT (and other generative assistants)

We will **allow** ChatGPT to be used for assignments

- Ignoring the presence/possibilities of ChatGPT is unwise
- An opportunity to *learn* how to integrate these tools into your workflow

But beware:

- We are assessing your ability to deploy these tools in research contexts
- You need some proficiency to recognise "good" code or fix broken code
- Huge uncertainty remains around the performance of generative tools
- The leading models are proprietary

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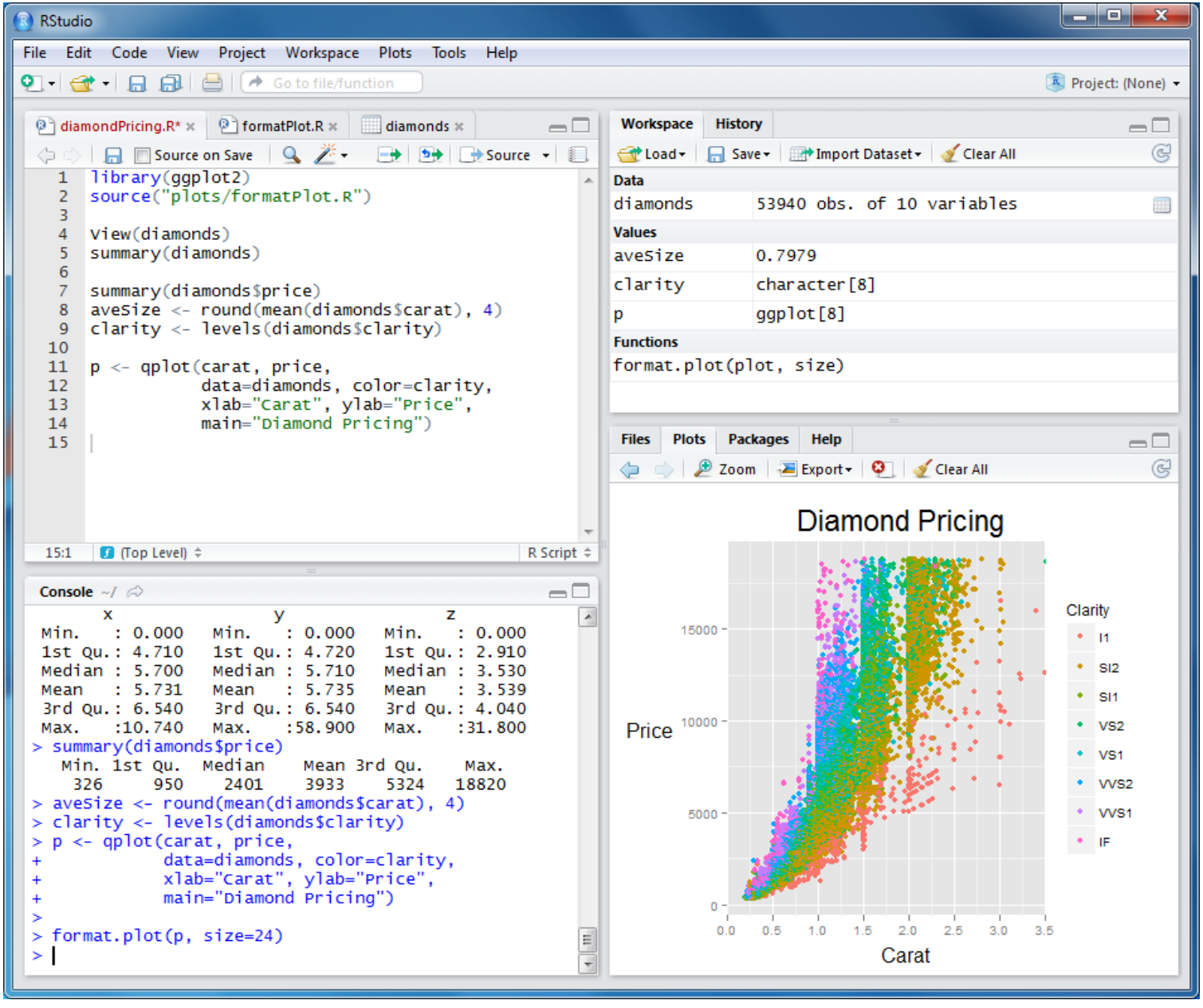
Why use R

