hw1-r-utkarsha

Home Work Assignment 1

Checking version of the R

```
R.version
```

```
               _
platform       x86_64-pc-linux-gnu
arch           x86_64
os             linux-gnu
system         x86_64, linux-gnu
status
major          4
minor          3.1
year           2023
month          06
day            16
svn rev        84548
language       R
version.string R version 4.3.1 (2023-06-16)
nickname       Beagle Scouts
```

Packages in R

Packages are **collections of functions, data sets, and documentation bundled together to extend the functionality** of the base R language. Packages are essential for adding specific capabilities to R

DMwR2 : Data Mining with R

Package focuses on **methods and tools for dealing with imbalanced data sets**, which are datasets where one class (or group) of observations significantly outnumbers the other install.packages("DMwR2")class.

Installing DMwR2 Package :

```
if (!require("DMwR2"))
  install.packages("DMwR2")

library("DMwR2")
```

the **help()** function is used to access documentation and information about functions, data sets, packages, and other objects in the R environment.

```
help(package="DMwR2")
```

To see the list of pre-loaded data in base R packages, type the function **data**():

```
data() #loads the information of the datasets
```

Using dataset provided in `DMwR2` by referencing its name directly

```
algae <- data(algae) # load algae dataset
algae#viewing the data
```

```
[1] "algae"
```

To view the first few rows of your dataset, you can use the **head()** function.

```
head(algae) #displays first 6 rows of t7he data
```

```
[1] "algae"
```

Similarly, you can use the **tail()** function to view the last few rows of your dataset.

```
tail(algae) # displays last 6 rows of the data
```

```
[1] "algae"
```

```
tail(algae, n = 10)  # Display the last 10 rows
```

```
[1] "algae"
```

To get summary statistics for your dataset, including mean, median, minimum, maximum, and quartiles for numeric columns, you can use the **summary()** function.

```
summary(algae)
```

```
   Length     Class      Mode
        1 character character
```

```
{#{r message=FALSE, warning=FALSE} manyNAs(algae) # find rows with too many
NAs
```

Libraries and packages in R:

library() function without any arguments to list all the packages that are currently loaded in your R session.

```
library()
```

(.packages()) function is used to list the names packages whose functions and objects are readily available for use in your R code.

```
(.packages())
```

```
[1] "DMwR2"     "stats"     "graphics"  "grDevices" "utils"     "datasets"
[7] "methods"   "base"
```

library(packagename) function loads and attaches a specific package, making its functions and datasets available for use in your R session

```
library(ggplot2) #attaching the required package in the current session
(.packages())
```

```
[1] "ggplot2"   "DMwR2"     "stats"     "graphics"  "grDevices" "utils"
[7] "datasets"  "methods"   "base"
```

Detaching a package means that its functions and objects are no longer accessible in your current R session. This can be **useful when you want to clean up your workspace or avoid conflicts between functions or objects with the same name in different packages**.

```
detach("package:ggplot2", unload=TRUE)
(.packages())
```

```
[1] "DMwR2"     "stats"     "graphics"  "grDevices" "utils"     "datasets"
[7] "methods"   "base"
```

