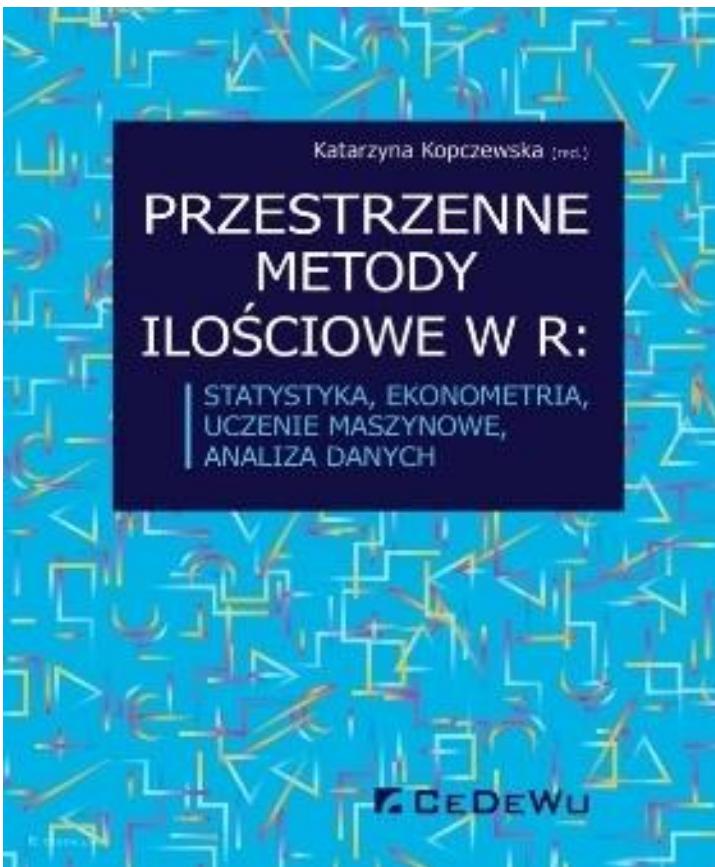
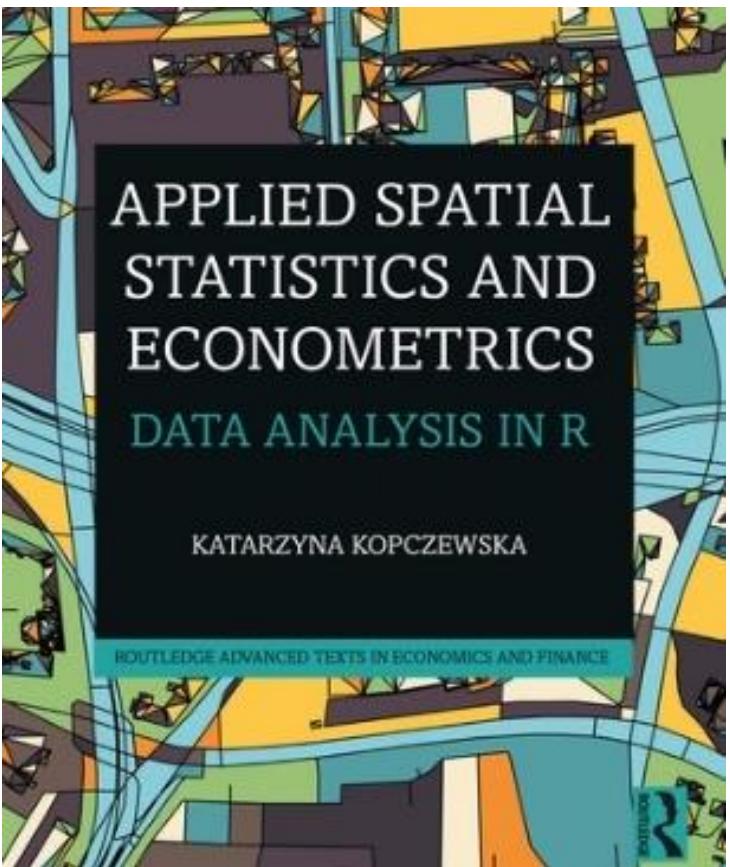


INTRODUCTION TO R

mgr Maria Kubara, WNE UW



ABOUT ME

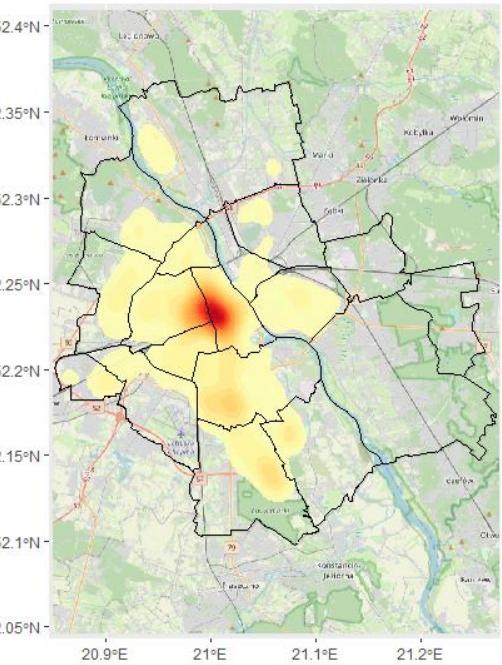
Working in R since 2017

MA with honours – Data
Science and Business
Analytics (WNE UW)

Graduate from the PhD
programme at Doctoral
School of Social Sciences
(University of Warsaw)
current status: submitted my
thesis and waiting for myPhD
defence ☺

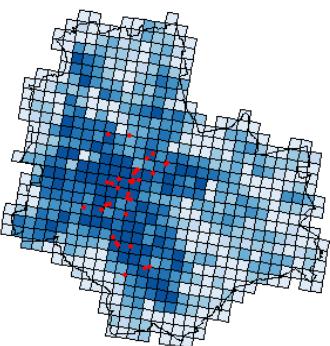
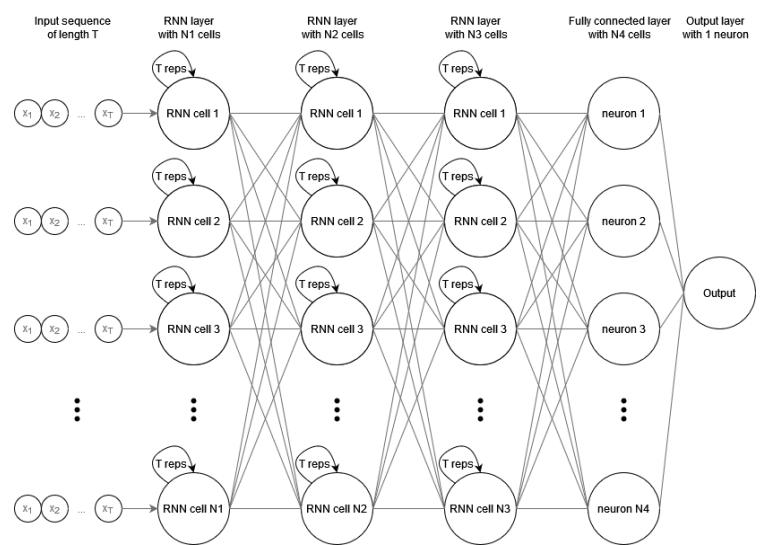
Individual research grant –
within the Diamond
Scholarship program

Eplainos Prize



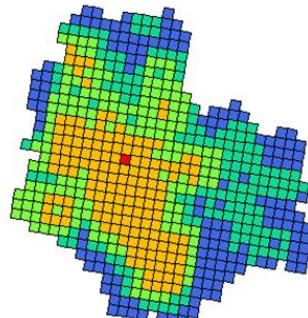
MY PHD PROJECT

„ANALYSIS OF THE SURVIVAL DETERMINANTS OF TECHNOLOGICAL STARTUPS – SPATIAL FACTORS AND INTERACTIONS”



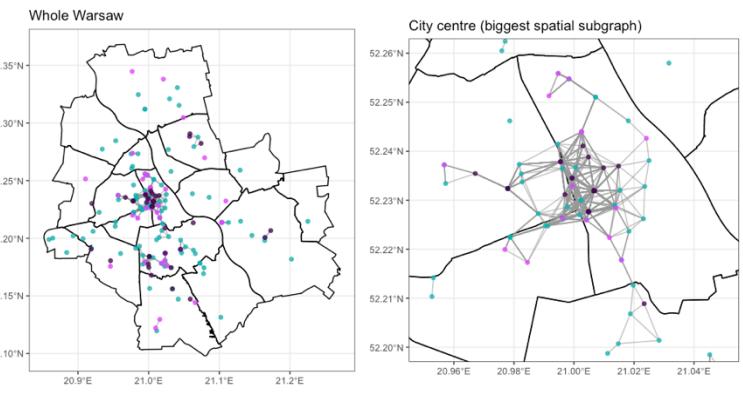
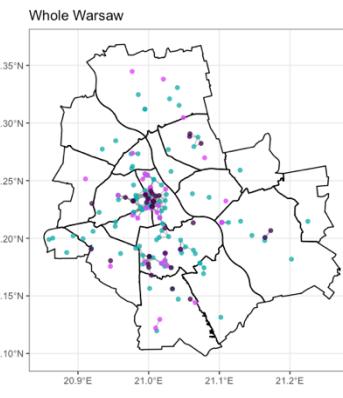
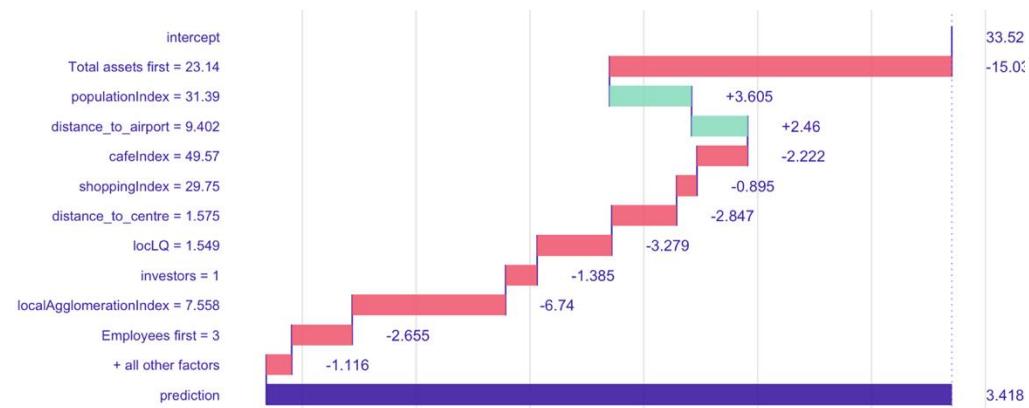
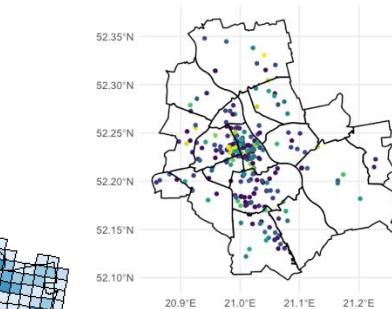
level

- under 0
- 0 to 1
- 1 to 2
- 2 to 5
- 5 to 11
- 11 to 24
- 24 to 44
- over 44

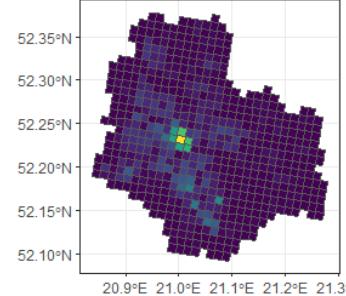


Initial assets

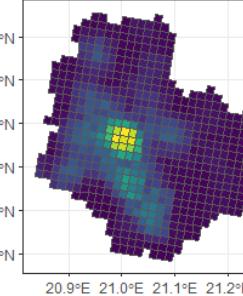
- Very low
- Low
- Medium
- High
- Very high



