Practical R: Packages

Abhijit Dasgupta

What are packages in R?

Packages

Packages are collections of functions, and sometimes data, that are usually unified for a common purpose

If *functions* are recipes, then *packages* are recipe books

If you want to cook from a recipe, you first have to grab the recipe book from your shelf

Similarly, if you want to use a function from a package, you first have to grab or activate the package in *your current R session*

This is done using the `library` function

For example,

```
library(tidyverse)
library(janitor)
```

Packages

There is another way to access functions from packages, if you're really only going to use one function from it.

The general form for this is `<package>::<function>` (note the **two** colons)

For example, if you just want to use the `clean_names` function from the **janitor** package, you can do so by

```
janitor::clean_names(dataset)
```

where `dataset` is the name of the data.frame whose column names you want to clean.

Important operational notes

Install packages once per computer

Never install packages inside a R Markdown file

Activate a package once per R session

The pacman package and the `pacman::p_load` function saves you a bunch of trouble by installing a package only if it doesn't exist on your computer and then activating the packaage. This one function removes a lot of the operational issues in installing and loading packages in R.

Where are the packages?

CRAN

CRAN is the Comprehensive R Archive Network, a network of mirrored repositories containing R packages.

Today, it really doesn't matter which of the repositories you use.

In RStudio, the default repository is Global (CDN) - RStudio which is a version in the cloud that typically works the fastest.

CRAN

You can install packages from CRAN using the following means:

```
install.packages("<package name>")
```

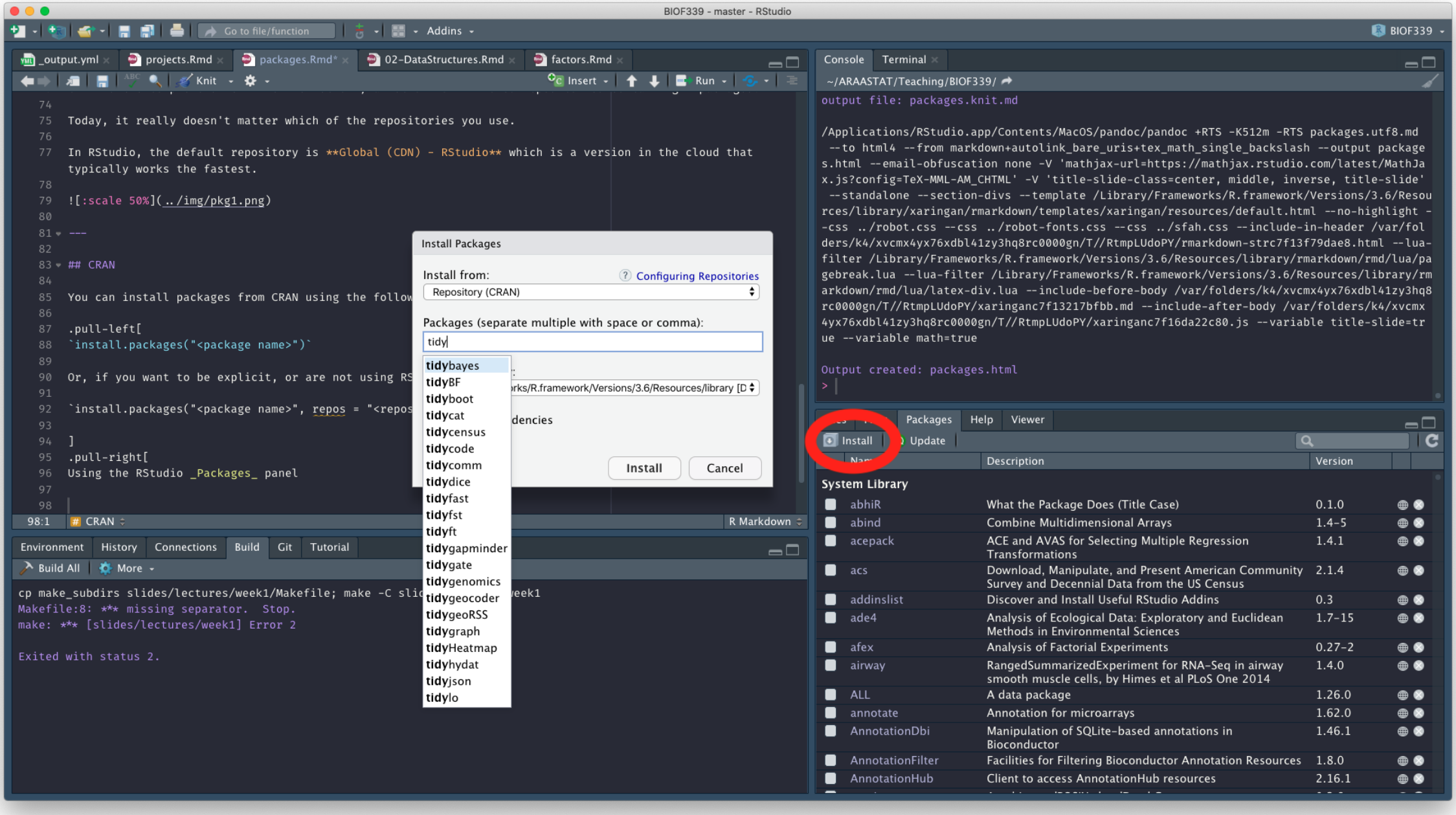
Or, if you want to be explicit, or are not using RStudio,

```
install.packages("<package name>", repos = "
<repository URL>")
```