installed.packages() function is used to retrieve a list of all packages that are currently installed on your system.

```
installed.packages()
```

```
                Package
abind           "abind"
AsioHeaders     "AsioHeaders"
askpass         "askpass"
backports       "backports"
base64enc       "base64enc"
bit             "bit"
bit64           "bit64"
bitops          "bitops"
blob            "blob"
bookdown        "bookdown"
brio            "brio"
broom           "broom"
bslib           "bslib"
cachem          "cachem"
callr           "callr"
```

```
caTools           "caTools"
cellranger        "cellranger"
cli               "cli"
clipr             "clipr"
colorspace        "colorspace"
commonmark        "commonmark"
conflicted        "conflicted"
cpp11             "cpp11"
crayon            "crayon"
credentials       "credentials"
crul              "crul"
curl              "curl"
data.table        "data.table"
DBI               "DBI"
dbplyr            "dbplyr"
desc              "desc"
diffobj           "diffobj"
digest            "digest"
dlookr            "dlookr"
DMwR2             "DMwR2"
dplyr             "dplyr"
dtplyr            "dtplyr"
ellipsis          "ellipsis"
evaluate          "evaluate"
extrafont         "extrafont"
extrafontdb       "extrafontdb"
fansi             "fansi"
farver            "farver"
fastmap           "fastmap"
fontawesome       "fontawesome"
fontBitstreamVera "fontBitstreamVera"
fontLiberation    "fontLiberation"
fontquiver        "fontquiver"
forcats           "forcats"
foreach           "foreach"
Formula           "Formula"
fs                "fs"
gargle            "gargle"
gdtools           "gdtools"
generics          "generics"
gert              "gert"
gfonts            "gfonts"
ggplot2           "ggplot2"
```

```
gh                "gh"
gitcreds          "gitcreds"
glmnet            "glmnet"
glue              "glue"
googledrive       "googledrive"
googlesheets4     "googlesheets4"
gplots            "gplots"
gridExtra         "gridExtra"
gtable            "gtable"
gtools            "gtools"
haven             "haven"
highr             "highr"
hms               "hms"
hrbrthemes        "hrbrthemes"
htmltools         "htmltools"
htmlwidgets       "htmlwidgets"
httpcode          "httpcode"
httpuv            "httpuv"
httr              "httr"
httr2             "httr2"
ids               "ids"
ini               "ini"
inum              "inum"
isoband           "isoband"
iterators         "iterators"
jomo              "jomo"
jquerylib         "jquerylib"
jsonlite          "jsonlite"
kableExtra        "kableExtra"
KernSmooth        "KernSmooth"
knitr             "knitr"
labeling          "labeling"
later             "later"
libcoin           "libcoin"
lifecycle         "lifecycle"
lme4              "lme4"
lubridate         "lubridate"
magrittr          "magrittr"
Matrix            "Matrix"
memoise           "memoise"
mgcv              "mgcv"
mice              "mice"
mime              "mime"
```

```
minqa             "minqa"
mitml             "mitml"
modelr            "modelr"
munsell           "munsell"
mvtnorm           "mvtnorm"
nlme              "nlme"
nloptr            "nloptr"
numDeriv          "numDeriv"
openssl           "openssl"
ordinal           "ordinal"
pacman            "pacman"
pagedown          "pagedown"
palmerpenguins    "palmerpenguins"
pan               "pan"
partykit          "partykit"
pillar            "pillar"
pkgconfig         "pkgconfig"
pkgload           "pkgload"
praise            "praise"
prettyunits       "prettyunits"
processx          "processx"
progress          "progress"
promises          "promises"
ps                "ps"
purrr             "purrr"
quantmod          "quantmod"
R6                "R6"
ragg              "ragg"
rappdirs          "rappdirs"
RColorBrewer      "RColorBrewer"
Rcpp              "Rcpp"
RcppEigen         "RcppEigen"
reactable         "reactable"
reactR            "reactR"
readr             "readr"
readxl            "readxl"
rematch           "rematch"
rematch2          "rematch2"
remotes           "remotes"
reprex            "reprex"
rlang             "rlang"
rmarkdown         "rmarkdown"
ROCR              "ROCR"
```

```
rprojroot         "rprojroot"
rstudioapi        "rstudioapi"
Rttf2pt1          "Rttf2pt1"
rvest             "rvest"
sass              "sass"
scales            "scales"
selectr           "selectr"
servr             "servr"
shape             "shape"
shiny             "shiny"
showtext          "showtext"
showtextdb        "showtextdb"
sourcetools       "sourcetools"
spatial           "spatial"
stringi           "stringi"
stringr           "stringr"
survival          "survival"
svglite           "svglite"
sys               "sys"
sysfonts          "sysfonts"
systemfonts       "systemfonts"
testthat          "testthat"
textshaping       "textshaping"
tibble            "tibble"
tidyr             "tidyr"
tidyselect        "tidyselect"
tidyverse         "tidyverse"
timechange        "timechange"
tinytex           "tinytex"
triebeard         "triebeard"
TTR               "TTR"
tzdb              "tzdb"
ucminf            "ucminf"
urltools          "urltools"
usethis           "usethis"
utf8              "utf8"
uuid              "uuid"
vctrs             "vctrs"
viridisLite       "viridisLite"
vroom             "vroom"
waldo             "waldo"
webshot           "webshot"
websocket         "websocket"
```

```
whisker           "whisker"
withr             "withr"
xfun              "xfun"
xml2              "xml2"
xtable            "xtable"
xts               "xts"
yaml              "yaml"
zip               "zip"
zoo               "zoo"
base              "base"
boot              "boot"
class             "class"
cluster           "cluster"
codetools         "codetools"
compiler          "compiler"
datasets          "datasets"
foreign           "foreign"
graphics          "graphics"
grDevices         "grDevices"
grid              "grid"
KernSmooth        "KernSmooth"
lattice           "lattice"
MASS              "MASS"
Matrix            "Matrix"
methods           "methods"
mgcv              "mgcv"
nlme              "nlme"
nnet              "nnet"
parallel          "parallel"
rpart             "rpart"
spatial           "spatial"
splines           "splines"
stats             "stats"
stats4            "stats4"
survival          "survival"
tcltk             "tcltk"
tools             "tools"
utils             "utils"
                  LibPath                                          Version
abind             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4-5"
AsioHeaders       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.22.1-2"
askpass           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.0"
backports         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.1"
```

```
base64enc         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1-3"
bit               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "4.0.5"
bit64             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "4.0.5"
bitops            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0-7"
blob              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.4"
bookdown          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.35"
brio              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.3"
broom             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.5"
bslib             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.1"
cachem            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.8"
callr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.7.3"
caTools           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.18.2"
cellranger        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.0"
cli               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.6.1"
clipr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.8.0"
colorspace        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1-0"
commonmark        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.9.0"
conflicted        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.0"
cpp11             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.6"
crayon            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.5.2"
credentials       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.2"
crul              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.0"
curl              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "5.0.2"
data.table        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.14.8"
DBI               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.3"
dbplyr            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.3.3"
desc              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.2"
diffobj           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.5"
digest            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.6.33"
dlookr            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.6.2"
DMwR2             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.0.2"
dplyr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.3"
dtplyr            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.1"
ellipsis          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.2"
evaluate          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.21"
extrafont         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.19"
extrafontdb       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0"
fansi             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.4"
farver            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1.1"
fastmap           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.1"
fontawesome       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.2"
fontBitstreamVera "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.1"
fontLiberation    "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.0"
```

```
fontquiver        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.2.1"
forcats           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.0"
foreach           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.5.2"
Formula           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2-5"
fs                "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.6.3"
gargle            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.5.2"
gdtools           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.3"
generics          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.3"
gert              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.9.3"
gfonts            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.2.0"
ggplot2           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.4.3"
gh                "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.0"
gitcreds          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.2"
glmnet            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "4.1-8"
glue              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.6.2"
googledrive       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1.1"
googlesheets4     "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.1"
gplots            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.1.3"
gridExtra         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.3"
gtable            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.4"
gtools            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.9.4"
haven             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.5.3"
highr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.10"
hms               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.3"
hrbrthemes        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.8.0"
htmltools         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.6"
htmlwidgets       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.6.2"
httpcode          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.0"
httpuv            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.6.11"
httr              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.7"
httr2             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.2.3"
ids               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.1"
ini               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.1"
inum              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0-5"
isoband           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.2.7"
iterators         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.14"
jomo              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.7-6"
jquerylib         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.4"
jsonlite          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.8.7"
kableExtra        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.4"
KernSmooth        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.23-22"
knitr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.43"
labeling          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.3"
```

```
later             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.1"
libcoin           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0-9"
lifecycle         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.3"
lme4              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1-34"
lubridate         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.9.2"
magrittr          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.3"
Matrix            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.6-1"
memoise           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.1"
mgcv              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.9-0"
mice              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.16.0"
mime              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.12"
minqa             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.5"
mitml             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4-5"
modelr            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.11"
munsell           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.0"
mvtnorm           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2-3"
nlme              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.1-163"
nloptr            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.3"
numDeriv          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2016.8-1.1"
openssl           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1.0"
ordinal           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2022.11-16"
pacman            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.1"
pagedown          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.20"
palmerpenguins    "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.1"
pan               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.9"
partykit          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2-20"
pillar            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.9.0"
pkgconfig         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.3"
pkgload           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.2.1"
praise            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.0"
prettyunits       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.1"
processx          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.8.2"
progress          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.2"
promises          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.1"
ps                "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.7.5"
purrr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.2"
quantmod          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.25"
R6                "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.5.1"
ragg              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.5"
rappdirs          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.3"
RColorBrewer      "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1-3"
Rcpp              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.11"
RcppEigen         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.3.9.3"
```

```
reactable         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.4"
reactR            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.4"
readr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1.4"
readxl            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.3"
rematch           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.0"
rematch2          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1.2"
remotes           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.4.2.1"
reprex            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.2"
rlang             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1.1"
rmarkdown         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.24"
ROCR              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0-11"
rprojroot         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.3"
rstudioapi        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.15.0"
Rttf2pt1          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.12"
rvest             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.3"
sass              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.7"
scales            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.1"
selectr           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4-2"
servr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.27"
shape             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.6"
shiny             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.7.5"
showtext          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.9-6"
showtextdb        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.0"
sourcetools       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.1.7-1"
spatial           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "7.3-17"
stringi           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.7.12"
stringr           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.5.0"
survival          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.5-7"
svglite           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.1.1"
sys               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.4.2"
sysfonts          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.8.8"
systemfonts       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.0.4"
testthat          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.1.10"
textshaping       "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.3.6"
tibble            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "3.2.1"
tidyr             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.0"
tidyselect        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.0"
tidyverse         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.0.0"
timechange        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.2.0"
tinytex           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.46"
triebeard         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.1"
TTR               "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.24.3"
tzdb              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.0"
```

```
ucminf           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.0"
urltools         "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.7.3"
usethis          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.2.2"
utf8             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.2.3"
uuid             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.1-1"
vctrs            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.6.3"
viridisLite      "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.2"
vroom            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.6.3"
waldo            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.1"
webshot          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.5.5"
websocket        "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.4.1"
whisker          "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.4.1"
withr            "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.5.0"
xfun             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.40"
xml2             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.3.5"
xtable           "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.8-4"
xts              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "0.13.1"
yaml             "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.3.7"
zip              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "2.3.0"
zoo              "/cloud/lib/x86_64-pc-linux-gnu-library/4.3" "1.8-12"
base             "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
boot             "/opt/R/4.3.1/lib/R/library"                 "1.3-28.1"
class            "/opt/R/4.3.1/lib/R/library"                 "7.3-22"
cluster          "/opt/R/4.3.1/lib/R/library"                 "2.1.4"
codetools        "/opt/R/4.3.1/lib/R/library"                 "0.2-19"
compiler         "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
datasets         "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
foreign          "/opt/R/4.3.1/lib/R/library"                 "0.8-84"
graphics         "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
grDevices        "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
grid             "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
KernSmooth       "/opt/R/4.3.1/lib/R/library"                 "2.23-21"
lattice          "/opt/R/4.3.1/lib/R/library"                 "0.21-8"
MASS             "/opt/R/4.3.1/lib/R/library"                 "7.3-60"
Matrix           "/opt/R/4.3.1/lib/R/library"                 "1.5-4.1"
methods          "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
mgcv             "/opt/R/4.3.1/lib/R/library"                 "1.8-42"
nlme             "/opt/R/4.3.1/lib/R/library"                 "3.1-162"
nnet             "/opt/R/4.3.1/lib/R/library"                 "7.3-19"
parallel         "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
rpart            "/opt/R/4.3.1/lib/R/library"                 "4.1.19"
spatial          "/opt/R/4.3.1/lib/R/library"                 "7.3-16"
splines          "/opt/R/4.3.1/lib/R/library"                 "4.3.1"
```

```
stats             "/opt/R/4.3.1/lib/R/library"                "4.3.1"
stats4            "/opt/R/4.3.1/lib/R/library"                "4.3.1"
survival          "/opt/R/4.3.1/lib/R/library"                "3.5-5"
tcltk             "/opt/R/4.3.1/lib/R/library"                "4.3.1"
tools             "/opt/R/4.3.1/lib/R/library"                "4.3.1"
utils             "/opt/R/4.3.1/lib/R/library"                "4.3.1"
                  Priority
abind             NA
AsioHeaders       NA
askpass           NA
backports         NA
base64enc         NA
bit               NA
bit64             NA
bitops            NA
blob              NA
bookdown          NA
brio              NA
broom             NA
bslib             NA
cachem            NA
callr             NA
caTools           NA
cellranger        NA
cli               NA
clipr             NA
colorspace        NA
commonmark        NA
conflicted        NA
cpp11             NA
crayon            NA
credentials       NA
crul              NA
curl              NA
data.table        NA
DBI               NA
dbplyr            NA
desc              NA
diffobj           NA
digest            NA
dlookr            NA
DMwR2             NA
dplyr             NA
```

```
dtplyr            NA
ellipsis          NA
evaluate          NA
extrafont         NA
extrafontdb       NA
fansi             NA
farver            NA
fastmap           NA
fontawesome       NA
fontBitstreamVera NA
fontLiberation    NA
fontquiver        NA
forcats           NA
foreach           NA
Formula           NA
fs                NA
gargle            NA
gdtools           NA
generics          NA
gert              NA
gfonts            NA
ggplot2           NA
gh                NA
gitcreds          NA
glmnet            NA
glue              NA
googledrive       NA
googlesheets4     NA
gplots            NA
gridExtra         NA
gtable            NA
gtools            NA
haven             NA
highr             NA
hms               NA
hrbrthemes        NA
htmltools         NA
htmlwidgets       NA
httpcode          NA
httpuv            NA
httr              NA
httr2             NA
ids               NA
```

```
ini               NA
inum              NA
isoband           NA
iterators         NA
jomo              NA
jquerylib         NA
jsonlite          NA
kableExtra        NA
KernSmooth        "recommended"
knitr             NA
labeling          NA
later             NA
libcoin           NA
lifecycle         NA
lme4              NA
lubridate         NA
magrittr          NA
Matrix            "recommended"
memoise           NA
mgcv              "recommended"
mice              NA
mime              NA
minqa             NA
mitml             NA
modelr            NA
munsell           NA
mvtnorm           NA
nlme              "recommended"
nloptr            NA
numDeriv          NA
openssl           NA
ordinal           NA
pacman            NA
pagedown          NA
palmerpenguins    NA
pan               NA
partykit          NA
pillar            NA
pkgconfig         NA
pkgload           NA
praise            NA
prettyunits       NA
processx          NA
```

```
progress          NA
promises          NA
ps                NA
purrr             NA
quantmod          NA
R6                NA
ragg              NA
rappdirs          NA
RColorBrewer      NA
Rcpp              NA
RcppEigen         NA
reactable         NA
reactR            NA
readr             NA
readxl            NA
rematch           NA
rematch2          NA
remotes           NA
reprex            NA
rlang             NA
rmarkdown         NA
ROCR              NA
rprojroot         NA
rstudioapi        NA
Rttf2pt1          NA
rvest             NA
sass              NA
scales            NA
selectr           NA
servr             NA
shape             NA
shiny             NA
showtext          NA
showtextdb        NA
sourcetools       NA
spatial           "recommended"
stringi           NA
stringr           NA
survival          "recommended"
svglite           NA
sys               NA
sysfonts          NA
systemfonts       NA
```

```
testthat          NA
textshaping       NA
tibble            NA
tidyr             NA
tidyselect        NA
tidyverse         NA
timechange        NA
tinytex           NA
triebeard         NA
TTR               NA
tzdb              NA
ucminf            NA
urltools          NA
usethis           NA
utf8              NA
uuid              NA
vctrs             NA
viridisLite       NA
vroom             NA
waldo             NA
webshot           NA
websocket         NA
whisker           NA
withr             NA
xfun              NA
xml2              NA
xtable            NA
xts               NA
yaml              NA
zip               NA
zoo               NA
base              "base"
boot              "recommended"
class             "recommended"
cluster           "recommended"
codetools         "recommended"
compiler          "base"
datasets          "base"
foreign           "recommended"
graphics          "base"
grDevices         "base"
grid              "base"
KernSmooth        "recommended"
```

```
lattice           "recommended"
MASS              "recommended"
Matrix            "recommended"
methods           "base"
mgcv              "recommended"
nlme              "recommended"
nnet              "recommended"
parallel          "base"
rpart             "recommended"
spatial           "recommended"
splines           "base"
stats             "base"
stats4            "base"
survival          "recommended"
tcltk             "base"
tools             "base"
utils             "base"
                  Depends
abind             "R (>= 1.5.0)"
AsioHeaders       NA
askpass           NA
backports         "R (>= 3.0.0)"
base64enc         "R (>= 2.9.0)"
bit               "R (>= 2.9.2)"
bit64             "R (>= 3.0.1), bit (>= 4.0.0), utils, methods, stats"
bitops            NA
blob              NA
bookdown          "R (>= 3.5.0)"
brio              NA
broom             "R (>= 3.5)"
bslib             "R (>= 2.10)"
cachem            NA
callr             "R (>= 3.4)"
caTools           "R (>= 3.6.0)"
cellranger        "R (>= 3.0.0)"
cli               "R (>= 3.4)"
clipr             NA
colorspace        "R (>= 3.0.0), methods"
commonmark        NA
conflicted        "R (>= 3.2)"
cpp11             "R (>= 3.5.0)"
crayon            NA
credentials       NA
```

```
crul              NA
curl              "R (>= 3.0.0)"
data.table        "R (>= 3.1.0)"
DBI               "methods, R (>= 3.0.0)"
dbplyr            "R (>= 3.1)"
desc              "R (>= 3.4)"
diffobj           "R (>= 3.1.0)"
digest            "R (>= 3.3.0)"
dlookr            "R (>= 3.2.0)"
DMwR2             "R(>= 3.0), methods"
dplyr             "R (>= 3.5.0)"
dtplyr            "R (>= 3.3)"
ellipsis          "R (>= 3.2)"
evaluate          "R (>= 3.0.2)"
extrafont         "R (>= 2.15)"
extrafontdb       "R (>= 2.14)"
fansi             "R (>= 3.1.0)"
farver            NA
fastmap           NA
fontawesome       "R (>= 3.3.0)"
fontBitstreamVera "R (>= 3.0.0)"
fontLiberation    "R (>= 3.0)"
fontquiver        "R (>= 3.0.0)"
forcats           "R (>= 3.4)"
foreach           "R (>= 2.5.0)"
Formula           "R (>= 2.0.0), stats"
fs                "R (>= 3.4)"
gargle            "R (>= 3.6)"
gdtools           "R (>= 4.0.0)"
generics          "R (>= 3.2)"
gert              NA
gfonts            "R (>= 2.10)"
ggplot2           "R (>= 3.3)"
gh                "R (>= 3.4)"
gitcreds          "R (>= 3.4)"
glmnet            "R (>= 3.6.0), Matrix (>= 1.0-6)"
glue              "R (>= 3.4)"
googledrive       "R (>= 3.6)"
googlesheets4     "R (>= 3.6)"
gplots            "R (>= 3.0)"
gridExtra         NA
gtable            "R (>= 3.5)"
gtools            "methods, stats, utils"
```

```
haven             "R (>= 3.6)"
highr             "R (>= 3.3.0)"
hms               NA
hrbrthemes        "R (>= 3.4.0)"
htmltools         "R (>= 2.14.1)"
htmlwidgets       NA
httpcode          NA
httpuv            "R (>= 2.15.1)"
httr              "R (>= 3.5)"
httr2             "R (>= 3.4)"
ids               NA
ini               NA
inum              "R (>= 3.3.0)"
isoband           NA
iterators         "R (>= 2.5.0), utils"
jomo              NA
jquerylib         NA
jsonlite          "methods"
kableExtra        "R (>= 3.1.0)"
KernSmooth        "R (>= 2.5.0), stats"
knitr             "R (>= 3.3.0)"
labeling          NA
later             NA
libcoin           "R (>= 3.4.0)"
lifecycle         "R (>= 3.4)"
lme4              "R (>= 3.5.0), Matrix (>= 1.2-1), methods, stats"
lubridate         "methods, R (>= 3.2)"
magrittr          "R (>= 3.4.0)"
Matrix            "R (>= 3.5.0), methods"
memoise           NA
mgcv              "R (>= 3.6.0), nlme (>= 3.1-64)"
mice              "R (>= 2.10.0)"
mime              NA
minqa             NA
mitml             NA
modelr            "R (>= 3.2)"
munsell           NA
mvtnorm           "R(>= 3.5.0)"
nlme              "R (>= 3.5.0)"
nloptr            NA
numDeriv          "R (>= 2.11.1)"
openssl           NA
ordinal           "R (>= 2.13.0), stats, methods"
```

```
pacman            "R (>= 3.5.0)"
pagedown          "R (>= 3.5.0)"
palmerpenguins    "R (>= 2.10)"
pan               NA
partykit          "R (>= 3.5.0), graphics, grid, libcoin (>= 1.0-0), mvtnorm"
pillar            NA
pkgconfig         NA
pkgload           "R (>= 3.4.0)"
praise            NA
prettyunits       NA
processx          "R (>= 3.4.0)"
progress          NA
promises          NA
ps                "R (>= 3.4)"
purrr             "R (>= 3.5.0)"
quantmod          "R (>= 3.2.0), xts(>= 0.9-0), zoo, TTR(>= 0.2), methods"
R6                "R (>= 3.0)"
ragg              NA
rappdirs          "R (>= 3.2)"
RColorBrewer      "R (>= 2.0.0)"
Rcpp              NA
RcppEigen         "R (>= 3.6.0)"
reactable         "R (>= 3.1)"
reactR            NA
readr             "R (>= 3.5)"
readxl            "R (>= 3.6)"
rematch           NA
rematch2          NA
remotes           "R (>= 3.0.0)"
reprex            "R (>= 3.4)"
rlang             "R (>= 3.5.0)"
rmarkdown         "R (>= 3.0)"
ROCR              "R (>= 3.6)"
rprojroot         "R (>= 3.0.0)"
rstudioapi        NA
Rttf2pt1          "R (>= 2.15)"
rvest             "R (>= 3.2)"
sass              NA
scales            "R (>= 3.2)"
selectr           "R (>= 3.0)"
servr             "R (>= 3.0.0)"
shape             "R (>= 2.01)"
shiny             "R (>= 3.0.2), methods"
```

```
showtext          "sysfonts (>= 0.7.1), showtextdb (>= 2.0)"
showtextdb        NA
sourcetools       "R (>= 3.0.2)"
spatial           "R (>= 3.0.0), graphics, stats, utils"
stringi           "R (>= 3.1)"
stringr           "R (>= 3.3)"
survival          "R (>= 3.5.0)"
svglite           "R (>= 3.0.0)"
sys               NA
sysfonts          NA
systemfonts       "R (>= 3.2.0)"
testthat          "R (>= 3.1)"
textshaping       "R (>= 3.2.0)"
tibble            "R (>= 3.4.0)"
tidyr             "R (>= 3.4.0)"
tidyselect        "R (>= 3.4)"
tidyverse         "R (>= 3.3)"
timechange        "R (>= 3.3)"
tinytex           NA
triebeard         NA
TTR               NA
tzdb              "R (>= 3.5.0)"
ucminf            "R (>= 3.5.0)"
urltools          "R (>= 2.10)"
usethis           "R (>= 3.6)"
utf8              "R (>= 2.10)"
uuid              "R (>= 2.9.0)"
vctrs             "R (>= 3.5.0)"
viridisLite       "R (>= 2.10)"
vroom             "R (>= 3.4)"
waldo             NA
webshot           "R (>= 3.0)"
websocket         NA
whisker           NA
withr             "R (>= 3.2.0)"
xfun              NA
xml2              "R (>= 3.1.0)"
xtable            "R (>= 2.10.0)"
xts               "R (>= 3.6.0), zoo (>= 1.7-12)"
yaml              NA
zip               NA
zoo               "R (>= 3.1.0), stats"
base              NA
```

```
boot             "R (>= 3.0.0), graphics, stats"
class            "R (>= 3.0.0), stats, utils"
cluster          "R (>= 3.5.0)"
codetools        "R (>= 2.1)"
compiler         NA
datasets         NA
foreign          "R (>= 4.0.0)"
graphics         NA
grDevices        NA
grid             NA
KernSmooth       "R (>= 2.5.0), stats"
lattice          "R (>= 4.0.0)"
MASS             "R (>= 4.0), grDevices, graphics, stats, utils"
Matrix           "R (>= 3.5.0), methods"
methods          NA
mgcv             "R (>= 3.6.0), nlme (>= 3.1-64)"
nlme             "R (>= 3.5.0)"
nnet             "R (>= 3.0.0), stats, utils"
parallel         NA
rpart            "R (>= 2.15.0), graphics, stats, grDevices"
spatial          "R (>= 3.0.0), graphics, stats, utils"
splines          NA
stats            NA
stats4           NA
survival         "R (>= 3.5.0)"
tcltk            NA
tools            NA
utils            NA
                 Imports
abind            "methods, utils"
AsioHeaders      NA
askpass          "sys (>= 2.1)"
backports        NA
base64enc        NA
bit              NA
bit64            NA
bitops           NA
blob             "methods, rlang, vctrs (>= 0.2.1)"
bookdown         "htmltools (>= 0.3.6), knitr (>= 1.38), rmarkdown (>= 2.14),\njquerylib, x
brio             NA
broom            "backports, dplyr (>= 1.0.0), ellipsis, generics (>= 0.0.2),\nglue, lifecy
bslib            "base64enc, cachem, grDevices, htmltools (>= 0.5.4), jquerylib\n(>= 0.1.3)
cachem           "rlang, fastmap (>= 1.1.1)"
```

```
callr             "processx (>= 3.6.1), R6, utils"
caTools           "bitops"
cellranger        "rematch, tibble"
cli               "utils"
clipr             "utils"
colorspace        "graphics, grDevices, stats"
commonmark        NA
conflicted        "cli (>= 3.4.0), memoise, rlang (>= 1.0.0)"
cpp11             NA
crayon            "grDevices, methods, utils"
credentials       "openssl (>= 1.3), sys (>= 2.1), curl, jsonlite, askpass"
crul              "curl (>= 3.3), R6 (>= 2.2.0), urltools (>= 1.6.0), httpcode\n(>= 0.2.0), j
curl              NA
data.table        "methods"
DBI               NA
dbplyr            "blob (>= 1.2.0), cli (>= 3.4.1), DBI (>= 1.0.0), dplyr (>=\n1.1.0), glue
desc              "cli, R6, rprojroot, utils"
diffobj           "crayon (>= 1.3.2), tools, methods, utils, stats"
digest            "utils"
dlookr            "dplyr (>= 0.7.6), showtext (>= 0.9-4), sysfonts (>= 0.7.1),\nggplot2 (>= 3
DMwR2             "xts (>= 0.9-7), zoo (>= 1.7-10), class (>= 7.3-14), rpart (>=\n4.1-10), qu
dplyr             "cli (>= 3.4.0), generics, glue (>= 1.3.2), lifecycle (>=\n1.0.3), magrittr
dtplyr            "cli (>= 3.4.0), data.table (>= 1.13.0), dplyr (>= 1.1.0),\nglue, lifecycle
ellipsis          "rlang (>= 0.3.0)"
evaluate          "methods"
extrafont         "extrafontdb, grDevices, utils, Rttf2pt1"
extrafontdb       NA
fansi             "grDevices, utils"
farver            NA
fastmap           NA
fontawesome       "rlang (>= 1.0.6), htmltools (>= 0.5.1.1)"
fontBitstreamVera NA
fontLiberation    NA
fontquiver        "fontBitstreamVera (>= 0.1.0), fontLiberation (>= 0.1.0)"
forcats           "cli (>= 3.4.0), glue, lifecycle, magrittr, rlang (>= 1.0.0),\ntibble"
foreach           "codetools, utils, iterators"
Formula           NA
fs                "methods"
gargle            "cli (>= 3.0.1), fs (>= 1.3.1), glue (>= 1.3.0), httr (>=\n1.4.5), jsonlite
gdtools           "Rcpp (>= 0.12.12), systemfonts (>= 0.1.1), htmltools, gfonts,\ntools, curl
generics          "methods"
gert              "askpass, credentials (>= 1.2.1), openssl (>= 2.0.3),\nrstudioapi (>= 0.11)
gfonts            "utils, htmltools, shiny, crul, jsonlite, glue, crayon"
```

```
ggplot2          "cli, glue, grDevices, grid, gtable (>= 0.1.1), isoband,\nlifecycle (> 1.0
gh               "cli (>= 3.0.1), gitcreds, httr2, ini, jsonlite, rlang (>=\n1.0.0)"
gitcreds         NA
glmnet           "methods, utils, foreach, shape, survival, Rcpp"
glue             "methods"
googledrive      "cli (>= 3.0.0), gargle (>= 1.5.0), glue (>= 1.4.2), httr,\njsonlite, life
googlesheets4    "cellranger, cli (>= 3.0.0), curl, gargle (>= 1.5.0), glue (>=\n1.3.0), goo
gplots           "gtools, stats, caTools, KernSmooth, methods"
gridExtra        "gtable, grid, grDevices, graphics, utils"
gtable           "cli, glue, grid, lifecycle, rlang (>= 1.1.0)"
gtools           NA
haven            "cli (>= 3.0.0), forcats (>= 0.2.0), hms, lifecycle, methods,\nreadr (>= 0
highr            "xfun (>= 0.18)"
hms              "lifecycle, methods, pkgconfig, rlang (>= 1.0.2), vctrs (>=\n0.3.8)"
hrbrthemes       "ggplot2 (>= 3.3.0), grDevices, grid, scales, extrafont, knitr,\nrmarkdown
htmltools        "utils, digest, grDevices, base64enc, rlang (>= 0.4.12),\nfastmap (>= 1.1.0
htmlwidgets      "grDevices, htmltools (>= 0.5.4), jsonlite (>= 0.9.16), yaml,\nknitr (>= 1
httpcode         NA
httpuv           "Rcpp (>= 1.0.7), utils, R6, promises, later (>= 0.8.0)"
httr             "curl (>= 5.0.2), jsonlite, mime, openssl (>= 0.8), R6"
httr2            "cli (>= 3.0.0), curl, glue, magrittr, openssl, R6, rappdirs,\nrlang (>= 1
ids              "openssl, uuid"
ini              NA
inum             "stats, libcoin (>= 1.0-0)"
isoband          "grid, utils"
iterators        NA
jomo             "stats, lme4, survival, MASS, ordinal, tibble"
jquerylib        "htmltools"
jsonlite         NA
kableExtra       "knitr (>= 1.16), magrittr, stringr (>= 1.0), xml2 (>= 1.1.1),\nrvest, rmar
KernSmooth       NA
knitr            "evaluate (>= 0.15), highr, methods, tools, xfun (>= 0.39),\nyaml (>= 2.1.1
labeling         "stats, graphics"
later            "Rcpp (>= 0.12.9), rlang"
libcoin          "stats, mvtnorm"
lifecycle        "cli (>= 3.4.0), glue, rlang (>= 1.0.6)"
lme4             "graphics, grid, splines, utils, parallel, MASS, lattice, boot,\nnlme (>= 3
lubridate        "generics, timechange (>= 0.1.1)"
magrittr         NA
Matrix           "grDevices, graphics, grid, lattice, stats, utils"
memoise          "rlang (>= 0.4.10), cachem"
mgcv             "methods, stats, graphics, Matrix, splines, utils"
mice             "broom, dplyr, generics, glmnet, graphics, grDevices, lattice,\nmethods, mi
```

```
mime              "tools"
minqa             "Rcpp (>= 0.9.10)"
mitml             "pan, jomo, haven, grDevices, graphics, stats, methods, utils"
modelr            "broom, magrittr, purrr (>= 0.2.2), rlang (>= 1.0.6), tibble,\ntidyr (>= 0
munsell           "colorspace, methods"
mvtnorm           "stats"
nlme              "graphics, stats, utils, lattice"
nloptr            NA
numDeriv          NA
openssl           "askpass"
ordinal           "ucminf, MASS, Matrix, numDeriv, nlme"
pacman            "remotes, methods, stats, utils"
pagedown          "rmarkdown (>= 2.13), bookdown (>= 0.8), htmltools, jsonlite,\nlater (>= 1
palmerpenguins    NA
pan               NA
partykit          "grDevices, stats, utils, survival, Formula (>= 1.2-1), inum\n(>= 1.0-0), i
pillar            "cli (>= 2.3.0), fansi, glue, lifecycle, rlang (>= 1.0.2), utf8\n(>= 1.1.0)
pkgconfig         "utils"
pkgload           "cli (>= 3.3.0), crayon, desc, fs, glue, methods, rlang (>=\n1.0.3), rproji
praise            NA
prettyunits       NA
processx          "ps (>= 1.2.0), R6, utils"
progress          "hms, prettyunits, R6, crayon"
promises          "fastmap (>= 1.1.0), later, magrittr (>= 1.5), R6, Rcpp, rlang,\nstats"
ps                "utils"
purrr             "cli (>= 3.6.1), lifecycle (>= 1.0.3), magrittr (>= 1.5.0),\nrlang (>= 1.1
quantmod          "curl, jsonlite(>= 1.1)"
R6                NA
ragg              "systemfonts (>= 1.0.3), textshaping (>= 0.3.0)"
rappdirs          NA
RColorBrewer      NA
Rcpp              "methods, utils"
RcppEigen         "Matrix (>= 1.1-0), Rcpp (>= 0.11.0), stats, utils"
reactable         "digest, htmltools (>= 0.5.2), htmlwidgets (>= 1.5.3),\njsonlite, reactR"
reactR            "htmltools"
readr             "cli (>= 3.2.0), clipr, crayon, hms (>= 0.4.1), lifecycle (>=\n0.2.0), metl
readxl            "cellranger, tibble (>= 2.0.1), utils"
rematch           NA
rematch2          "tibble"
remotes           "methods, stats, tools, utils"
reprex            "callr (>= 3.6.0), cli (>= 3.2.0), clipr (>= 0.4.0), fs, glue,\nknitr (>= 1
rlang             "utils"
rmarkdown         "bslib (>= 0.2.5.1), evaluate (>= 0.13), fontawesome (>=\n0.5.0), htmltools
```

```
ROCR              "methods, graphics, grDevices, gplots, stats"
rprojroot         NA
rstudioapi        NA
Rttf2pt1          NA
rvest             "glue, cli, httr (>= 0.5), lifecycle (>= 1.0.0), magrittr,\nrlang (>= 1.0.
sass              "fs (>= 1.2.4), rlang (>= 0.4.10), htmltools (>= 0.5.1), R6,\nrappdirs"
scales            "farver (>= 2.0.3), labeling, lifecycle, munsell (>= 0.5), R6,\nRColorBrew
selectr           "methods, stringr, R6"
servr             "mime (>= 0.2), httpuv (>= 1.5.2), xfun, jsonlite"
shape             "stats, graphics, grDevices"
shiny             "utils, grDevices, httpuv (>= 1.5.2), mime (>= 0.3), jsonlite\n(>= 0.9.16)
showtext          "grDevices"
showtextdb        "sysfonts (>= 0.7), utils"
sourcetools       NA
spatial           NA
stringi           "tools, utils, stats"
stringr           "cli, glue (>= 1.6.1), lifecycle (>= 1.0.3), magrittr, rlang\n(>= 1.0.0), s
survival          "graphics, Matrix, methods, splines, stats, utils"
svglite           "systemfonts (>= 1.0.0)"
sys               NA
sysfonts          NA
systemfonts       NA
testthat          "brio, callr (>= 3.5.1), cli (>= 3.4.0), desc, digest, ellipsis\n(>= 0.2.0)
textshaping       "systemfonts (>= 1.0.0)"
tibble            "fansi (>= 0.4.0), lifecycle (>= 1.0.0), magrittr, methods,\npillar (>= 1.8
tidyr             "cli (>= 3.4.1), dplyr (>= 1.0.10), glue, lifecycle (>= 1.0.3),\nmagrittr,
tidyselect        "cli (>= 3.3.0), glue (>= 1.3.0), lifecycle (>= 1.0.3), rlang\n(>= 1.0.4),
tidyverse         "broom (>= 1.0.3), conflicted (>= 1.2.0), cli (>= 3.6.0),\ndbplyr (>= 2.3.
timechange        NA
tinytex           "xfun (>= 0.29)"
triebeard         "Rcpp"
TTR               "xts (>= 0.10-0), zoo, curl"
tzdb              NA
ucminf            NA
urltools          "Rcpp, methods, triebeard"
usethis           "cli (>= 3.0.1), clipr (>= 0.3.0), crayon, curl (>= 2.7), desc\n(>= 1.4.2)
utf8              NA
uuid              NA
vctrs             "cli (>= 3.4.0), glue, lifecycle (>= 1.0.3), rlang (>= 1.1.0)"
viridisLite       NA
vroom             "bit64, cli (>= 3.2.0), crayon, glue, hms, lifecycle (>=\n1.0.3), methods,
waldo             "cli, diffobj (>= 0.3.4), fansi, glue, methods, rematch2, rlang\n(>= 1.0.0)
webshot           "magrittr, jsonlite, callr"
```

```
websocket         "R6, later (>= 1.2.0)"
whisker           NA
withr             "graphics, grDevices, stats"
xfun              "stats, tools"
xml2              "methods"
xtable            "stats, utils"
xts               "methods"
yaml              NA
zip               NA
zoo               "utils, graphics, grDevices, lattice (>= 0.20-27)"
base              NA
boot              NA
class             "MASS"
cluster           "graphics, grDevices, stats, utils"
codetools         NA
compiler          NA
datasets          NA
foreign           "methods, utils, stats"
graphics          "grDevices"
grDevices         NA
grid              "grDevices, utils"
KernSmooth        NA
lattice           "grid, grDevices, graphics, stats, utils"
MASS              "methods"
Matrix            "graphics, grid, lattice, stats, utils"
methods           "utils, stats"
mgcv              "methods, stats, graphics, Matrix, splines, utils"
nlme              "graphics, stats, utils, lattice"
nnet              NA
parallel          "tools, compiler"
rpart             NA
spatial           NA
splines           "graphics, stats"
stats             "utils, grDevices, graphics"
stats4            "graphics, methods, stats"
survival          "graphics, Matrix, methods, splines, stats, utils"
tcltk             "utils"
tools             NA
utils             NA
                  LinkingTo
abind             NA
AsioHeaders       NA
askpass           NA
```

```
backports          NA
base64enc          NA
bit                NA
bit64              NA
bitops             NA
blob               NA
bookdown           NA
brio               NA
broom              NA
bslib              NA
cachem             NA
callr              NA
caTools            NA
cellranger         NA
cli                NA
clipr              NA
colorspace         NA
commonmark         NA
conflicted         NA
cpp11              NA
crayon             NA
credentials        NA
crul               NA
curl               NA
data.table         NA
DBI                NA
dbplyr             NA
desc               NA
diffobj            NA
digest             NA
dlookr             NA
DMwR2              NA
dplyr              NA
dtplyr             NA
ellipsis           NA
evaluate           NA
extrafont          NA
extrafontdb        NA
fansi              NA
farver             NA
fastmap            NA
fontawesome        NA
fontBitstreamVera  NA
```

```
fontLiberation    NA
fontquiver        NA
forcats           NA
foreach           NA
Formula           NA
fs                NA
gargle            NA
gdtools           "Rcpp"
generics          NA
gert              NA
gfonts            NA
ggplot2           NA
gh                NA
gitcreds          NA
glmnet            "RcppEigen, Rcpp"
glue              NA
googledrive       NA
googlesheets4     NA
gplots            NA
gridExtra         NA
gtable            NA
gtools            NA
haven             "cpp11"
highr             NA
hms               NA
hrbrthemes        NA
htmltools         NA
htmlwidgets       NA
httpcode          NA
httpuv            "Rcpp, later"
httr              NA
httr2             NA
ids               NA
ini               NA
inum              NA
isoband           NA
iterators         NA
jomo              NA
jquerylib         NA
jsonlite          NA
kableExtra        NA
KernSmooth        NA
knitr             NA
```

```
labeling          NA
later             "Rcpp"
libcoin           "mvtnorm"
lifecycle         NA
lme4              "Rcpp (>= 0.10.5), RcppEigen"
lubridate         NA
magrittr          NA
Matrix            NA
memoise           NA
mgcv              NA
mice              "cpp11, Rcpp"
mime              NA
minqa             "Rcpp"
mitml             NA
modelr            NA
munsell           NA
mvtnorm           NA
nlme              NA
nloptr            "testthat"
numDeriv          NA
openssl           NA
ordinal           NA
pacman            NA
pagedown          NA
palmerpenguins    NA
pan               NA
partykit          NA
pillar            NA
pkgconfig         NA
pkgload           NA
praise            NA
prettyunits       NA
processx          NA
progress          NA
promises          "later, Rcpp"
ps                NA
purrr             "cli"
quantmod          NA
R6                NA
ragg              "systemfonts, textshaping"
rappdirs          NA
RColorBrewer      NA
Rcpp              NA
```

```
RcppEigen         "Rcpp"
reactable         NA
reactR            NA
readr             "cpp11, tzdb (>= 0.1.1)"
readxl            "cpp11 (>= 0.4.0), progress"
rematch           NA
rematch2          NA
remotes           NA
reprex            NA
rlang             NA
rmarkdown         NA
ROCR              NA
rprojroot         NA
rstudioapi        NA
Rttf2pt1          NA
rvest             NA
sass              NA
scales            NA
selectr           NA
servr             NA
shape             NA
shiny             NA
showtext          NA
showtextdb        NA
sourcetools       NA
spatial           NA
stringi           NA
stringr           NA
survival          NA
svglite           "cpp11, systemfonts"
sys               NA
sysfonts          NA
systemfonts       "cpp11 (>= 0.2.1)"
testthat          NA
textshaping       "cpp11 (>= 0.2.1), systemfonts (>= 1.0.0)"
tibble            NA
tidyr             "cpp11 (>= 0.4.0)"
tidyselect        NA
tidyverse         NA
timechange        "cpp11 (>= 0.2.7)"
tinytex           NA
triebeard         "Rcpp"
TTR               "xts"
```

```
tzdb             "cpp11 (>= 0.4.2)"
ucminf           NA
urltools         "Rcpp"
usethis          NA
utf8             NA
uuid             NA
vctrs            NA
viridisLite      NA
vroom            "cpp11 (>= 0.2.0), progress (>= 1.2.1), tzdb (>= 0.1.1)"
waldo            NA
webshot          NA
websocket        "cpp11, AsioHeaders, later"
whisker          NA
withr            NA
xfun             NA
xml2             NA
xtable           NA
xts              "zoo"
yaml             NA
zip              NA
zoo              NA
base             NA
boot             NA
class            NA
cluster          NA
codetools        NA
compiler         NA
datasets         NA
foreign          NA
graphics         NA
grDevices        NA
grid             NA
KernSmooth       NA
lattice          NA
MASS             NA
Matrix           NA
methods          NA
mgcv             NA
nlme             NA
nnet             NA
parallel         NA
rpart            NA
spatial          NA
```

```
splines           NA
stats             NA
stats4            NA
survival          NA
tcltk             NA
tools             NA
utils             NA
                  Suggests
abind             NA
AsioHeaders       NA
askpass           "testthat"
backports         NA
base64enc         NA
bit               "testthat (>= 0.11.0), roxygen2, knitr, rmarkdown,\nmicrobenchmark, bit64
bit64             NA
bitops            NA
blob              "covr, crayon, pillar (>= 1.2.1), testthat"
bookdown          "bslib (>= 0.2.4), downlit (>= 0.4.0), htmlwidgets, jsonlite,\nrstudioapi,
brio              "covr, testthat (>= 2.1.0)"
broom             "AER, AUC, bbmle, betareg, biglm, binGroup, boot, btergm (>=\n1.10.6), car
bslib             "bsicons, curl, fontawesome, ggplot2, knitr, magrittr,\nrappdirs, rmarkdow
cachem            "testthat"
callr             "asciicast, cli (>= 1.1.0), covr, mockery, ps, rprojroot,\nspelling, testt
caTools           "MASS, rpart"
cellranger        "covr, testthat (>= 1.0.0), knitr, rmarkdown"
cli               "callr, covr, crayon, digest, glue (>= 1.6.0), grDevices,\nhtmltools, htmlw
clipr             "covr, knitr, rmarkdown, rstudioapi (>= 0.5), testthat (>=\n2.0.0)"
colorspace        "datasets, utils, KernSmooth, MASS, kernlab, mvtnorm, vcd,\ntcltk, shiny, s
commonmark        "curl, testthat, xml2"
conflicted        "callr, covr, dplyr, Matrix, methods, pkgload, testthat (>=\n3.0.0), withr"
cpp11             "bench, brio, callr, cli, covr, decor, desc, ggplot2, glue,\nknitr, lobstr
crayon            "mockery, rstudioapi, testthat, withr"
credentials       "testthat, knitr, rmarkdown"
crul              "testthat, roxygen2 (>= 7.1.1), fauxpas (>= 0.1.0), webmockr\n(>= 0.1.0), l
curl              "spelling, testthat (>= 1.0.0), knitr, jsonlite, rmarkdown,\nmagrittr, http
data.table        "bit64 (>= 4.0.0), bit (>= 4.0.4), curl, R.utils, xts,\nnanotime, zoo (>= 1
DBI               "blob, covr, DBItest, dbplyr, downlit, dplyr, glue, hms,\nknitr, magrittr,
dbplyr            "bit64, covr, knitr, Lahman, nycflights13, odbc, RMariaDB (>=\n1.0.2), rmar
desc              "callr, covr, gh, spelling, testthat, whoami, withr"
diffobj           "knitr, rmarkdown"
digest            "tinytest, simplermarkdown"
dlookr            "DBI, classInt, dbplyr, forecast (>= 8.3), Hmisc, ISLR,\nnycflights13, ppsr
DMwR2             NA
```

```
dplyr             "bench, broom, callr, covr, DBI, dbplyr (>= 2.2.1), ggplot2,\nknitr, Lahman
dtplyr            "bench, covr, knitr, rmarkdown, testthat (>= 3.1.2), tidyr (>=\n1.1.0), wal
ellipsis          "covr, testthat"
evaluate          "covr, ggplot2, lattice, rlang, testthat (>= 3.0.0), withr"
extrafont         "fontcm"
extrafontdb       NA
fansi             "unitizer, knitr, rmarkdown"
farver            "covr, testthat (>= 3.0.0)"
fastmap           "testthat (>= 2.1.1)"
fontawesome       "covr, dplyr (>= 1.0.8), knitr (>= 1.31), testthat (>= 3.0.0),\nrsvg"
fontBitstreamVera NA
fontLiberation    NA
fontquiver        "testthat, htmltools"
forcats           "covr, dplyr, ggplot2, knitr, readr, rmarkdown, testthat (>=\n3.0.0), withr
foreach           "randomForest, doMC, doParallel, testthat, knitr, rmarkdown"
Formula           NA
fs                "covr, crayon, knitr, pillar (>= 1.0.0), rmarkdown, spelling,\ntestthat (>=
gargle            "aws.ec2metadata, aws.signature, covr, httpuv, knitr,\nrmarkdown, sodium, s
gdtools           "testthat, methods"
generics          "covr, pkgload, testthat (>= 3.0.0), tibble, withr"
gert              "spelling, knitr, rmarkdown, testthat"
gfonts            "knitr, rmarkdown, testthat (>= 2.1.0), vcr, covr"
ggplot2           "covr, dplyr, ggplot2movies, hexbin, Hmisc, knitr, lattice,\nmapproj, maps
gh                "covr, knitr, mockery, rmarkdown, rprojroot, spelling,\ntestthat (>= 3.0.0)
gitcreds          "codetools, covr, knitr, mockery, oskeyring, rmarkdown,\ntestthat (>= 3.0.0
glmnet            "knitr, lars, testthat, xfun, rmarkdown"
glue              "covr, crayon, DBI, dplyr, forcats, ggplot2, knitr, magrittr,\nmicrobenchma
googledrive       "curl, dplyr (>= 1.0.0), knitr, mockr, rmarkdown, spelling,\ntestthat (>= 3
googlesheets4     "readr, rmarkdown, spelling, testthat (>= 3.1.7)"
gplots            "grid, MASS, knitr, r2d2"
gridExtra         "ggplot2, egg, lattice, knitr, testthat"
gtable            "covr, ggplot2, knitr, profvis, rmarkdown, testthat (>= 3.0.0)"
gtools            "car, gplots, knitr, rstudioapi, SGP, taxize"
haven             "covr, crayon, fs, knitr, pillar (>= 1.4.0), rmarkdown,\ntestthat (>= 3.0.0
highr             "knitr, markdown, testit"
hms               "crayon, lubridate, pillar (>= 1.1.0), testthat (>= 3.0.0)"
hrbrthemes        "testthat, dplyr, gridExtra, hunspell, stringi, gcookbook,\nclipr, vdiffr,
htmltools         "markdown, testthat, withr, Cairo, ragg, shiny"
htmlwidgets       "testthat"
httpcode          "testthat"
httpuv            "testthat, callr, curl, websocket"
httr              "covr, httpuv, jpeg, knitr, png, readr, rmarkdown, testthat\n(>= 0.8.0), xm
httr2             "askpass, bench, clipr, covr, docopt, httpuv, jose, jsonlite,\nknitr, purrr
```

```
ids               "knitr, rcorpora, rmarkdown, testthat"
ini               "testthat"
inum              NA
isoband           "covr, ggplot2, knitr, magick, microbenchmark, rmarkdown, sf,\ntestthat, xm
iterators         "RUnit, foreach"
jomo              "mitml"
jquerylib         "testthat"
jsonlite          "httr, vctrs, testthat, knitr, rmarkdown, R.rsp, sf"
kableExtra        "testthat, magick, formattable, sparkline"
KernSmooth        "MASS, carData"
knitr             "bslib, codetools, DBI (>= 0.4-1), digest, formatR, gifski,\ngridSVG, htmlw
labeling          NA
later             "knitr, rmarkdown, testthat (>= 2.1.0)"
libcoin           "coin"
lifecycle         "covr, crayon, knitr, lintr, rmarkdown, testthat (>= 3.0.1),\ntibble, tidyv
lme4              "knitr, rmarkdown, MEMSS, testthat (>= 0.8.1), ggplot2,\nmlmRev, optimx (>=
lubridate         "covr, knitr, rmarkdown, testthat (>= 2.1.0), vctrs (>= 0.5.0)"
magrittr          "covr, knitr, rlang, rmarkdown, testthat"
Matrix            "MASS, datasets, sfsmisc"
memoise           "digest, aws.s3, covr, googleAuthR, googleCloudStorageR, httr,\ntestthat"
mgcv              "parallel, survival, MASS"
mice              "broom.mixed, future, furrr, haven, knitr, lme4, MASS,\nmiceadds, pan, para
mime              NA
minqa             NA
mitml             "mice, miceadds, Amelia, lme4, nlme, lavaan, geepack, glmmTMB,\nsurvival, M
modelr            "compiler, covr, ggplot2, testthat (>= 3.0.0)"
munsell           "ggplot2, testthat"
mvtnorm           "qrng, numDeriv"
nlme              "Hmisc, MASS, SASmixed"
nloptr            "knitr, rmarkdown, xml2, testthat (>= 3.0.0), covr"
numDeriv          NA
openssl           "curl, testthat (>= 2.1.0), digest, knitr, rmarkdown,\njsonlite, jose, sodi
ordinal           "lme4, nnet, xtable, testthat (>= 0.8), tools"
pacman            "BiocManager, knitr, lattice, testthat (>= 0.9.0), XML"
pagedown          "promises, testit, xaringan, pdftools, revealjs, covr, xml2"
palmerpenguins    "knitr, rmarkdown, tibble, ggplot2, dplyr, tidyr, recipes"
pan               "mitools, lme4"
partykit          "XML, pmml, rJava, sandwich, strucchange, vcd, AER, mlbench,\nTH.data (>= 1
pillar            "bit64, DBI, debugme, DiagrammeR, dplyr, formattable, ggplot2,\nknitr, lubr
pkgconfig         "covr, testthat, disposables (>= 1.0.3)"
pkgload           "bitops, covr, mathjaxr, mockr, pak, pkgbuild, Rcpp, remotes,\nrstudioapi,
praise            "testthat"
prettyunits       "codetools, covr, testthat"
```

```
processx          "callr (>= 3.7.3), cli (>= 3.3.0), codetools, covr, curl,\ndebugme, paralle
progress          "Rcpp, testthat, withr"
promises          "future (>= 1.21.0), knitr, purrr, rmarkdown, spelling,\ntestthat, vembedr
ps                "callr, covr, curl, pillar, pingr, processx (>= 3.1.0), R6,\nrlang, testtha
purrr             "covr, dplyr (>= 0.7.8), httr, knitr, lubridate, rmarkdown,\ntestthat (>= 3
quantmod          "DBI,RMySQL,RSQLite,timeSeries,xml2,downloader"
R6                "testthat, pryr"
ragg              "covr, graphics, grid, testthat"
rappdirs          "roxygen2, testthat (>= 3.0.0), covr, withr"
RColorBrewer      NA
Rcpp              "tinytest, inline, rbenchmark, pkgKitten (>= 0.1.2)"
RcppEigen         "inline, tinytest, pkgKitten, microbenchmark"
reactable         "covr, crosstalk, dplyr, fontawesome, knitr, leaflet, MASS,\nrmarkdown, shi
reactR            "htmlwidgets (>= 1.5.3), rmarkdown, shiny, V8, knitr, usethis,\njsonlite"
readr             "covr, curl, datasets, knitr, rmarkdown, spelling, stringi,\ntestthat (>= 3
readxl            "covr, knitr, rmarkdown, testthat (>= 3.1.6), withr"
rematch           "covr, testthat"
rematch2          "covr, testthat"
remotes           "brew, callr, codetools, curl, covr, git2r (>= 0.23.0), knitr,\nmockery, pk
reprex            "covr, fortunes, miniUI, mockr, rprojroot, sessioninfo, shiny,\nspelling, s
rlang             "cli (>= 3.1.0), covr, crayon, fs, glue, knitr, magrittr,\nmethods, pillar
rmarkdown         "digest, dygraphs, fs, rsconnect, downlit (>= 0.4.0), katex\n(>= 1.4.0), sa
ROCR              "testthat, knitr, rmarkdown"
rprojroot         "covr, knitr, lifecycle, mockr, rmarkdown, testthat (>=\n3.0.0), withr"
rstudioapi        "testthat, knitr, rmarkdown, clipr, covr"
Rttf2pt1          NA
rvest             "covr, knitr, readr, repurrrsive, rmarkdown, spelling, stringi\n(>= 0.3.1)
sass              "testthat, knitr, rmarkdown, withr, shiny, curl"
scales            "bit64, covr, dichromat, ggplot2, hms (>= 0.5.0), stringi,\ntestthat (>= 3
selectr           "testthat, XML, xml2"
servr             "tools, later, rstudioapi, knitr (>= 1.9), rmarkdown"
shape             NA
shiny             "datasets, Cairo (>= 1.5-5), testthat (>= 3.0.0), knitr (>=\n1.6), markdown
showtext          "knitr, rmarkdown, prettydoc, curl, jsonlite"
showtextdb        "curl"
sourcetools       "testthat"
spatial           "MASS"
stringi           NA
stringr           "covr, htmltools, htmlwidgets, knitr, rmarkdown, testthat (>=\n3.0.0)"
survival          NA
svglite           "covr, fontquiver (>= 0.2.0), htmltools, knitr, rmarkdown,\ntestthat, xml2
sys               "unix (>= 1.4), spelling, testthat"
sysfonts          "curl, jsonlite"
```

```
systemfonts       "testthat (>= 2.1.0), covr, knitr, rmarkdown, tools"
testthat          "covr, curl (>= 0.9.5), diffviewer (>= 0.1.0), knitr,\nrmarkdown, rstudioap
textshaping       "covr, knitr, rmarkdown"
tibble            "bench, bit64, blob, brio, callr, cli, covr, crayon (>=\n1.3.4), Diagrammer
tidyr             "covr, data.table, knitr, readr, repurrrsive (>= 1.1.0),\nrmarkdown, testth
tidyselect        "covr, crayon, dplyr, knitr, magrittr, rmarkdown, stringr,\ntestthat (>= 3
tidyverse         "covr (>= 3.6.1), feather (>= 0.3.5), glue (>= 1.6.2), mockr\n(>= 0.2.0), r
timechange        "testthat (>= 0.7.1.99), knitr"
tinytex           "testit, rstudioapi"
triebeard         "knitr, rmarkdown, testthat"
TTR               "RUnit"
tzdb              "covr, testthat (>= 3.0.0)"
ucminf            "numDeriv"
urltools          "testthat, knitr"
usethis           "covr, knitr, magick, pkgload, rmarkdown, roxygen2 (>= 7.1.2),\nspelling (>
utf8              "cli, covr, knitr, rlang, rmarkdown, testthat (>= 3.0.0),\nwithr"
uuid              NA
vctrs             "bit64, covr, crayon, dplyr (>= 0.8.5), generics, knitr,\npillar (>= 1.4.4)
viridisLite       "hexbin (>= 1.27.0), ggplot2 (>= 1.0.1), testthat, covr"
vroom             "archive, bench (>= 1.1.0), covr, curl, dplyr, forcats, fs,\nggplot2, knitr
waldo             "covr, R6, testthat (>= 3.0.0), withr, xml2"
webshot           "httpuv, knitr, rmarkdown, shiny, testthat (>= 3.0.0)"
websocket         "httpuv, testthat, knitr, rmarkdown"
whisker           "markdown"
withr             "callr, covr, DBI, knitr, lattice, methods, rlang, rmarkdown\n(>= 2.12), RS
xfun              "testit, parallel, codetools, rstudioapi, tinytex (>= 0.30),\nmime, markdow
xml2              "covr, curl, httr, knitr, magrittr, mockery, rmarkdown,\ntestthat (>= 2.1.0
xtable            "knitr, plm, zoo, survival"
xts               "timeSeries, timeDate, tseries, chron, tinytest"
yaml              "RUnit"
zip               "covr, processx, R6, testthat, withr"
zoo               "AER, coda, chron, ggplot2 (>= 3.0.0), mondate, scales,\nstinepack, strucch
base              "methods"
boot              "MASS, survival"
class             NA
cluster           "MASS, Matrix"
codetools         NA
compiler          NA
datasets          NA
foreign           NA
graphics          NA
grDevices         "KernSmooth"
grid              NA
```

```
KernSmooth        "MASS, carData"
lattice           "KernSmooth, MASS, latticeExtra, colorspace"
MASS              "lattice, nlme, nnet, survival"
Matrix            "MASS, expm"
methods           "codetools"
mgcv              "parallel, survival, MASS"
nlme              "Hmisc, MASS, SASmixed"
nnet              "MASS"
parallel          "methods"
rpart             "survival"
spatial           "MASS"
splines           "Matrix, methods"
stats             "MASS, Matrix, SuppDists, methods, stats4"
stats4            NA
survival          NA
tcltk             NA
tools             "codetools, methods, xml2, curl, commonmark, knitr, xfun, mathjaxr, V8"
utils             "methods, xml2, commonmark, knitr"
                  Enhances
abind             NA
AsioHeaders       NA
askpass           NA
backports         NA
base64enc         "png"
bit               NA
bit64             NA
bitops            NA
blob              NA
bookdown          NA
brio              NA
broom             NA
bslib             NA
cachem            NA
callr             NA
caTools           NA
cellranger        NA
cli               NA
clipr             NA
colorspace        NA
commonmark        NA
conflicted        NA
cpp11             NA
crayon            NA
```

```
credentials       NA
crul              NA
curl              NA
data.table        NA
DBI               NA
dbplyr            NA
desc              NA
diffobj           NA
digest            NA
dlookr            NA
DMwR2             NA
dplyr             NA
dtplyr            NA
ellipsis          NA
evaluate          NA
extrafont         NA
extrafontdb       NA
fansi             NA
farver            NA
fastmap           NA
fontawesome       NA
fontBitstreamVera NA
fontLiberation    NA
fontquiver        NA
forcats           NA
foreach           NA
Formula           NA
fs                NA
gargle            NA
gdtools           NA
generics          NA
gert              NA
gfonts            NA
ggplot2           "sp"
gh                NA
gitcreds          NA
glmnet            NA
glue              NA
googledrive       NA
googlesheets4     NA
gplots            NA
gridExtra         NA
gtable            NA
```

```
gtools            NA
haven             NA
highr             NA
hms               NA
hrbrthemes        NA
htmltools         "knitr"
htmlwidgets       "shiny (>= 1.1)"
httpcode          NA
httpuv            NA
httr              NA
httr2             NA
ids               NA
ini               NA
inum              NA
isoband           NA
iterators         NA
jomo              NA
jquerylib         NA
jsonlite          NA
kableExtra        NA
KernSmooth        NA
knitr             NA
labeling          NA
later             NA
libcoin           NA
lifecycle         NA
lme4              NA
lubridate         "chron, data.table, timeDate, tis, zoo"
magrittr          NA
Matrix            "SparseM, graph"
memoise           NA
mgcv              NA
mice              NA
mime              NA
minqa             NA
mitml             NA
modelr            NA
munsell           NA
mvtnorm           NA
nlme              NA
nloptr            NA
numDeriv          NA
openssl           NA
```

```
ordinal           NA
pacman            NA
pagedown          NA
palmerpenguins    NA
pan               NA
partykit          NA
pillar            NA
pkgconfig         NA
pkgload           NA
praise            NA
prettyunits       NA
processx          NA
progress          NA
promises          NA
ps                NA
purrr             NA
quantmod          NA
R6                NA
ragg              NA
rappdirs          NA
RColorBrewer      NA
Rcpp              NA
RcppEigen         NA
reactable         NA
reactR            NA
readr             NA
readxl            NA
rematch           NA
rematch2          NA
remotes           NA
reprex            NA
rlang             "winch"
rmarkdown         NA
ROCR              NA
rprojroot         NA
rstudioapi        NA
Rttf2pt1          NA
rvest             NA
sass              NA
scales            NA
selectr           NA
servr             NA
shape             NA
```

```
shiny             NA
showtext          NA
showtextdb        NA
sourcetools       NA
spatial           NA
stringi           NA
stringr           NA
survival          NA
svglite           NA
sys               NA
sysfonts          NA
systemfonts       NA
testthat          NA
textshaping       NA
tibble            NA
tidyr             NA
tidyselect        NA
tidyverse         NA
timechange        NA
tinytex           NA
triebeard         NA
TTR               "quantmod"
tzdb              NA
ucminf            NA
urltools          NA
usethis           NA
utf8              NA
uuid              NA
vctrs             NA
viridisLite       NA
vroom             NA
waldo             NA
webshot           NA
websocket         NA
whisker           NA
withr             NA
xfun              NA
xml2              NA
xtable            NA
xts               NA
yaml              NA
zip               NA
zoo               NA
```

```
base            NA
boot            NA
class           NA
cluster         NA
codetools       NA
compiler        NA
datasets        NA
foreign         NA
graphics        NA
grDevices       NA
grid            NA
KernSmooth      NA
lattice         "chron"
MASS            NA
Matrix          "MatrixModels, SparseM, graph, igraph, maptools, sfsmisc, sp,\nspdep"
methods         NA
mgcv            NA
nlme            NA
nnet            NA
parallel        "snow, Rmpi"
rpart           NA
spatial         NA
splines         NA
stats           NA
stats4          NA
survival        NA
tcltk           NA
tools           NA
utils           NA
                License                                 License_is_FOSS
abind           "LGPL (>= 2)"                           NA
AsioHeaders     "BSL-1.0"                               NA
askpass         "MIT + file LICENSE"                    NA
backports       "GPL-2 | GPL-3"                         NA
base64enc       "GPL-2 | GPL-3"                         NA
bit             "GPL-2 | GPL-3"                         NA
bit64           "GPL-2 | GPL-3"                         NA
bitops          "GPL (>= 2)"                            NA
blob            "MIT + file LICENSE"                    NA
bookdown        "GPL-3"                                 NA
brio            "MIT + file LICENSE"                    NA
broom           "MIT + file LICENSE"                    NA
bslib           "MIT + file LICENSE"                    NA
```

```
cachem            "MIT + file LICENSE"                    NA
callr             "MIT + file LICENSE"                    NA
caTools           "GPL-3"                                 NA
cellranger        "MIT + file LICENSE"                    NA
cli               "MIT + file LICENSE"                    NA
clipr             "GPL-3"                                 NA
colorspace        "BSD_3_clause + file LICENSE"           NA
commonmark        "BSD_2_clause + file LICENSE"           NA
conflicted        "MIT + file LICENSE"                    NA
cpp11             "MIT + file LICENSE"                    NA
crayon            "MIT + file LICENSE"                    NA
credentials       "MIT + file LICENSE"                    NA
crul              "MIT + file LICENSE"                    NA
curl              "MIT + file LICENSE"                    NA
data.table        "MPL-2.0 | file LICENSE"                NA
DBI               "LGPL (>= 2.1)"                         NA
dbplyr            "MIT + file LICENSE"                    NA
desc              "MIT + file LICENSE"                    NA
diffobj           "GPL-2 | GPL-3"                         NA
digest            "GPL (>= 2)"                            NA
dlookr            "GPL-2 | file LICENSE"                  NA
DMwR2             "GPL (>= 2)"                            NA
dplyr             "MIT + file LICENSE"                    NA
dtplyr            "MIT + file LICENSE"                    NA
ellipsis          "MIT + file LICENSE"                    NA
evaluate          "MIT + file LICENSE"                    NA
extrafont         "GPL-2"                                 NA
extrafontdb       "GPL-2"                                 NA
fansi             "GPL-2 | GPL-3"                         NA
farver            "MIT + file LICENSE"                    NA
fastmap           "MIT + file LICENSE"                    NA
fontawesome       "MIT + file LICENSE"                    NA
fontBitstreamVera "file LICENCE"                          "yes"
fontLiberation    "file LICENSE"                          "yes"
fontquiver        "GPL-3 | file LICENSE"                  NA
forcats           "MIT + file LICENSE"                    NA
foreach           "Apache License (== 2.0)"               NA
Formula           "GPL-2 | GPL-3"                         NA
fs                "MIT + file LICENSE"                    NA
gargle            "MIT + file LICENSE"                    NA
gdtools           "GPL-3 | file LICENSE"                  NA
generics          "MIT + file LICENSE"                    NA
gert              "MIT + file LICENSE"                    NA
```

```
gfonts           "GPL-3"                                NA
ggplot2          "MIT + file LICENSE"                   NA
gh               "MIT + file LICENSE"                   NA
gitcreds         "MIT + file LICENSE"                   NA
glmnet           "GPL-2"                                NA
glue             "MIT + file LICENSE"                   NA
googledrive      "MIT + file LICENSE"                   NA
googlesheets4    "MIT + file LICENSE"                   NA
gplots           "GPL-2"                                NA
gridExtra        "GPL (>= 2)"                           NA
gtable           "MIT + file LICENSE"                   NA
gtools           "GPL-2"                                NA
haven            "MIT + file LICENSE"                   NA
highr            "GPL"                                  NA
hms              "MIT + file LICENSE"                   NA
hrbrthemes       "MIT + file LICENSE"                   NA
htmltools        "GPL (>= 2)"                           NA
htmlwidgets      "MIT + file LICENSE"                   NA
httpcode         "MIT + file LICENSE"                   NA
httpuv           "GPL (>= 2) | file LICENSE"            NA
httr             "MIT + file LICENSE"                   NA
httr2            "MIT + file LICENSE"                   NA
ids              "MIT + file LICENSE"                   NA
ini              "GPL-3"                                NA
inum             "GPL-2"                                NA
isoband          "MIT + file LICENSE"                   NA
iterators        "Apache License (== 2.0)"              NA
jomo             "GPL-2"                                NA
jquerylib        "MIT + file LICENSE"                   NA
jsonlite         "MIT + file LICENSE"                   NA
kableExtra       "MIT + file LICENSE"                   NA
KernSmooth       "Unlimited"                            NA
knitr            "GPL"                                  NA
labeling         "MIT + file LICENSE | Unlimited"       NA
later            "MIT + file LICENSE"                   NA
libcoin          "GPL-2"                                NA
lifecycle        "MIT + file LICENSE"                   NA
lme4             "GPL (>= 2)"                           NA
lubridate        "GPL (>= 2)"                           NA
magrittr         "MIT + file LICENSE"                   NA
Matrix           "GPL (>= 2) | file LICENCE"            NA
memoise          "MIT + file LICENSE"                   NA
mgcv             "GPL (>= 2)"                           NA
```

```
mice              "GPL (>= 2)"                          NA
mime              "GPL"                                 NA
minqa             "GPL-2"                               NA
mitml             "GPL (>= 2)"                          NA
modelr            "GPL-3"                               NA
munsell           "MIT + file LICENSE"                  NA
mvtnorm           "GPL-2"                               NA
nlme              "GPL (>= 2)"                          NA
nloptr            "LGPL (>= 3)"                         NA
numDeriv          "GPL-2"                               NA
openssl           "MIT + file LICENSE"                  NA
ordinal           "GPL (>= 2)"                          NA
pacman            "GPL-2"                               NA
pagedown          "MIT + file LICENSE"                  NA
palmerpenguins    "CC0"                                 NA
pan               "GPL-3"                               NA
partykit          "GPL-2 | GPL-3"                       NA
pillar            "MIT + file LICENSE"                  NA
pkgconfig         "MIT + file LICENSE"                  NA
pkgload           "GPL-3"                               NA
praise            "MIT + file LICENSE"                  NA
prettyunits       "MIT + file LICENSE"                  NA
processx          "MIT + file LICENSE"                  NA
progress          "MIT + file LICENSE"                  NA
promises          "MIT + file LICENSE"                  NA
ps                "MIT + file LICENSE"                  NA
purrr             "MIT + file LICENSE"                  NA
quantmod          "GPL-3"                               NA
R6                "MIT + file LICENSE"                  NA
ragg              "MIT + file LICENSE"                  NA
rappdirs          "MIT + file LICENSE"                  NA
RColorBrewer      "Apache License 2.0"                  NA
Rcpp              "GPL (>= 2)"                          NA
RcppEigen         "GPL (>= 2) | file LICENSE"           NA
reactable         "MIT + file LICENSE"                  NA
reactR            "MIT + file LICENSE"                  NA
readr             "MIT + file LICENSE"                  NA
readxl            "MIT + file LICENSE"                  NA
rematch           "MIT + file LICENSE"                  NA
rematch2          "MIT + file LICENSE"                  NA
remotes           "MIT + file LICENSE"                  NA
reprex            "MIT + file LICENSE"                  NA
rlang             "MIT + file LICENSE"                  NA
```