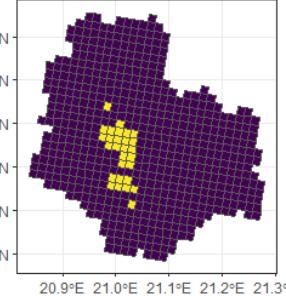
One-variable model



Two-variables model



True clusters in T+1=2018



prediction

0.500 0.550 0.600 0.650 0.700 0.75

prediction

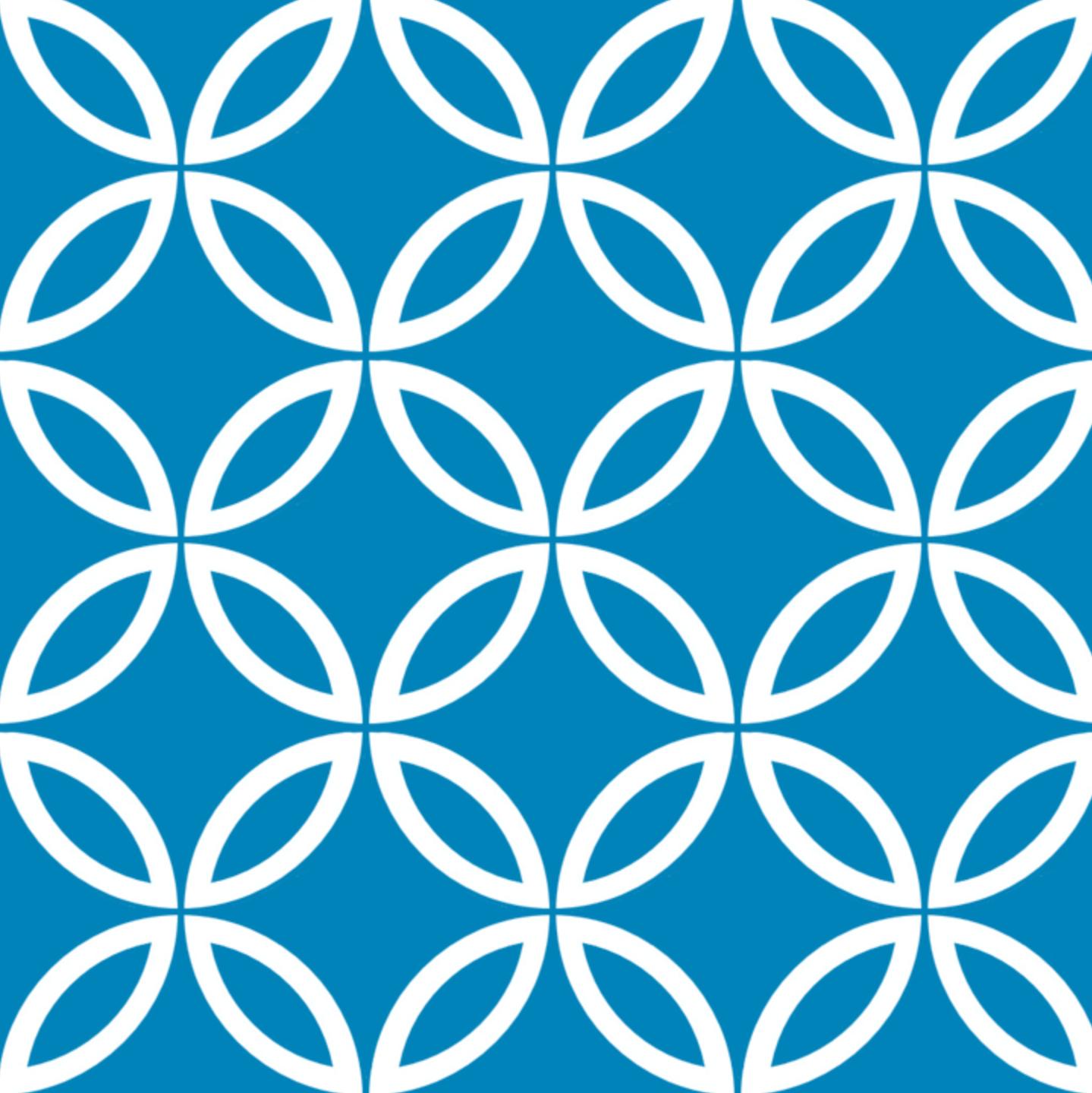
0.500 0.5250 0.5500 0.575

cluster

0.00 0.25 0.50 0.75 1.00

PASSING RULES

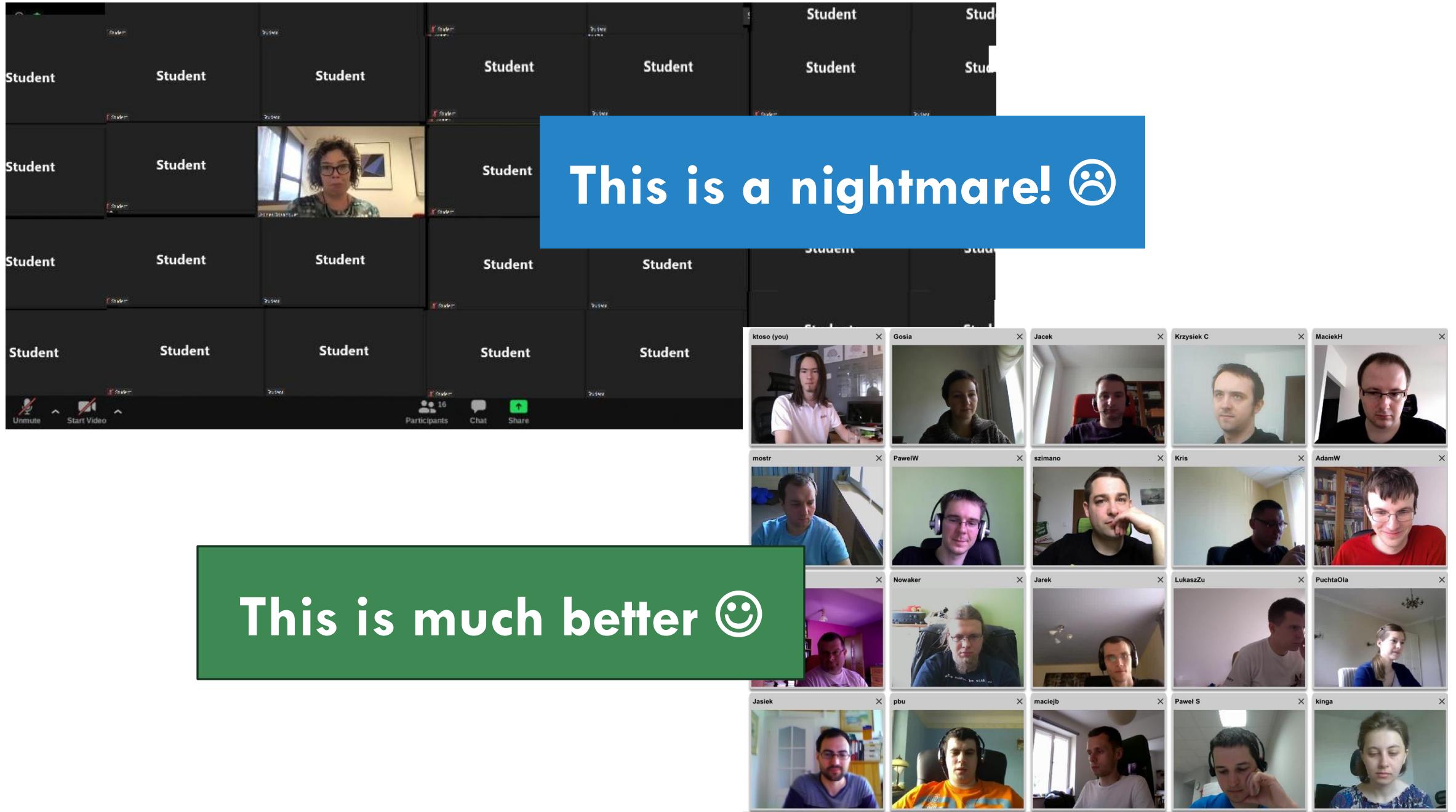
- Quizzes/class work (max 30)
 - submitted within 48h of the class – 100%
 - submitted within a week after the class – max 80% points
 - abcd questions + some coding
- Exam (max 70) – ONSITE!!!
 - in the exam session
- Activity (bonus)
- Additional homework (without points – own exam practice)
 - around Christmas break
 - structured in the same way as the exam



ORGANISATION INFO

- ❖ The most important place with materials → OUR MOODLE PAGE (joint for all the groups)
- ❖ Attendance is not obligatory. I just check your tests
- ❖ Our classes this year are online (☹ I prefer onsite courses, 100%)
 - ❖ keep our camera on (I really don't care what your background is, if there is a cat or if you are folding your laundry, it doesn't matter to me. I only care to see the people out there)
 - ❖ engage and ask questions (this time is really just for you)
 - ❖ recordings will be posted, but only after the weekly test is closed





COURSE MATERIAL (IN SHORT)

1. Intro to R and RStudio.
2. Learning datatypes and data structures in R.
3. The basis of statistical analysis and modelling in R.
4. Visualization in base R.
5. Loops and functions.
6. Tidyverse.
7. Rmarkdown.
8. Bonus class: how to prepare clean and reproducible code in R.

WHAT IS R?

Programming language and an environment for statistical calculations and graphics.

ADVANTAGES OF R

R provides a wide variety of **statistical techniques** (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, ...)

R allows for creating high quality **graphics** with mathematical formulas and symbols.

R is available as Free Software under the terms of the [Free Software Foundation's GNU General Public License](#). It is accessible on many platforms – Windows, MacOS, Linux.

R ENVIRONMENT

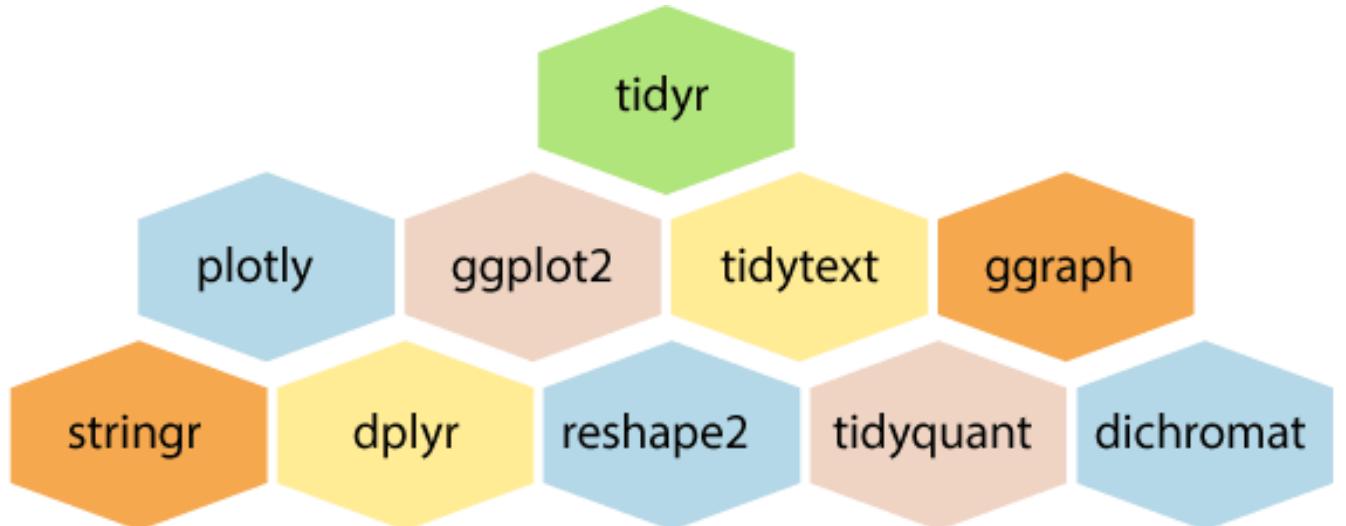
- ❖ Provides an effective data handling and storage facility,
- ❖ Allows for array and matrix calculations,
- ❖ Contains a large and coherent collection of intermediate tools for data analysis,
- ❖ Has graphical facilities for data analysis and display either on-screen or on hardcopy.
- ❖ Is a well-developed, simple and effective programming language which includes conditionals, loops, user-defined recursive functions and input and output facilities.

ADDITIONAL PACKAGES

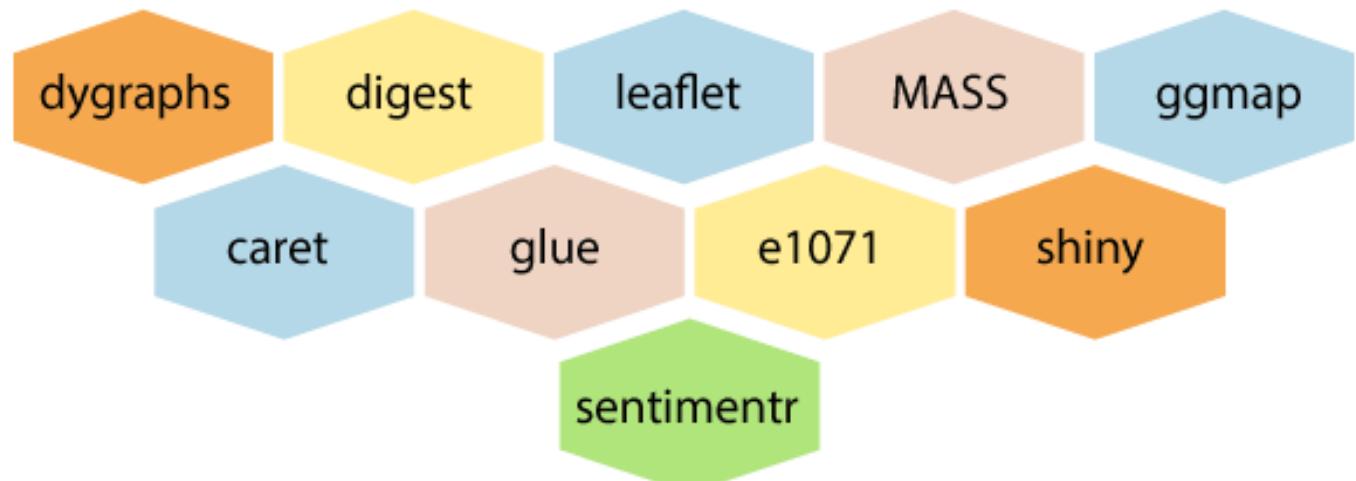
You can easily extend R possibilities with the usage of **packages**.

Packages are usually written by other R community members. They allow to use additional functions and methods.