.pull-right[Using the RStudio *Packages* panel

(see next slide)

You can find packages using CRAN Task Views


BIOF339 - master - RStudio
Go to file/function
Addins
BIOF339
_output.yml
projects.Rmd
packages.Rmd*
02-DataStructures.Rmd
factors.Rmd
Knit
Insert
Run
74
75 Today, it really doesn't matter which of the repositories you use.
76
77 In RStudio, the default repository is **Global (CDN) - RStudio** which is a version in the cloud that typically works the fastest.
78
79 ![:scale 50%](../img/pkg1.png)
80
81 ---
82
83 ## CRAN
84
85 You can install packages from CRAN using the follow
86
87 .pull-left[
88 `install.packages("<package name>")`
89
90 Or, if you want to be explicit, or are not using RS
91
92 `install.packages("<package name>", repos = "<repos
93
94]
95 .pull-right[
96 Using the RStudio _Packages_ panel
97
98
98:1
CRAN
R Markdown
Install Packages
Install from:
Configuring Repositories
Repository (CRAN)
Packages (separate multiple with space or comma):
tidy
tidybayes
tidyBF
tidyboot
tidycat
tidycensus
tidycode
tidycomm
tidydice
tidyfast
tidyfst
tidyft
tidygapminder
tidygate
tidygenomics
tidygeocoder
tidygeoRSS
tidygraph
tidyHeatmap
tidyhydat
tidyjson
tidylo
rks/R.framework/Versions/3.6/Resources/library [D
dencies
Install
Cancel
Environment
History
Connections
Build
Git
Tutorial
Build All
More
cp make_subdirs slides/lectures/week1/Makefile; make -C slid
eek1
Makefile:8: *** missing separator. Stop.
make: *** [slides/lectures/week1] Error 2
Exited with status 2.
Console
Terminal
~/ARAASTAT/Teaching/BIOF339/
output file: packages.knit.md
/Applications/RStudio.app/Contents/MacOS/pandoc/pandoc +RTS -K512m -RTS packages.utf8.md --to html4 --from markdown+autolink_bare_uris+tex_math_single_backslash --output packages.html --email-obfuscation none -V 'mathjax-url=https://mathjax.rstudio.com/latest/MathJax.js?config=TeX-MML-AM_CHTML' -V 'title-slide-class=center, middle, inverse, title-slide' --standalone --section-divs --template /Library/Frameworks/R.framework/Versions/3.6/Resources/library/xaringan/rmarkdown/templates/xaringan/resources/default.html --no-highlight --css ../robot.css --css ../robot-fonts.css --css ../sfah.css --include-in-header /var/folders/k4/xvcmx4yx76xdbl41zy3hq8rc0000gn/T//RtmpLUdoPY/rmarkdown-strc7f13f79dae8.html --lua-filter /Library/Frameworks/R.framework/Versions/3.6/Resources/library/rmarkdown/rmd/lua/pagebreak.lua --lua-filter /Library/Frameworks/R.framework/Versions/3.6/Resources/library/rmarkdown/rmd/lua/latex-div.lua --include-before-body /var/folders/k4/xvcmx4yx76xdbl41zy3hq8rc0000gn/T//RtmpLUdoPY/xaringanc7f13217bfbb.md --include-after-body /var/folders/k4/xvcmx4yx76xdbl41zy3hq8rc0000gn/T//RtmpLUdoPY/xaringanc7f16da22c80.js --variable title-slide=true --variable math=true
Output created: packages.html
>
Packages
Help
Viewer
Install
Update
Description
Version
System Library
abhiR What the Package Does (Title Case) 0.1.0
abind Combine Multidimensional Arrays 1.4-5
acepack ACE and AVAS for Selecting Multiple Regression Transformations 1.4.1
acs Download, Manipulate, and Present American Community Survey and Decennial Data from the US Census 2.1.4
addinslist Discover and Install Useful RStudio Addins 0.3
ade4 Analysis of Ecological Data: Exploratory and Euclidean Methods in Environmental Sciences 1.7-15
afex Analysis of Factorial Experiments 0.27-2
airway RangedSummarizedExperiment for RNA-Seq in airway smooth muscle cells, by Himes et al PLoS One 2014 1.4.0
ALL A data package 1.26.0
annotate Annotation for microarrays 1.62.0
AnnotationDbi Manipulation of SQLite-based annotations in Bioconductor 1.46.1
AnnotationFilter Facilities for Filtering Bioconductor Annotation Resources 1.8.0
AnnotationHub Client to access AnnotationHub resources 2.16.1

GitHub

GitHub is where many R packages reside during development.

