Calling Functions - Scoping - Practice file

In-class practice / DSC 205 / Lyon College Spring 2024

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March 8, 2024

README

- This file contains exercises for the lecture "Calling Functions - Scoping" in the Advanced Introduction to Data Science course (DSC205)
- Most of this material can be found in Davies, Book of R, Chapter 9. Solutions can be found in GitHub (PDF).

Identify and pledge yourself

1. In Emacs, replace the placeholder `[yourname]` at the top of this file by your own name and write `(pledged)` next to it
2. Go with the cursor on the headline and hange the `TODO` label to `DONE` by entering `S-<right>` ("Shift + right-arrow").

Scoping

Example: `data` as an argument, and as a function -

1. create a row-wise 3x3 matrix of the numbers {1..9}
2. list all datasets in the package `MASS`

```
matrix(data=1:9,nrow=3,byrow=TRUE)
```

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

```
data("ToothGrowth")
library("MASS")
data(package="MASS")

Data sets in package 'MASS':

Aids2                   Australian AIDS Survival Data
Animals                 Brain and Body Weights for 28 Species
Boston                  Housing Values in Suburbs of Boston
Cars93                  Data from 93 Cars on Sale in the USA in 1993
Cushings                Diagnostic Tests on Patients with Cushing's Syndrome
DDT                     DDT in Kale
GAGurine                Level of GAG in Urine of Children
Insurance               Numbers of Car Insurance claims
Melanoma                Survival from Malignant Melanoma
OME                     Tests of Auditory Perception in Children with OME
Pima.te                 Diabetes in Pima Indian Women
Pima.tr                 Diabetes in Pima Indian Women
Pima.tr2                Diabetes in Pima Indian Women
Rabbit                  Blood Pressure in Rabbits
Rubber                  Accelerated Testing of Tyre Rubber
SP500                   Returns of the Standard and Poors 500
Sitka                   Growth Curves for Sitka Spruce Trees in 1988
Sitka89                 Growth Curves for Sitka Spruce Trees in 1989
Skye                    AFM Compositions of Aphyric Skye Lavas
Traffic                 Effect of Swedish Speed Limits on Accidents
UScereal                Nutritional and Marketing Information on US Cereals
UScrime                 The Effect of Punishment Regimes on Crime Rates
VA                      Veteran's Administration Lung Cancer Trial
abbey                   Determinations of Nickel Content
accdeaths               Accidental Deaths in the US 1973-1978
anorexia                Anorexia Data on Weight Change
bacteria                Presence of Bacteria after Drug Treatments
beav1                   Body Temperature Series of Beaver 1
beav2                   Body Temperature Series of Beaver 2
biopsy                  Biopsy Data on Breast Cancer Patients
birthwt                 Risk Factors Associated with Low Infant Birth Weight
cabbages                Data from a cabbage field trial
caith                   Colours of Eyes and Hair of People in Caithness
cats                    Anatomical Data from Domestic Cats
```

cement	Heat Evolved by Setting Cements
chem	Copper in Wholemeal Flour
coop	Co-operative Trial in Analytical Chemistry
cpus	Performance of Computer CPUs
crabs	Morphological Measurements on Leptograpsus Crabs
deaths	Monthly Deaths from Lung Diseases in the UK
drivers	Deaths of Car Drivers in Great Britain 1969-84
eagles	Foraging Ecology of Bald Eagles
epil	Seizure Counts for Epileptics
farms	Ecological Factors in Farm Management
fgl	Measurements of Forensic Glass Fragments
forbes	Forbes' Data on Boiling Points in the Alps
galaxies	Velocities for 82 Galaxies
gehan	Remission Times of Leukaemia Patients
genotype	Rat Genotype Data
geyser	Old Faithful Geyser Data
gilgais	Line Transect of Soil in Gilgai Territory
hills	Record Times in Scottish Hill Races
housing	Frequency Table from a Copenhagen Housing Conditions Survey
immer	Yields from a Barley Field Trial
leuk	Survival Times and White Blood Counts for Leukaemia Patients
mammals	Brain and Body Weights for 62 Species of Land Mammals
mcycle	Data from a Simulated Motorcycle Accident
menarche	Age of Menarche in Warsaw
michelson	Michelson's Speed of Light Data
minn38	Minnesota High School Graduates of 1938
motors	Accelerated Life Testing of Motorettes
muscle	Effect of Calcium Chloride on Muscle Contraction in Rat Hearts
newcomb	Newcomb's Measurements of the Passage Time of Light
nlschools	Eighth-Grade Pupils in the Netherlands
npk	Classical N, P, K Factorial Experiment
npr1	US Naval Petroleum Reserve No. 1 data
oats	Data from an Oats Field Trial
painters	The Painter's Data of de Piles
petrol	N. L. Prater's Petrol Refinery Data
phones	Belgium Phone Calls 1950-1973
quine	Absenteeism from School in Rural New South Wales

```
road                    Road Accident Deaths in US States
rotifer                 Numbers of Rotifers by Fluid Density
ships                   Ships Damage Data
shoes                   Shoe wear data of Box, Hunter and Hunter
shrimp                  Percentage of Shrimp in Shrimp Cocktail
shuttle                 Space Shuttle Autolander Problem
snails                  Snail Mortality Data
steam                   The Saturated Steam Pressure Data
stormer                 The Stormer Viscometer Data
survey                  Student Survey Data
synth.te                Synthetic Classification Problem
synth.tr                Synthetic Classification Problem
topo                    Spatial Topographic Data
waders                  Counts of Waders at 15 Sites in South Africa
whiteside               House Insulation: Whiteside's Data
wtloss                  Weight Loss Data from an Obese Patient
```