rmarkdown	"GPL-3"	NA
ROCR	"GPL (>= 2)"	NA
rprojroot	"MIT + file LICENSE"	NA
rstudioapi	"MIT + file LICENSE"	NA
Rttf2pt1	"file LICENSE"	"yes"
rvest	"MIT + file LICENSE"	NA
sass	"MIT + file LICENSE"	NA
scales	"MIT + file LICENSE"	NA
selectr	"BSD_3_clause + file LICENCE"	NA
servr	"GPL"	NA
shape	"GPL (>= 3)"	NA
shiny	"GPL-3 | file LICENSE"	NA
showtext	"Apache License (>= 2.0)"	NA
showtextdb	"Apache License (>= 2.0)"	NA
sourcetools	"MIT + file LICENSE"	NA
spatial	"GPL-2 | GPL-3"	NA
stringi	"file LICENSE"	"yes"
stringr	"MIT + file LICENSE"	NA
survival	"LGPL (>= 2)"	NA
svglite	"GPL (>= 2)"	NA
sys	"MIT + file LICENSE"	NA
sysfonts	"GPL-2"	NA
systemfonts	"MIT + file LICENSE"	NA
testthat	"MIT + file LICENSE"	NA
textshaping	"MIT + file LICENSE"	NA
tibble	"MIT + file LICENSE"	NA
tidyr	"MIT + file LICENSE"	NA
tidyselect	"MIT + file LICENSE"	NA
tidyverse	"MIT + file LICENSE"	NA
timechange	"GPL-3"	NA
tinytex	"MIT + file LICENSE"	NA
triebeard	"MIT + file LICENSE"	NA
TTR	"GPL (>= 2)"	NA
tzdb	"MIT + file LICENSE"	NA
ucminf	"GPL (>= 2)"	NA
urltools	"MIT + file LICENSE"	NA
usethis	"MIT + file LICENSE"	NA
utf8	"Apache License (== 2.0) | file LICENSE"	NA
uuid	"MIT + file LICENSE"	NA
vctrs	"MIT + file LICENSE"	NA
viridisLite	"MIT + file LICENSE"	NA
vroom	"MIT + file LICENSE"	NA
waldo	"MIT + file LICENSE"	NA

```
webshot          "GPL-2"                                NA
websocket        "GPL-2"                                NA
whisker          "GPL-3"                                NA
withr            "MIT + file LICENSE"                   NA
xfun             "MIT + file LICENSE"                   NA
xml2             "MIT + file LICENSE"                   NA
xtable           "GPL (>= 2)"                           NA
xts              "GPL (>= 2)"                           NA
yaml             "BSD_3_clause + file LICENSE"          NA
zip              "MIT + file LICENSE"                   NA
zoo              "GPL-2 | GPL-3"                        NA
base             "Part of R 4.3.1"                      NA
boot             "Unlimited"                            NA
class            "GPL-2 | GPL-3"                        NA
cluster          "GPL (>= 2)"                           NA
codetools        "GPL"                                  NA
compiler         "Part of R 4.3.1"                      NA
datasets         "Part of R 4.3.1"                      NA
foreign          "GPL (>= 2)"                           NA
graphics         "Part of R 4.3.1"                      NA
grDevices        "Part of R 4.3.1"                      NA
grid             "Part of R 4.3.1"                      NA
KernSmooth       "Unlimited"                            NA
lattice          "GPL (>= 2)"                           NA
MASS             "GPL-2 | GPL-3"                        NA
Matrix           "GPL (>= 2) | file LICENCE"            NA
methods          "Part of R 4.3.1"                      NA
mgcv             "GPL (>= 2)"                           NA
nlme             "GPL (>= 2)"                           NA
nnet             "GPL-2 | GPL-3"                        NA
parallel         "Part of R 4.3.1"                      NA
rpart            "GPL-2 | GPL-3"                        NA
spatial          "GPL-2 | GPL-3"                        NA
splines          "Part of R 4.3.1"                      NA
stats            "Part of R 4.3.1"                      NA
stats4           "Part of R 4.3.1"                      NA
survival         "LGPL (>= 2)"                          NA
tcltk            "Part of R 4.3.1"                      NA
tools            "Part of R 4.3.1"                      NA
utils            "Part of R 4.3.1"                      NA
                 License_restricts_use OS_type MD5sum NeedsCompilation Built
abind            NA                    NA      NA     "no"             "4.3.0"
AsioHeaders      NA                    NA      NA     "no"             "4.3.0"
```

```
askpass          NA                   NA      NA     "yes"          "4.3.0"
backports        NA                   NA      NA     "yes"          "4.3.0"
base64enc        NA                   NA      NA     "yes"          "4.3.0"
bit              NA                   NA      NA     "yes"          "4.3.0"
bit64            NA                   NA      NA     "yes"          "4.3.0"
bitops           NA                   NA      NA     "yes"          "4.3.0"
blob             NA                   NA      NA     "no"           "4.3.0"
bookdown         NA                   NA      NA     "no"           "4.3.0"
brio             NA                   NA      NA     "yes"          "4.3.0"
broom            NA                   NA      NA     "no"           "4.3.0"
bslib            NA                   NA      NA     "no"           "4.3.0"
cachem           NA                   NA      NA     "yes"          "4.3.0"
callr            NA                   NA      NA     "no"           "4.3.0"
caTools          NA                   NA      NA     "yes"          "4.3.0"
cellranger       NA                   NA      NA     "no"           "4.3.0"
cli              NA                   NA      NA     "yes"          "4.3.0"
clipr            NA                   NA      NA     "no"           "4.3.0"
colorspace       NA                   NA      NA     "yes"          "4.3.0"
commonmark       NA                   NA      NA     "yes"          "4.3.0"
conflicted       NA                   NA      NA     "no"           "4.3.0"
cpp11            NA                   NA      NA     "no"           "4.3.0"
crayon           NA                   NA      NA     "no"           "4.3.0"
credentials      NA                   NA      NA     "no"           "4.3.0"
crul             NA                   NA      NA     "no"           "4.3.0"
curl             NA                   NA      NA     "yes"          "4.3.0"
data.table       NA                   NA      NA     "yes"          "4.3.0"
DBI              NA                   NA      NA     "no"           "4.3.0"
dbplyr           NA                   NA      NA     "no"           "4.3.0"
desc             NA                   NA      NA     "no"           "4.3.0"
diffobj          NA                   NA      NA     "yes"          "4.3.0"
digest           NA                   NA      NA     "yes"          "4.3.0"
dlookr           NA                   NA      NA     "no"           "4.3.0"
DMwR2            NA                   NA      NA     "no"           "4.3.0"
dplyr            NA                   NA      NA     "yes"          "4.3.0"
dtplyr           NA                   NA      NA     "no"           "4.3.0"
ellipsis         NA                   NA      NA     "yes"          "4.3.0"
evaluate         NA                   NA      NA     "no"           "4.3.0"
extrafont        NA                   NA      NA     "no"           "4.3.0"
extrafontdb      NA                   NA      NA     NA             "4.3.0"
fansi            NA                   NA      NA     "yes"          "4.3.0"
farver           NA                   NA      NA     "yes"          "4.3.0"
fastmap          NA                   NA      NA     "yes"          "4.3.0"
fontawesome      NA                   NA      NA     "no"           "4.3.0"
```

```
fontBitstreamVera NA                NA      NA     "no"            "4.3.0"
fontLiberation    NA                NA      NA     "no"            "4.3.0"
fontquiver        NA                NA      NA     "no"            "4.3.0"
forcats           NA                NA      NA     "no"            "4.3.0"
foreach           NA                NA      NA     "no"            "4.3.0"
Formula           NA                NA      NA     "no"            "4.3.0"
fs                NA                NA      NA     "yes"           "4.3.0"
gargle            NA                NA      NA     "no"            "4.3.0"
gdtools           NA                NA      NA     "yes"           "4.3.0"
generics          NA                NA      NA     "no"            "4.3.0"
gert              NA                NA      NA     "yes"           "4.3.0"
gfonts            NA                NA      NA     "no"            "4.3.0"
ggplot2           NA                NA      NA     "no"            "4.3.0"
gh                NA                NA      NA     "no"            "4.3.0"
gitcreds          NA                NA      NA     "no"            "4.3.0"
glmnet            NA                NA      NA     "yes"           "4.3.0"
glue              NA                NA      NA     "yes"           "4.3.0"
googledrive       NA                NA      NA     "no"            "4.3.0"
googlesheets4     NA                NA      NA     "no"            "4.3.0"
gplots            NA                NA      NA     "no"            "4.3.0"
gridExtra         NA                NA      NA     "no"            "4.3.0"
gtable            NA                NA      NA     "no"            "4.3.0"
gtools            NA                NA      NA     "yes"           "4.3.0"
haven             NA                NA      NA     "yes"           "4.3.0"
highr             NA                NA      NA     "no"            "4.3.0"
hms               NA                NA      NA     "no"            "4.3.0"
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ini               NA                NA      NA     "no"            "4.3.0"
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kableExtra        NA                NA      NA     "no"            "4.3.0"
KernSmooth        NA                NA      NA     "yes"           "4.3.0"
```

