Week-3: Code-along

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I. Code to edit and execute

To be submitted on canvas before attending the tutorial

Loading packages

```
# Load package tidyverse
library(tidyverse)
```

Assigning values to variables

```
# Example a.: execute this example
x <- 'A'
```

```
# Complete the code for Example b and execute it
x <- "Apple"
```

```
# Complete the code for Example c and execute it
x <- FALSE
```

```
# Complete the code for Example d and execute it
x <- 5L
```

```
# Complete the code for Example e and execute it
x <- 5
```

```
# Complete the code for Example f and execute it
x <- 1i
```

Checking the type of variables

```
# Example a.: execute this example
x <- 'A'
typeof(x)
```

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

```
# Complete the code for Example b and execute it
x <- "Apple"
typeof(x)
```

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

```
# Complete the code for Example c and execute it
x <- FALSE
typeof(x)
```

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

```
# Complete the code for Example d and execute it
x <- 5L
typeof(x)
```

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

```
# Complete the code for Example e and execute it
x <- 5
typeof(x)
```

```
## [1] "double"
```

```
# Complete the code for Example f and execute it
x <- 1i
typeof(x)
```

```
## [1] "complex"
```

Need for data types

```
# import the cat-lovers data from the csv file you downloaded from canvas
read.csv("cat-lovers.csv")
```

```
##                    name                                                number_of_cats
## 1        Bernice Warren                                                            0
## 2         Woodrow Stone                                                            0
## 3           Willie Bass                                                            1
## 4        Tyrone Estrada                                                            3
## 5          Alex Daniels                                                            3
## 6             Jane Bates                                                           2
## 7        Latoya Simpson                                                            1
## 8           Darin Woods                                                            1
## 9            Agnes Cobb                                                           0
## 10        Tabitha Grant                                                           0
## 11          Perry Cross                                                           0
## 12          Wanda Silva                                                           0
## 13          Alicia Sims                                                           1
## 14          Emily Logan                                                           3
## 15      Woodrow Elliott                                                           3
## 16       Brent Copeland                                                           2
## 17        Pedro Carlson                                                           1
## 18           Patsy Luna                                                           1
## 19        Brett Robbins                                                           0
## 20        Oliver George                                                           0
## 21         Calvin Perry                                                           1
## 22       Lora Gutierrez                                                           1
## 23     Charlotte Sparks                                                           0
## 24            Earl Mack                                                           0
## 25          Leslie Wade                                                           4
## 26      Santiago Barker                                                           0
## 27            Jose Bell                                                           0
## 28          Lynda Smith                                                           0
## 29    Bradford Marshall                                                           0
## 30        Irving Miller                                                           0
## 31     Caroline Simpson                                                           0
## 32        Frances Welch                                                           0
## 33        Melba Jenkins                                                           0
## 34     Veronica Morales                                                           0
## 35   Juanita Cunningham                                                           0
## 36       Maurice Howard                                                           0
## 37           Teri Pierce                                                          0
## 38        Phil Franklin                                                           0
## 39        Jan Zimmerman                                                           0
## 40         Leslie Price                                                           0
## 41     Bessie Patterson                                                           0
## 42           Ethel Wolfe                                                          0
## 43         Naomi Wright                                                           1
## 44          