Global environments

Example: create three new objects and confirm their existence in the global environment:

1. a `numeric` variable `foo`
2. a `character` variable `bar`
3. an anonymous (non-argument) function `hello` that prints "Hello!"
4. check the global environment
5. run `hello`

```
foo = 1:3
bar = 'A'
hello <- function() print("Hello!")
ls()
hello()
```

```
[1] "bar"         "foo"         "h"           "hello"       "ToothGrowth"
[1] "Hello!"
```

Package environments and namespaces

1. List all built-in `datasets`

```
data()


Data sets in package 'datasets':

AirPassengers               Monthly Airline Passenger Numbers 1949-1960
BJsales                     Sales Data with Leading Indicator
BJsales.lead (BJsales)      Sales Data with Leading Indicator
BOD                         Biochemical Oxygen Demand
CO2                         Carbon Dioxide Uptake in Grass Plants
ChickWeight                 Weight versus age of chicks on different diets
DNase                       Elisa assay of DNase
EuStockMarkets              Daily Closing Prices of Major European Stock Indices,
    1991-1998
Formaldehyde                Determination of Formaldehyde
HairEyeColor                Hair and Eye Color of Statistics Students
Harman23.cor                Harman Example 2.3
Harman74.cor                Harman Example 7.4
Indometh                    Pharmacokinetics of Indomethacin
InsectSprays                Effectiveness of Insect Sprays
JohnsonJohnson              Quarterly Earnings per Johnson & Johnson Share
LakeHuron                   Level of Lake Huron 1875-1972
LifeCycleSavings            Intercountry Life-Cycle Savings Data
Loblolly                    Growth of Loblolly pine trees
Nile                        Flow of the River Nile
Orange                      Growth of Orange Trees
OrchardSprays               Potency of Orchard Sprays
PlantGrowth                 Results from an Experiment on Plant Growth
Puromycin                   Reaction Velocity of an Enzymatic Reaction
Seatbelts                   Road Casualties in Great Britain 1969-84
Theoph                      Pharmacokinetics of Theophylline
Titanic                     Survival of passengers on the Titanic
ToothGrowth                 The Effect of Vitamin C on Tooth Growth in Guinea Pigs
UCBAdmissions               Student Admissions at UC Berkeley
UKDriverDeaths              Road Casualties in Great Britain 1969-84
UKgas                       UK Quarterly Gas Consumption
USAccDeaths                 Accidental Deaths in the US 1973-1978
```