knitr	NA	NA	NA	"no"	"4.3.0"
labeling	NA	NA	NA	"no"	"4.3.0"
later	NA	NA	NA	"yes"	"4.3.0"
libcoin	NA	NA	NA	"yes"	"4.3.0"
lifecycle	NA	NA	NA	"no"	"4.3.0"
lme4	NA	NA	NA	"yes"	"4.3.0"
lubridate	NA	NA	NA	"yes"	"4.3.0"
magrittr	NA	NA	NA	"yes"	"4.3.0"
Matrix	NA	NA	NA	"yes"	"4.3.0"
memoise	NA	NA	NA	"no"	"4.3.0"
mgcv	NA	NA	NA	"yes"	"4.3.0"
mice	NA	NA	NA	"yes"	"4.3.0"
mime	NA	NA	NA	"yes"	"4.3.0"
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nloptr	NA	NA	NA	"yes"	"4.3.0"
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pacman	NA	NA	NA	"no"	"4.3.0"
pagedown	NA	NA	NA	"no"	"4.3.0"
palmerpenguins	NA	NA	NA	"no"	"4.3.0"
pan	NA	NA	NA	"yes"	"4.3.0"
partykit	NA	NA	NA	"yes"	"4.3.0"
pillar	NA	NA	NA	"no"	"4.3.0"
pkgconfig	NA	NA	NA	"no"	"4.3.0"
pkgload	NA	NA	NA	"no"	"4.3.0"
praise	NA	NA	NA	"no"	"4.3.0"
prettyunits	NA	NA	NA	"no"	"4.3.0"
processx	NA	NA	NA	"yes"	"4.3.0"
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purrr	NA	NA	NA	"yes"	"4.3.0"
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R6	NA	NA	NA	"no"	"4.3.0"
ragg	NA	NA	NA	"yes"	"4.3.0"
rappdirs	NA	NA	NA	"yes"	"4.3.0"
RColorBrewer	NA	NA	NA	"no"	"4.3.0"

```
Rcpp            NA                  NA      NA      "yes"           "4.3.0"
RcppEigen       NA                  NA      NA      "yes"           "4.3.0"
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reactR          NA                  NA      NA      "no"            "4.3.0"
readr           NA                  NA      NA      "yes"           "4.3.0"
readxl          NA                  NA      NA      "yes"           "4.3.0"
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remotes         NA                  NA      NA      "no"            "4.3.0"
reprex          NA                  NA      NA      "no"            "4.3.0"
rlang           NA                  NA      NA      "yes"           "4.3.0"
rmarkdown       NA                  NA      NA      "no"            "4.3.0"
ROCR            NA                  NA      NA      "no"            "4.3.0"
rprojroot       NA                  NA      NA      "no"            "4.3.0"
rstudioapi      NA                  NA      NA      "no"            "4.3.0"
Rttf2pt1        NA                  NA      NA      "yes"           "4.3.0"
rvest           NA                  NA      NA      "no"            "4.3.0"
sass            NA                  NA      NA      "yes"           "4.3.0"
scales          NA                  NA      NA      "no"            "4.3.0"
selectr         NA                  NA      NA      "no"            "4.3.0"
servr           NA                  NA      NA      "no"            "4.3.0"
shape           NA                  NA      NA      "no"            "4.3.0"
shiny           NA                  NA      NA      "no"            "4.3.0"
showtext        NA                  NA      NA      "yes"           "4.3.0"
showtextdb      NA                  NA      NA      "no"            "4.3.0"
sourcetools     NA                  NA      NA      "yes"           "4.3.0"
spatial         NA                  NA      NA      "yes"           "4.3.0"
stringi         NA                  NA      NA      "yes"           "4.3.0"
stringr         NA                  NA      NA      "no"            "4.3.0"
survival        NA                  NA      NA      "yes"           "4.3.0"
svglite         NA                  NA      NA      "yes"           "4.3.0"
sys             NA                  NA      NA      "yes"           "4.3.0"
sysfonts        NA                  NA      NA      "yes"           "4.3.0"
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testthat        NA                  NA      NA      "yes"           "4.3.0"
textshaping     NA                  NA      NA      "yes"           "4.3.0"
tibble          NA                  NA      NA      "yes"           "4.3.0"
tidyr           NA                  NA      NA      "yes"           "4.3.0"
tidyselect      NA                  NA      NA      "no"            "4.3.0"
tidyverse       NA                  NA      NA      "no"            "4.3.0"
timechange      NA                  NA      NA      "yes"           "4.3.0"
tinytex         NA                  NA      NA      "no"            "4.3.0"
triebeard       NA                  NA      NA      "yes"           "4.3.0"
```

