

# Lab1

## 1. Outline

- Set up Git
- Exercises

## 2. Sign up your account on Github: <https://github.com/>

## 3. Add your profiles

## 4. Add a new repository, R\_project, as a public folder and initialize README file

### Create a new repository

A repository contains all the files for your project, including the revision history.

Owner



Repository name

R\_project



Great repository names are short and memorable. Need inspiration? How about **animated-octo-winner**.

Description (optional)

☒ **Public**

Anyone can see this repository. You choose who can commit.

☐ **Private**

You choose who can see and commit to this repository.

☒ **Initialize this repository with a README**

This will let you immediately clone the repository to your computer. Skip this step if you're importing an existing repository.

Add .gitignore: **None**

Add a license: **None**



Create repository

pokekarat / R\_project

Unwatch 1 Star 0 Fork 0

[Code](#) [Issues 0](#) [Pull requests 0](#) [Projects 0](#) [Wiki](#) [Insights](#) [Settings](#)

No description, website, or topics provided. [Add topics](#)

1 commit

1 branch

0 releases

1 contributor

Branch: master

New pull request

Create new file

Upload files

Find file

Clone or download

pokekarat Initial commit

Latest commit 4bc583c just now

README.md

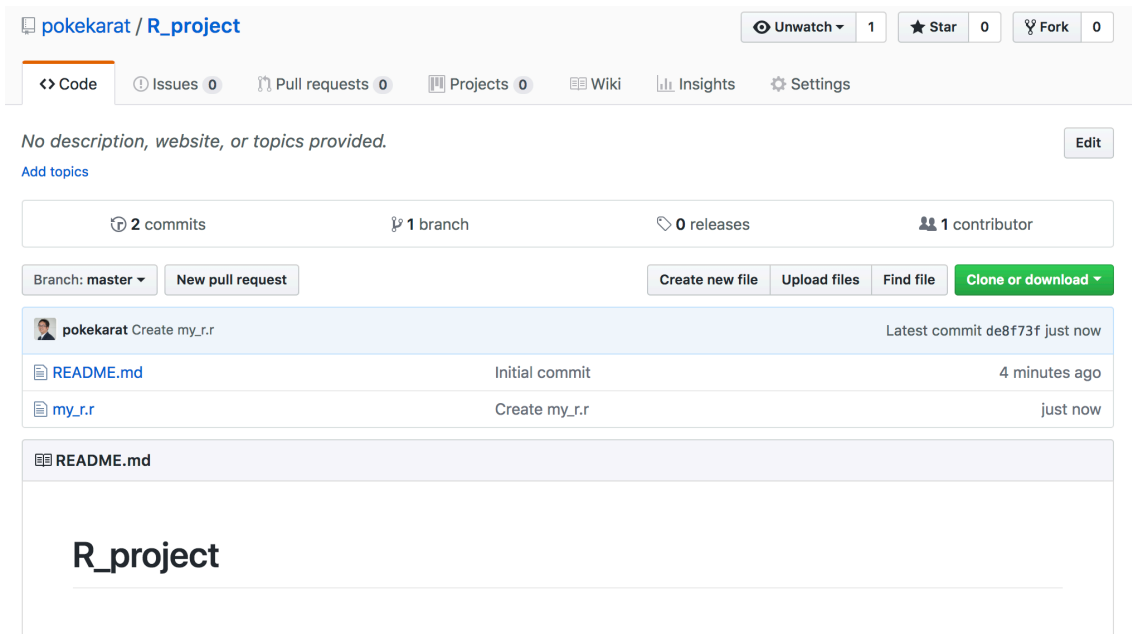
Initial commit

just now

README.md

R\_project

## 5. Create my\_r.r file inside R\_project, and commit new file



pokekarat / R\_project

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No description, website, or topics provided. [Edit](#)

[Add topics](#)

