Psychological Statistics Lab 2

PSYC 2020-A01 / PSYC 6022-A01 | 2025-08-29 | Descriptive Statistics I

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Outline

- Assignment 1 Review
- R Projects
- Central Tendency Review
- R Functions
- Central Tendency in R

Assignment 1 Review

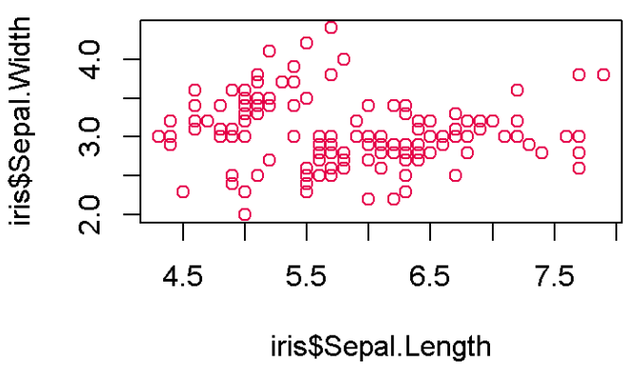
Check Working Directory

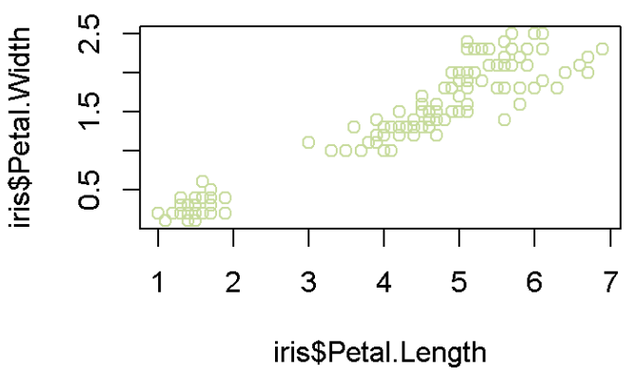
```
getwd()
```

Plotting

Make sure to select the right variable for plotting!

```
plot(iris$Sepal.Length, iris$Sepal.Width,
     col = "#E50046")
plot(iris$Petal.Length, iris$Petal.Width,
     col = "#C7DB9C")
```





R Projects

RStudio's way of helping organizing files, scripts, etc.

I strongly recommend this!!

- File > New Project
- If you don't already have a folder associated with this class, "New Directory"
- If you do, "Existing Directory"

All R Scripts under the same project share a *working directory*

- Location of files
- Default folder for reading or writing files

Setting Working Directory

`getwd()` tells us the location of our working directory

`setwd("C:/Users/Desktop/R Example")` sets the working directory

Or, `here::here()` lets us do relative directories (my favorite!)

- Just use the command at the top of the file to see where your directory is
- Do need to install the `here` package first

```
1 install.packages("here")
```

Then, when you need a file, you can reference it relatively

```
1 here::here()
```

```
[1] "C:/Users/jessi/OneDrive - Georgia Institute of Technology/Courses/GTA/PSYC 2020/PSYC 2020L Site"
```

```
1 here::here("lab 2", "cat.png")
```

```
[1] "C:/Users/jessi/OneDrive - Georgia Institute of Technology/Courses/GTA/PSYC 2020/PSYC 2020L Site/lab 2/cat.png"
```

Review of Central Tendency!

Mean: Sum of all values divided by the total number of values

Median: When sorted lowest to highest, the middle value

Mode: The value that appears most often

Central Tendency Practice

Given this dataset:

```
1 c(0, 2, 2, 4)
```

```
[1] 0 2 2 4
```

What is the mean?

What is the median?

What is the mode?

Central Tendency Practice

Given this dataset:

```
1 c(0, 1, 2, 4)
```

```
[1] 0 1 2 4
```

What is the mean?

What is the median?

What is the mode?