To install a package directly from GitHub, you need the remotes package, and then you can use

```
remotes::install_github("<owner>/<repo>")
```

For example, if you want to install the development version of dplyr:

```
remotes::install_github("tidyverse/dplyr")
```

Bioconductor

The Bioconductor is a R organization dedicated to bioinformatics. It has its own repository of over 1900 packages

To install Bioconductor packages, you first need to install the BiocManager package from CRAN (note the upper and lower case letters). Then you can install packages by

```
BiocManager::install('<package name>')
```

For example, if you want to install the DESeq2 package that computes differential gene expressions:

```
BiocManager::install('DESeq2')
```

Installing packages, a summary

From CRAN

```
install.packages("tidyverse")
```

From Bioconductor

```
install.packages("BiocManager") # do once
BioManager::install('limma')
```

From GitHub

```
install.packages('remotes') # do once
remotes::install_github("rstudio/rmarkdown")
# usual format is username/packagename
```

GitHub often hosts development version of packages published on CRAN or Bioconductor

Both CRAN and Bioconductor have stringent checks to make sure packages can run properly, with no obvious program flaws. There are typically no guarantees about analytic or theoretical correctness, but most packages have been crowd-validated and there are several reliable developer groups including RStudio

Packages commonly used

An incomplete listing

Data ingestion

Package	Description
readr	Read Rectangular Text Data
readxl	Read Excel Files
haven	Import and Export 'SPSS', 'Stata' and 'SAS' Files
DBI	R Database Interface
rvest	Easily Harvest (Scrape) Web Pages
jsonlite	A Simple and Robust JSON Parser and Generator for R

Data munging

Package	Description
tidyr	Tidy Messy Data
dplyr	A Grammar of Data Manipulation
stringr	Simple, Consistent Wrappers for Common String Operations
lubridate	Make Dealing with Dates a Little Easier
forcats	Tools for Working with Categorical Variables (Factors)
purrr	Functional Programming Tools
janitor	Simple Tools for Examining and Cleaning Dirty Data

Data visualization

Package	Description
ggplot2	Create Elegant Data Visualisations Using the Grammar of Graphics
lattice	Trellis Graphics for R
visdat	Preliminary Visualisation of Data
naniar	Data Structures, Summaries, and Visualisations for Missing Data
htmlwidgets	HTML Widgets for R
leaflet	Create Interactive Web Maps with the JavaScript 'Leaflet' Library
highcharter	A Wrapper for the 'Highcharts' Library
plotly	Create Interactive Web Graphics via 'plotly.js'

There is an entire package ecosystem around `ggplot2` that can be seen here. These include specialized plots, different themes and colors, animations, etc.

Statistics

Data description

Package	Description
tableone	Create 'Table 1' to Describe Baseline Characteristics with or without Propensity Score Weights
table1	Tables of Descriptive Statistics in HTML
stargazer	Well-Formatted Regression and Summary Statistics Tables
arsenal	An Arsenal of 'R' Functions for Large-Scale Statistical Summaries
gtsummary	Presentation-Ready Data Summary and Analytic Result Tables
flextable	Functions for Tabular Reporting
Hmisc	Harrell Miscellaneous

Statistics

Analysis

Package	Description
stats	The R Stats Package
survival	Survival Analysis
infer	Tidy Statistical Inference
rsample	General Resampling Infrastructure
broom	Convert Statistical Objects into Tidy Tibbles
finalfit	Quickly Create Elegant Regression Results Tables and Plots when Modelling

Statistical modeling

Package	Description
stats	The R Stats Package
survival	Survival Analysis
recipes	Preprocessing Tools to Create Design Matrices
rms	Regression Modeling Strategies
broom	Convert Statistical Objects into Tidy Tibbles
rsample	General Resampling Infrastructure

Machine Learning

Package	Description
caret	Classification and Regression Training
parsnip	A Common API to Modeling and Analysis Functions
yardstick	Tidy Characterizations of Model Performance
rpart	Recursive Partitioning and Regression Trees
party	A Laboratory for Recursive Partytioning
randomForest	Breiman and Cutler's Random Forests for Classification and Regression
baguette	Efficient Model Functions for Bagging
kernlab	Kernel-Based Machine Learning Lab
earth	Multivariate Adaptive Regression Splines

Reporting

Package	Description
rmarkdown	Dynamic Documents for R
knitr	A General-Purpose Package for Dynamic Report Generation in R
bookdown	Authoring Books and Technical Documents with R Markdown
distill	'R Markdown' Format for Scientific and Technical Writing
rticles	Article Formats for R Markdown
blogdown	Create Blogs and Websites with R Markdown
flexdashboard	R Markdown Format for Flexible Dashboards
shiny	Web Application Framework for R
officer	Manipulation of Microsoft Word and PowerPoint Documents