2 commits 1 branch 0 releases 1 contributor

Branch: master New pull request

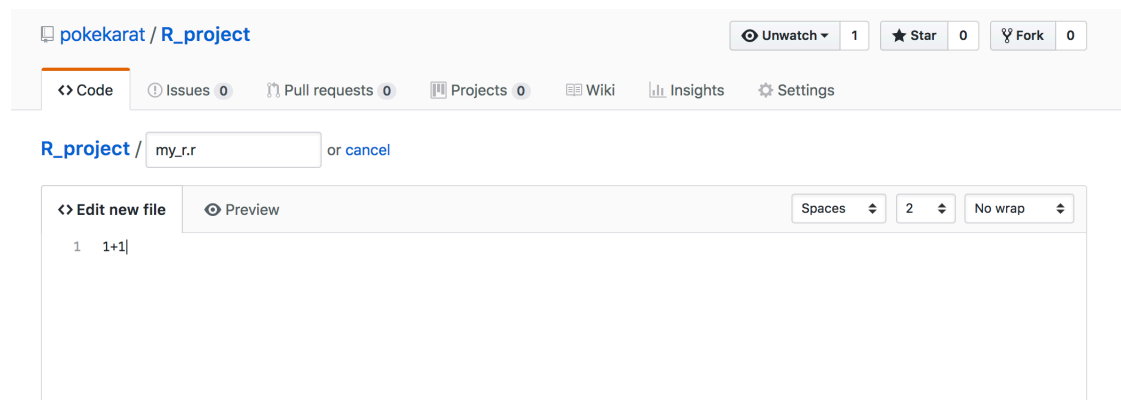
Create new file Upload files Find file Clone or download

pokekarat Create my\_r.r Latest commit de8f73f just now

README.md	Initial commit	4 minutes ago
my_r.r	Create my_r.r	just now

README.md

# R\_project



pokekarat / R\_project

Unwatch 1 Star 0 Fork 0

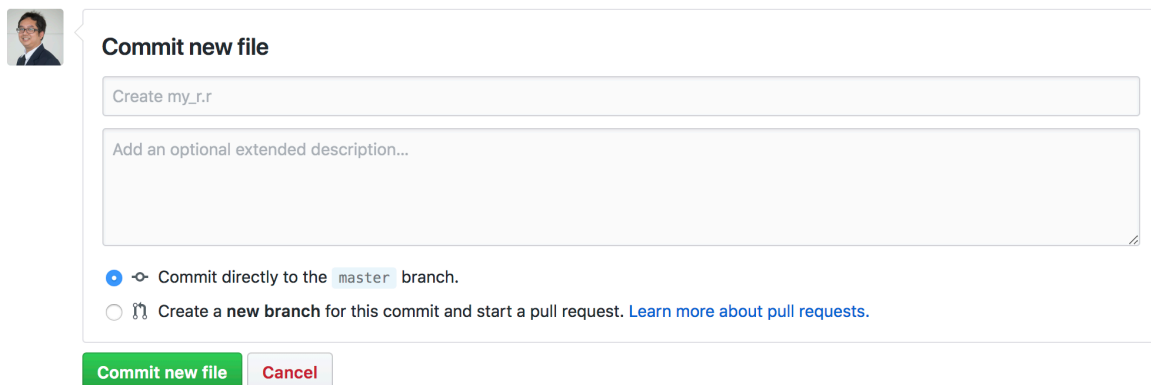
Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

R\_project / my\_r.r or cancel

Edit new file Preview

Spaces 2 No wrap

```
1 1+1
```



Commit new file

Create my\_r.r

Add an optional extended description...

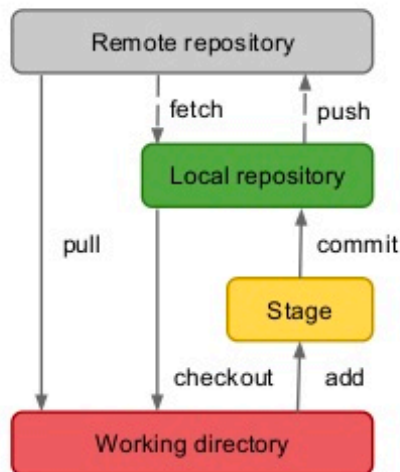
☒ Commit directly to the master branch.

☐ Create a new branch for this commit and start a pull request. [Learn more about pull requests.](#)

Commit new file Cancel

## 6. Git workflow

### Understanding of workflow



- Obtain a repository
  - `git init` or `git clone`
- Make some changes
- Stage your changes
  - `git add`
- Commit changes to the local repository
  - `git commit -m "My message"`
- Push changes to remote
  - `git push remotename remotebranch`

### Exercises

#### 1. Create the vectors:

- (a)  $(1, 2, 3, \dots, 19, 20)$
- (b)  $(20, 19, \dots, 2, 1)$
- (c)  $(1, 2, 3, \dots, 19, 20, 19, 18, \dots, 2, 1)$
- (d)  $(4, 6, 3)$  and assign it to the name `tmp`.