R Functions

A *function* performs some operation on an *input* and produces some *output*

Saw this last week

```
1 head(iris)
```

```
  Sepal.Length Sepal.Width Petal.Length Petal.Width Species
1          5.1         3.5          1.4         0.2  setosa
2          4.9         3.0          1.4         0.2  setosa
3          4.7         3.2          1.3         0.2  setosa
4          4.6         3.1          1.5         0.2  setosa
5          5.0         3.6          1.4         0.2  setosa
6          5.4         3.9          1.7         0.4  setosa
```

What is the function? Input? Output?

Central Tendency in R: Mean

We can calculate central tendencies in two ways:

Given this dataset, calculate the mean

```
1 c(2, 3, 12, 4, 4)
```

```
[1]  2  3 12  4  4
```

By hand (computer)

R Code | Start Over | Run Code

```
1 # let's calculate the mean!
```

With the `mean()` function

R Code | Start Over | Run Code

```
1 # let's calculate the mean!
```

Central Tendency in R: Median

Given this dataset, calculate the median

```
1 c(2, 3, 12, 4, 4)
```

```
[1]  2  3 12  4  4
```

By hand (computer)

R Code | Start Over | Run Code

```
1 # let's calculate the median!
```

With the `median()` function

R Code | Start Over | Run Code

```
1 # let's calculate the median!
```

Central Tendency in R: Mode

Given this dataset, calculate the mode

```
1 c(2, 3, 12, 4, 4)
```

```
[1]  2  3 12  4  4
```

With the `mode()` function

R Code | Start Over | Run Code

```
1 # let's calculate the mode!
```

Doesn’t work :(

Have to create our own

R Functions

We've seen some built-in R functions (e.g., `mean()`, `median()`), but we can also make our own

```
function_name <- function(argument) {
  do some stuff
  return(this stuff)
}
```

ⓘ Don't actually need to call `return()`; R will automatically return the last expression

Then, you can call the function

```
function_name(specific_argument)
```

To keep the results, make sure to assign them to some variable

```
very_important_results <- function_name(specific_argument)
```

R Functions

R Code | Start Over | Run Code

```
1  # write a function that takes in two numbers,
2  # adds them together, and returns the sum!
```

R Code | Start Over | Run Code

```
1  # write a function that takes in two vectors,
2  # puts them in a dataframe,
3  # and returns the dataframe!
```

Let’s go back to finding the mode

Central Tendency in R: Mode

Given this dataset, calculate the mode

```r
# note from jess: considering switching to just showing table()

c(2, 3, 12, 4, 4)
```

```
[1]  2  3 12  4  4
```

```r
my_mode <- function(x) {
  values <- unique(x)
  counts <- tabulate(match(x, values))
  max_index <- which.max(counts)
  values[max_index]
}
```

How does this work?

R Code | Start Over | Run Code

```r
# let's calculate the mode!
```

Descriptive Statistics in R

Takes time to look at all these for a lot of variables, even with functions

The `summary()` function provides us a quick overview of this information

R Code | Start Over | Run Code

```
1  # let's get descriptive statistics for the iris dataset
```

What all do we get?