Sadie Frank                                                           3
## 45        Lonnie Cannon                                                           3
## 46          Tony Garcia                                                           2
## 47         Darla Newton                                                           1
## 48         Ginger Clark 1.5 - honestly I think one of my cats is half human
## 49      Lionel Campbell                                                           0
## 50       Florence Klein                                                           0
## 51      Harriet Leonard                                                           1
## 52 Terrence Harrington                                                           0
## 53        Travis Garner                                                          1
## 54             Doug Bass                                                      three
```

```
## 55          Pat Norris                                                1
## 56          Dawn Young                                                1
## 57       Shari Alvarez                                                1
## 58     Tamara Robinson                                                0
## 59        Megan Morgan                                                0
## 60         Kara Obrien                                                2
##      handedness
## 1          left
## 2          left
## 3          left
## 4          left
## 5          left
## 6          left
## 7          left
## 8          left
## 9          left
## 10         left
## 11         left
## 12         left
## 13         left
## 14        right
## 15        right
## 16        right
## 17        right
## 18        right
## 19        right
## 20        right
## 21        right
## 22        right
## 23        right
## 24        right
## 25        right
## 26        right
## 27        right
## 28        right
## 29        right
## 30        right
## 31        right
## 32        right
## 33        right
## 34        right
## 35        right
## 36        right
## 37        right
## 38        right
## 39        right
## 40        right
## 41        right
## 42        right
## 43        right
## 44        right
## 45        right
## 46        right
## 47        right
## 48        right
## 49        right
```

```
## 50        right
## 51        right
## 52        right
## 53        right
## 54        right
## 55        right
## 56 ambidextrous
## 57 ambidextrous
## 58 ambidextrous
## 59 ambidextrous
## 60 ambidextrous
```

```
cat_lovers <- read.csv("cat-lovers.csv")
```

```
# Compute the mean of the number of cats: execute this command
mean(cat_lovers$number_of_cats)
```

```
## Warning in mean.default(cat_lovers$number_of_cats): argument is not numeric or
## logical: returning NA
```

```
## [1] NA
```

```
# Get more information about the mean() command using ? operator
?mean()
```

```
# Convert the variable number_of_cats using as.integer()
as.integer(cat_lovers$number_of_cats)
```

```
## Warning: NAs introduced by coercion
```

```
##  [1]  0  0  1  3  3  2  1  1  0  0  0  0  1  3  3  2  1  1  0  0  1  1  0  0  4
## [26]  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  3  3  2  1 NA  0  0
## [51]  1  0  1 NA  1  1  1  0  0  2
```

```
# Display the elements of the column number_of_cats
cat_lovers$number_of_cats
```

```
##  [1] "0"
##  [2] "0"
##  [3] "1"
##  [4] "3"
##  [5] "3"
##  [6] "2"
##  [7] "1"
##  [8] "1"
##  [9] "0"
## [10] "0"
## [11] "0"
## [12] "0"
## [13] "1"
## [14] "3"
## [15] "3"
## [16] "2"
## [17] "1"
## [18] "1"
## [19] "0"
## [20] "0"
## [21] "1"
## [22] "1"
## [23] "0"
## [24] "0"
## [25] "4"
## [26] "0"
## [27] "0"
## [28] "0"
## [29] "0"
## [30] "0"
## [31] "0"
## [32] "0"
## [33] "0"
## [34] "0"
## [35] "0"
## [36] "0"
## [37] "0"
## [38] "0"
## [39] "0"
## [40] "0"
## [41] "0"
## [42] "0"
## [43] "1"
## [44] "3"
## [45] "3"
## [46] "2"
## [47] "1"
## [48] "1.5 - honestly I think one of my cats is half human"
## [49] "0"
## [50] "0"
## [51] "1"
## [52] "0"
## [53] "1"
## [54] "three"
## [55] "1"
```

```
## [56] "1"
## [57] "1"
## [58] "0"
## [59] "0"
## [60] "2"
```

```
# Display the elements of the column number_of_cats after converting it using as.nume
ric()
as.numeric(cat_lovers$number_of_cats)
```

```
## Warning: NAs introduced by coercion
```

```
##  [1]  0  0  1  3  3  2  1  1  0  0  0  0  1  3  3  2  1  1  0  0  1  1  0  0  4
## [26]  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  3  3  2  1 NA  0  0
## [51]  1  0  1 NA  1  1  1  0  0  2
```

Create an empty vector

```
# Empty vector
x <- vector()
# Type of the empty vector
typeof(x)
```

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

Create vectors of type logical

```
# Method 1
x<-vector("logical",length=5)
# Display the contents of x
print(x)
```

```
## [1] FALSE FALSE FALSE FALSE FALSE
```

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 2
x<-logical(5)
# Display the contents of x
print(x)
```

```
## [1] FALSE FALSE FALSE FALSE FALSE
```

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 3
x<-c(TRUE,FALSE,TRUE,FALSE,TRUE)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

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

Create vectors of type character

```
# Method 1
x <- vector("character",length=5)
# Display the contents of x
print(x)
```