Because R is a free software – adding new elements to it is legal and simple. Thanks to that, R potential can be enhanced fast with the help of its users.



list of Packages



Package 4

Package 3

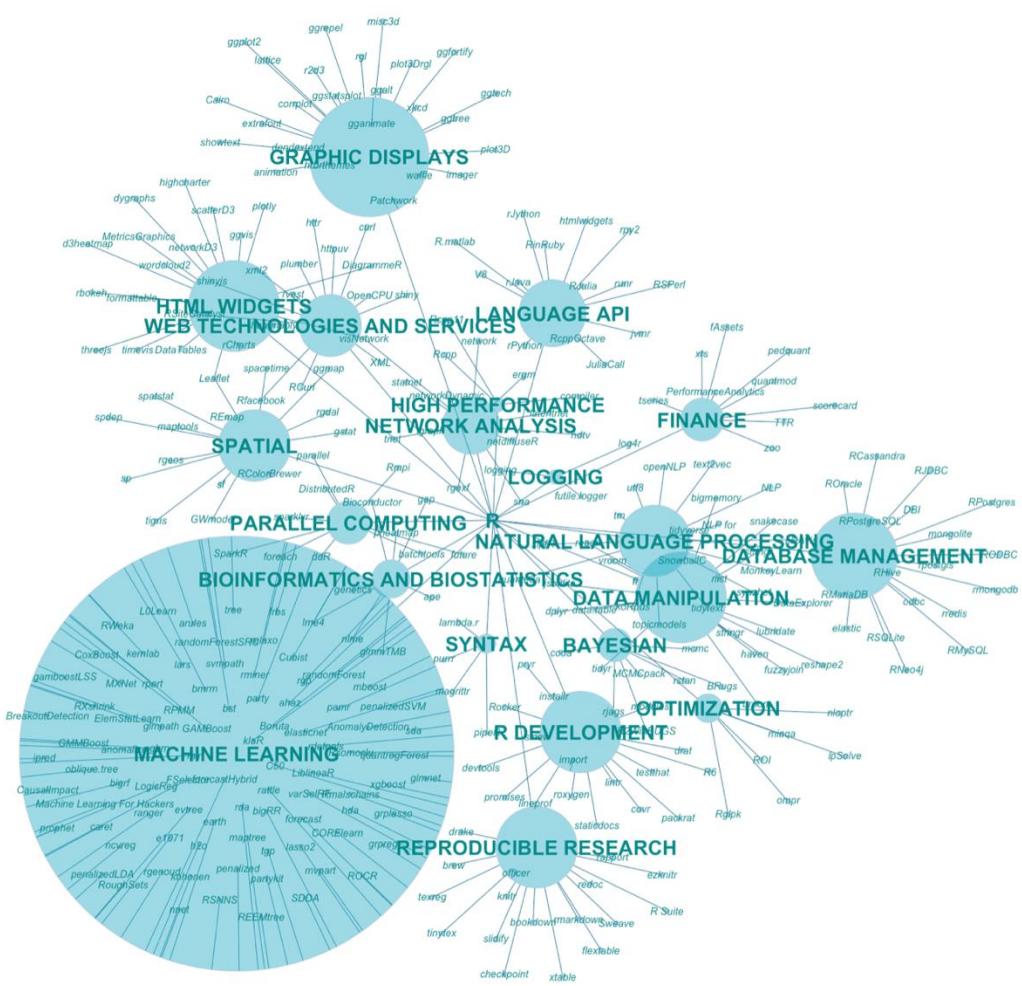
Package 2

Package 1

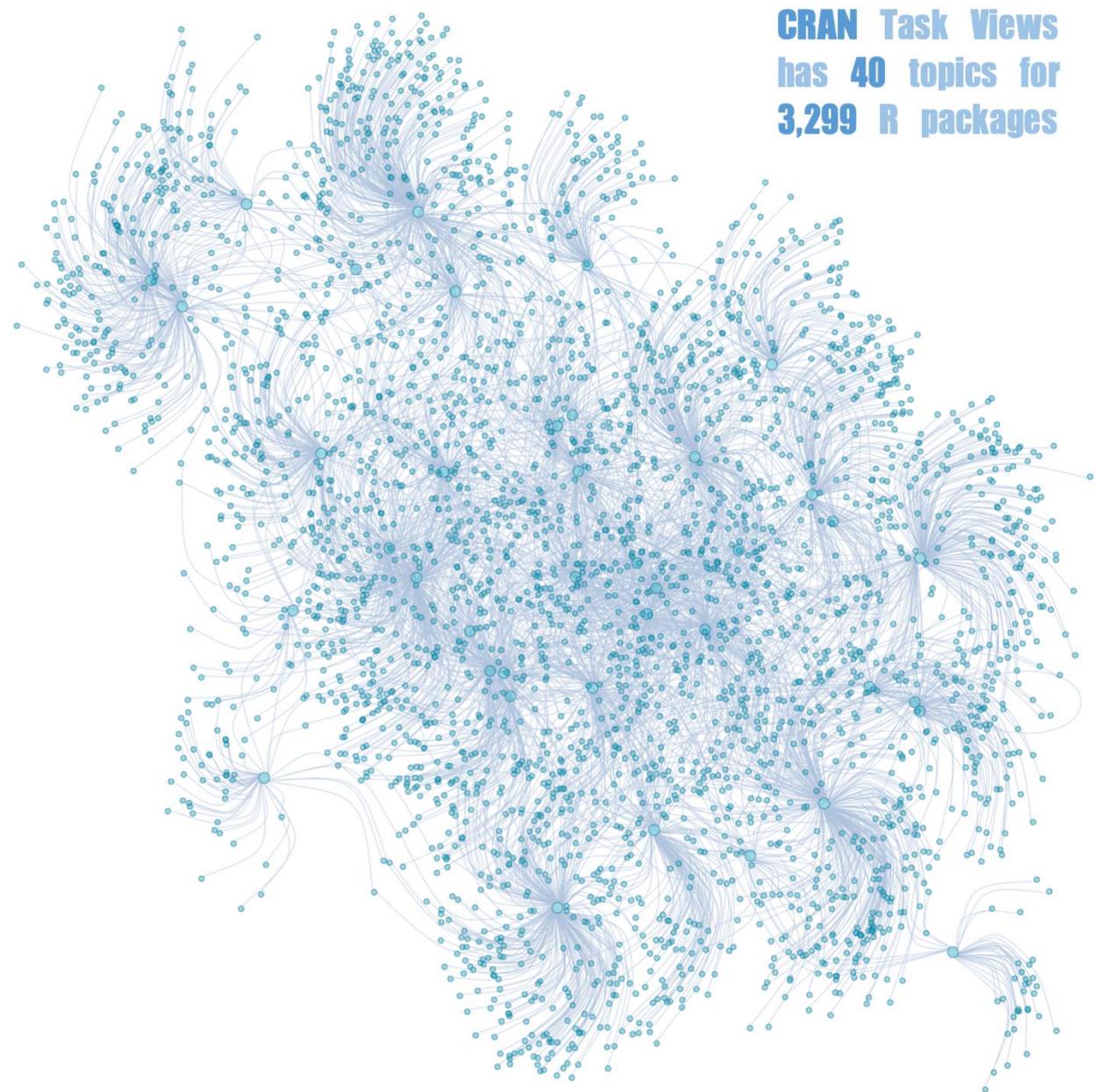
R language



CRAN Task Views



Awesome list of 324 R packages in 20 catagories



Source: <https://awesome-r.com>

Source: <https://cran.r-project.org>

Źródło: <https://www.informationisbeautifulawards.com/showcase/4498-cran-r-packages>

WHERE TO FIND INFORMATION ABOUT R?

<https://www.r-project.org/> - main website about R project, information about current versions, description of the language, reports from the recent changes and documentation

<https://cran.r-project.org/> - downloading the newest R version (Linux, MacOS, Windows)

<https://cran.r-project.org/web/views/> - Task Views – thematical catalog of the packages

<https://cran.r-project.org/web/packages/MASS/index.html> - websites regarding given packages (e.g. MASS package)

<https://rseek.org/> - search engine for packages and posts about R

<https://www.r-bloggers.com/> - blog of R community

<https://www.r-project.org/> - main website about R project, information about current versions, description of the language, reports from the recent changes and documentation

Detailed information about R



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The R Project for Statistical Computing

Getting Started

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To [download R](#), please choose your preferred [CRAN mirror](#).

If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

News **Information regarding recent R versions (new version available every 3-4 months)**

- [R version 4.1.1 \(Kick Things\) prerelease versions](#) will appear starting Saturday 2021-07-31.
Final release is scheduled for Tuesday 2021-08-10.
- [R version 4.1.0 \(Camp Pontanezen\)](#) has been released on 2021-05-18.
- [R version 4.0.5 \(Shake and Throw\)](#) was released on 2021-03-31.
- Thanks to the organisers of useR! 2020 for a successful online conference. Recorded tutorials and talks from the conference are available on the [R Consortium YouTube channel](#).
- You can support the R Foundation with a renewable subscription as a [supporting member](#)

News via Twitter

[News from the R Foundation](#)

Documentation and help pages



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The Comprehensive R Archive Network

Download and Install R

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- [Download R for Linux \(Debian, Fedora/Redhat, Ubuntu\)](#) [Links for the newest R installation](#)
- [Download R for macOS](#)
- [Download R for Windows](#)

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

Source Code for all Platforms

Windows and Mac users most likely want to download the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

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- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

CRAN Task Views

CRAN task views aim to provide some guidance which packages on CRAN are relevant for tasks related to a certain topic. They give a brief overview of the included packages and can be automatically installed using the [ctv](#) package. The views are intended to have a sharp focus so that it is sufficiently clear which packages should be included (or excluded) - and they are *not* meant to endorse the "best" packages for a given task.

- To automatically install the views, the [ctv](#) package needs to be installed, e.g., via

```
install.packages("ctv")
```

and then the views can be installed via `install.views` or `update.views` (where the latter only installs those packages are not installed and up-to-date), e.g.,

```
ctv::install.views("Econometrics")
```

```
ctv::update.views("Econometrics")
```

- The task views are maintained by volunteers. You can help them by suggesting packages that should be included in their task views. The contact e-mail addresses are listed on the individual task view pages.
- For general concerns regarding task views contact the [ctv](#) package maintainer.

Topics [Thematic list of packages in R](#)

Bayesian	Bayesian Inference
ChemPhys	Chemometrics and Computational Physics
ClinicalTrials	Clinical Trial Design, Monitoring, and Analysis
Cluster	Cluster Analysis & Finite Mixture Models
Databases	Databases with R
DifferentialEquations	Differential Equations
Distributions	Probability Distributions
Econometrics	Econometrics
Environmetrics	Analysis of Ecological and Environmental Data
ExperimentalDesign	Design of Experiments (DoE) & Analysis of Experimental Data
ExtremeValue	Extreme Value Analysis
Finance	Empirical Finance
FunctionalData	Functional Data Analysis

Maintainer: Dirk Eddelbuettel

Contact: [Dirk.Eddelbuettel at R-project.org](mailto:Dirk.Eddelbuettel@R-project.org)

Version: 2021-08-05

URL: <https://CRAN.R-project.org/view=Finance>

This CRAN Task View contains a list of packages useful for empirical work in Finance, grouped by topic.

Description of the thematical group

Besides these packages, a very wide variety of functions suitable for empirical work in Finance is provided by both the basic R system (and its set of recommended core packages), and a number of other packages on the Comprehensive R Archive Network (CRAN). Consequently, several of the other CRAN Task Views may contain suitable packages, in particular the [Econometrics](#), [Multivariate](#), [Optimization](#), [Robust](#), [SocialSciences](#) and [TimeSeries](#) Task Views.

The `ctv` package supports these Task Views. Its functions `install.views` and `update.views` allow, respectively, installation or update of packages from a given Task View; the option `coreOnly` can restrict operations to packages labeled as *core* below.

Contributions are always welcome, and encouraged. Since the start of this CRAN task view in April 2005, most contributions have arrived as email suggestions. The source file for this particular task view file now also reside in a GitHub repository (see below) so that pull requests are also possible.

Standard regression models

Subcategories with listed packages, allowing for making certain calculations

- A detailed overview of the available regression methodologies is provided by the [Econometrics](#) task view. This is complemented by the [Robust](#) task view, which focuses on more robust and resistant methods.
- Linear models such as ordinary least squares (OLS) can be estimated by `lm()` (from the `stats` package contained in the basic R distribution). Maximum Likelihood (ML) estimation can be undertaken with the standard `optim()` function. Many other suitable methods are listed in the [Optimization](#) view. Non-linear least squares can be estimated with the `nls()` function, as well as with `nlme()` from the [nlme](#) package.
- For the linear model, a variety of regression diagnostic tests are provided by the [car](#), [lmtest](#), [strucchange](#), [urca](#), and [sandwich](#) packages. The [Rcmdr](#) package provide user interfaces that may be of interest as well.

Time series

Subcategories with listed packages, allowing for making certain calculations

- A detailed overview of tools for time series analysis can be found in the [TimeSeries](#) task view. Below a brief overview of the most important methods in finance is given.
- Classical time series functionality is provided by the `arima()` and `KalmanLike()` commands in the basic R distribution.
- The [dse](#) and [timsac](#) packages provide a variety of more advanced estimation methods; [fracdiff](#) can estimate fractionally integrated series; [longmemo](#) covers related material.
- For volatility modeling, the standard GARCH(1,1) model can be estimated with the `garch()` function in the [tseries](#) package. Rmetrics (see below) contains the [fGarch](#) package which has additional models. The [rugarch](#) Link forwarding to the package's website (with documentation) as ARFIMA, in-mean, external regressors and various other specifications; with methods for fit, forecast, simulation, inference and plotting are provided too. The [rmgarch](#) builds on it to provide the ability to estimate several multivariate GARCH models. The [betategarch](#) package can estimate and simulate the Beta-t-EGARCH model by Harvey. The [bayesGARCH](#)

MASS: Support Functions and Datasets for Venables and Ripley's MASS

Functions and datasets to support Venables and Ripley, "Modern Applied Statistics with S" (4th edition, 2002)

Name and short description of
the package

Version: 7.3-54

Priority: recommended

Depends: R (\geq 3.3.0), grDevices, graphics, stats, utils

Imports: methods

Suggests: lattice, nlme, nnet, survival

Published: 2021-05-03

Author: Brian Ripley [aut, cre, cph], Bill Venables [ctb], Douglas M. Bates [ctb], Kurt Hornik [trl] (partial port ca 1998), Albrecht Gebhardt [trl] (partial port ca 1998), David Firth [ctb]

Maintainer: Brian Ripley <ripley at stats.ox.ac.uk>

Contact: <MASS@stats.ox.ac.uk>

License: [GPL-2](#) | [GPL-3](#)

URL: <http://www.stats.ox.ac.uk/pub/MASS4/>

NeedsCompilation: yes

Citation: [MASS citation info](#)

Materials: [NEWS](#)

In views: [Distributions](#), [Econometrics](#), [Environmetrics](#), [Multivariate](#), [NumericalMathematics](#), [Psychometrics](#), [Robust](#), [SocialSciences](#), [TeachingStatistics](#)

CRAN checks: [MASS results](#)

Dependencies and requirements of given package (including the R version)

TaskViews this package belongs to

Downloads:

Reference manual: [MASS.pdf](#) Documentation! Your greatest friend in programming and the most reliable source of knowledge!!!