- Minimum and maximum
- 1st quantile, median, 3rd quantile
- Mean

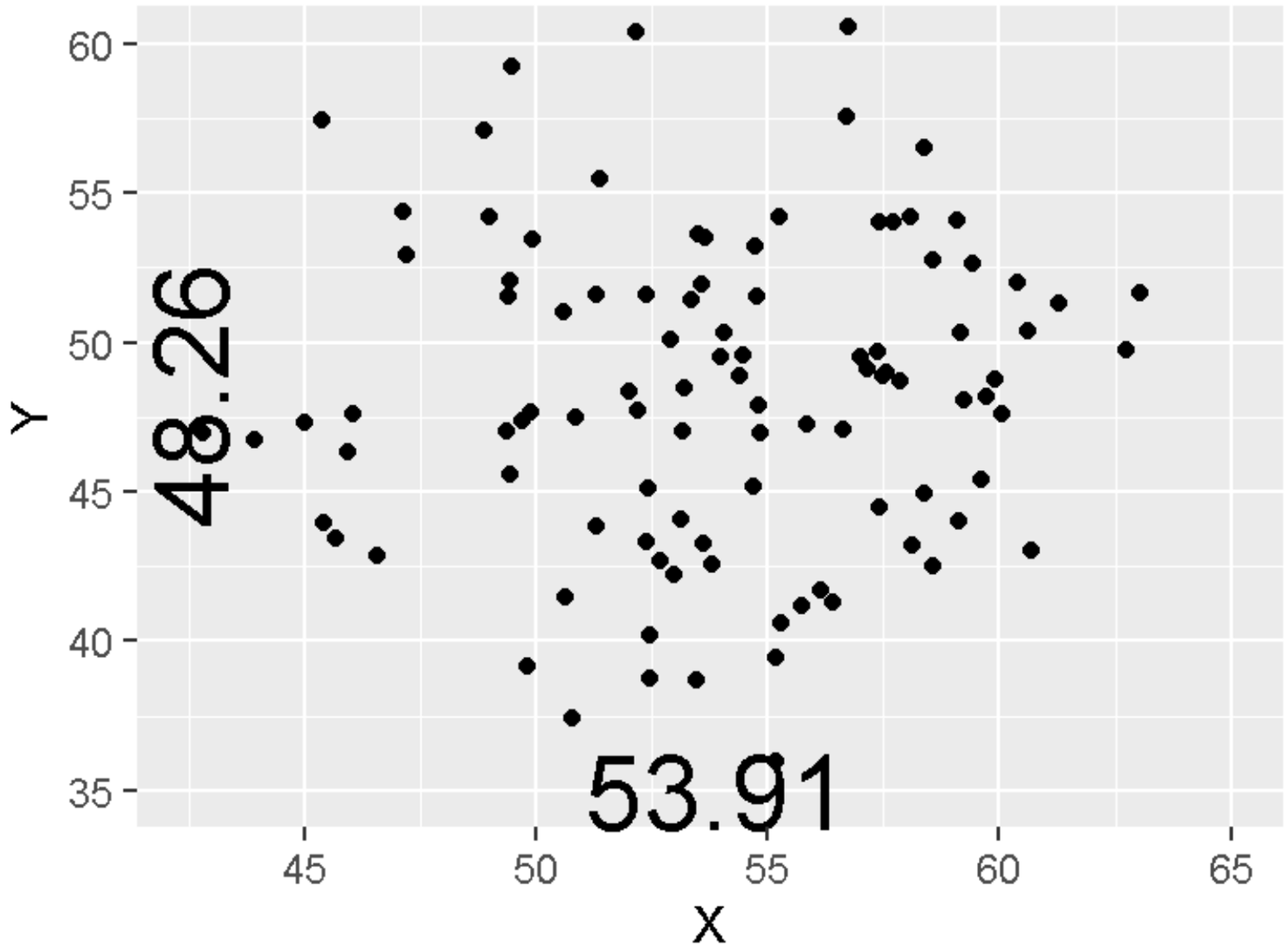
Visualizations!

Summary statistics are great, but don't trust them alone!

