Variables, functions, loading data

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Learning Objectives

- Gain some familiarity and comfort with rstudio
- Review how to assign variables
- Learn about and use functions
- Learn about and use vectors
- Write code to work with a data set, and calculate some descriptive statistics

Arithmetic

The grey rectangle below is a "code chunk". Everything withing the grey area is interpreted as R code. To run the code, click the green triangle in the upper-right corner.

In this example, R can perform basic math:

```
2+2
```

```
[1] 4
```

Now it's your turn. Enter code below to subtract ten from twenty-two:

```
22-10
```

```
[1] 12
```

Assigning Variables

We'll be working a lot with variables throughout this semester. A variable is a name you give to some value. The value could be a single number, a word, a bunch of words, an entire data set, etc.

Most scripting languages use the "=" sign to assign a value to a variable, but R uses "<-".

```
# assigns 10 to x
x<-10
```

It's important to note that creating a new variable using code above doesn't give you any output. Often it's a good idea to print your variable to the screen, just to confirm it worked the way you intended:

```
# prints x
x
```

```
[1] 10
```

```
#Anything preceded by a "#" is a "comment". It does not get executed as code.
#Comments can be super helpful to provide info on your code.
```

Now it's your turn. Create a variable "y", set it equal to 7+9, and then print it out:

```
y<-7+9
y
```

```
[1] 16
```

Functions

Coding languages, including R, have functions that help you quickly execute common tasks. Functions typically take the form of:

functionName(argument1, argument2, etc.…)

Arguments are the inputs you send to a function, so it has all the information it needs to perform its operation.

For example, the function `sqrt(number)` takes the square root of a number. This lets us quickly compute the answer, rather than having to write the formula for a square root.

```r
sqrt(9)
```

```
[1] 3
```

YOUR TURN: In the chunk below, create a variable `z`, set it equal to the square root of 90, and print it out:

```r
z<-sqrt(90)
z
```

```
[1] 9.486833
```

One nice thing about rstudio is that you can readily access documentation for functions by using the "help" command:

```r
help(sqrt)
```

The documentation appears in the lower right window in the "help" tab.

One key question: how do you know what functions exist, and what they do?
Answer: you Google what you're trying to do! In the case of R, you might search "How do I do 'x' in R?"

Let's say you are interested in calculating the absolute value (positive distance from zero) of -35 in R. Take a moment with your group/neighbors, and try to find the answer by searching the internet. In the code chunk below, use the function you found to compute this calculation:

```r
# compute the absolute value of -35

abs(-35)
```

```
[1] 35
```

Vectors

So far we've created variables that have single values (e.g. `x<-7`), but there are often cases where we need to assign *multiple values* to a variable. These types of variables are called *vectors*.

In order to create a vector, you can use the "c" function (c stands for "combine"). Here's an example:

```r
myFirstVector<-c(3,7,1,10)

myFirstVector
```

```
[1]  3  7  1 10
```

Now it's your turn. Create a vector called **`mySecondVector`**, assign the values 8, -11, 100, 35 to it, and print it to the screen:

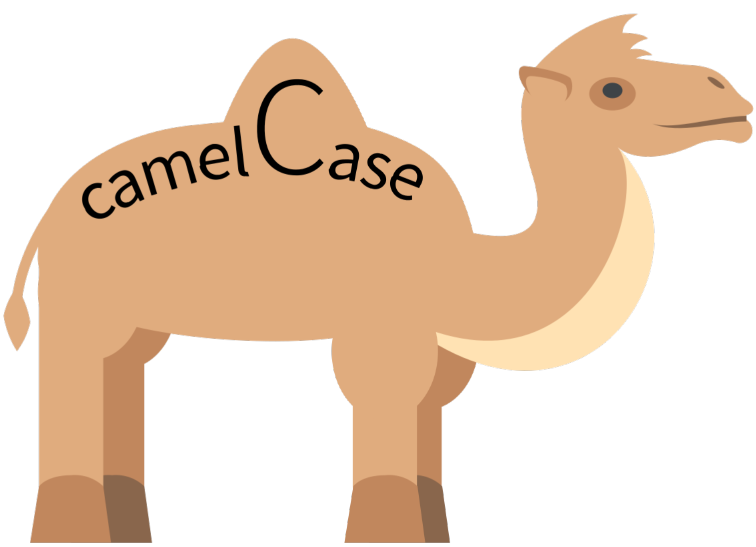
```r
# use the "c" function to create mySecondVector:

mySecondVector<-c(8,-11,100, 35)

mySecondVector
```

```
[1]   8 -11 100  35
```

Before moving on, let's talk a little about variable naming conventions. We started out using **`x`**, **`y`**, and **`z`** when learning about variables. That technically works, but it's better practice to be more descriptive in your variable names. The examples above and below use a syntax called "camel case". This allows you to string words together without spaces, but preserves quick readability. From this point on, we're going to create variables with camel case - you should too!