TTR	NA	NA	NA	"yes"	"4.3.0"
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ucminf	NA	NA	NA	"yes"	"4.3.0"
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usethis	NA	NA	NA	"no"	"4.3.0"
utf8	NA	NA	NA	"yes"	"4.3.0"
uuid	NA	NA	NA	"yes"	"4.3.0"
vctrs	NA	NA	NA	"yes"	"4.3.0"
viridisLite	NA	NA	NA	"no"	"4.3.0"
vroom	NA	NA	NA	"yes"	"4.3.0"
waldo	NA	NA	NA	"no"	"4.3.0"
webshot	NA	NA	NA	"no"	"4.3.0"
websocket	NA	NA	NA	"yes"	"4.3.0"
whisker	NA	NA	NA	"no"	"4.3.0"
withr	NA	NA	NA	"no"	"4.3.0"
xfun	NA	NA	NA	"yes"	"4.3.0"
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xts	NA	NA	NA	"yes"	"4.3.0"
yaml	NA	NA	NA	"yes"	"4.3.0"
zip	NA	NA	NA	"yes"	"4.3.0"
zoo	NA	NA	NA	"yes"	"4.3.0"
base	NA	NA	NA	NA	"4.3.1"
boot	NA	NA	NA	"no"	"4.3.1"
class	NA	NA	NA	"yes"	"4.3.1"
cluster	NA	NA	NA	"yes"	"4.3.1"
codetools	NA	NA	NA	"no"	"4.3.1"
compiler	NA	NA	NA	NA	"4.3.1"
datasets	NA	NA	NA	NA	"4.3.1"
foreign	NA	NA	NA	"yes"	"4.3.1"
graphics	NA	NA	NA	"yes"	"4.3.1"
grDevices	NA	NA	NA	"yes"	"4.3.1"
grid	NA	NA	NA	"yes"	"4.3.1"
KernSmooth	NA	NA	NA	"yes"	"4.3.1"
lattice	NA	NA	NA	"yes"	"4.3.1"
MASS	NA	NA	NA	"yes"	"4.3.1"
Matrix	NA	NA	NA	"yes"	"4.3.1"
methods	NA	NA	NA	"yes"	"4.3.1"
mgcv	NA	NA	NA	"yes"	"4.3.1"
nlme	NA	NA	NA	"yes"	"4.3.1"
nnet	NA	NA	NA	"yes"	"4.3.1"
parallel	NA	NA	NA	"yes"	"4.3.1"
rpart	NA	NA	NA	"yes"	"4.3.1"

```
spatial           NA                    NA      NA     "yes"           "4.3.1"
splines           NA                    NA      NA     "yes"           "4.3.1"
stats             NA                    NA      NA     "yes"           "4.3.1"
stats4            NA                    NA      NA     NA              "4.3.1"
survival          NA                    NA      NA     "yes"           "4.3.1"
tcltk             NA                    NA      NA     "yes"           "4.3.1"
tools             NA                    NA      NA     "yes"           "4.3.1"
utils             NA                    NA      NA     "yes"           "4.3.1"
```