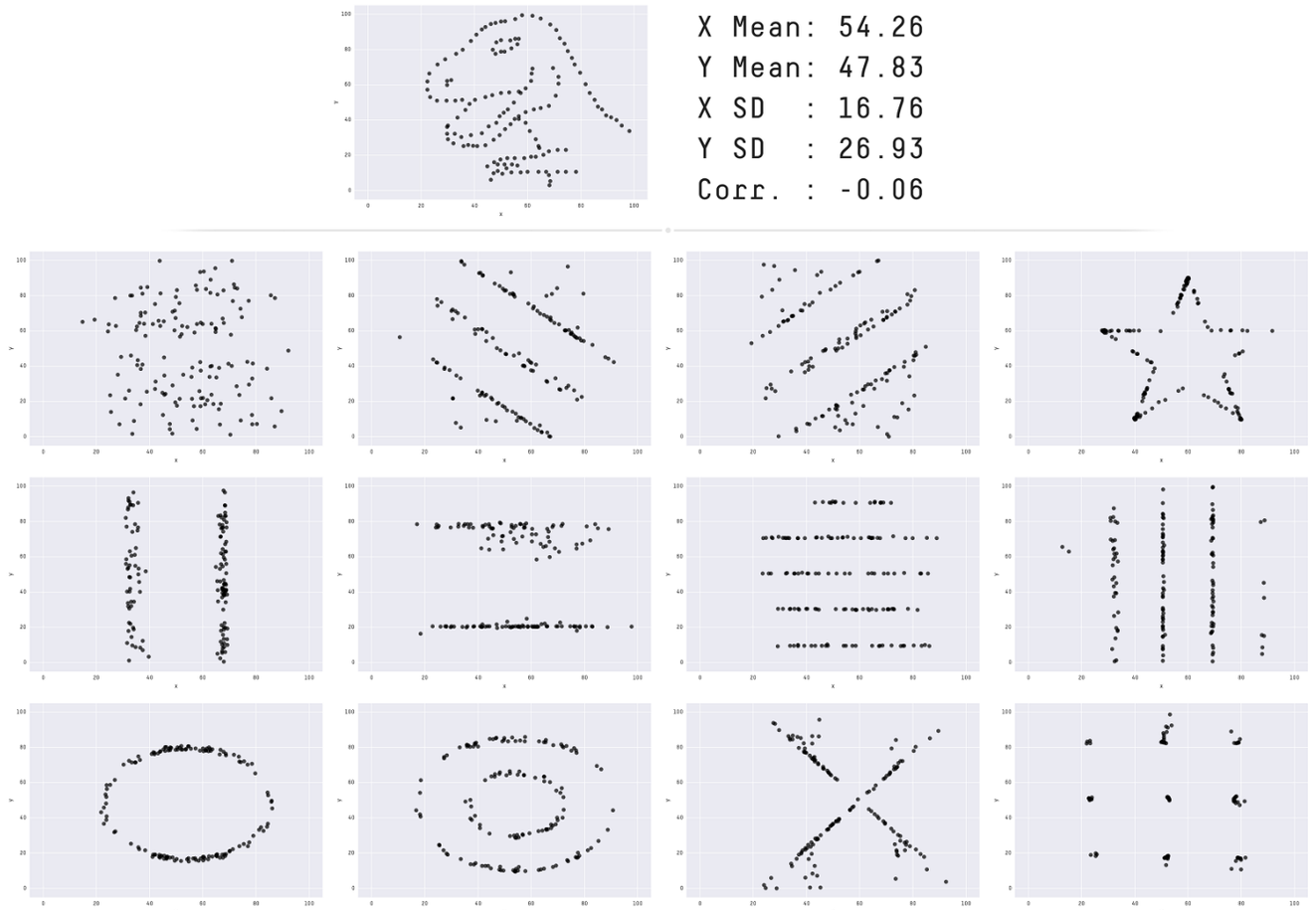
What do you think a dataset with these descriptives would look like?

```
X_mean <- 54.26
Y_mean <- 47.83

X_sd <- 16.76
Y_sd <- 26.93

cor <- -0.06
```

Visualizations!



Visualizations!



Datasaurus Dozen

Visualizations

Don’t rush: graph your data!

What should graphs do?