USArrests	Violent Crime Rates by US State
USJudgeRatings	Lawyers' Ratings of State Judges in the US Superior Court
USPersonalExpenditure	Personal Expenditure Data
UScitiesD	Distances Between European Cities and Between US Citie
VADeaths	Death Rates in Virginia (1940)
WWWusage	Internet Usage per Minute
WorldPhones	The World's Telephones
ability.cov	Ability and Intelligence Tests
airmiles	Passenger Miles on Commercial US Airlines, 1937-1960
airquality	New York Air Quality Measurements
anscombe	Anscombe's Quartet of 'Identical' Simple Linear Regressions
attenu	The Joyner-Boore Attenuation Data
attitude	The Chatterjee-Price Attitude Data
austres	Quarterly Time Series of the Number of Australian Residents
beaver1 (beavers)	Body Temperature Series of Two Beavers
beaver2 (beavers)	Body Temperature Series of Two Beavers
cars	Speed and Stopping Distances of Cars
chickwts	Chicken Weights by Feed Type
co2	Mauna Loa Atmospheric CO2 Concentration
crimtab	Student's 3000 Criminals Data
discoveries	Yearly Numbers of Important Discoveries
esoph	Smoking, Alcohol and (O)esophageal Cancer
euro	Conversion Rates of Euro Currencies
euro.cross (euro)	Conversion Rates of Euro Currencies
eurodist	Distances Between European Cities and Between US Citie
faithful	Old Faithful Geyser Data
fdeaths (UKLungDeaths)	Monthly Deaths from Lung Diseases in the UK
freeny	Freeny's Revenue Data
freeny.x (freeny)	Freeny's Revenue Data
freeny.y (freeny)	Freeny's Revenue Data
infert	Infertility after Spontaneous and Induced Abortion
iris	Edgar Anderson's Iris Data
iris3	Edgar Anderson's Iris Data
islands	Areas of the World's Major Landmasses
ldeaths (UKLungDeaths)	Monthly Deaths from Lung Diseases in the UK
lh	Luteinizing Hormone in Blood Samples
longley	Longley's Economic Regression Data

```
lynx                        Annual Canadian Lynx trappings 1821-1934
mdeaths (UKLungDeaths)      Monthly Deaths from Lung Diseases in the UK
morley                      Michelson Speed of Light Data
mtcars                      Motor Trend Car Road Tests
nhtemp                      Average Yearly Temperatures in New Haven
nottem                      Average Monthly Temperatures at Nottingham, 1920-1939
npk                         Classical N, P, K Factorial Experiment
occupationalStatus          Occupational Status of Fathers and their Sons
precip                      Annual Precipitation in US Cities
presidents                  Quarterly Approval Ratings of US Presidents
pressure                    Vapor Pressure of Mercury as a Function of Temperature
quakes                      Locations of Earthquakes off Fiji
randu                       Random Numbers from Congruential Generator RANDU
rivers                      Lengths of Major North American Rivers
rock                        Measurements on Petroleum Rock Samples
sleep                       Student's Sleep Data
stack.loss (stackloss)      Brownlee's Stack Loss Plant Data
stack.x (stackloss)         Brownlee's Stack Loss Plant Data
stackloss                   Brownlee's Stack Loss Plant Data
state.abb (state)           US State Facts and Figures
state.area (state)          US State Facts and Figures
state.center (state)        US State Facts and Figures
state.division (state)      US State Facts and Figures
state.name (state)          US State Facts and Figures
state.region (state)        US State Facts and Figures
state.x77 (state)           US State Facts and Figures
sunspot.month               Monthly Sunspot Data, from 1749 to "Present"
sunspot.year                Yearly Sunspot Data, 1700-1988
sunspots                    Monthly Sunspot Numbers, 1749-1983
swiss                       Swiss Fertility and Socioeconomic Indicators (1888)
    Data
treering                    Yearly Treering Data, -6000-1979
trees                       Diameter, Height and Volume for Black Cherry Trees
uspop                       Populations Recorded by the US Census
volcano                     Topographic Information on Auckland's Maunga Whau
    Volcano
warpbreaks                  The Number of Breaks in Yarn during Weaving
women                       Average Heights and Weights for American Women

Data sets in package 'dplyr':
```

```
band_instruments            Band membership
band_instruments2           Band membership
band_members                Band membership
starwars                    Starwars characters
storms                      Storm tracks data

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waders                  Counts of Waders at 15 Sites in South Africa
whiteside               House Insulation: Whiteside's Data
wtloss                  Weight Loss Data from an Obese Patient


Use 'data(package = .packages(all.available = TRUE))'
to list the data sets in all *available* packages.
```