Package source: [MASS_7.3-54.tar.gz](#)

Windows binaries: r-devel: [MASS_7.3-54.zip](#), r-release: [MASS_7.3-54.zip](#), r-oldrel: [MASS_7.3-54.zip](#)

macOS binaries: r-release (arm64): [MASS_7.3-54.tgz](#), r-release (x86_64): [MASS_7.3-54.tgz](#), r-oldrel: [MASS_7.3-54.tgz](#)

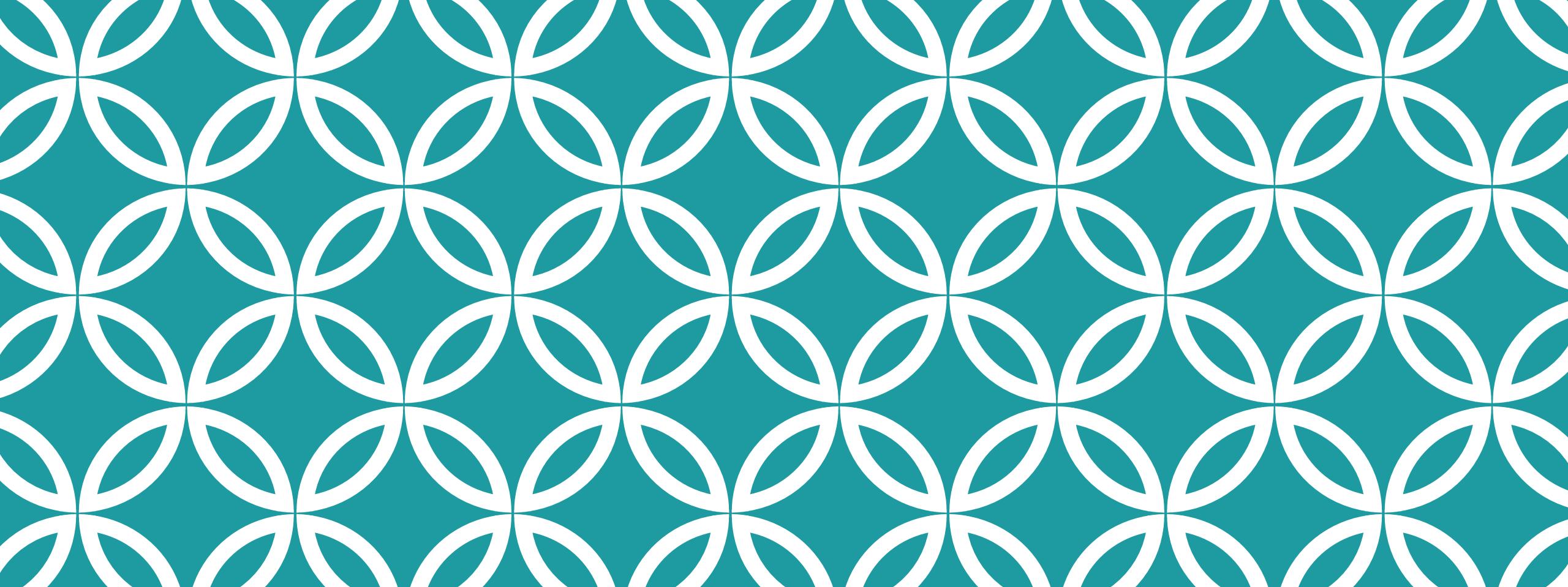
Old sources: [MASS archive](#)

Previous versions of the package

Reverse dependencies:

Reverse depends: [abc](#), [ABCp2](#), [acfMPPeriod](#), [AdaptFitOS](#), [addhaz](#), [anchors](#), [Aoptbdvce](#), [arm](#), [aSPU](#), [ASSET](#), [BALLI](#), [bapred](#), [bayeslongitudinal](#), [bayespref](#), [bayess](#), [BayesVarSel](#), [bbemkr](#), [BCLustLonG](#), [BCSub](#), [bhm](#), [biclust](#), [bigReg](#), [BioMark](#), [biostat3](#), [biotools](#), [bivrp](#), [biwt](#), [Blendstat](#), [blmeco](#), [bmem](#), [BNPTSclust](#), [Boom](#), [bootspecdens](#), [bootStepAIC](#), [Boptbd](#), [BSGS](#), [bSims](#), [calibrate](#), [cap](#), [caper](#), [capushe](#), [CARBayes](#), [CARBayesST](#), [catdata](#), [CBPS](#), [ccda](#), [CEoptim](#), [CepLDA](#), [changepointsVar](#), [CircStats](#), [clickstream](#), [CLME](#), [clusterGeneration](#), [clusterSim](#), [cold](#), [coloredICA](#), [CompR](#), [convevol](#), [COSINE](#), [countgmifs](#), [CovSel](#), [cquad](#), [CRTgeeDR](#), [csurvey](#), [ctl](#), [CVEK](#), [cwm](#), [DCluster](#), [ddalpha](#), [Deducer](#), [deltaPlotR](#), [depmix](#), [depmixS4](#), [DepthProc](#), [designmatch](#), [Devore7](#), [dhglm](#), [distrMod](#), [dml](#), [dmm](#), [dmt](#), [DoubleCone](#), [Dowd](#), [dr](#), [drc](#), [DTRlearn2](#), [EDFIR](#), [EDISON](#),

Other packages which utilize the functions from this package



R INSTALLATION

Installing R for the first time on a given machine



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- [Download R for Windows](#)

R is part of many Linux distributions, you should check with your Linux package management system in addition to the link above.

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- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

WINDOWS

R for Windows

Subdirectories:

[base](#)

Binaries for base distribution. This is what you want to [install R for the first time](#).

[contrib](#)

Binaries of contributed CRAN packages (for R $\geq 2.13.x$; managed by Uwe Ligges). There is also information on [third party software](#) available for CRAN Windows services and corresponding environment and make variables.

[old contrib](#)

Binaries of contributed CRAN packages for outdated versions of R (for R $< 2.13.x$; managed by Uwe Ligges).

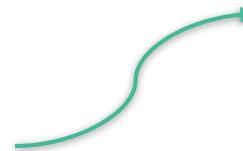
[Rtools](#)

Tools to build R and R packages. This is what you want to build your own packages on Windows, or to build R itself.

Please do not submit binaries to CRAN. Package developers might want to contact Uwe Ligges directly in case of questions / suggestions related to Windows binaries.

You may also want to read the [R FAQ](#) and [R for Windows FAQ](#).

Note: CRAN does some checks on these binaries for viruses, but cannot give guarantees. Use the normal precautions with downloaded executables.



R-4.3.1 for Windows

[Download R-4.3.1 for Windows](#) (79 megabytes, 64 bit)

[README on the Windows binary distribution](#)

[New features in this version](#)

This build requires UCRT, which is part of Windows since Windows 10 and Windows Server 2016. On older systems, UCRT has to be installed manually from [here](#).

If you want to double-check that the package you have downloaded matches the package distributed by CRAN, you can compare the [md5sum](#) of the .exe to the [fingerprint](#) on the master server.

Frequently asked questions

- [Does R run under my version of Windows?](#)
- [How do I update packages in my previous version of R?](#)

Please see the [R FAQ](#) for general information about R and the [R Windows FAQ](#) for Windows-specific information.

Other builds

- Patches to this release are incorporated in the [r-patched snapshot build](#).
- A build of the development version (which will eventually become the next major release of R) is available in the [r-devel snapshot build](#).
- [Previous releases](#)

Note to webmasters: A stable link which will redirect to the current Windows binary release is
<CRAN MIRROR>/bin/windows/base/release.html.

Last change: 2023-06-16

Download the file and go through the installation procedure (choose default options)

MAC OS

R for macOS

This directory contains binaries for the base distribution and of R and packages to run on macOS. R and package binaries for R versions older than 4.0.0 are only available from the [CRAN archive](#) so users of such versions should adjust the CRAN mirror setting (<https://cran-archive.r-project.org>) accordingly.

Note: Although we take precautions when assembling binaries, please use the normal precautions with downloaded executables.

R 4.4.1 "Race for Your Life" released on 2024/06/14

Please check the integrity of the downloaded package by checking the signature:

`pkgutil --check-signature R-4.4.1-arm64.pkg`

in the *Terminal* application. If Apple tools are not available you can check the SHA1 checksum of the downloaded image:
`openssl sha1 R-4.4.1-arm64.pkg`

Latest release:

Choose a version appropriate for your system

For Apple silicon (M1-3) Macs:

[R-4.4.1-arm64.pkg](#)

SHA1-

hash: 616560b17092bbdd8b814d9ed92d098e52204830
(ca. 94MB, notarized and signed)

For older Intel Macs:

[R-4.4.1-x86_64.pkg](#)

SHA1-

hash: e66eb09244121d7db7f8fb41d3c06a7579fc93b5
(ca. 96MB, notarized and signed)

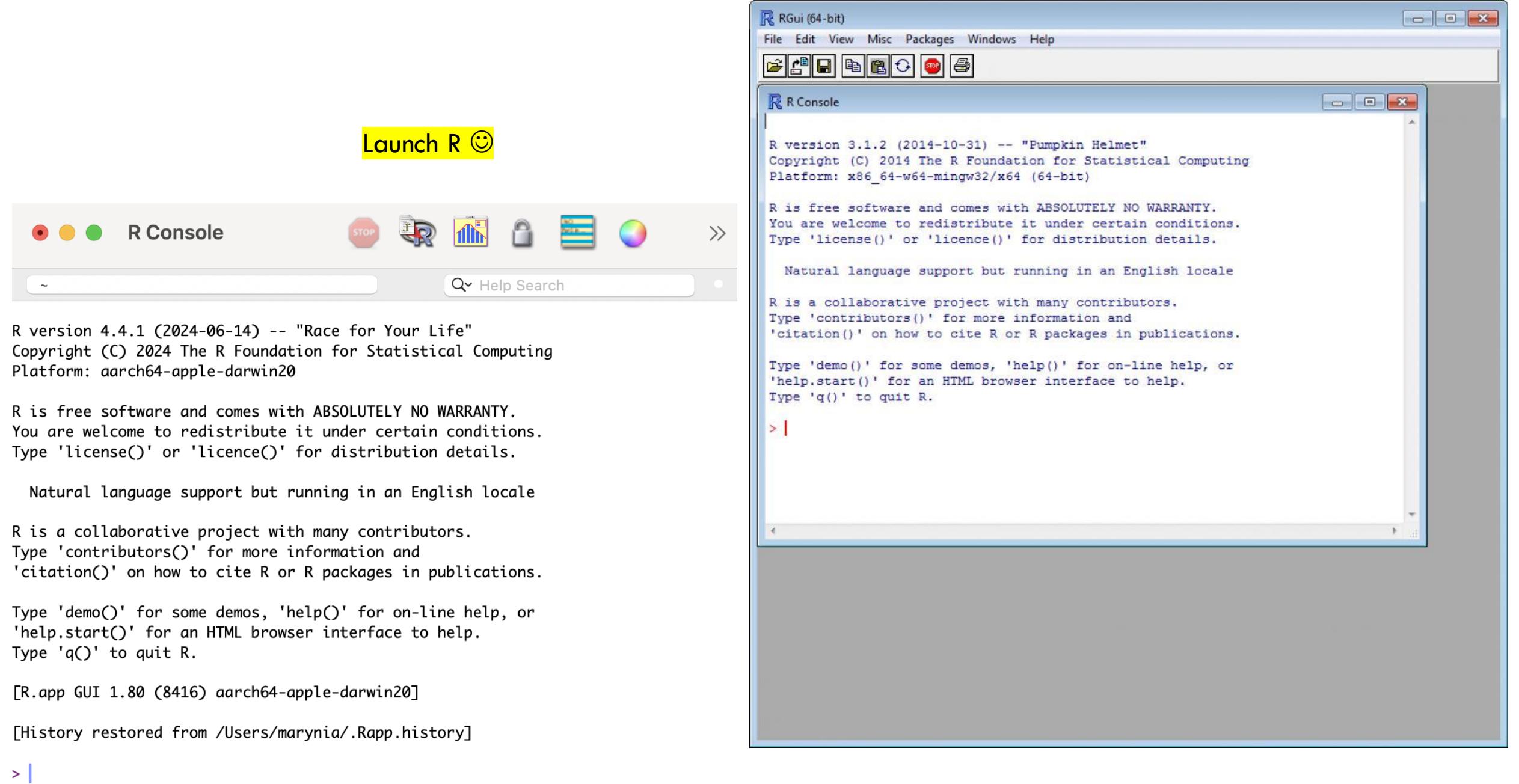
R 4.4.1 binary for macOS 11 (**Big Sur**) and higher, signed and notarized packages.