old.packages() function is used to check for and list packages that have newer versions available on CRAN . This function is **helpful for keeping your packages up-to-date**.

```
old.packages()
```

```
           Package      LibPath                       Installed Built
KernSmooth "KernSmooth" "/opt/R/4.3.1/lib/R/library" "2.23-21" "4.3.1"
Matrix     "Matrix"     "/opt/R/4.3.1/lib/R/library" "1.5-4.1" "4.3.1"
mgcv       "mgcv"       "/opt/R/4.3.1/lib/R/library" "1.8-42"  "4.3.1"
nlme       "nlme"       "/opt/R/4.3.1/lib/R/library" "3.1-162" "4.3.1"
spatial    "spatial"    "/opt/R/4.3.1/lib/R/library" "7.3-16"  "4.3.1"
survival   "survival"   "/opt/R/4.3.1/lib/R/library" "3.5-5"   "4.3.1"
           ReposVer  Repository
KernSmooth "2.23-22" "http://rspm/default/__linux__/focal/latest/src/contrib"
Matrix     "1.6-1"   "http://rspm/default/__linux__/focal/latest/src/contrib"
mgcv       "1.9-0"   "http://rspm/default/__linux__/focal/latest/src/contrib"
nlme       "3.1-163" "http://rspm/default/__linux__/focal/latest/src/contrib"
spatial    "7.3-17"  "http://rspm/default/__linux__/focal/latest/src/contrib"
survival   "3.5-7"   "http://rspm/default/__linux__/focal/latest/src/contrib"
```

update.packages() function is used to update one or more packages to their latest versions available on CRAN

```
update.packages() #ask will update the package without asking for confirmation & checkBuil
```

You can use the **::** operator followed by the function name to see the package namespace it comes from. For example, to find out which package the mean function belongs to, you can do:

```
mean
```

```
function (x, ...)
UseMethod("mean")
<bytecode: 0x563fd4391f58>
<environment: namespace:base>
```

help() function is used to access documentation and information about functions, datasets & packages.

```
help(mean)
```

An alternative way to access help is by using a question mark **?**

```
?mean
```

RsiteSearch() function allows you to search for specific terms, keywords, or phrases within the vast collection of R packages, functions, and documentation hosted on CRAN.

```
RSiteSearch('neural networks')
```

```
A search query has been submitted to https://search.r-project.org
The results page should open in your browser shortly
```

R objects and Variables

Variables are assigned values, which can be numeric, character, logical, or other data types.

```
vat <- 0.2
vat
```

```
[1] 0.2
```

Enclosing a statement or expression in () will have values printed directly to the console.

```
(vat <- 0.2)
```

```
[1] 0.2
```

examples :

```
x <- 5
y <- vat * x
y
```

```
[1] 1
```

```
z <-(y/2)^2
y
```

```
[1] 1
```

```
z
```

```
[1] 0.25
```

ls() or **objects()** function to list the names of objects (variables, functions, datasets, etc.) that are currently present in your workspace or environment.

```
ls()
```

```
[1] "algae"           "algae.sols"      "has_annotations" "test.algae"
[5] "vat"             "x"               "y"               "z"
```

```
objects()
```

```
[1] "algae"           "algae.sols"      "has_annotations" "test.algae"
[5] "vat"             "x"               "y"               "z"
```

rm() function is used to remove or delete objects from environment. Deleting objects means they will no longer be available for use, and t**here is no undo operation.**

```
rm(vat)
ls()
```

```
[1] "algae"           "algae.sols"      "has_annotations" "test.algae"
[5] "x"               "y"               "z"
```

R Functions

functions are blocks of reusable code that perform specific tasks or computations.

```
max(4, 5, 6, 12, -4)
```

```
[1] 12
```

```
mean(4, 5, 6, 12, -4)
```

```
[1] 4
```

sample() function is used to generate random samples or permutations of elements from a given vector or set.

```
max(sample(1:100, 30)) # 1:100 is the vector set and 30 is random number of samples
```

```
[1] 99
```

```
mean(sample(1:100, 30))
```

```
[1] 48.26667
```

set.seed()

Setting the seed allows you to reproduce random results in your code. When you use random functions or generate random numbers without specifying a seed, the results will be different each time you run the code. **runif()**, **rnorm()**, or **sample()**, will produce the same random results as long as you use the same seed value.

```
set.seed(1)
rnorm(1)
```

```
[1] -0.6264538
```

```r
set.seed(2)
rnorm(1)
```

```
[1] -0.8969145
```

```r
rnorm(1)
```

```
[1] 0.1848492
```

To create a new function, **se** (standard error of means), first test if **se** exists in our current environment.

```r
exists("se")
```

```
[1] FALSE
```

No object named **se** exists, now create the function that computes the standard error of a sample:

```r
se <- function(x){
  variance <- var(x)
  n <-length(x)
  return (sqrt(variance/n))
}
```

We can check if object exists or not using exists() function

```r
exists("se")
```

```
[1] TRUE
```

Function with multiple arguments :

```r
convMeters <- function (x, to="inch"){
  factor = switch(to, inch=39.3701, foot=3.28084, yard=1.09361, mile=0.000621371, NA)
  if(is.na(factor)) stop ("unknown target unit")
```

```
  else return (x*factor)
}
convMeters(23, "foot") #calling the function with parameters
```

```
[1] 75.45932
```

```
convMeters(40) #inch is used as default if 2nd argument is not used
```

```
[1] 1574.804
```

```
convMeters(to="yard", 56.2) #arguements can be provided in different order also
```

```
[1] 61.46088
```

Factors

Factors are a data type used to represent categorical or nominal data.

To create a factor with specific levels using the **factor()** function in R, you can specify the levels using the **levels** argument.

```
g <-c('f', 'm', 'f', 'f', 'f', 'm', 'm', 'f')
g #returs the values
```

```
[1] "f" "m" "f" "f" "f" "m" "m" "f"
```

```
g <- factor(g) #returns the levels of the factor
g
```

```
[1] f m f f f m m f
Levels: f m
```

More compact way to creating a factor with known levels, f and m:

```
other.g <-factor(c('m', 'm', 'm', 'm'), levels= c('f', 'm'))
other.g
```

```
[1] m m m m
Levels: f m
```

table() function to create a contingency table when you have two categorical variables.

```
g <- factor(c('f', 'm', 'f', 'f', 'f', 'm', 'm', 'f'))
table(g)
```

```
g
f m
5 3
```

```
a <- factor(c('adult', 'juvenile','adult', 'juvenile','adult', 'juvenile','juvenile', 'juv
table(a, g)
```

```
          g
a          f m
  adult    3 0
  juvenile 2 3
```

R assumes the values at the same index in the two factors are associated with the same entity.

```
# a <- factor(c('adult', 'juvenile','adult', 'juvenile','adult', 'juvenile','juvenile'))
# table(a, g) # will give an error as number of arguements should be same
```

```
a <- factor(c('adult', 'juvenile','adult', 'juvenile','adult', 'juvenile','juvenile', 'juv
t <- table(a, g)
t
```

```
          g
a          f m
  adult    3 0
  juvenile 2 3
```

Marginal frequencies for a factor:

```r
margin.table(t, 1)#1 refers to the first factor, a (age)
```

```
a
   adult juvenile
       3        5
```

```r
margin.table(t, 2)# now find the marginal freq of the second factor g
```

```
g
f m
5 3
```

```r
prop.table(t, 1) #use the margin generated for the 1st factor a
```

```
          g
a            f   m
  adult    1.0 0.0
  juvenile 0.4 0.6
```

```r
prop.table(t, 2)
```

```
          g
a            f   m
  adult    0.6 0.0
  juvenile 0.4 1.0
```

```r
prop.table(t) #overall
```

```
          g
a              f     m
  adult    0.375 0.000
  juvenile 0.250 0.375
```

```r
prop.table(t) * 100
```

```
          g
a             f    m
  adult    37.5  0.0
  juvenile 25.0 37.5
```

R structures

Vectors

Data structure used to store and manipulate a sequence of values.

```r
v <- c(2, 5, 3, 4) #creating the vector
length(v) #returns the lenght of the vector
```

```
[1] 4
```

```r
mode(v) #returns the data type of vector
```

```
[1] "numeric"
```

```r
v <- c(2, 5, 3, 4, NA) #NA will represent the missing value
mode(v)
```

```
[1] "numeric"
```

Boolean vector

```r
b <- c(TRUE, FALSE, NA, TRUE)
mode(b)
```

```
[1] "logical"
```

```
b[3] #retuirns the 3rd element from vector
```

```
[1] NA
```

```
b[3] <- TRUE #update the value of 3rd element
b
```

```
[1]  TRUE FALSE  TRUE  TRUE
```

```
e <-vector()
mode(e)
```

```
[1] "logical"
```

```
e <- c()
mode(e)
```

```
[1] "NULL"
```

```
length(e) # returns the length as 0 as vector is empty
```

```
[1] 0
```

```
b2 <-c(b[1], b[3], b[5]) #using vector elements to create other vector
b2
```

```
[1] TRUE TRUE   NA
```

```
sqrt(v) # finding sqaure root of all elements in the vector
```

```
[1] 1.414214 2.236068 1.732051 2.000000       NA
```

Vector arithmetic

```r
v1 <- c(3, 6, 9)
v2 <- c(1, 4, 8)
v1+v2 #addition
```

```
[1]  4 10 17
```

```r
v1*v2 #dot product
```

```
[1]  3 24 72
```

```r
v1-v2 #subtraction
```

```
[1] 2 2 1
```

```r
v1/v2 #divsion
```

```
[1] 3.000 1.500 1.125
```

```r
v3 <- c(1, 4)
v1+v3 # Dynamically matches the length of longer vector making v3(1,4,1)
```

```
Warning in v1 + v3: longer object length is not a multiple of shorter object
length
```

```
[1]  4 10 10
```

```r
#vector for 'for' loop:
mysum <- function (x){
  sum <- 0
  for(i in 1:length(x)){
    sum <- sum + x[i]
  }
  return (sum)
```

```
}
(mysum (c(1, 2, 3)))
```

```
[1] 6
```