For parts (e), (f) and (g) look at the help for the function `rep`.

- (e)  $(4, 6, 3, 4, 6, 3, \dots, 4, 6, 3)$  where there are 10 occurrences of 4.
- (f)  $(4, 6, 3, 4, 6, 3, \dots, 4, 6, 3, 4)$  where there are 11 occurrences of 4, 10 occurrences of 6 and 10 occurrences of 3.
- (g)  $(4, 4, \dots, 4, 6, 6, \dots, 6, 3, 3, \dots, 3)$  where there are 10 occurrences of 4, 20 occurrences of 6 and 30 occurrences of 3.

#### 4. Calculate the following:

(a)  $\sum_{i=10}^{100} (i^3 + 4i^2).$

(b)  $\sum_{i=1}^{25} \left( \frac{2^i}{i} + \frac{3^i}{i^2} \right)$

6. Execute the following lines which create two vectors of random integers which are chosen with replacement from the integers 0, 1, ..., 999. Both vectors have length 250.

```
set.seed(50)
xVec <- sample(0:999, 250, replace=T)
yVec <- sample(0:999, 250, replace=T)
```

Suppose  $\mathbf{x} = (x_1, x_2, \dots, x_n)$  denotes the vector `xVec` and  $\mathbf{y} = (y_1, y_2, \dots, y_n)$  denotes the vector `yVec`.

- (a) Create the vector  $(y_2 - x_1, \dots, y_n - x_{n-1})$ .
- (b) Create the vector  $\left( \frac{\sin(y_1)}{\cos(x_2)}, \frac{\sin(y_2)}{\cos(x_3)}, \dots, \frac{\sin(y_{n-1})}{\cos(x_n)} \right)$ .
- (c) Create the vector  $(x_1 + 2x_2 - x_3, x_2 + 2x_3 - x_4, \dots, x_{n-2} + 2x_{n-1} - x_n)$ .
- (d) Calculate  $\sum_{i=1}^{n-1} \frac{e^{-x_{i+1}}}{x_i + 10}$ .

## 7. Matrix

- 7.1 Create the following matrix **B** with 15 rows:

$$\mathbf{B} = \begin{bmatrix} 10 & -10 & 10 \\ 10 & -10 & 10 \\ \dots & \dots & \dots \\ 10 & -10 & 10 \end{bmatrix}$$

Calculate the  $3 \times 3$  matrix  $\mathbf{B}^T \mathbf{B}$ . (Look at the help for `crossprod`.)

- 7.2 Write a function which takes a single argument which is a matrix. The function should return a matrix which is the same as the function argument but every odd number is doubled.

Hence the result of using the function on the matrix

$$\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$$

should be:

$$\begin{bmatrix} 2 & 2 & 6 \\ 10 & 2 & 6 \\ -2 & -2 & -6 \end{bmatrix}$$

## 8. Functions

- (a) Write functions `tmpFn1` and `tmpFn2` such that if `xVec` is the vector  $(x_1, x_2, \dots, x_n)$ , then `tmpFn1(xVec)` returns the vector  $(x_1, x_2^2, \dots, x_n^n)$  and `tmpFn2(xVec)` returns the vector  $\left(x_1, \frac{x_2^2}{2}, \dots, \frac{x_n^n}{n}\right)$ .
- (b) Now write a function `tmpFn3` which takes 2 arguments `x` and `n` where `x` is a single number and `n` is a strictly positive integer. The function should return the value of

$$1 + \frac{x}{1} + \frac{x^2}{2} + \frac{x^3}{3} + \dots + \frac{x^n}{n}$$

Write a function `tmpFn(xVec)` such that if `xVec` is the vector  $\mathbf{x} = (x_1, \dots, x_n)$  then `tmpFn(xVec)` returns the vector of moving averages:

$$\frac{x_1 + x_2 + x_3}{3}, \quad \frac{x_2 + x_3 + x_4}{3}, \quad \dots, \quad \frac{x_{n-2} + x_{n-1} + x_n}{3}$$

Try out your function; for example, try `tmpFn( c(1:5,6:1) )`.