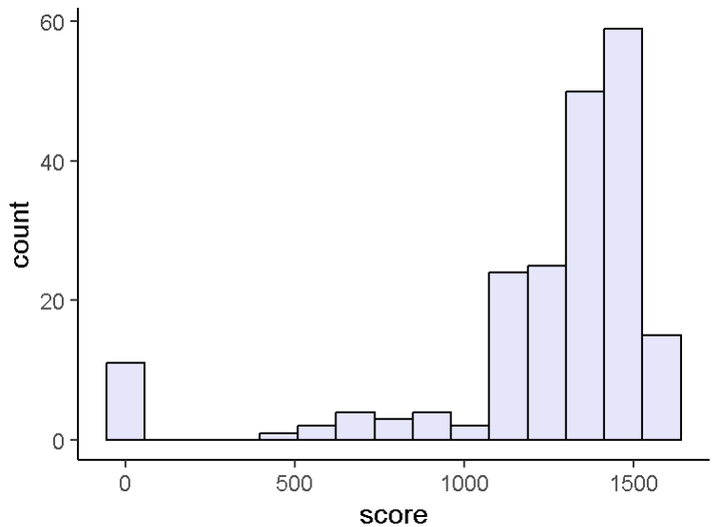
- Show the data
- Draw the reader primarily to the data (not the graphical effects)
- Avoid distorting the data
- Present many numbers with minimum ink
- Make large data sets coherent
- Encourage the reader to compare different pieces of data

Visualizations: Histograms

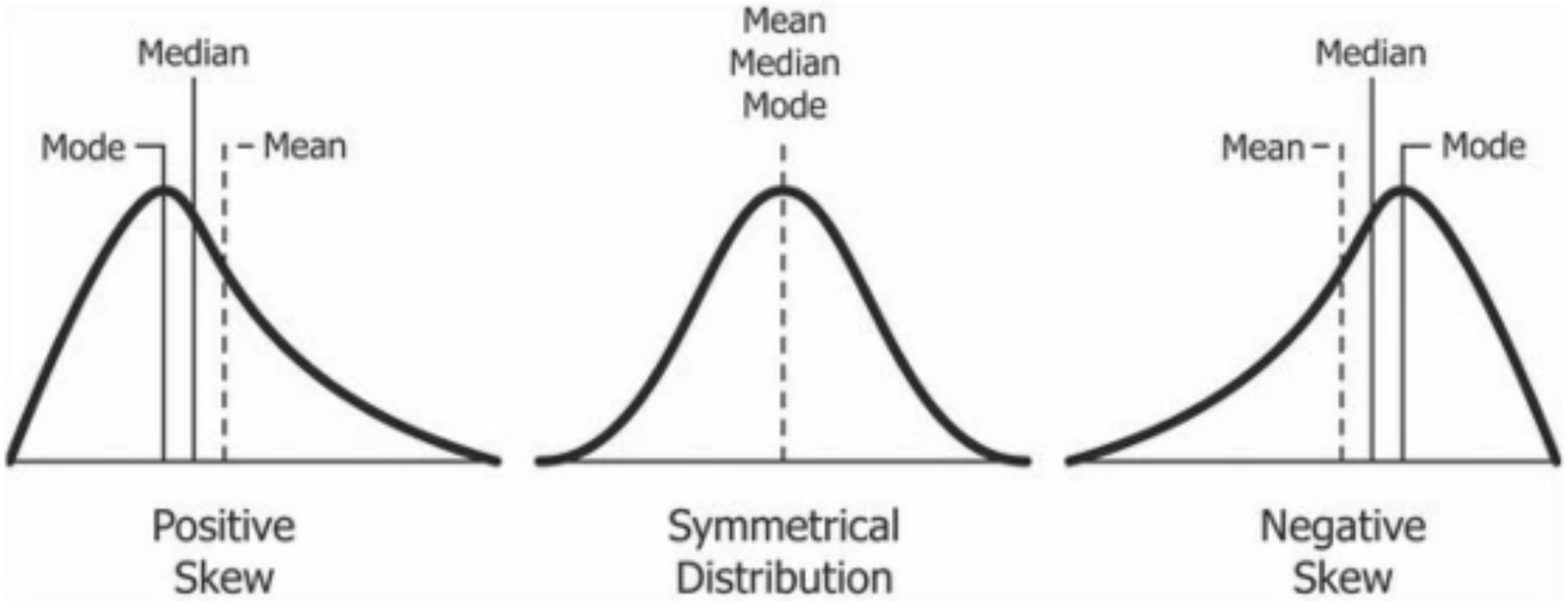
An example of (simulated) SAT scores

What do we see here?