It may not be immediately clear what the utility of vectors is, so let's take a look at a practical use case. Below is a vector containing the responses from you and your classmates (and U of Arizona students) on self-reported fishing skill (1 being low, 5 being high):

```
fishingSkill<-c(1,2,2,1,1,1,1,2,2,5,1,2,2,1,5,3,4,4,4,2,1,2,2,3,2,1,2,2,2,1,5,2,3,1,4,5,2,2,

fishingSkill
```

```
 [1] 1 2 2 1 1 1 1 2 2 5 1 2 2 1 5 3 4 4 4 2 1 2 2 3 2 1 2 2 2 1 5 2 3 1 4 5 2 2
[39] 2 1 1 1 1 2 3 1 1 2 1 3 1 1 1 1 2 2 5 3 1 1 1 1 2 1 3 2 5 1 2 3 3 2 3 5 2
```

Let's say we're interested in finding the average of all the responses. We can do this by use the `mean` function in R: (we'll dive more into descriptive statistics next week, and how they differ from inferential)

```
avgFishingSkill<-mean(fishingSkill)

avgFishingSkill
```

```
[1] 2.146667
```

We can also calculate the median (the "middle" value, when data is in numerical order) with the `median` function:

```
medianFishingSkill<-median(fishingSkill)

medianFishingSkill
```

```
[1] 2
```

We can also calculate the standard deviation (a measurement of how spread apart the data is):

```
sdFishingSkill<-sd(fishingSkill)

sdFishingSkill
```

```
[1] 1.248711
```

Now it's your turn. Given the vector below of self-reported cooking skill ranking, calculate its mean, median, and standard deviation:

```r
cookingSkill<-c(4,5,4,1,2,5,4,4,4,4,3,2,2,2,4,4,4,3,3,5,3,3,4,4,5,5,3,4,3,3,4,4,3,4,1,4,3,4,

# calculate the mean

mean(cookingSkill)
```

```
[1] 3.302632
```

```r
#calculate median

median(cookingSkill)
```

```
[1] 3.5
```

```r
# calculate the standard deviation

sd(cookingSkill)
```

```
[1] 1.107787
```

Working with a data set

One of the most common uses of R is to load a data set into R as a variable, and then use that data to ask and answer questions with code. Let's start off by loading a package called the Tidyverse. The Tidyverse is a series of functions written by data scientists to make working with data a little easier. We can load it by running the following command:

```r
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.1     v tibble    3.2.1
v lubridate 1.9.3     v tidyr     1.3.1
v purrr     1.0.2
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
```

```
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becom
```

Notice in the Files tab in the lower-right window, there is a file titled teamAntarcticaData.csv. This is a copy of the spreadsheet data from the Google form. Below, we can assign the entire data set to a variable using the `read_csv` function:

```
#load the data
teamAntarcticaData<-read_csv("teamAntarcticaData.csv")
```

```
Rows: 75 Columns: 12
-- Column specification --------------------------------------------------------
Delimiter: ","
chr (7): Timestamp, school, swim, animals, parkaColor, teamFlag, distance
dbl (5): fishing, cold, remote, bedsideManner, cooking

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
#print to screen
teamAntarcticaData
```

```
# A tibble: 75 x 12
   Timestamp       school fishing swim   cold animals remote parkaColor teamFlag
   <chr>           <chr>    <dbl> <chr> <dbl> <chr>    <dbl> <chr>      <chr>
 1 8/30/2022 16:0~ Unive~       1 Yes       4 Yes          4 Gold       Penguin
 2 8/30/2022 16:0~ Unive~       2 Yes       4 Yes          5 Blue       Bear
 3 8/30/2022 16:0~ Unive~       2 Yes       4 Yes          3 Green      Penguin
 4 8/30/2022 16:0~ Unive~       1 Yes       1 Yes          1 Blue       Seal
 5 8/30/2022 16:0~ Unive~       1 Yes       3 Yes          3 White      Sea Spi~
 6 8/30/2022 16:0~ Unive~       1 Yes       3 Yes          3 hot pink   Penguin
 7 8/30/2022 16:0~ Unive~       1 Yes       2 Yes          3 Blue       Sea Spi~
 8 8/30/2022 16:0~ Unive~       2 Yes       2 Yes          4 Blue       Penguin
 9 8/30/2022 16:0~ Unive~       2 Yes       2 Yes          5 White      Bear
10 8/30/2022 16:0~ Unive~       5 Yes       5 Yes          5 Blue       Penguin
# i 65 more rows
# i 3 more variables: distance <chr>, bedsideManner <dbl>, cooking <dbl>
```