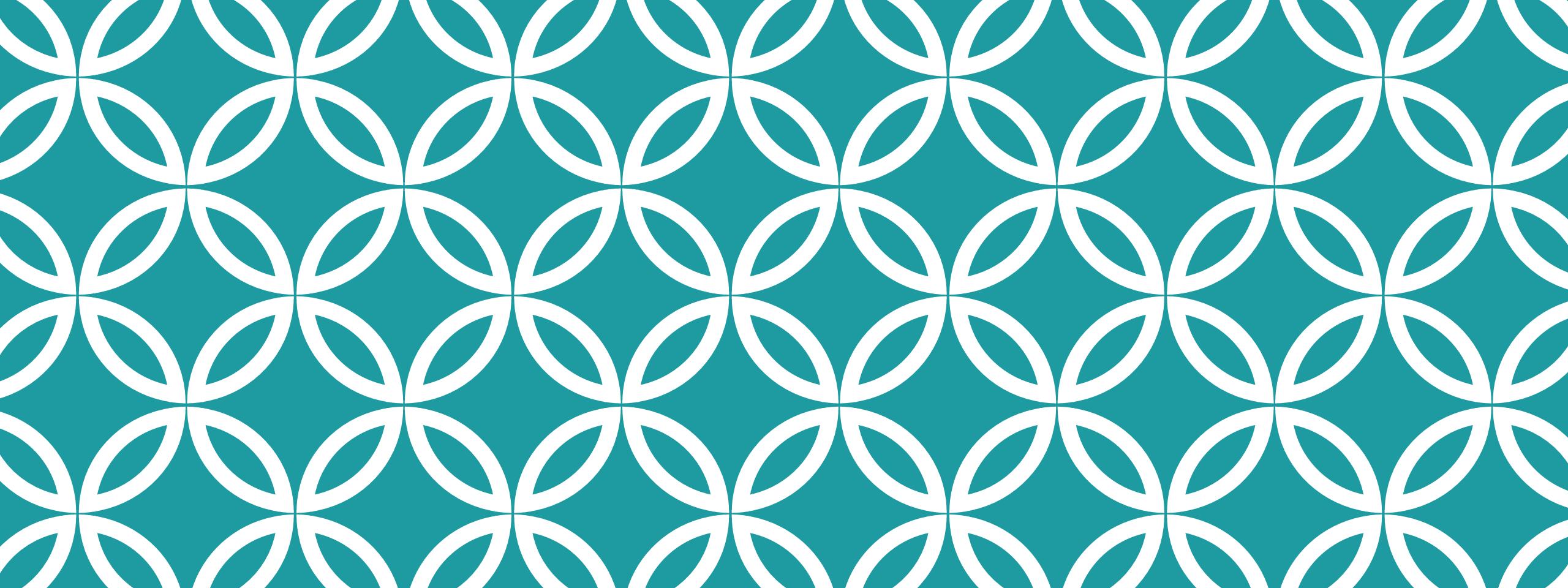
Contains R 4.4.1 framework, R.app GUI 1.80, Tcl/Tk 8.6.12 X11 libraries and Texinfo 6.8. The latter two components are optional and can be omitted when choosing "custom install", they are only needed if you want to use the `tcltk` R package or build package documentation from sources.

macOS Ventura users: there is a known bug in Ventura preventing installations from some locations without a prompt. If the installation fails, move the downloaded file away from the *Downloads* folder (e.g., to your home or Desktop).

Note: the use of X11 (including `tcltk`) requires [XQuartz](#) (version 2.8.5 or later). Always re-install XQuartz when upgrading your macOS to a new major version.

Download the file and go through the installation procedure





UPDATE R

Updating R on a machine
with previous version of R

R Console

R version 4.0.4 (2021-02-15) -- "Lost Library Book"

Copyright (C) 2021 The R Foundation for Statistical Computing

Platform: x86_64-w64-mingw32/x64 (64-bit)

R jest oprogramowaniem darmowym i dostarczany jest BEZ JAKIEJKOLWIEK GWARANCJI.

Możesz go rozpowszechniać pod pewnymi warunkami.

Wpisz 'license()' lub 'licence()' aby uzyskać szczegóły dystrybucji.

R jest projektem kolaboracyjnym z wieloma uczestnikami.

Wpisz 'contributors()' aby uzyskać więcej informacji oraz

'citation()' aby dowiedzieć się jak cytować R lub pakiety R w publikacjach.

Wpisz 'demo()' aby zobaczyć demo, 'help()' aby uzyskać pomoc on-line, lub

'help.start()' aby uzyskać pomoc w przeglądarce HTML.

Wpisz 'q()' aby wyjść z R.

> |

Open your current R version

R Console

```
R version 4.0.4 (2021-02-15) -- "Lost Library Book"
Copyright (C) 2021 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
```

```
R jest oprogramowaniem darmowym i dostarczany jest BEZ JAKIEJKOLWIEK GWARANCJI.
Możesz go rozpowszechniać pod pewnymi warunkami.
Wpisz 'license()' lub 'licence()' aby uzyskać szczegóły dystrybucji.
```

```
R jest projektem kolaboracyjnym z wieloma uczestnikami.
Wpisz 'contributors()' aby uzyskać więcej informacji oraz
'citation()' aby dowiedzieć się jak cytować R lub pakiety R w publikacjach
```

```
Wpisz 'demo()' aby zobaczyć demo, 'help()' aby uzyskać pomoc on-line, lub
'help.start()' aby uzyskać pomoc w przeglądarce HTML.
```

Wp:

Make sure that you have installed the package „installr”

```
> install.packages("installr")
Instalowanie pakietu w 'C:/Users/maria/Documents/R/win-library/4.0'
(ponieważ 'lib' nie jest określony)
--- Proszę wybrać serwer lustrzany CRAN do użycia w tej sesji ---
```

Secure CRAN mirrors

- 0-Cloud [https]
- Australia (Canberra) [https]
- Australia (Melbourne 1) [https]
- Australia (Melbourne 2) [https]
- Australia (Perth) [https]
- Austria [https]**
- Belgium (Brussels) [https]
- Brazil (BA) [https]
- Brazil (PR) [https]
- Brazil (RJ) [https]
- Brazil (SP 1) [https]
- Brazil (SP 2) [https]
- Bulgaria [https]
- Canada (MB) [https]
- Canada (ON 2) [https]
- Chile (Santiago) [https]
- China (Beijing 2) [https]
- China (Hefei) [https]
- China (Hong Kong) [https]
- China (Guangzhou) [https]
- China (Lanzhou) [https]
- China (Nanjing) [https]
- China (Shanghai 1) [https]
- China (Shanghai 2) [https]
- China (Shenzhen) [https]
- Costa Rica [https]
- Cyprus [https]
- Czech Republic [https]
- Denmark [https]
- East Asia [https]
- Ecuador (Cuenca) [https]
- Ecuador (Quito) [https]
- Estonia [https]
- France (Lyon) [https]
- France (Lyon 2) [https]
- France (Marseille) [https]
- France (Montpellier) [https]
- France (Paris 1) [https]

OK

Anuluj

**Choose server, from which you will
be downloading the package (any
server you'd like)**

```
R Console

próbowanie adresu URL 'https://cran.wu.ac.at/bin/windows/contrib/4.0/installr_0$ ^  
Content type 'application/zip' length 350806 bytes (342 KB)  
downloaded 342 KB

pakiet 'installr' został pomyślnie rozpakowany oraz sumy MD5 zostały sprawdzone  
Pobrane pakiety binarne są w  
    C:\Users\maria\AppData\Local\Temp\RtmpoL44JK\downloaded_packages  
> library(installr)

Welcome to installr version 0.23.2

More information is available on the installr project website:  
https://github.com/talgalili/installr/

Contact: <tal.galili@gmail.com>
Suggestions and bug-reports can be submitted at: https://github.com/talgalili/installr/issues

To suppress this message use:  
suppressPackageStartupMessages(library(installr))

Komunikat ostrzegawczy:  
pakiet 'installr' został zbudowany w wersji R 4.0.5
> updateR() Run updateR() command
```

Information X

i There is a newer version of R for you to download!

You are using R version: 4.0.4 (2021-02-15)
And the latest R version is: 4.1.0 (2021-05-18)

OK

Information

X



There is a newer version of R for you to download!
You are using R version: 4.0.4 (2021-02-15)
And the latest R version is: 4.1.0 (2021-05-18)

OK

C.compares the current R version installed on a given machine to the newest available version.
If your R is up-to-date the process ends here.

Question



Do you wish to see the NEWS regarding this new version of R?

YES NO

After clicking “Yes” there will be a website opened in your webbrowser informing you about the changes in R. Choose any.

Question



Do you wish to install the latest version of R?

YES NO

After clicking “Yes” the installation file will be downloading. After running it, the process of new R installation will begin.

49% downloaded

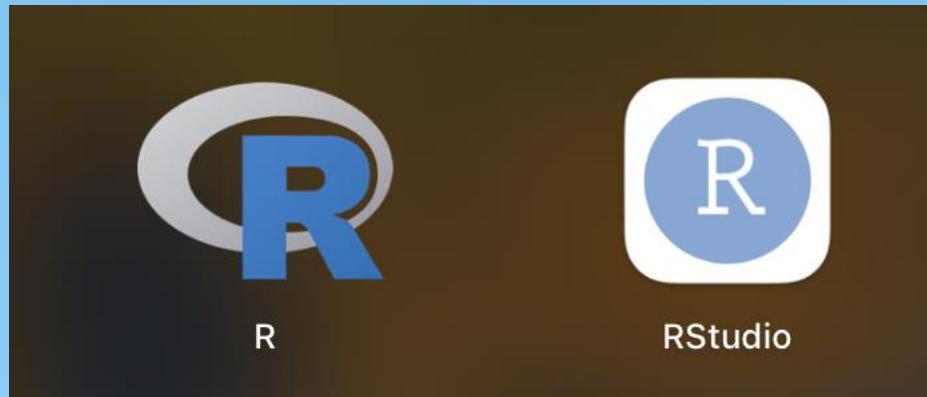
URL: <https://cran.rstudio.com/bin/windows/base/R-4.1.0-win.exe>



There is a newer version of R for you to download!

Compares the current R version installed on a

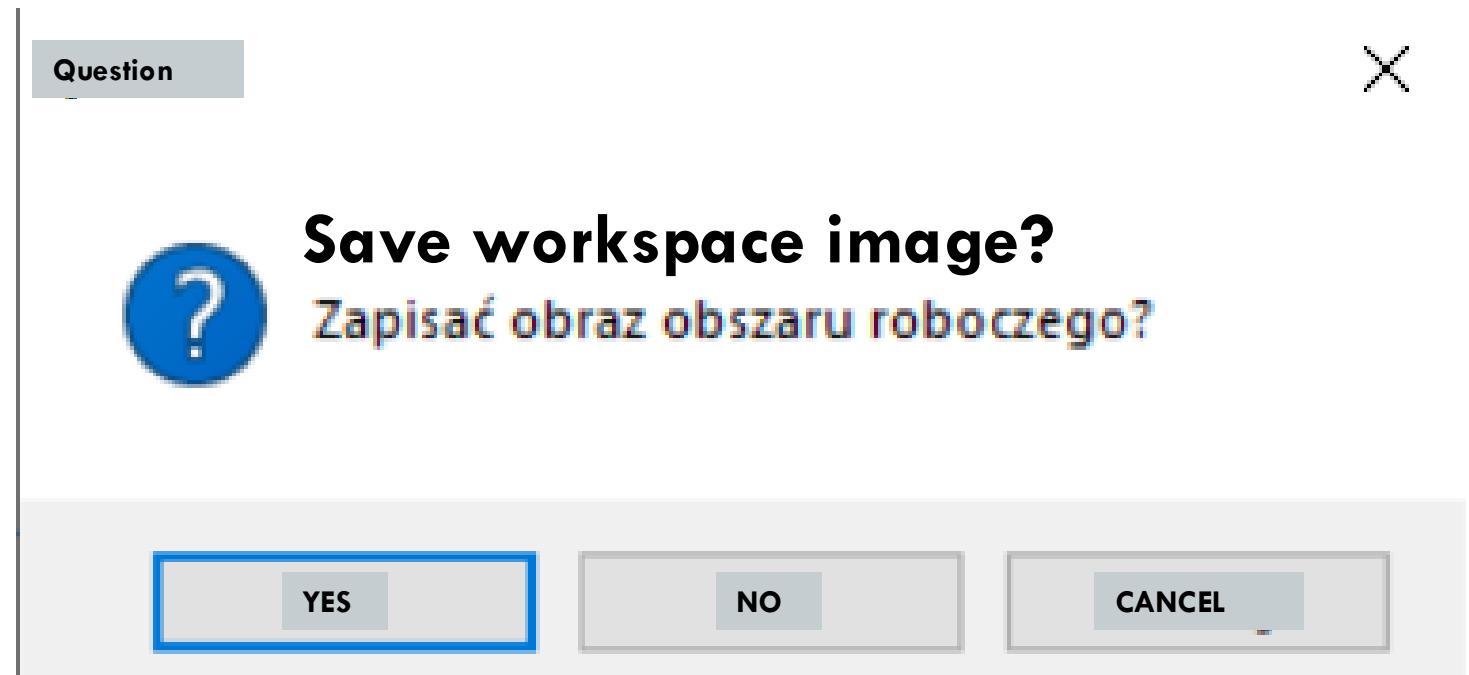
If this process fails on Mac, just go to <https://cloud.r-project.org/bin/macosx/> and download the pkg file with the newest version of R and go through the installation process once again. R in your Launchpad will be replaced with the newest version, and RStudio will use the newest R on your computer as well.

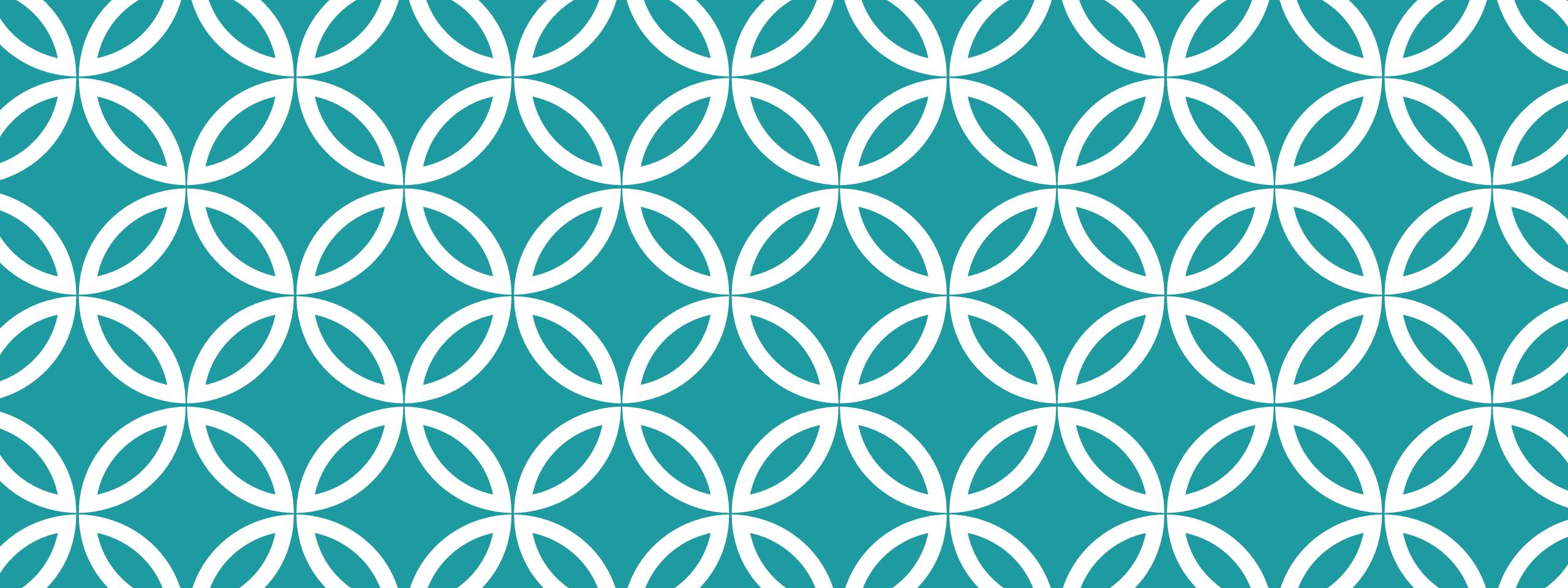
URL: <https://cran.rstudio.com/bin/windows/base/R-4.1.0-win.exe>

WORKSPACE IMAGE

The answer is always: NO.