- Outliers at zero! Not a possible SAT score
- Negatively skewed: more data on the left than on the right



Skew



Positive skew, right-tailed

The mass of the distribution is concentrated on the left of the figure

Negative skew, left-tailed

The mass of the distribution is concentrated on the right of the figure

Skewness Demonstration

Full screen version here

Skewness demonstration!

Credits to Fabio Setti

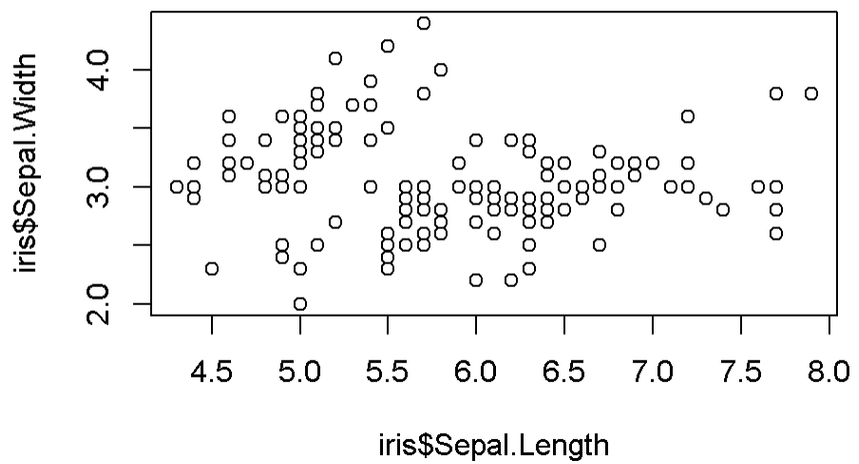
Let’s Do Some Visualization

Base R Graphics

R has some plotting features built in—we saw this last week

```
1  plot(iris$Sepal.Length, iris$Sepal.Width)
```

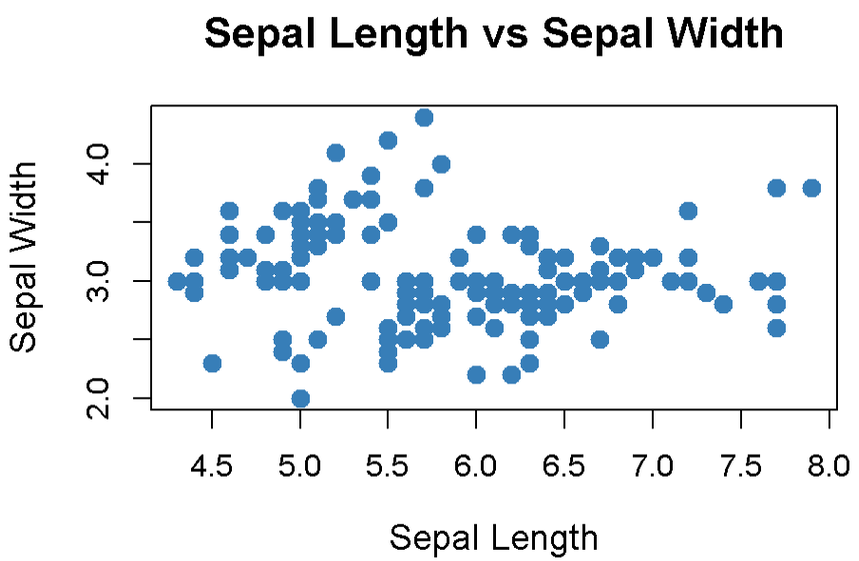
What do we think about this?