- It's free and open-source
- Quite accessible even to novice coders
- Frequently used in academia and the private sector
- Flexible and extensible through many *packages*
- Excellent online documentation and troubleshooting resources
- A fully-fledged programming language, making it easier to transition to/from other languages

RStudio


RStudio
File Edit Code View Project Workspace Plots Tools Help
Go to file/function
Project: (None)
diamondPricing.R*
formatPlot.R
diamonds
Source on Save
Source
1 library(ggplot2)
2 source("plots/formatPlot.R")
3
4 View(diamonds)
5 summary(diamonds)
6
7 summary(diamonds$price)
8 aveSize <- round(mean(diamonds$carat), 4)
9 clarity <- levels(diamonds$clarity)
10
11 p <- qplot(carat, price,
12 data=diamonds, color=clarity,
13 xlab="Carat", ylab="Price",
14 main="Diamond Pricing")
15
15:1 (Top Level) R Script
Console ~/
x y z
Min. : 0.000 Min. : 0.000 Min. : 0.000
1st Qu.: 4.710 1st Qu.: 4.720 1st Qu.: 2.910
Median : 5.700 Median : 5.710 Median : 3.530
Mean : 5.731 Mean : 5.735 Mean : 3.539
3rd Qu.: 6.540 3rd Qu.: 6.540 3rd Qu.: 4.040
Max. :10.740 Max. :58.900 Max. :31.800
> summary(diamonds$price)
Min. 1st Qu. Median Mean 3rd Qu. Max.
326 950 2401 3933 5324 18820
> aveSize <- round(mean(diamonds$carat), 4)
> clarity <- levels(diamonds$clarity)
> p <- qplot(carat, price,
+ data=diamonds, color=clarity,
+ xlab="Carat", ylab="Price",
+ main="Diamond Pricing")
>
> format.plot(p, size=24)
>
Workspace History
Load Save Import Dataset Clear All
Data
diamonds 53940 obs. of 10 variables
Values
aveSize 0.7979
clarity character[8]
p ggplot[8]
Functions
format.plot(plot, size)
Files Plots Packages Help
Zoom Export Clear All
Diamond Pricing
Price
Carat
Clarity
I1
SI2
SI1
VS2
VS1
VVS2
VVS1
IF
0
5000
10000
15000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5

Installing R and RStudio

- Please install R and RStudio on your laptop and bring it to lectures and labs
- Software:
  - R – Install from `https://www.r-project.org/`
  - RStudio – Install from `https://posit.co/download/rstudio-desktop/`
- *Try to install both before the lab this week. If there are any issues with the installation, we can discuss them in the lab*

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Version control

- A version control system (VCS) is key when working on code, particularly when collaborating
- It keeps records of changes in files - *who* made *which* changes *when*
- Possibility of reverting changes and going back to previous states
- When a VCS keeps the entire code and history on each collaborator's machine, it is called distributed

Main ideas

- Have code files stored in a folder on own computer
- Record changes in this code with time stamps
- Revert back to earlier code if e.g. something broke
- Store the code from local computer also online such that others can see changes and time stamps
- Create separate versions to try out new ideas without impacting the main code
- Discuss with others whether these modifications should also be included into the main code

Git/GitHub

- Git: A very popular distributed version control system
- Created by Linus Torvalds in 2005 to facilitate Linux kernel development
- Other options e.g. Mercurial, Subversion
- GitHub: Service to host collections of code online with many extra functionalities (UI, documentation, issues, user profiles...)

Terminology

- *Repository/repo*: A collection of code and other files
- *Clone*: Download a repo to a computer
- *Commit*: Create a snapshot of (code) files and describe how they have changed
- *Push*: Update changes made locally on a computer also in the remote repository
- *Pull*: Obtain changes made by others which are stored in the remote repository

Installing Git

- Mac:
  - Type `git` into your Terminal and hit enter
  - If not installed already, `https://git-scm.com/download/mac` (use/first install Homebrew)
- Windows:
  - Downlod from `https://git-scm.com/download/win`
- Register a GitHub account at https://github.com/
  - You can apply for student benefits via `https://education.github.com/benefits?type=student`