Generating vectors:

```
(x <-1:10)
```

```
 [1]  1  2  3  4  5  6  7  8  9 10
```

```
(x <-10:1)
```

```
 [1] 10  9  8  7  6  5  4  3  2  1
```

```
10:15-1 #priority of the : operator is more than arithmatic operators
```

```
[1]  9 10 11 12 13 14
```

```
10:(15-1)
```

```
[1] 10 11 12 13 14
```

seq() to generate sequence with real numbers:

```
(seq(from=1, to=5, length=4)) # 4 values between 1 and 5 inclusive, even intervals/steps
```

```
[1] 1.000000 2.333333 3.666667 5.000000
```

```
(seq(length=10, from=-2, by=0.5)) #10 values, starting from 2, interval/step = 0.5
```

```
 [1] -2.0 -1.5 -1.0 -0.5  0.0  0.5  1.0  1.5  2.0  2.5
```

```r
(rep(5, 10)) #rep(a, b) is used for repeating the a, b number of times
```

```
 [1] 5 5 5 5 5 5 5 5 5 5
```

```r
(rep("hi", 3))
```

```
[1] "hi" "hi" "hi"
```

```r
(rep(1:2, 3)) #repeating the multiple values
```

```
[1] 1 2 1 2 1 2
```

```r
(rep(TRUE:FALSE, 3)) #repating the boolean values
```

```
[1] 1 0 1 0 1 0
```

```r
(rep(1:2, each=3)) #repeating multiple values seperately
```

```
[1] 1 1 1 2 2 2
```

gl() function is used to generate factor levels for creating factors with specific patterns, such as repeated or nested factors.

```r
gl(3, 5) #three levels, each repeat 5 times
```

```
 [1] 1 1 1 1 1 2 2 2 2 2 3 3 3 3 3
Levels: 1 2 3
```

```r
gl(2, 5, labels= c('female', 'male'))#two levels, each level repeat 5 times
```

```
 [1] female female female female female male   male   male   male   male
Levels: female male
```

```
#first argument 2 says two levels.
#second argument 1 says repeat once
#third argment 20 says generate 20 values
gl(2, 1, 20, labels=c('female', 'male'))#10 alternating female and male pairs, a total of
```

```
 [1] female male   female male   female male   female male   female male
[11] female male   female male   female male   female male   female male
Levels: female male
```

```
n <- rep(1:2, each=3)
(n <- factor(n,
             levels = c(1, 2),
             labels = c('female','male')
             ))
```

```
[1] female female female male   male   male
Levels: female male
```

Generate 10 values following a normal distribution with mean = 10 and standard deviation = 3

```
(rnorm(10, mean=10, sd=3))
```

```
 [1] 14.763536  6.608873  9.759245 10.397261 12.123864  9.280906 15.953422
 [8]  9.583639 11.252952 12.945258
```

Exercise

Generate a random sample of normally distributed data of size 100, with a mean of 20 and standard deviation 4

```
sam <- (rnorm(100, mean=20, sd=4))
sam
```

```
 [1] 18.42922 15.84132 27.12892 10.75572 23.51442 20.14323 24.05131 21.72906
 [9] 28.36328 15.20030 26.35855 27.81861 20.01975 10.19317 21.90895 17.61377
[17] 23.16881 21.15855 22.95575 21.27584 24.30466 18.86337 16.89330 17.61736
[25] 13.09608 16.38966 17.76375 19.01395 18.46566 12.16359 16.63318 27.61419
[33] 22.48998 27.96368 18.77807 19.63662 19.26335 15.20493 16.64685 28.26521
[41] 17.75101 25.10286 15.80971 12.13649 18.70812 23.74345 24.55692 26.68648
[49] 12.84703 28.12497 17.18742 20.63266 22.02494 16.72002 12.00461 18.08283
[57] 20.33672 16.41805 16.31490 21.32180 19.43336 21.73939 19.78511 16.37156
[65] 25.21405 23.08716 24.21010 14.35985 23.98394 13.21694 17.86651 14.51092
[73] 11.16832 27.28849 17.38643 18.86128 18.45220 21.54678 26.40156 26.72462
[81] 15.26557 14.56617 13.94932 14.98758 27.83743 20.03058 16.62954 17.59536
[89] 24.29784 21.04239 18.74291 17.00148 16.55121 28.19216 23.75968 28.03475
[97] 18.31451 18.59666 15.89048 18.99792
```

```r
mean_sam <- mean(sam) # Calculate the mean

sd_value <- sd(sam) # Calculate the standard deviation

sample_size <- length(sam) # Calculate the sample size

se <- sd_value / sqrt(sample_size) ## Compute the standard error
se
```

```
[1] 0.4688534
```

Sub-setting

Subsetting isthe process of selecting a subset of elements or rows from data.

```r
x <- c(0, -3, 4, -1, 45, 90, -5)
#select all elements that is greater than 0
(gtzero <- x[x>0])
```

```
[1]  4 45 90
```

```r
x <- c(0, -3, 4, -1, 45, 90, -5)
(x[x<=-2 | x>5])        #Using OR operator
```

```
[1] -3 45 90 -5
```

```
(x[x>40 & x<100]) #using AND operator
```

```
[1] 45 90
```

```
x <- c(0, -3, 4, -1, 45, 90, -5)
(x[c(4, 6)]) #using vector index to selective elements
```

```
[1] -1 90
```

```
(y<-c(4,6)) #same as above
```

```
[1] 4 6
```

```
(x[y])
```

```
[1] -1 90
```

```
(x[1:3]) #select the 1st to the 3rd elements in the vector
```

```
[1]  0 -3  4
```

```
x <- c(0, -3, 4, -1, 45, 90, -5)
(x[-1]) #usinf negative index to exclude the element
```

```
[1] -3  4 -1 45 90 -5
```

```
(x[-c(4, 6)]) #using negative index to remove multiple elements
```

```
[1]  0 -3  4 45 -5
```

```
(x[-(1:3)]) #using negative index to remove range of elements
```

```
[1] -1 45 90 -5
```

Named elements

Named elements allow you to associate names or labels with individual components, making it easier to reference and work with your data.

```
x <- c(0, -3, 4, -1, 45, 90, -5)
names(x) <- c('s1', 's2', 's3', 's4', 's5', 's6', 's7')
x
```

```
s1 s2 s3 s4 s5 s6 s7
 0 -3  4 -1 45 90 -5
```

```
(pH <- c(area1=4.5, area2=5.7, area3=9.8, mud=7.2)) #naming elements while creating the ve
```

```
area1 area2 area3   mud
  4.5   5.7   9.8   7.2
```

```
pH['mud'] #selecting element using the lable.
```

```
mud
7.2
```

```
pH[c('area1', 'mud')]
```

```
area1   mud
  4.5   7.2
```

```
# x[-s1] #cannot use negative lable to exclude the element
#x[-"s1"]
```

```
#x[s1:s7] #inavlid argument
#x[c('s1':'s7')]
```

```
pH[] #empty index returns all the elements of the vector
```

```
area1 area2 area3   mud
  4.5   5.7   9.8   7.2
```

```
pH
```

```
area1 area2 area3   mud
  4.5   5.7   9.8   7.2
```

```
pH[] <- 0 #resetting the value of vactor to zero
pH
```

```
area1 area2 area3   mud
    0     0     0     0
```

Matrices and Arrays

Matrices and arrays are data structures used to store and manipulate multi-dimensional data.

```
m <- c(45, 23, 66, 77, 33, 44, 56, 12, 78, 23)
is.vector(m) #checking if vector or not
```

```
[1] TRUE
```

```
is.matrix(m) #checking of it's a matrix or not
```

```
[1] FALSE
```

```r
is.array(m) #checking of it's a array
```

```
[1] FALSE
```

```r
dim(m) <-c(2, 5)#organizing the vector as matrix of 2*5 dimension
m
```

```
     [,1] [,2] [,3] [,4] [,5]
[1,]   45   66   33   56   78
[2,]   23   77   44   12   23
```

```r
is.vector(m) #checking if vector or not
```

```
[1] FALSE
```

```r
is.matrix(m) #checking of it's a matrix or not
```

```
[1] TRUE
```

```r
is.array(m) #checking of it's a array
```

```
[1] TRUE
```

```r
(m <- matrix(c(45, 23, 66, 77, 33, 44, 56, 12, 78, 23), 2, 5, byrow = TRUE)) #If byrow = T
```

```
     [,1] [,2] [,3] [,4] [,5]
[1,]   45   23   66   77   33
[2,]   44   56   12   78   23
```

Exercise:

Create a matrix with two columns:

First columns hold age data for a group of students `11, 11, 12, 13, 14, 9, 8`, and second columns hold grades `5, 5, 6, 7, 8, 4, 3`.

```r
test <-matrix(c(11, 11, 12, 13, 14, 9, 8, 5, 5, 6, 7, 8, 4, 3), 7, 2)
test
```

```
     [,1] [,2]
[1,]   11    5
[2,]   11    5
[3,]   12    6
[4,]   13    7
[5,]   14    8
[6,]    9    4
[7,]    8    3
```

```r
m <- c(45, 23, 66, 77, 33, 44, 56, 12, 78, 23)
#then 'organize' the vector as a matrix
dim(m) <- c(2, 5)#make the vector a 2 by 5 matrix, 2x5 must = lenght of the vector
m
```

```
     [,1] [,2] [,3] [,4] [,5]
[1,]   45   66   33   56   78
[2,]   23   77   44   12   23
```

```r
m[2, 3]#the element at row 2 and column 3
```

```
[1] 44
```

```r
(s<- m[2, 1]) # select one value
```

```
[1] 23
```

```r
(m<- m [c(1,2), -c(3, 5)]) #select 1st row and 1st, 2nd, and 4th columns: result is a vect
```

```
     [,1] [,2] [,3]
[1,]   45   66   56
[2,]   23   77   12
```

```r
(m [1, ]) #select complete row or column: 1st row, result is a vector
```

```
[1] 45 66 56
```

```r
(v<-m [, 1]) # 1st column, result is a vector
```

```
[1] 45 23
```

```r
is.vector(m) #checking if vector or not
```

```
[1] FALSE
```

```r
is.matrix(m) #checking of it's a matrix or not
```

```
[1] TRUE
```

```r
is.vector(s) #checking if vector or not
```

```
[1] TRUE
```

```r
is.vector(v) #checking if vector or not
```

```
[1] TRUE
```

```r
is.matrix(v)
```

```
[1] FALSE
```

if the result of subsetting a matrix is a single row or a single column, it remains as a matrix with one row or one column when `drop = FALSE`.

```r
m <- matrix(c(45, 23, 66, 77, 33, 44, 56, 12, 78, 23), 2, 5)
(m<-m [, 2, drop = FALSE])
```

```
     [,1]
[1,]   66
[2,]   77
```

```r
is.matrix(m)
```

```
[1] TRUE
```

```r
is.vector(m)
```

```
[1] FALSE
```

cbind() and rbind(): join together two or more vectors or matrices, by column, or by row, respectively:

```r
cbind (c(1,2,3), c(4, 5, 6))
```

```
     [,1] [,2]
[1,]    1    4
[2,]    2    5
[3,]    3    6
```

```r
rbind (c(1,2,3), c(4, 5, 6))
```

```
     [,1] [,2] [,3]
[1,]    1    2    3
[2,]    4    5    6
```

```r
m <- matrix(c(45, 23, 66, 77, 33, 44, 56, 12, 78, 23), 2, 5)
(a <- rbind (c(1,2,3,4,5), m))
```

```
     [,1] [,2] [,3] [,4] [,5]
[1,]    1    2    3    4    5
[2,]   45   66   33   56   78
[3,]   23   77   44   12   23
```

```
is.array(a)
```

```
[1] TRUE
```

```
is.matrix(a)
```

```
[1] TRUE
```

Exercise:

What will `m1-m4` look like?

```
m1 <- matrix(rep(10, 9), 3, 3)
m2 <- cbind (c(1,2,3), c(4, 5, 6))
m3 <- cbind (m1[,1], m2[2,])
m4 <- cbind (m1[,1], m2[,2])
# m5 <- m1-m4 # will give an error as arrays that do not have compatible dimensions
```

Named rows and columns in matrix:

```
sales <- matrix(c(10, 30, 40, 50, 43, 56, 21, 30), 2, 4, byrow=TRUE)
colnames(sales) <- c('1qrt', '2qrt', '3qrt', '4qrt')
rownames(sales) <- c('store1', 'store2')
sales
```

```
       1qrt 2qrt 3qrt 4qrt
store1   10   30   40   50
store2   43   56   21   30
```

Exercise:

Find `store1` `1qrt` sale. 2. List `store2`'s 1st and 4th quarter sales:

```
  sales['store1', '1qrt']
```

```
[1] 10
```

```
  sales['store2', c('1qrt', '4qrt')]
```

```
1qrt 4qrt
  43   30
```

Arrays

Arrays are similar to matrices, but arrays can have more than 2 dimensions

```
  a <- array(1:48, dim= c(4, 3, 2))
  a
```

```
, , 1

     [,1] [,2] [,3]
[1,]    1    5    9
[2,]    2    6   10
[3,]    3    7   11
[4,]    4    8   12

, , 2

     [,1] [,2] [,3]
[1,]   13   17   21
[2,]   14   18   22
[3,]   15   19   23
[4,]   16   20   24
```

```
  a [1, 3, 2]
```

```
[1] 21
```

```
  a [1, , 2]
```

```
[1] 13 17 21
```

```
  a [1, , 2, drop=FALSE]
```

```
, , 1

     [,1] [,2] [,3]
[1,]   13   17   21
```

```
  a [4, 3, ]
```

```
[1] 12 24
```

```
  a [c(2, 3), , -2]
```

```
     [,1] [,2] [,3]
[1,]    2    6   10
[2,]    3    7   11
```

```
  dimnames(a)[[1]] <-c("1qrt", "2qrt", "3qrt", "4qrt")
  dimnames(a)[[2]] <-c("store1", "store2", "store3")
  dimnames(a)[[3]] <-c("2017", "2018")
  a #using list() to specify names
```

```
, , 2017

     store1 store2 store3
1qrt      1      5      9
2qrt      2      6     10
3qrt      3      7     11
4qrt      4      8     12
```

```
, , 2018

     store1 store2 store3
1qrt     13     17     21
2qrt     14     18     22
3qrt     15     19     23
4qrt     16     20     24
```

```
ar <- array(data     = 1:27,
            dim      = c(3, 3, 3),
            dimnames = list(c("a", "b", "c"), c("d", "e", "f"),           c("g", "h", "i")
ar
```

```
, , g

  d e f
a 1 4 7
b 2 5 8
c 3 6 9

, , h

   d  e  f
a 10 13 16
b 11 14 17
c 12 15 18

, , i

   d  e  f
a 19 22 25
b 20 23 26
c 21 24 27
```

Split array into matrices

```
matrix1 <- ar[,,g]
matrix1 <- ar[,,'g']
matrix1
```

```
  d e f
a 1 4 7
b 2 5 8
c 3 6 9
```

```
matrix2 <- ar[,,'h']
matrix2
```

```
   d  e  f
a 10 13 16
b 11 14 17
c 12 15 18
```

```
sum <-matrix1 + matrix2
sum
```

```
   d  e  f
a 11 17 23
b 13 19 25
c 15 21 27
```

```
matrix1*3 #multiplying all matrix elememts by 3
```

```
  d  e  f
a 3 12 21
b 6 15 24
c 9 18 27
```

```
matrix1*c(2, 3)
```

```
Warning in matrix1 * c(2, 3): longer object length is not a multiple of shorter
object length
```

```
  d  e  f
a 2 12 14
b 6 10 24
c 6 18 18
```

```
matrix1*c(2,3,2,3,2,3,2,3,2) #multiplying matrix with an vector
```

```
  d  e  f
a 2 12 14
b 6 10 24
c 6 18 18
```

```
matrix1*c(1, 2, 3)
```

```
  d  e  f
a 1  4  7
b 4 10 16
c 9 18 27
```

```
matrix1/c(1, 2, 3)
```

```
  d   e f
a 1 4.0 7
b 1 2.5 4
c 1 2.0 3
```

```
matrix1/c(1, 2, 3, 1, 2, 3, 1, 2, 3)
```

```
  d   e f
a 1 4.0 7
b 1 2.5 4
c 1 2.0 3
```

Lists:

a list is a versatile and flexible data structure that can hold elements of different data types, including vectors, matrices, data frames, functions, and even other lists.