Base R Graphics

Better… (thanks, ChatGPT)

Plot | Code



We will learn a few plots in base R plotting, and then we will learn a *better* way of making plots:

`ggplot2`

R Graph Gallery

Let’s Do Some Visualization

Base R Graphics: Histogram

`hist()` function

Required arguments:

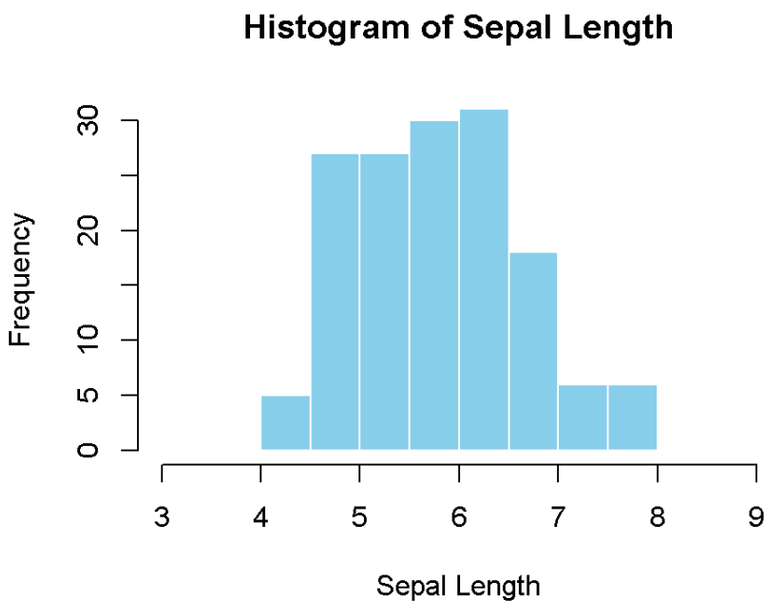
- `x` = vector (variable) you want to plot (remember the $ function!)

Optional arguments:

- `breaks`: number of bins
- `main`: title
- `xlab`: label for x-axis
- `ylab`: label for y-axis
- `col`: color for bars
- `xlim`: range for x-axis
- `ylim`: range for y-axis
- `prob`: `T`/`F`, y-axis proportion instead of frequency

If you do not set specific values for non-essential subarguments, it will use the default