Instead of saving the “workspace image” and creating unnecessary files, it’s better to save scripts with the used code and/or save given objects and datafiles after modifications with the usage of `save()` function. We will discuss it in the following classes.





R STUDIO

Helpful IDE for writing code and
creating bigger projects in R

RSTUDIO

<https://posit.co/downloads/> (before website rstudio.com, now after rebranding)

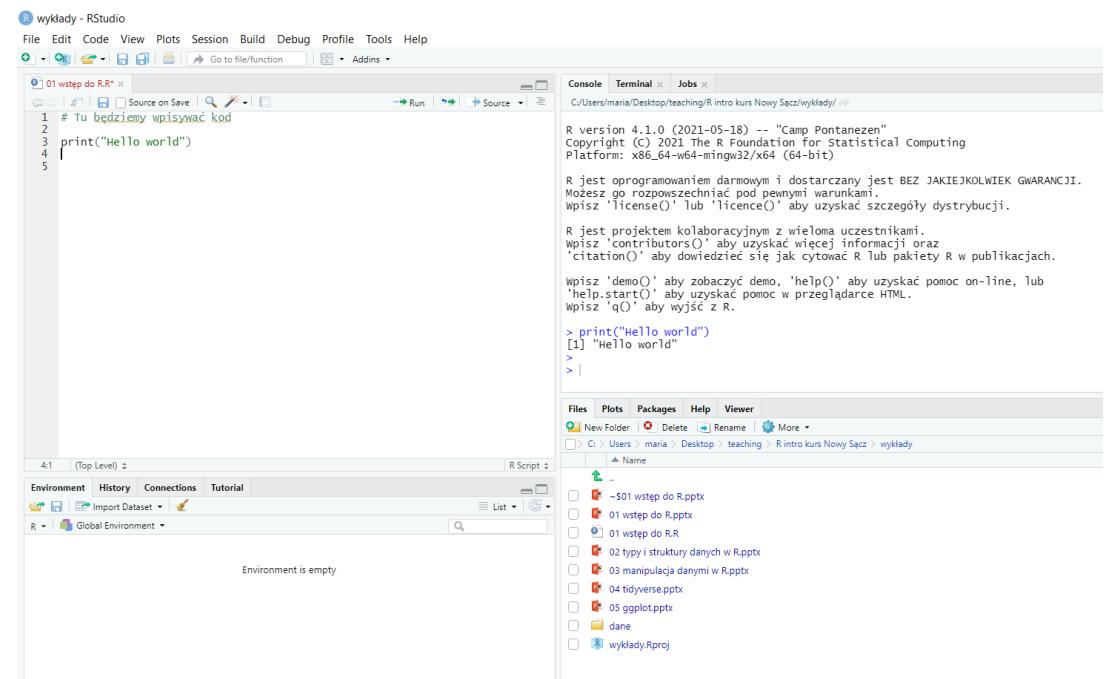
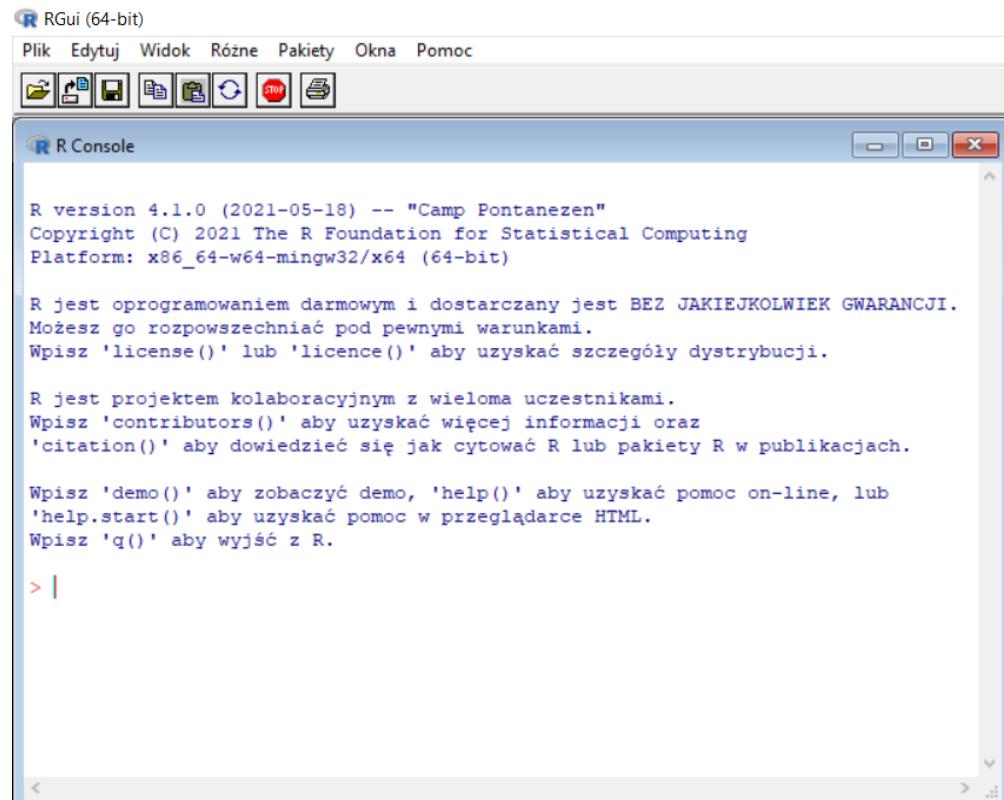
RStudio is an IDE (*integrated development environment*) – environment for writing code in R

It allows for better code management in R, e.g. creating code scripts or checking the syntax

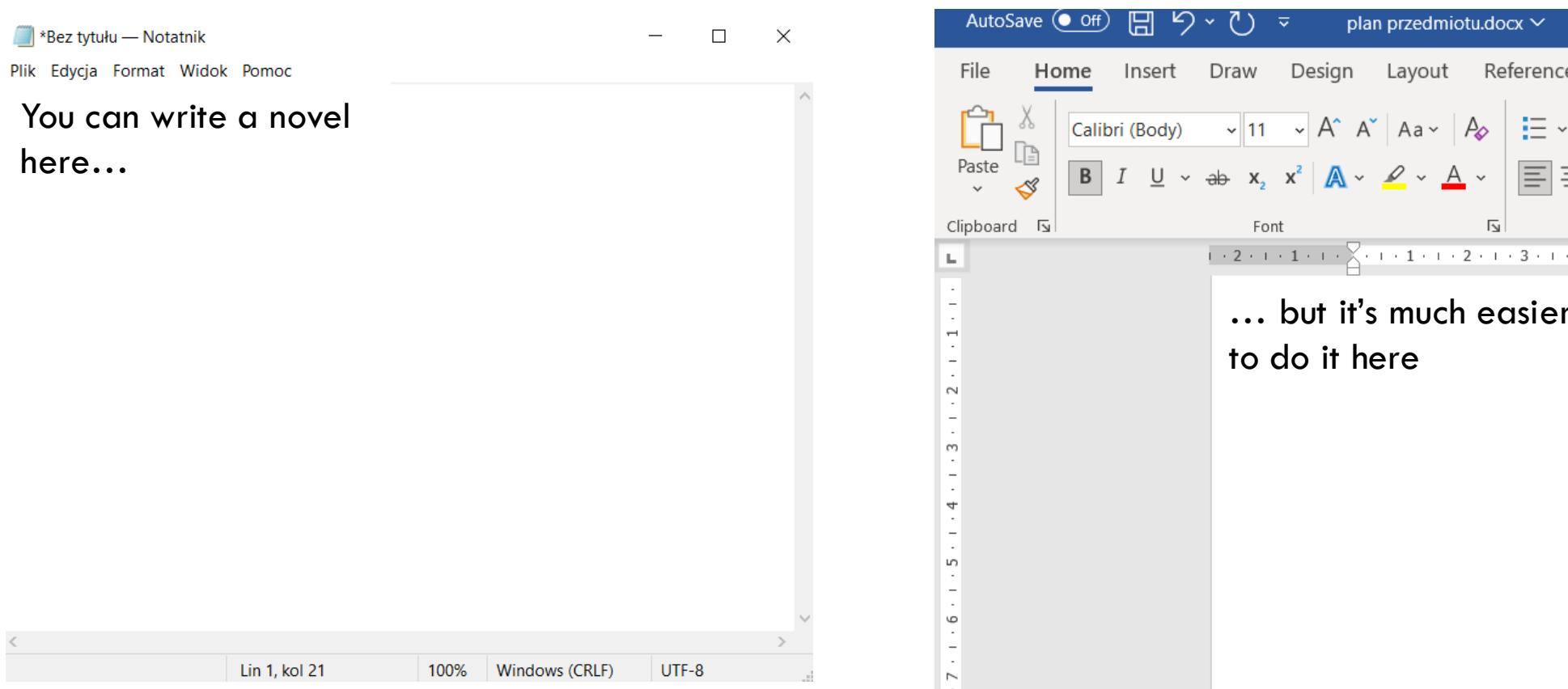
It allows for creating projects, which group individual code scripts and organize work on a bigger programming task

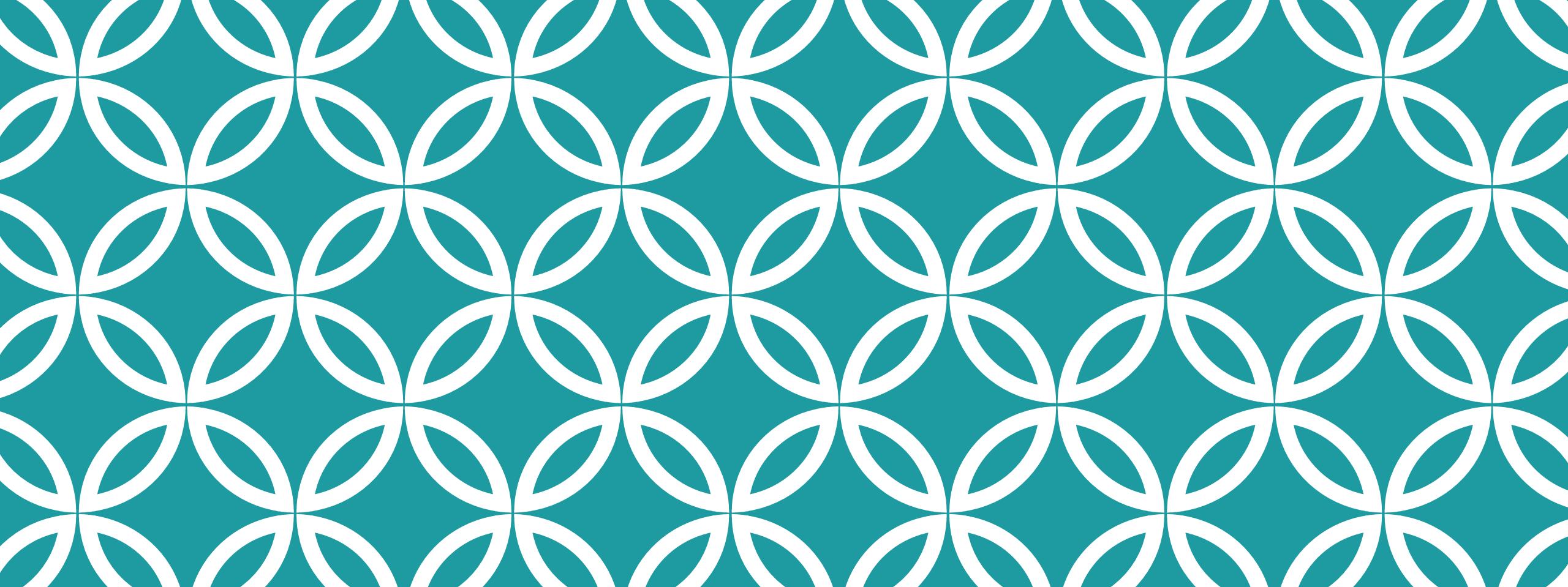
It allows free solutions (*open source*), as well as paid versions for the commercial usage

DIFFERENCE BETWEEN R AND RSTUDIO . . .



... IS MAINLY THE COMFORT





INSTALLING R STUDIO

To install RStudio you need to have an up-to-date R version **already** installed on your computer.



Open the website of RStudio provider- POSIT <https://posit.co/downloads/> and choose appropriate version

DOWNLOAD

RStudio IDE

The most popular coding environment for R, built with love by Posit.

Used by millions of people weekly, the RStudio integrated development environment (IDE) is a set of tools built to help you be more productive with R and Python. It includes a console, syntax-highlighting editor that supports direct code execution. It also features tools for plotting, viewing history, debugging and managing your workspace.

If you're a professional data scientist and want guidance on adopting open-source tools at your organization, don't hesitate to [book a call with us](#).

[DOWNLOAD RSTUDIO](#)

[DOWNLOAD RSTUDIO SERVER](#)

DOWNLOAD

RStudio Desktop

Used by millions of people weekly, the RStudio integrated development environment (IDE) is a set of tools built to help you be more productive with R and Python.