you can access a component of a list by using the **$** operator, followed by the name of the component you want to access.

```
mylist <- list(stud.id=34453,
               stud.name="John",
               stud.marks= c(13, 3, 12, 15, 19)
               )

mylist$stud.id
```

```
[1] 34453
```

```
mylist[1] #accessing 1 st element
```

```
$stud.id
[1] 34453
```

```
mylist[[1]]
```

```
[1] 34453
```

```
mylist["stud.id"]
```

```
$stud.id
[1] 34453
```

```
handle <- "stud.id" #renaming
mylist[handle]
```

```
$stud.id
[1] 34453
```

```
mylist[["stud.id"]] # extracting single elements from a list
```

```
[1] 34453
```

```r
mylist <- list(stud.id=34453,
               stud.name="John",
               stud.marks= c(13, 3, 12, 15, 19)
               )
mylist$stud.marks
```

```
[1] 13  3 12 15 19
```

```r
mylist$stud.marks[2]
```

```
[1] 3
```

```r
names(mylist)
```

```
[1] "stud.id"    "stud.name"  "stud.marks"
```

```r
names(mylist) <- c('id','name','marks') #changing names

names(mylist)
```

```
[1] "id"    "name"  "marks"
```

```r
mylist
```

```
$id
[1] 34453

$name
[1] "John"

$marks
[1] 13  3 12 15 19
```

```
mylist$parents.names <- c('Ana', "Mike")
mylist
```

```
$id
[1] 34453

$name
[1] "John"

$marks
[1] 13  3 12 15 19

$parents.names
[1] "Ana"  "Mike"
```

```
newlist <- list(age=19, sex="male");
expandedlist <-c(mylist, newlist) #concating 2 lists
expandedlist
```

```
$id
[1] 34453

$name
[1] "John"

$marks
[1] 13  3 12 15 19

$parents.names
[1] "Ana"  "Mike"

$age
[1] 19

$sex
[1] "male"
```

```
length(expandedlist) #length of the new list
```

```
[1] 6
```

Exercise:

Starting with the expanded list given above, what will be the result of the following statement? Consider the statement one by one.

```
expandedlist <- expandedlist[-5]
expandedlist <- expandedlist[c(-1,-5)]
expandedlist$parents.names <- NULL
expandedlist[['marks']] <- NULL
```

```
mylist
```

```
$id
[1] 34453

$name
[1] "John"

$marks
[1] 13  3 12 15 19

$parents.names
[1] "Ana"  "Mike"
```

```
unlist(mylist) # convert to a one-dimensional vector
```

```
          id           name         marks1         marks2         marks3
     "34453"         "John"           "13"            "3"           "12"
      marks4         marks5 parents.names1 parents.names2
        "15"           "19"          "Ana"         "Mike"
```

```
mode(mylist) #finding the type
```

```
[1] "list"
```

```
  mode(unlist(mylist))
```

```
[1] "character"
```

```
  is.vector(unlist(mylist)) #atomic list with names
```

```
[1] TRUE
```

```
  is.list(mylist)
```

```
[1] TRUE
```

```
  is.atomic(mylist)
```

```
[1] FALSE
```

```
  is.list(unlist(mylist))
```

```
[1] FALSE
```

Data Frames

A data frame is a widely used data structure for organizing and manipulating tabular data.

```
  my.dataframe <- data.frame(site=c('A', 'B', 'A','A', 'B'),
                             season=c('winter', 'summer', 'summer', 'spring', 'fall'),
  my.dataframe
```

```
  site season  ph
1    A winter 7.4
2    B summer 6.3
3    A summer 8.6
4    A spring 7.2
5    B   fall 8.9
```

Exercise:

Given ‘my.dataframes‘, what values will the following statements access?

```
my.dataframe <- data.frame(site=c('A', 'B', 'A','A', 'B'),
                           season=c('winter', 'summer', 'summer', 'spring', 'fall'),
my.dataframe[3, 2]
```

```
[1] "summer"
```

```
my.dataframe[['site']]
```

```
[1] "A" "B" "A" "A" "B"
```

```
my.dataframe['site']
```

```
  site
1    A
2    B
3    A
4    A
5    B
```

```
my.dataframe[my.dataframe$ph>7, ]
```

```
  site season  ph
1    A winter 7.4
3    A summer 8.6
4    A spring 7.2
5    B   fall 8.9
```

```
my.dataframe[my.dataframe$ph>7, 'site']
```

```
[1] "A" "A" "A" "B"
```

```
my.dataframe[my.dataframe$ph>7, c('site', 'ph')]
```

```
  site  ph
1    A 7.4
3    A 8.6
4    A 7.2
5    B 8.9
```

subset() function in R is used to create a subset of a data frame or matrix based on specified conditions or criteria.

```
subset(my.dataframe, ph>7)
```

```
  site season  ph
1    A winter 7.4
3    A summer 8.6
4    A spring 7.2
5    B   fall 8.9
```

```
subset(my.dataframe, ph>7, c("site", "ph"))
```

```
  site  ph
1    A 7.4
3    A 8.6
4    A 7.2
5    B 8.9
```

```
subset(my.dataframe[1:2,], ph>7, c(site, ph))
```

```
  site  ph
1    A 7.4
```

```
my.dataframe[my.dataframe$season=='summer', 'ph'] <- my.dataframe[my.dataframe$season=='su
                                                                  my.dataframe[my.datafram
```

```
[1] 7.3 9.6
```

```
my.dataframe[my.dataframe$season=='summer' & my.dataframe$ph>8, 'ph'] <- my.dataframe[my.d

my.dataframe[my.dataframe$season=='summer', 'ph']
```

```
[1]  7.3 10.6
```

```
my.dataframe$NO3 <- c(234.5, 123.4, 456.7, 567.8, 789.0)
my.dataframe
```

```
  site season   ph   NO3
1    A winter  7.4 234.5
2    B summer  7.3 123.4
3    A summer 10.6 456.7
4    A spring  7.2 567.8
5    B   fall  8.9 789.0
```

```
#my.dataframe$NO3<-NULL
my.dataframe <- my.dataframe[, -4]
my.dataframe
```

```
  site season   ph
1    A winter  7.4
2    B summer  7.3
3    A summer 10.6
4    A spring  7.2
5    B   fall  8.9
```

```
str(my.dataframe)
```

```
'data.frame':   5 obs. of  3 variables:
 $ site  : chr  "A" "B" "A" "A" ...
 $ season: chr  "winter" "summer" "summer" "spring" ...
 $ ph    : num  7.4 7.3 10.6 7.2 8.9
```

```
nrow(my.dataframe) # number of rows in dataframe
```

```
[1] 5
```

```
ncol(my.dataframe) #number of columns in dataframes
```

```
[1] 3
```

```
dim(my.dataframe)
```

```
[1] 5 3
```

```
 #edit(my.dataframe) #this brings up a data editor

 #View(my.dataframe) #this brings up a uneditable tab that display the data for you to vie
```

```
names(my.dataframe)
```

```
[1] "site"   "season" "ph"
```

```
names(my.dataframe) <- c('area', 'season', 'P.h.')
my.dataframe
```

```
  area season P.h.
1    A winter  7.4
2    B summer  7.3
3    A summer 10.6
4    A spring  7.2
5    B   fall  8.9
```

```
names(my.dataframe)[3] <- 'ph'
my.dataframe
```

```
  area season   ph
1    A winter  7.4
2    B summer  7.3
3    A summer 10.6
4    A spring  7.2
5    B   fall  8.9
```

Tibbles

Tibbles are designed to make data manipulation and analysis more intuitive and less error-prone.

```
if( !require("tibble"))
install.packages("tibble")
```

```
Loading required package: tibble
```

```
                                                                    library(tibble)
```

```
my.tibble <- tibble(TempCels = sample(-10:40, size=100, replace=TRUE),
                    TempFahr = TempCels*9/5+32,
                    Location = rep(letters[1:2], each=50))
my.tibble
```

```
# A tibble: 100 x 3
   TempCels TempFahr Location
      <int>    <dbl> <chr>
 1       24     75.2 a
 2        7     44.6 a
 3       32     89.6 a
 4       -9     15.8 a
 5        3     37.4 a
 6       23     73.4 a
 7       10     50   a
 8       19     66.2 a
 9        1     33.8 a
10       16     60.8 a
# i 90 more rows
```

```
if( !require("palmerpenguins"))
install.packages("palmerpenguins")
```

```
Loading required package: palmerpenguins
```

```
library(palmerpenguins)
data(penguins)
dim(penguins)
```

```
[1] 344   8
```

```
class(penguins)
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

```
penguins
```

```
# A tibble: 344 x 8
   species island    bill_length_mm bill_depth_mm flipper_length_mm body_mass_g
   <fct>   <fct>              <dbl>         <dbl>             <int>       <int>
 1 Adelie  Torgersen           39.1          18.7               181        3750
 2 Adelie  Torgersen           39.5          17.4               186        3800
 3 Adelie  Torgersen           40.3          18                 195        3250
 4 Adelie  Torgersen           NA            NA                  NA          NA
 5 Adelie  Torgersen           36.7          19.3               193        3450
 6 Adelie  Torgersen           39.3          20.6               190        3650
 7 Adelie  Torgersen           38.9          17.8               181        3625
 8 Adelie  Torgersen           39.2          19.6               195        4675
 9 Adelie  Torgersen           34.1          18.1               193        3475
10 Adelie  Torgersen           42            20.2               190        4250
# i 334 more rows
# i 2 more variables: sex <fct>, year <int>
```

```
pe <-as_tibble(penguins)
class(pe)
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

```
pe
```

```
# A tibble: 344 x 8
   species island    bill_length_mm bill_depth_mm flipper_length_mm body_mass_g
   <fct>   <fct>              <dbl>         <dbl>             <int>       <int>
 1 Adelie  Torgersen           39.1          18.7               181        3750
 2 Adelie  Torgersen           39.5          17.4               186        3800
 3 Adelie  Torgersen           40.3          18                 195        3250
 4 Adelie  Torgersen           NA            NA                  NA          NA
 5 Adelie  Torgersen           36.7          19.3               193        3450
 6 Adelie  Torgersen           39.3          20.6               190        3650
 7 Adelie  Torgersen           38.9          17.8               181        3625
 8 Adelie  Torgersen           39.2          19.6               195        4675
 9 Adelie  Torgersen           34.1          18.1               193        3475
10 Adelie  Torgersen           42            20.2               190        4250
# i 334 more rows
# i 2 more variables: sex <fct>, year <int>
```

```
x <- 1:16
mode(x) #finding type of frame
```

```
[1] "numeric"
```

```
is.numeric(x)
```

```
[1] TRUE
```

```
mode(x) <- "character"
mode(x)
```

```
[1] "character"
```

```
class(x)
```

```
[1] "character"
```

```
  x <- factor(x)
  class(x)
```

```
[1] "factor"
```

```
  mode(x)
```

```
[1] "numeric"
```

```
  is.array(x)
```

```
[1] FALSE
```

```
  is.data.frame(x)
```

```
[1] FALSE
```

```
  is.matrix(x)
```

```
[1] FALSE
```

```
  is_tibble(x)
```

```
[1] FALSE
```

```
  is.vector(x)
```

```
[1] FALSE
```

```
  typeof(x)
```

```
[1] "integer"
```

```
  class(pe[1:15, c("bill_length_mm", "bill_depth_mm")]) #subsetting tibble in smaller one
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

```
  class(penguins[1:15, c("bill_length_mm", "bill_depth_mm")])
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

```
  class(pe[1:15, c("bill_length_mm")])
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

```
  class(penguins[1:15, c("bill_length_mm")])
```

```
[1] "tbl_df"     "tbl"        "data.frame"
```

dplyr

Provides a set of functions and a consistent, user-friendly grammar for working with data frames or tibbles.

```
  if( !require("dplyr"))
  install.packages("dplyr")
```

```
Loading required package: dplyr
```

```

Attaching package: 'dplyr'
```

```
The following objects are masked from 'package:stats':

    filter, lag
```

```
The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```
  library(dplyr)
```

```
  select(filter(pe, species=="Adelie"), bill_length_mm, bill_depth_mm) #Select bill lengths
```

```
# A tibble: 152 x 2
   bill_length_mm bill_depth_mm
            <dbl>         <dbl>
 1           39.1          18.7
 2           39.5          17.4
 3           40.3          18
 4           NA            NA
 5           36.7          19.3
 6           39.3          20.6
 7           38.9          17.8
 8           39.2          19.6
 9           34.1          18.1
10           42            20.2
# i 142 more rows
```

```
  filter(select(pe, bill_length_mm, bill_depth_mm, species), species=="Adelie")
```

```
# A tibble: 152 x 3
   bill_length_mm bill_depth_mm species
            <dbl>         <dbl> <fct>
 1           39.1          18.7 Adelie
 2           39.5          17.4 Adelie
 3           40.3          18   Adelie
 4           NA            NA   Adelie
 5           36.7          19.3 Adelie
 6           39.3          20.6 Adelie
 7           38.9          17.8 Adelie
 8           39.2          19.6 Adelie
 9           34.1          18.1 Adelie
10           42            20.2 Adelie
# i 142 more rows
```

Exercise

How would you achieve the same result as the above but use tibble subsetting?

```
pe
```

```
# A tibble: 344 x 8
   species island    bill_length_mm bill_depth_mm flipper_length_mm body_mass_g
   <fct>   <fct>              <dbl>         <dbl>             <int>       <int>
 1 Adelie  Torgersen           39.1          18.7               181        3750
 2 Adelie  Torgersen           39.5          17.4               186        3800
 3 Adelie  Torgersen           40.3          18                 195        3250
 4 Adelie  Torgersen           NA            NA                  NA          NA
 5 Adelie  Torgersen           36.7          19.3               193        3450
 6 Adelie  Torgersen           39.3          20.6               190        3650
 7 Adelie  Torgersen           38.9          17.8               181        3625
 8 Adelie  Torgersen           39.2          19.6               195        4675
 9 Adelie  Torgersen           34.1          18.1               193        3475
10 Adelie  Torgersen           42            20.2               190        4250
# i 334 more rows
# i 2 more variables: sex <fct>, year <int>
```

```
pe[pe$species=='Adelie', c("bill_length_mm", "bill_depth_mm")]
```

```
# A tibble: 152 x 2
   bill_length_mm bill_depth_mm
            <dbl>         <dbl>
 1           39.1          18.7
 2           39.5          17.4
 3           40.3          18
 4           NA            NA
 5           36.7          19.3
 6           39.3          20.6
 7           38.9          17.8
 8           39.2          19.6
 9           34.1          18.1
10           42            20.2
# i 142 more rows
```

```
subset(pe, pe$species=='Adelie', c("bill_length_mm", "bill_depth_mm"))
```

```
# A tibble: 152 x 2
   bill_length_mm bill_depth_mm
            <dbl>         <dbl>
 1           39.1          18.7
 2           39.5          17.4
 3           40.3          18
 4           NA            NA
 5           36.7          19.3
 6           39.3          20.6
 7           38.9          17.8
 8           39.2          19.6
 9           34.1          18.1
10           42            20.2
# i 142 more rows
```

```
  select(pe, bill_length_mm, bill_depth_mm, species) |> filter(species=="Adelie")
```

```
# A tibble: 152 x 3
   bill_length_mm bill_depth_mm species
            <dbl>         <dbl> <fct>
 1           39.1          18.7 Adelie
 2           39.5          17.4 Adelie
 3           40.3          18   Adelie
 4           NA            NA   Adelie
 5           36.7          19.3 Adelie
 6           39.3          20.6 Adelie
 7           38.9          17.8 Adelie
 8           39.2          19.6 Adelie
 9           34.1          18.1 Adelie
10           42            20.2 Adelie
# i 142 more rows
```

```
  filter(pe, species=="Adelie") |> select(bill_length_mm, bill_depth_mm, species)
```

```
# A tibble: 152 x 3
   bill_length_mm bill_depth_mm species
            <dbl>         <dbl> <fct>
 1           39.1          18.7 Adelie
 2           39.5          17.4 Adelie
```

```
 3           40.3          18   Adelie
 4           NA            NA   Adelie
 5           36.7          19.3 Adelie
 6           39.3          20.6 Adelie
 7           38.9          17.8 Adelie
 8           39.2          19.6 Adelie
 9           34.1          18.1 Adelie
10           42            20.2 Adelie
# i 142 more rows
```

Exercise

Create a data object to hold student names (`Judy`, `Max`, `Dan`) and their grades (‘78,85,99) `Convert number grades to letter grades`:90-100:A;80-89:B;70-79:C; \<70:F‘

```
students <- list(names=c("Judy", "Max", "Dan"),
                 grades=c(78, 85, 99))
print ("before:")
```

```
[1] "before:"
```

```
students
```

```
$names
[1] "Judy" "Max"  "Dan"

$grades
[1] 78 85 99
```

```
gradeConvertor<- function (grade){
  grade = as.numeric(grade)
  if(grade > 100 | grade < 0) print ("grade out of the range")
  else if(grade >= 90 & grade <= 100) return ("A")
  else if(grade >= 80 & grade < 90) return ("B")
  else if(grade >= 70 & grade < 80) return ("C")
  else return ("F")
} # providing different conditions

#students$grades <-sapply(students$grades, gradeConvertor)
```

```
  for(i in 1:length(students$grades)){
    students$grades[i] = gradeConvertor(students$grades[i])
  }

  print ("after:")
```

```
[1] "after:"
```

```
  students
```

```
$names
[1] "Judy" "Max"  "Dan"

$grades
[1] "C" "B" "A"
```