2. List all objects of the `graphics` package:

```
ls(package:graphics)
```

```
 [1] "abline"          "arrows"          "assocplot"       "axis"            "Axis
 [6] "axis.Date"       "axis.POSIXct"    "axTicks"         "barplot"         "barp
[11] "box"             "boxplot"         "boxplot.default" "boxplot.matrix"  "bxp"
[16] "cdplot"          "clip"            "close.screen"    "co.intervals"    "cont
[21] "contour.default" "coplot"          "curve"           "dotchart"        "eras
[26] "filled.contour"  "fourfoldplot"    "frame"           "grconvertX"      "grco
[31] "grid"            "hist"            "hist.default"    "identify"        "imag
[36] "image.default"   "layout"          "layout.show"     "lcm"             "lege
[41] "lines"           "lines.default"   "locator"         "matlines"        "matp
[46] "matpoints"       "mosaicplot"      "mtext"           "pairs"           "pair
[51] "panel.smooth"    "par"             "persp"           "pie"             "plot
[56] "plot.default"    "plot.design"     "plot.function"   "plot.new"        "plot
```

```
[61] "plot.xy"          "points"          "points.default"  "polygon"         "poly
[66] "rasterImage"      "rect"            "rug"             "screen"          "segm
[71] "smoothScatter"    "spineplot"       "split.screen"    "stars"           "sten
[76] "strheight"        "stripchart"      "strwidth"        "sunflowerplot"   "symb
[81] "text"             "text.default"    "title"           "xinch"           "xspl
[86] "xyinch"           "yinch"
Warning message:
In ls(package:graphics) : 'package:graphics' converted to character string
```

3. Load (after installation in the R console buffer) the `dplyr` package and run the function `dplyr::filter`.

```
library(dplyr)
dplyr::filter
```

```
function (.data, ..., .by = NULL, .preserve = FALSE)
{
    check_by_typo(...)
    by <- enquo(.by)
    if (!quo_is_null(by) && !is_false(.preserve)) {
abort("Can't supply both `.by` and `.preserve`.")
    }
    UseMethod("filter")
}
<bytecode: 0x5623f0b64810>
<environment: namespace:dplyr>
```

Local or lexical environments

Example: create a 2x2 `matrix` named `youthspeak` and pass as `data` in the argument: "OMG", "LOL", "IMO", "YOLO".

```
youthspeak <- matrix(data=c("OMG", "LOL", "IMO", "YOLO"),nrow=2)
youthspeak
```

```
     [,1]  [,2]
[1,] "OMG" "IMO"
[2,] "LOL" "YOLO"
```

Search Path

1. You can view the search path with `search()`. Try calling it without `()`.

```
search
search()
```

```
function ()
.Internal(search())
<bytecode: 0x5623ee2e6cb0>
<environment: namespace:base>
 [1] ".GlobalEnv"        "package:dplyr"     "package:MASS"      "ESSR"
 [5] "package:stats"     "package:graphics"  "package:grDevices" "package:utils"
 [9] "package:datasets"  "package:methods"   "Autoloads"         "package:base"
```

2. Example: create a vector `foo` of 5 elements with values between 0 and 3 with `seq`, and print it:

```
seq(from=0,to=3,length.out=5)
```

```
[1] 0.00 0.75 1.50 2.25 3.00
```

3. You can look up the environment of any function using `environment`. Look up `seq`:

```
environment(seq)
```

```
<environment: namespace:base>
```

4. When a package is loaded with `library`, it is inserted in the search path right after the global environment, along with all its dependencies: load the package `MASS` and print only the element of `search()` that indicates this package.

```
library(MASS)
search()[which(search()=="package:MASS")] # if you
```

```
[1] "package:MASS"
```

Reserved and protected names

1. What happens when you assign a value to an `NaN` object?

```
NaN <- 1
```

```
Error in NaN <- 1 : invalid (do_set) left-hand side to assignment
```

2. `T` and `F` can also be overwritten - don't do it since they are the abbreviations for `TRUE` and `FALSE`. Show this with a short script:
   (a) Overwrite `T` with `FALSE`.
   (b) `paste` the string "2 + 2 = 5" and the expression `(2+2==5) == T`

```
T <- FALSE
paste("2+2=5 is", (2+2==5) == T)
```

```
[1] "2+2=5 is TRUE"
```

3. With all these confusing changes, clear the global environment now:
   (a) show all user-defined variables
   (b) clear them
   (c) show that the environment is clean (`character(0)`).

```
ls()
rm(list=ls())
ls()
```

```
[1] "bar"         "foo"         "h"           "hello"       "T"           "ToothGr
[7] "youthspeak"
character(0)
```

Display package content

1. Find the built-in and automatically loaded `methods` package in `search()` using `which`:

```
search()[which(search()=="package:methods")]
```

```
[1] "package:methods"
```