Don't want to download or install anything? Get started with RStudio on [Posit Cloud for free](#). If you're a professional data scientist looking to download RStudio and also need common enterprise features, don't hesitate to [book a call with us](#).

1: Install R

Make sure that your R is installed already

RStudio requires R 3.3.0+. Choose a version of R that matches your computer's operating system.

2: Install RStudio

Download the newest version of RStudio (the website usually detects a version suitable for your operating system)

[DOWNLOAD RSTUDIO DESKTOP FOR WINDOWS](#)

Size: 212.78 MB | [SHA-256: BCF6B866](#) | Version: 2023.06.2+561 | Released: 2023-08-30

[All Installers and Tarballs](#)

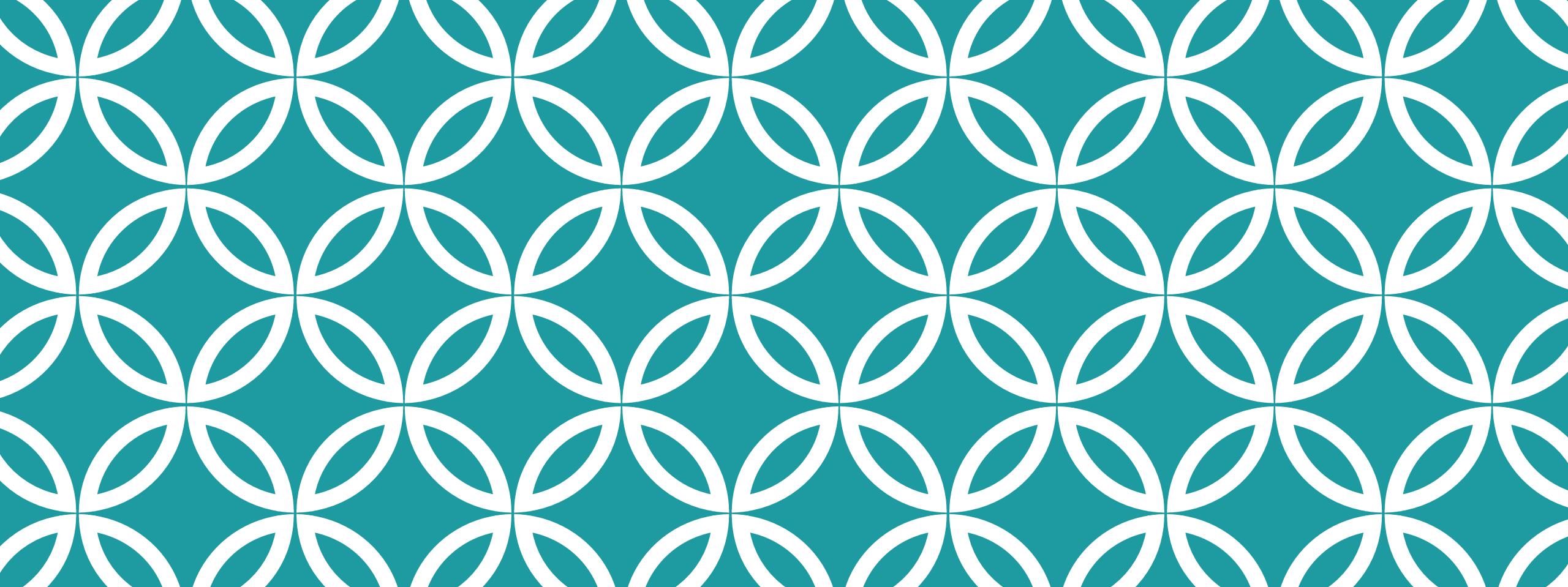
If needed, scroll down and choose suitable installer

OS	Download	Size	SHA-256
Windows 10/11	RSTUDIO-2023.06.2-561.EXE ↓	212.78 MB	BCF6B866
macOS 11+	RSTUDIO-2023.06.2-561.DMG ↓	375.50 MB	ED47CA60
Ubuntu 20/Debian 11	RSTUDIO-2023.06.2-561-AMD64.DEB ↓	146.05 MB	981FCBB3
Ubuntu 22	RSTUDIO-2023.06.2-561-AMD64.DEB ↓	146.60 MB	BB6B3C21
Fedora 19/Red Hat 7	RSTUDIO-2023.06.2-561-X86_64.RPM ↓	162.31 MB	7EAFA813

```
. Name it "profitPerStudent".  
a$students  
When using RStudio you may get a pop-up  
about a software update (regarding IDE). It is  
good to keep RStudio updated, to get the  
newest bugfixes and the most stable version of  
the environment.  
i RStudio 2023.06.2+561 is now available (you're using 2023.06.1+524)  
→ Quit and Download...  
→ Remind Later  
→ Ignore Update  
IMPORTANT! Updating R and updating  
RStudio are two different things. R is the  
heart of our operations. RStudio is just a  
layer on top of it, which makes our work  
a little bit more comfortable.
```

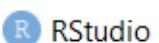
Copyright (C) 2023 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.
Type 'help()' for on-line help and 'demo()' for examples.
Type 'help2dgrid()' for help on R packages in your browser interface to R.



WORK IN RSTUDIO

Creating scripts and projects



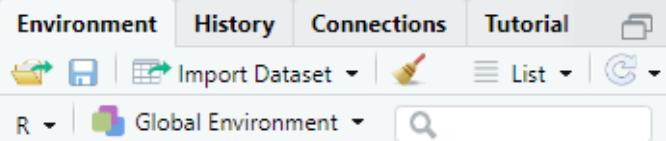
File Edit Code View Plots Session Build Debug Profile Tools Help



Go to file/function



Project: (None)



Environment is empty

Console Terminal x Jobs x

~/

R version 4.1.0 (2021-05-18) -- "Camp Pontanezen"
Copyright (C) 2021 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R jest oprogramowaniem darmowym i dostarczany jest BEZ JAKIEJKOL
WIEK GWARANCJI. **Information about R will**
Możesz go rozoznaczać, instalować, itd.
Wpisz 'license()' w konsoli, aby uzyskać szczegółowe informacje o licencji.
display in a language chosen podczas instalacji.

R jest projektem kolaboracyjnym z wieloma uczestnikami.
Wpisz 'contributors()' aby uzyskać więcej informacji oraz
'citation()' aby dowiedzieć się jak cytować R lub pakiety R w publikacjach.

Wpisz 'demo()' aby zobaczyć demo, 'help()' aby uzyskać pomoc online, lub
'help.start()' aby uzyskać pomoc w przeglądarce HTML.
Wpisz 'q()' aby wyjść z R.

> |

Files Plots Packages Help Viewer



Default view of RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help



Hide Toolbar

Project: (None)

Panes

- Actual Size Ctrl+0
- Zoom In Ctrl++
- Zoom Out Ctrl+-
- Switch to Tab... Ctrl+Shift+.
- Next Tab Ctrl+Tab
- Previous Tab Ctrl+Shift+Tab
- First Tab Ctrl+Shift+F11
- Last Tab Ctrl+Shift+F12
- Move Focus to Source Ctrl+1
- Move Focus to Console Ctrl+2
- Move Focus to Terminal Alt+Shift+M
- Move Focus to Help Ctrl+3

- History Ctrl+4
- Show Files Ctrl+5
- Show Plots Ctrl+6
- Show Packages Ctrl+7
- Show Environment Ctrl+8
- Show Viewer Ctrl+9
- Show Connections Ctrl+F5
- Show Tutorial
- Show Jobs
- Show Other Panes

dins

- Show All Panes Ctrl+Alt+Shift+0
- Add Source Column Ctrl+F7
- Console on Left
- Console on Right
- Zoom Left / Center Column Ctrl+Alt+Shift+F12
- Zoom Right Column Ctrl+Alt+Shift+F11
- Zoom Source Ctrl+Shift+1
- Zoom Console Ctrl+Shift+2
- Zoom Help Ctrl+Shift+3
- Zoom History Ctrl+Shift+4
- Zoom Files Ctrl+Shift+5
- Zoom Plots Ctrl+Shift+6
- Zoom Packages Ctrl+Shift+7
- Zoom Environment Ctrl+Shift+8
- Zoom Viewer Ctrl+Shift+9
- Zoom Tutorial Ctrl+Shift+F6
- Zoom Connections Ctrl+Shift+F5
- Adjust Left Splitter
- Adjust Right Splitter
- Adjust Center Splitter
- Adjust Source Column Splitter
- Pane Layout...

Editing the view

(displaying/hiding the panels,

showing console on the right/left,

zoom itd.)

File Edit Code View Plots Session Build Debug Profile Tools Help

Go to file/function

Environment History Connections Tutorial

Import Dataset List

R Global Environment

Environment is empty

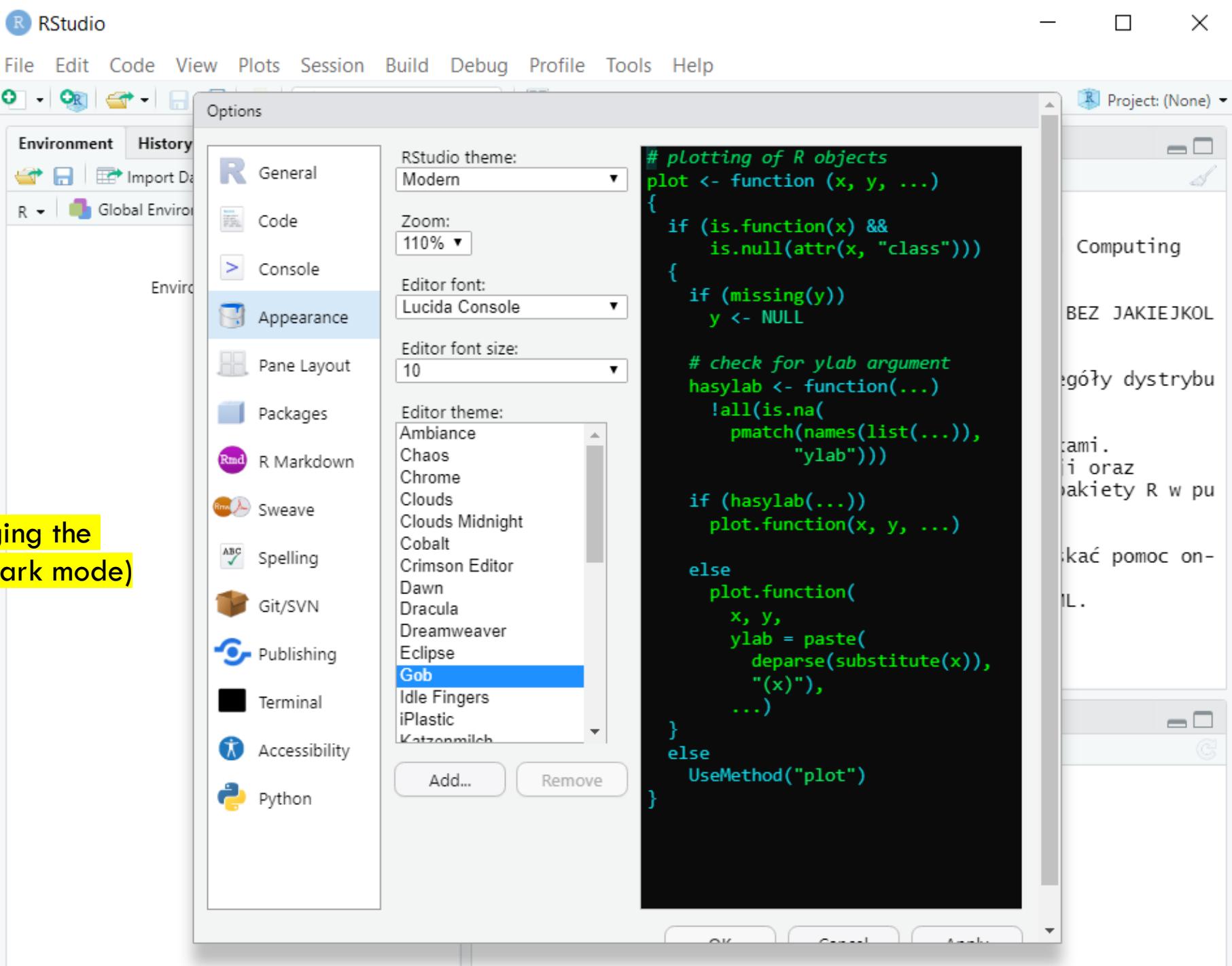
R version Copyright Platform:
R jest op WIEK GWARA
Możesz go Wpisz 'lic cji.
R jest pro Wpisz 'con 'citation(blikacjach

Wpisz 'demo()' aby zobaczyć demo, 'help()' aby uzyskać pomoc on-line lub start() aby uzyskać pomoc w przeglądarce HTML.
wpisz 'q()' aby wyjść z R.

Install Packages...
Check for Package Updates...
Version Control
Shell...
Terminal
Jobs
Addins
Keyboard Shortcuts Help Alt+Shift+K
Modify Keyboard Shortcuts...
Show Command Palette Ctrl+Shift+P
Project Options...
Global Options...

Project: (None)

Files Plots Packages Help Viewer



File Edit Code View Plots Session Build Debug Profile Tools Help

New File

New Project...

Open File... Ctrl+O

Open File in New Column...

Recent Files

Open Project...

Open Project in New Session...

Recent Projects

Import Dataset

Save Ctrl+S

Save As...

Save All Ctrl+Alt+S

Publish...

Print...

Close Ctrl+W

Close All Ctrl+Shift+W

Close All Except Current Ctrl+Alt+Shift+W

Close Project

Quit Session... Ctrl+Q

R Script

Ctrl+Shift+N

Project: (None) ▾

R Notebook

Creating new script (file with the code)

R Markdown...

Shiny Web App...

Plumber API...

C File

C++ File

Header File

Markdown File

HTML File

CSS File

JavaScript File

D3 Script

Python Script

Shell Script

SQL Script

Stan File

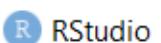
Text File

R Sweave

R HTML

R Presentation

R Documentation...



RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help



Go to file/function



Addins



Project: (None)

Environment Create a project Connections Tutorial

Import Dataset List C

R Global Environment

Environment is empty

Creating new project

```
R version 4.1.0 (2021-05-18) -- "Camp Pontanezen"  
Copyright (C) 2021 The R Foundation for Statistical Computing  
Platform: x86_64-w64-mingw32/x64 (64-bit)  
  
R jest oprogramowaniem darmowym i dostarczany jest BEZ JAKIEJKOL  
WIEK GWARANCJI.  
Możesz go rozpowszechniać pod pewnymi warunkami.  
Wpisz 'license()' lub 'licence()' aby uzyskać szczegóły dystrybu  
cji.  
  
R jest projektem kolaboracyjnym z wieloma uczestnikami.  
Wpisz 'contributors()' aby uzyskać więcej informacji oraz  
'citation()' aby dowiedzieć się jak cytować R lub pakiety R w pu  
blikacjach.  
  
Wpisz 'demo()' aby zobaczyć demo, 'help()' aby uzyskać pomoc on  
line, lub  
'help.start()' aby uzyskać pomoc w przeglądarce HTML.  
Wpisz 'q()' aby wyjść z R.
```

> |

Files Plots Packages Help Viewer

X C



Go to file/function

Addins

Project: (None)

Environment History Connections Tutorial

Import Dataset List C

R Global Environment

Console Terminal x Jobs x

~/ ↻

R version 4.1.0 (2021-05-18) -- "Camp Pontanezen"
Copyright (C) 2021 The R Foundation for Statistical Computing

New Project Wizard

Create Project

Choosing new directory (folder)

- New Directory**
Start a project in a brand new working directory >
- Existing Directory**
Associate a project with an existing working directory >
- Version Control**
Checkout a project from a version control repository >

Cancel

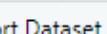
jest BEZ JAKIEJKOL
mi.
szczegóły dystrybu
estnikami.
ormacji oraz
lub pakiety R w pu
y uzyskać pomoc on-
ce HTML.

Environment

History

Connections

Tutorial



Console

Terminal

Jobs

~/

R version 4.1.0 (2021-05-18) -- "Camp Pontanezen"
Copyright (C) 2021 The R Foundation for Statistical Computing

Environment

New Project Wizard

Back

Project Type

New Project

R Package

Shiny Web Application

R Package using Rcpp

R Package using RcppArmadillo

R Package using RcppEigen

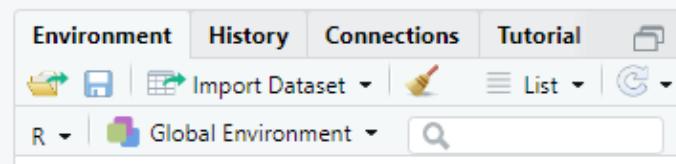
R Package using devtools

Choosing "new project"

Create a new
project in an empty
directory

Cancel

jest BEZ JAKIEJKOL
mi.
szczegóły dystrybu-
estnikami.
ormacji oraz
lub pakiety R w pu-
y uzyskać pomoc on-
ce HTML.



Console Terminal x Jobs x
~/ ↗

R version 4.1.0 (2021-05-18) -- "Camp Pontanezen"
Copyright (C) 2021 The R Foundation for Statistical Computing

New Project Wizard

Back Create New Project

Directory name:

Create project as subdirectory of:

Create a git repository

Use renv with this project

Choosing the project path and naming the folder which will be containing it

Open in new session

jest BEZ JAKIEJKOL
mi.
szczegóły dystrybu
estnikami.
ormacji oraz
lub pakiety R w pu
y uzyskać pomoc on-
ce HTML.

R nowy projekt - RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Go to file/function Addins

Environment History Connections Tutorial Import Dataset List Global Environment

Environment is empty

Console Terminal Jobs

C:/Users/maria/Desktop/nowy projekt/ Wpisz 'contributors()' aby uzyskać więcej informacji oraz 'citation()' aby dowiedzieć się jak cytować R lub pakiety R w publikacjach.

Wpisz 'demo()' aby zobaczyć demo, 'help()' aby uzyskać pomoc on-line, lub 'help.start()' aby uzyskać pomoc w przeglądarce HTML.

Wpisz 'q()' aby wyjść z R.

Files Plots Packages Help Viewer

New Folder Delete Rename More

C: > Users > maria > Desktop > nowy projekt

	Name	Size	Modified
	..		
	nowy projekt.Rproj	218 B	Aug 6, 2021, 2:48 PM

After creating the project RStudio will automatically switch to the new project view

RStudio view while working on a project

The screenshot shows the RStudio interface with several key components highlighted:

- Code Editor:** Shows a script with comments and code. A yellow box highlights the text "Editing code and adding comments in a given script".
- Console:** Displays R session output. A yellow box highlights the text "Run code and check its results in the console".
- Environment View:** Shows loaded variables `a` and `b`. A yellow box highlights the text "Loaded variables and datasets in the current session".
- File Browser:** Shows the project structure under "wykłady". A yellow box highlights the text "Looking through the files belonging to the project".

Annotations in yellow boxes:

- Editing code and adding comments in a given script
- Run code and check its results in the console
- Loaded variables and datasets in the current session
- Looking through the files belonging to the project

Code in the editor:

```
1 #####
2 #####
3 ##### Anal
4 #####
5 #####
6 # Skrypt w RStudio
7 # Znak hash rozpoczęta komentarz
8
9 # Znak hash rozpoczęty komentarz
10
11 # Skrót klawiatury ctrl+shift+C pozwala na
12 # skomentowanie/odkomentowanie większego bloku tekstu
13
14 #####
15 #####
16
17 # Obliczenia w R
18
19 1+2
20
21 3*15
22
23
```

Console output:

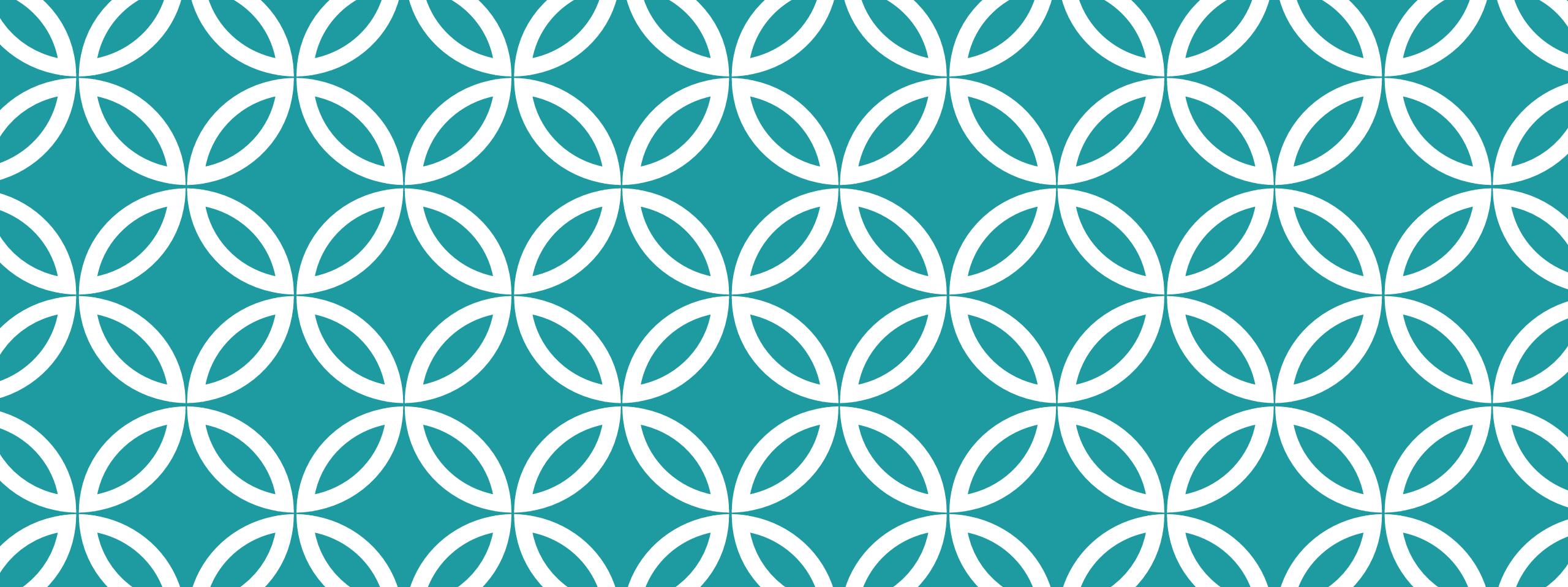
```
R 4.1.1 · C:/Users/maria/Desktop/teaching/2021 Zima Analiza danych z R WSB
> #####
#####
> # Obliczenia w R
>
> 1+2
[1] 3
> 3*15
[1] 45
> a
Error: object 'a' not found
>
> a <- 1
>
> a
[1] 1
>
> # znak <- służy do przypisywania wartości
```

Environment View:

Values	a	1
	b	1

File Browser:

Name	Size	Modified
..		
.Rhistory	20.6 KB	Oct 6, 2021
~\$01 wstęp do R.pptx		
01 wstęp do R.pptx		
01 wstęp do R.R		
02 typy i struktury danych w R.pptx	1.9 MB	Oct 1, 2021
02 typy i struktury danych w R.R	12.1 KB	Sep 21, 2021
03 przetwarzanie danych w R.pptx	307.7 KB	Oct 1, 2021



BASIC OPERATIONS IN R

VARIABLE

Variable – used for storing data and results of the operations. Value of the variable can be a number, sequence of characters or other data structure. Variable must have a name, which will be used for calling its content in the code. Name is set freely by the user, but needs to comply with these conditions:

- Must start with a letter or an underscore _ symbol
- May contain only letters, numbers and underscore
- In names there is a difference between upper and lower-case
- You can use local letters in the names (like polish symbols qśćź, etc. – beware of the code sharing)

Assigning value to the variable:

a <- 12 or a = 12

FUNCTION

Function – sequence of instructions, making up for a block of code, which can be used multiple times in different places. Functions usually return certain values after finishing their work.

#example function call in R

```
function(argument1, argument2, argument3, ...)
```

#saving the function result to a variable

```
a <- function(argument1, argument2, argument3, ...)
```

BASIC OPERATIONS IN R

2+2

Simple mathematical operations

variable1 = 1

Assigning value to a variable

variable1 <- 1

Assigning value to a variable

vector1 <- c(1,2,3)

Creating a vector with values 1,2,3

vector2 <- c(1:10)

Vector with values from 1 to 10

help(c)

Opening documentation regarding given function

wekt <- rep(2, times=3)

Creating a vector with three repetitions of number 2

LOOK FOR HELP WITH YOUR CODE

how to do a vector 1 to 10 in R X |  

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[How do you create vectors with specific intervals in R? - Stack ...](#)

11 maj 2018 · 3 odpowiedzi

In R the equivalent function is seq and you can use it with the option by : seq(from = 5, to = 100, by = 5) # [1] 5 10 15 20 25 30 35 40 45 ...

[R numbers from 1 to 100 - Stack Overflow](#) 2 odpowiedzi 13 lip 2012

[R, generate number vector only contains 0 and 1 ...](#) 2 odpowiedzi 20 mar 2015

[Changing vector of 1-10 to vector of 1-3 using R ...](#) 2 odpowiedzi 15 mar 2015

[Counting the number of elements with the values ...](#) 19 odpowiedzi 7 lis 2011

[Więcej wyników z stackoverflow.com](#)

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How do you create vectors with specific intervals in R?

Asked 8 years, 4 months ago Active 2 years, 9 months ago Viewed 154k times

I have a question about creating vectors. If I do `a <- 1:10`, "a" has the values 1,2,3,4,5,6,7,8,9,10.

46 My question is how do you create a vector with specific intervals between its elements. For example, I would like to create a vector that has the values from 1 to 100 but only count in intervals of 5 so that I get a vector that has the values 5,10,15,20,...,95,100

12 I think that in Matlab we can do `1:5:100`, how do we do this using R?

5 I could try doing `5*(1:20)` but is there a shorter way? (since in this case I would need to know the whole length (100) and then divide by the size of the interval (5) to get the 20)

[r](#) [vector](#) [intervals](#)

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edited Jun 19 '17 at 6:22



zx8754

42.7k ● 10 ● 97 ● 158

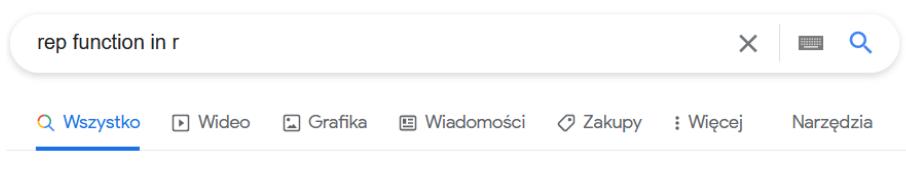
asked Mar 24 '13 at 17:24



Luli

513 ● 1 ● 4 ● 4

READ THE DOCUMENTATION



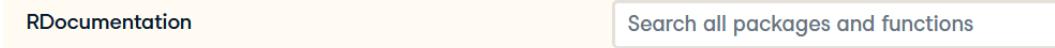
Około 573 000 000 wyników (0,50 s)

<https://www.rdocumentation.org> › rep › Tłumaczenie strony

rep function - RDocumentation

rep replicates the values in x . It is a generic **function**, and the (internal) default **method** is described here. **rep.int** and **rep_len** are faster simplified ...

Find the documentation in
the web or use these
commands within R:
help(functionname)
?functionname



Description

'rep' replicates the values in 'x' . It is a generic function, and the (internal) default method is described here.

'rep.int' and 'rep_len' are faster simplified versions for two common cases. Internally, they are generic, so methods can be defined for them.

Usage

```
rep(x, ...)  
rep.int(x, times)  
rep_len(x, length.out)
```

Arguments

x a vector (of any mode including a `list`) or a factor or (for 'rep' only) a `POSIXct` or `POSIXlt` or `Date` object; or an S4 object containing such an object.