```
## [1] "" "" "" "" ""
```

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 2
x <- character(5)
# Display the contents of x
print(x)
```

```
## [1] "" "" "" "" ""
```

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 3
x <- c('A','b','r','q')
# Display the contents of x
print(x)
```

```
## [1] "A" "b" "r" "q"
```

```
# Display the type of x
print(typeof(x))
```

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

Create vectors of type integer

```
# Method 1
x <- vector("integer",length=5L)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 2
x <- integer(5L)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 3
x <- c(1L,2L,3L,4L,5L)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 4
x <- seq(from=1L,to=5L,by=1L)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

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

```
# Method 5
x <- 1:5
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

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

Create vectors of type double

```
# Method 1
x <- vector("double",length=5)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

```
## [1] "double"
```

```
# Method 2
x <- double(5)
# Display the contents of x
print(x)
```

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

```
# Display the type of x
print(typeof(x))
```

```
## [1] "double"
```

```
# Method 3
x <- c(1.787,0.63573,2.3890)
# Display the contents of x
print(x)
```

```
## [1] 1.78700 0.63573 2.38900
```

```
# Display the type of x
print(typeof(x))
```

```
## [1] "double"
```

Implicit coercion

Example 1

```
# Create a vector
x <- c(1.8)
# Check the type of x
typeof(x)
```

```
## [1] "double"
```

```
# Add a character to the vector
x <- c(1.8)
x <- c(x,'a')
# Check the type of x
typeof(x)
```

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

Example 2

```
# Create a vector
x <- c(TRUE)
# Check the type of x
typeof(x)
```

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

```
# Add a number to the vector
x <- c(TRUE)
x <- c(x,2)
# Check the type of x
typeof(x)
```

```
## [1] "double"
```

Example 3

```
# Create a vector
x <- c('a')
# Check the type of x
typeof(x)
```

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

```
# Add a logical value to the vector
x <- c('a')
x <- c(x,TRUE)
# Check the type of x
typeof(x)
```

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

Example 4

```
# Create a vector
x <- c(1L)
# Check the type of x
typeof(x)
```

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

```
# Add a number to the vector
x <- c(1L)
x <- c(x,2)
# Check the type of x
typeof(x)
```

```
## [1] "double"
```

Explicit coercion

Example 1

```
# Create a vector
x <- c(1L)
# Check the type of x
typeof(x)
```

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

```
# Convert the vector to type character
x <- as.character(x)
# Check the type of x
typeof(x)
```

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

Example 2

```
# Create a vector
x <- c('A')
# Check the type of x
typeof(x)
```

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

```
# Convert the vector to type double
x <- as.numeric(x)
```

```
## Warning: NAs introduced by coercion
```

```
# Check the type of x
typeof(x)
```

```
## [1] "double"
```

Accessing elements of the vector

```
# Create a vector
x <- c(1,10,9,8,1,3,5)
```

```
# Access one element with index 3
x <- c(1,10,9,8,1,3,5)
x[3]
```

```
## [1] 9
```

```
# Access elements with consecutive indices, 2 to 4: 2,3,4
x <- c(1,10,9,8,1,3,5)
x[2:4]
```

```
## [1] 10  9  8
```

```
# Access elements with non-consecutive indices, 1,3,5
x <- c(1,10,9,8,1,3,5)
x[c(1,3,5)]
```

```
## [1] 1 9 1
```

```
# Access elements using logical vector
x <- c(1,10,9,8,1,3,5)
x[c(TRUE,FALSE,FALSE,TRUE,FALSE,FALSE,TRUE)]
```

```
## [1] 1 8 5
```

```
# Access elements using the conditional operator <
x <- c(1,10,9,8,1,3,5)
x[x<10]
```

```
## [1] 1 9 8 1 3 5
```

Examining vectors

```
# Display the length of the vector
print(length(x))
```

```
## [1] 7
```

```
# Display the type of the vector
print(typeof(x))
```

```
## [1] "double"
```

```
# Display the structure of the vector
str(x)
```

```
##  num [1:7] 1 10 9 8 1 3 5
```