2. Display only the first 20 items contained in the built-in and automatically loaded `methods` package using `ls`.

```
ls('package:methods')[1:20]
```

```
 [1] "addNextMethod"         "allNames"              "Arith"
 [4] "as"                    "as<-"                  "asMethodDefinition"
 [7] "assignClassDef"        "assignMethodsMetaData" "balanceMethodsList"
[10] "body<-"                "cacheGenericsMetaData" "cacheMetaData"
[13] "cacheMethod"           "callGeneric"           "callNextMethod"
[16] "canCoerce"             "cbind2"                "checkAtAssignment"
[19] "checkSlotAssignment"   "classesToAM"
```

3. How many items are there in total in `package:methods`?

```
length(ls('package:methods'))
```

```
[1] 203
```

Functions and environments

1. Which environment owns the `read.table` function?

```
environment(read.table)
```

```
<environment: namespace:utils>
```

2. Which environment owns the `data` function?

```
environment(data)
```

```
<environment: namespace:utils>
```

3. Which environment owns the `matrix` function?

```
environment(matrix)
```

```
<environment: namespace:base>
```

4. Which environment owns the `jpeg` function?

```
environment(jpeg)
```

```
<environment: namespace:grDevices>
```

5. Where is the help for `jpeg`? Save the `help` for `jpeg` in an object `h`, and then print the `head` of `h`.

```
class(help(jpeg))
h <- help(jpeg)
head(h)
```

```
[1] "help_files_with_topic"
[1] "/usr/lib/R/library/grDevices/help/png"
```