Creating a repository

- First, log on to https://github.com/ with your account
- Click on the alias in the upper right hand corner $->$ Your repositories $->$ New
- Select a name, e.g. 'firstrepository'
- Select private to make it visible only to you and accounts you can select
- For the .gitignore choose the R pre-set
- Add an empty README
- Click on Create
- The repo now exists on GitHub

Configuring Git user and email

- Next, you will once need to configure Git on your computer and link it to GitHub
- Open Mac Terminal or Windows Git Bash
- Set your username in Git by pasting in Terminal/Git Bash: `git config --global user.name "Your Name"` (replace with your name before hitting enter)
- Set your commit email in Git: `git config --global user.email your@email.com`
- Then navigate to the folder where you would like to locate the repository on your computer with cd (change directory)

Cloning a respository

- The next step is to copy (clone) the online repository to your computer
- On your repository page on GitHub, click on Code and copy the URL (https)
- In the command line, enter `git clone ...` and replace ... with the copied url
- You will now be asked to enter your user name and password, for this we will have to create an access token as the last step in this setup (**note: some users are instead asked at this point to enter their password via a pop-up window - in this case, no access token has to be created manually and you can skip the next slide**)

GitHub authentication

- On GitHub, click on the alias in the upper right hand corner $->$ Settings $->$ Developer settings $->$ Personal access tokens $->$ Generate new token
- Pick a name, e.g. "command line", choose an expiration, select "repo" (this will allow to access private and public repos from the command line), and click Generate token
- Copy the token (it will only be visible once)
- Now go back to the command line, enter your GitHub user name and as password paste the token
- That's it, the setup of Git & GitHub is done and the repository was copied as well (no need to repeat the authentication until the token expires)

Creating a file

- We will now create a new file in the repository and log these changes
- With RStudio or a text editor (e.g. download VS Code at https://code.visualstudio.com/), add a file somecode.R into the repo folder
- At the command line, change into the repo folder with `cd firstrepo` (change directory)
- Now you are ready to commit the changes that were made to the repo

Committing changes

- First check whether anything changed with `git status` (make sure you are in the repo folder on your computer)
- Next add all untracked changes to the so-called staging area with `git add .` (we can also add only specific files)
- Commit/log changes with `git commit -m "added a code sample"`
- That's it!
- To study this again, add another line of code to the file and repeat the above steps
- Run `git log` to see the history of commits

Pushing changes to the remote repository

- To store these changes also in the remote repository, run `git push` afterwards
- It is now possible to review the changes in the browser which is very helpful for large code files
  - First, go to the repository page on GitHub and click on the clock symbol next to 'commits' in the upper right hand corner
  - Click on the key describing a specific commit, which could e.g. look something like '472cb9d', then you will see which lines of code changed
- If someone else has changed the online repository, run `git pull` to obtain the newest files

Review of key commands

- `git clone ...`: Download online repository to local computer
- `git status`: See status of files in repository
- `git add .`: Stage all changes made (alternatively add distinct file names to be staged)
- `git commit -m "some message "`: Commit (i.e. record) staged changes
- `git push`: Upload local changes to remote repository
- `git pull`: If files changed online, update local repository first

Some further concepts

- *Fork*: Own copy of a repository (pushed changes to this copy do not affect the original remote repository - different from git clone)
- *Branch*: A parallel version of the code originating from a duplication at one point
- *Merge*: Combine branches
- *Pull request*: GitHub based request to merge a branch or a fork into other code
- We will discuss these in the lab

Extensions for Git/GitHub

- People often use a combination of Git via the command line and the user interface of the GitHub website
- There is also a graphical user interface from GitHub to replace the command line (GitHub Desktop), or Git can be used directly through RStudio as an R-specific alternative to using the more general command line
- For detailed online manuals and books that discuss Git, see e.g. `https://git-scm.com/book/en/v2`
- To review GitHub, see e.g. `https://docs.github.com/e`

Useful command line prompts for Mac/Linux

- `pwd` – "Print working directory"
- `cd` – "Change directory" using relative filepaths
  - `cd ..` goes back one folder level
- `ls` – "lists" all folders and files in the current directory
- Other helpful commands can be `mkdir`, `rmdir`, `rm`, and `touch`

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Coding

Let's review some R code:

- `01-rmarkdown.Rmd`
- `02-vector-lists-dfs.Rmd`