Earlier in this exercise we looked at the array of responses for both fishing and cooking aptitude, though in both cases the vectors were hand-typed (by me). A much more common way to acquire, and then use, a vector of data is to directly query the data set. You can get a vector (a.k.a. column) of data by using the following syntax:

`dataSet$columnName`

Let's get all responses for fishing aptitude directly from the data set:

```
fishing<-teamAntarcticaData$fishing

fishing
```

```
 [1] 1 2 2 1 1 1 1 2 2 5 1 2 2 1 5 3 4 4 4 2 1 2 2 3 2 1 2 2 2 1 5 2 3 1 4 5 2 2
[39] 2 1 1 1 1 2 3 1 1 2 1 3 1 1 1 1 2 2 5 3 1 1 1 1 2 1 3 2 5 1 2 3 3 2 3 5 2
```

And just like before, we can calculate the mean, median, and standard deviation:

```
mean(fishing)
```

```
[1] 2.146667
```

```
median(fishing)
```

```
[1] 2
```

```
sd(fishing)
```

```
[1] 1.248711
```

Now it's your turn:

Use the data set to get the column values for tolerance of cold (hint: after typing the $, use auto-complete to select the column name). Calculate its mean, median, and standard deviation.

```
# create a vector that contains the column values for cold tolerance



cold<-teamAntarcticaData$cold

#calculate the mean

mean(cold)
```

```
[1] 3.373333
```

```
#calculate the median

median(cold)
```

```
[1] 3
```

```
# calculate the standard deviation

sd(cold)
```

```
[1] 0.9969322
```

Now do the same for comfort level with being in a remote location:

```
# create a vector that contains the column values for comfort level with remote location

comfort<-teamAntarcticaData$remote


#calculate the mean

mean(comfort)
```

```
[1] 3.28
```

```
#calculate the median

median(comfort)
```

```
[1] 3
```

```
# calculate the standard deviation

sd(comfort)
```

```
[1] 1.133757
```

Now create a vector to get the responses for parka color. How is this data different from the other examples we've seen? What can we learn from the data?

```
parkas<-teamAntarcticaData$parkaColor

parkas
```

```
 [1] "Gold"              "Blue"              "Green"
 [4] "Blue"              "White"             "hot pink"
 [7] "Blue"              "Blue"              "White"
[10] "Blue"              "purple"            "White"
[13] "Green"             "Black"             "White"
[16] "Orange"            "Orange"            "Orange"
[19] "White"             "Blue"              "Black"
[22] "Blue"              "Pink, if possible" "green"
[25] "Black"             "Black"             "White"
[28] "Black"             "White"             "Blue"
[31] "Green"             "Blue"              "Black"
[34] "Blue"              "White"             "Blue"
[37] "Green"             "Blue"              "Black"
[40] "Blue"              "Blue"              "Black"
[43] "Blue"              "Black"             "Blue"
[46] "Orange"            "Orange"            "Blue"
[49] "Orange"            "Black"             "Black"
[52] "Pink"              "Baby Pink"         "Blue"
[55] "Lavender/purple"   "White"             "Black"
[58] "Black"             "Blue"              "Black"
[61] "Orange"            "Blue"              "Blue"
[64] "Blue"              "Orange"            "White"
[67] "Orange"            "Black"             NA
[70] "Black"             "White"             "Black"
[73] "Black"             "Orange"            "Purple"
```