6. If you check the location that the last output seems to provide, you'll be disappointed: there is only an `.rdb` file at that place. These files are created when R is built and installed. They are not meant to be directly read or manipulated. However, you can try to read `.rds` files with the `readRDS` function:

```
readRDS("/usr/lib/R/library/grDevices/help/aliases.rds")
```

```
  grDevices-package                .axisPars               .ps.prolog
"grDevices-package"              "axisTicks"             "postscript"
adjustcolor         as.graphicsAnnot                as.raster
      "adjustcolor"       "as.graphicsAnnot"              "as.raster"
    as.raster.array      as.raster.character        as.raster.logical
"as.raster"              "as.raster"              "as.raster"
   as.raster.matrix        as.raster.numeric            as.raster.raw
"as.raster"              "as.raster"              "as.raster"
       atop                axisTicks                      bar
 "plotmath"              "axisTicks"               "plotmath"
     bgroup                    bitmap                   blues9
 "plotmath"             "dev2bitmap"               "densCols"
bmp                      bold               bolditalic
```

```
      "png"              "plotmath"              "plotmath"
      boxplot.stats             bringToTop          cairoSymbolFont
    "boxplot.stats"            "bringToTop"        "cairoSymbolFont"
  cairo_pdf               cairo_ps            check.options
    "cairo"                 "cairo"          "check.options"
      chull                 CIDFont                      cm
    "chull"              "Type1Font"                  "cm"
  cm.colors                 col2rgb           colorConverter
 "palettes"               "col2rgb"               "make.rgb"
  colorRamp         colorRampPalette                  colors
"colorRamp"              "colorRamp"                "colors"
colorspaces                 colours             contourLines
     "convertColor"                "colors"           "contourLines"
       convertColor                densCols         dev.capabilities
     "convertColor"               "densCols"       "dev.capabilities"
dev.capture              dev.control                 dev.copy
      "dev.capture"                  "dev2"                   "dev2"
       dev.copy2eps            dev.copy2pdf                dev.cur
     "dev2"                   "dev2"                  "dev"
  dev.flush                 dev.hold          dev.interactive
"dev.flush"              "dev.flush"        "dev.interactive"
   dev.list                  dev.new                 dev.next
      "dev"                    "dev"                   "dev"
    dev.off                 dev.prev               dev.print
      "dev"                    "dev"                  "dev2"
    dev.set                 dev.size              dev2bitmap
      "dev"                "dev.size"            "dev2bitmap"
      devAskNewPage                  device      deviceIsInteractive
    "devAskNewPage"              "Devices"        "dev.interactive"
    Devices             displaystyle                     dot
  "Devices"                "plotmath"              "plotmath"
 embedFonts               extendrange                   frac
       "embedFonts"           "extendrange"              "plotmath"
   getGraphicsEvent      getGraphicsEventEnv            graphics.off
 "getGraphicsEvent"       "getGraphicsEvent"                  "dev"
      gray                gray.colors               grDevices
    "gray"              "gray.colors"      "grDevices-package"
      grey                grey.colors                  group
    "gray"              "gray.colors"              "plotmath"
     grSoftVersion                     hat                      hcl
```

```
    "grSoftVersion"               "plotmath"                     "hcl"
 hcl.colors                 hcl.pals              heat.colors
 "palettes"               "palettes"               "palettes"
    Hershey                      hsv                     inf
  "Hershey"                    "hsv"                "plotmath"
   integral                is.raster                    italic
 "plotmath"              "as.raster"                "plotmath"
   Japanese                     jpeg                  make.rgb
 "Japanese"                    "png"                "make.rgb"
  msgWindow                  n2mfrow                 nclass.FD
"msgWindow"                "n2mfrow"                  "nclass"
       nclass.scott           nclass.Sturges                      over
   "nclass"                 "nclass"                "plotmath"
    palette           palette.colors             palette.pals
  "palette"                 "palette"                  "palette"
pdf              pdf.options                 pdfFonts
      "pdf"             "pdf.options"        "postscriptFonts"
    phantom                   pictex                    plain
 "plotmath"                 "pictex"                "plotmath"
   plotmath                     png                postscript
 "plotmath"                   "png"              "postscript"
    postscriptFonts              pretty.Date            pretty.POSIXt
  "postscriptFonts"            "pretty.Date"            "pretty.Date"
 print.recordedplot         print.SavedPlots               ps.options
       "recordplot"                "windows"              "ps.options"
     quartz           quartz.options              quartz.save
   "quartz"                 "quartz"                 "quartz"
 quartzFont              quartzFonts                  rainbow
      "quartzFonts"            "quartzFonts"               "palettes"
     recordGraphics              recordPlot              replayPlot
   "recordGraphics"            "recordplot"            "recordplot"
rgb                  rgb2hsv                     ring
      "rgb"                "rgb2hsv"                "plotmath"
   savePlot        scriptscriptstyle             scriptstyle
 "savePlot"               "plotmath"               "plotmath"
     setEPS      setGraphicsEventEnv setGraphicsEventHandlers
       "ps.options"       "getGraphicsEvent"       "getGraphicsEvent"
      setPS                stayOnTop                      sup
       "ps.options"            "bringToTop"               "plotmath"
svg                  symbol           terrain.colors
```

```
    "cairo"               "plotmath"               "palettes"
  textstyle                    tiff              topo.colors
 "plotmath"                   "png"               "palettes"
    trans3d                Type1Font                underline
  "trans3d"              "Type1Font"               "plotmath"
    widehat                widetilde                win.graph
 "plotmath"              "plotmath"                 "windows"
      win.metafile                win.print                   windows
  "windows"               "windows"                 "windows"
    windows.options             windowsFont             windowsFonts
  "windows.options"          "windowsFonts"           "windowsFonts"
X11                      x11              X11.options
      "x11"                    "x11"                     "x11"
    X11Font                  X11Fonts                    xfig
 "x11Fonts"               "x11Fonts"                  "xfig"
  xy.coords                  xyTable               xyz.coords
"xy.coords"               "xyTable"             "xyz.coords"
       [.SavedPlots
  "windows"
```

7. Show that `base::matrix` is called **after** `utils::read.table` by comparing the indices in the `character` vector `search()`.

   Tip: to extract indices, you can use the `which` function in connection with logical operators.

```
environment(matrix)
environment(read.table)
search()
which(search()=="package:base")
which(search()=="package:utils")
```

```
<environment: namespace:base>
<environment: namespace:utils>
 [1] ".GlobalEnv"        "package:dplyr"     "package:MASS"      "ESSR"
 [5] "package:stats"     "package:graphics"  "package:grDevices" "package:utils"
 [9] "package:datasets"  "package:methods"   "Autoloads"         "package:base"
[1] 12
[1] 8
```

Functions and packages

Use `ls` and a test for `character` string equality to confirm that the function `smoothScatter` is part of the `graphics` package.

Tip: given a set of logical vectors, the function `any` tests if at least one of the values is true. E.g.

```
any(c("Jim","Jane","Joe") == "Jane")  # this is TRUE
any(c("Jim","Jane","Joe") == "Janet")  # this is FALSE
```

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

```
any(ls('package:graphics')=='smoothScatter')
```

```
[1] TRUE
```