Lists

```
# Initialise a named list
my_pie = list(type="key lime", diameter=7, is.vegetarian=TRUE)
# display the list
my_pie
```

```
## $type
## [1] "key lime"
##
## $diameter
## [1] 7
##
## $is.vegetarian
## [1] TRUE
```

```
# Print the names of the list
names(my_pie)
```

```
## [1] "type"          "diameter"      "is.vegetarian"
```

```
# Retrieve the element named type
my_pie$type
```

```
## [1] "key lime"
```

```
# Retrieve a truncated list
my_pie["type"]
```

```
## $type
## [1] "key lime"
```

```
# Retrieve the element named type
my_pie[["type"]]
```

```
## [1] "key lime"
```

Exploring data-sets

```
# Install package
install.packages("openintro")
```

```
# Load the package
library(openintro)
```

```
## Loading required package: airports
```

```
## Loading required package: cherryblossom
```

```
## Loading required package: usdata
```

```
# Load package
library(tidyverse)
```

```
## ── Attaching packages
## ──────────────────────────────────────
## tidyverse 1.3.2 ──
```

```
## ✔ ggplot2 3.3.6     ✔ purrr   0.3.4
## ✔ tibble  3.1.8     ✔ dplyr   1.0.9
## ✔ tidyr   1.2.0     ✔ stringr 1.4.0
## ✔ readr   2.1.2     ✔ forcats 0.5.1
## ── Conflicts ──────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
```

```
# Catch a glimpse of the data-set: see how the rows are stacked one below another
glimpse(loans_full_schema)
```

```
## Rows: 10,000
## Columns: 55
## $ emp_title                          <chr> "global config engineer ", "warehouse…
## $ emp_length                         <dbl> 3, 10, 3, 1, 10, NA, 10, 10, 10, 3, 1…
## $ state                              <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, I…
## $ homeownership                      <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN…
## $ annual_income                      <dbl> 90000, 40000, 40000, 30000, 35000, 34…
## $ verified_income                    <fct> Verified, Not Verified, Source Verifi…
## $ debt_to_income                     <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.4…
## $ annual_income_joint                <dbl> NA, NA, NA, NA, 57000, NA, 155000, NA…
## $ verification_income_joint          <fct> , , , , Verified, , Not Verified, , ,…
## $ debt_to_income_joint               <dbl> NA, NA, NA, NA, 37.66, NA, 13.12, NA,…
## $ delinq_2y                          <int> 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0…
## $ months_since_last_delinq           <int> 38, NA, 28, NA, NA, 3, NA, 19, 18, NA…
## $ earliest_credit_line               <dbl> 2001, 1996, 2006, 2007, 2008, 1990, 2…
## $ inquiries_last_12m                 <int> 6, 1, 4, 0, 7, 6, 1, 1, 3, 0, 4, 4, 8…
## $ total_credit_lines                 <int> 28, 30, 31, 4, 22, 32, 12, 30, 35, 9,…
## $ open_credit_lines                  <int> 10, 14, 10, 4, 16, 12, 10, 15, 21, 6,…
## $ total_credit_limit                 <int> 70795, 28800, 24193, 25400, 69839, 42…
## $ total_credit_utilized              <int> 38767, 4321, 16000, 4997, 52722, 3898…
## $ num_collections_last_12m           <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ num_historical_failed_to_pay       <int> 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0…
## $ months_since_90d_late              <int> 38, NA, 28, NA, NA, 60, NA, 71, 18, N…
## $ current_accounts_delinq            <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ total_collection_amount_ever       <int> 1250, 0, 432, 0, 0, 0, 0, 0, 0, 0, 0,…
## $ current_installment_accounts       <int> 2, 0, 1, 1, 1, 0, 2, 2, 6, 1, 2, 1, 2…
## $ accounts_opened_24m                <int> 5, 11, 13, 1, 6, 2, 1, 4, 10, 5, 6, 7…
## $ months_since_last_credit_inquiry   <int> 5, 8, 7, 15, 4, 5, 9, 7, 4, 17, 3, 4,…
## $ num_satisfactory_accounts          <int> 10, 14, 10, 4, 16, 12, 10, 15, 21, 6,…
## $ num_accounts_120d_past_due         <int> 0, 0, 0, 0, 0, 0, 0, NA, 0, 0, 0, 0, …
## $ num_accounts_30d_past_due          <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ num_active_debit_accounts          <int> 2, 3, 3, 2, 10, 1, 3, 5, 11, 3, 2, 2,…
## $ total_debit_limit                  <int> 11100, 16500, 4300, 19400, 32700, 272…
## $ num_total_cc_accounts              <int> 14, 24, 14, 3, 20, 27, 8, 16, 19, 7, …
## $ num_open_cc_accounts               <int> 8, 14, 8, 3, 15, 12, 7, 12, 14, 5, 8,…
## $ num_cc_carrying_balance            <int> 6, 4, 6, 2, 13, 5, 6, 10, 14, 3, 5, 3…
## $ num_mort_accounts                  <int> 1, 0, 0, 0, 0, 3, 2, 7, 2, 0, 2, 3, 3…
## $ account_never_delinq_percent       <dbl> 92.9, 100.0, 93.5, 100.0, 100.0, 78.1…
## $ tax_liens                          <int> 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ public_record_bankrupt             <int> 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0…
## $ loan_purpose                       <fct> moving, debt_consolidation, other, de…
## $ application_type                   <fct> individual, individual, individual, i…
## $ loan_amount                        <int> 28000, 5000, 2000, 21600, 23000, 5000…
## $ term                               <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 3…
## $ interest_rate                      <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.7…
## $ installment                        <dbl> 652.53, 167.54, 71.40, 664.19, 786.87…
## $ grade                              <fct> C, C, D, A, C, A, C, B, C, A, C, B, C…
## $ sub_grade                          <fct> C3, C1, D1, A3, C3, A3, C2, B5, C2, A…
## $ issue_month                        <fct> Mar-2018, Feb-2018, Feb-2018, Jan-201…
## $ loan_status                        <fct> Current, Current, Current, Current, C…
## $ initial_listing_status             <fct> whole, whole, fractional, whole, whol…
## $ disbursement_method                <fct> Cash, Cash, Cash, Cash, Cash, Cash, C…
## $ balance                            <dbl> 27015.86, 4651.37, 1824.63, 18853.26,…
## $ paid_total                         <dbl> 1999.330, 499.120, 281.800, 3312.890,…
## $ paid_principal                     <dbl> 984.14, 348.63, 175.37, 2746.74, 1569…
```

```
## $ paid_interest                    <dbl> 1015.19, 150.49, 106.43, 566.15, 754.…
## $ paid_late_fees                   <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
```

```
# Selecting numeric variables
loans <- loans_full_schema %>% # <-- pipe operator
  select(paid_total, term, interest_rate,
         annual_income,paid_late_fees,debt_to_income)
# View the columns stacked one below another
glimpse(loans)
```

```
## Rows: 10,000
## Columns: 6
## $ paid_total     <dbl> 1999.330, 499.120, 281.800, 3312.890, 2324.650, 873.130…
## $ term           <dbl> 60, 36, 36, 36, 36, 36, 60, 60, 36, 36, 60, 60, 36, 60,…
## $ interest_rate  <dbl> 14.07, 12.61, 17.09, 6.72, 14.07, 6.72, 13.59, 11.99, 1…
## $ annual_income  <dbl> 90000, 40000, 40000, 30000, 35000, 34000, 35000, 110000…
## $ paid_late_fees <dbl> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0…
## $ debt_to_income <dbl> 18.01, 5.04, 21.15, 10.16, 57.96, 6.46, 23.66, 16.19, 3…
```

```
# Selecting categoric variables
loans <- loans_full_schema %>%
  select(grade,state,homeownership,disbursement_method) # type the chosen columns as
in the lecture slide
# View the columns stacked one below another
glimpse(loans)
```

```
## Rows: 10,000
## Columns: 4
## $ grade               <fct> C, C, D, A, C, A, C, B, C, A, C, B, C, B, D, D, D,…
## $ state               <fct> NJ, HI, WI, PA, CA, KY, MI, AZ, NV, IL, IL, FL, SC…
## $ homeownership       <fct> MORTGAGE, RENT, RENT, RENT, RENT, OWN, MORTGAGE, M…
## $ disbursement_method <fct> Cash, Cash, Cash, Cash, Cash, Cash, Cash, Cash, Ca…
```