Plot | Code

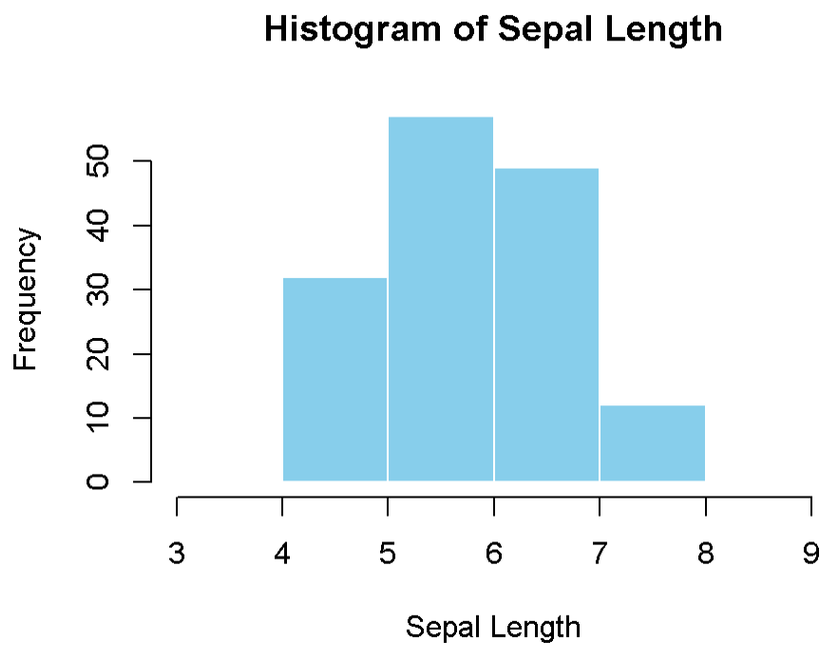


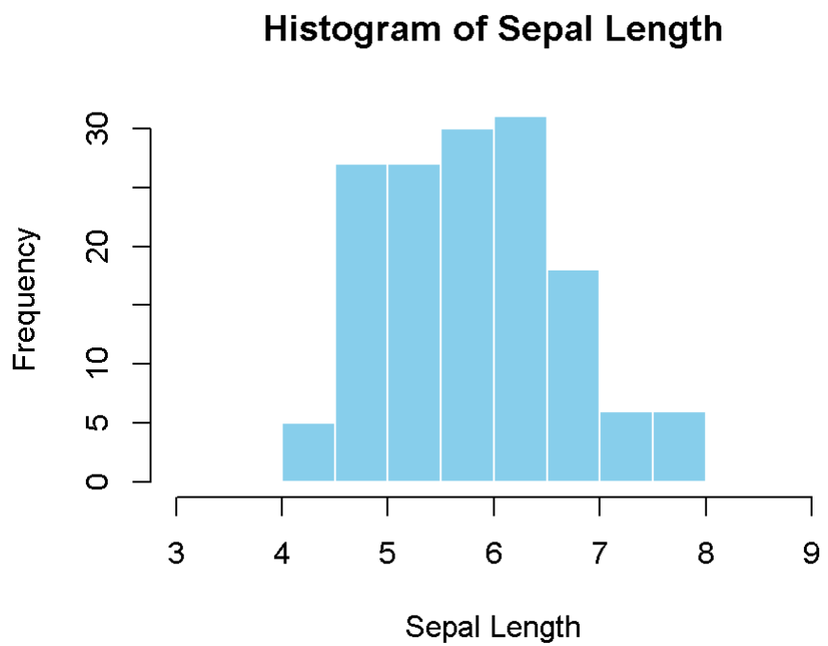
Let’s Do Some Visualization

Base R Graphics: Histogram

An important decision for histograms is this number (or width) of bins

Specified with the `breaks` argument



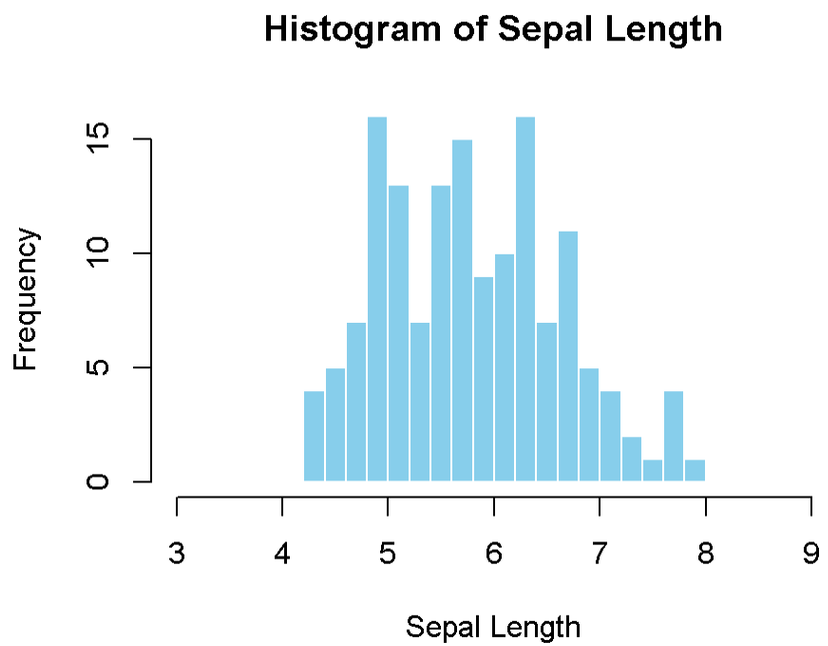


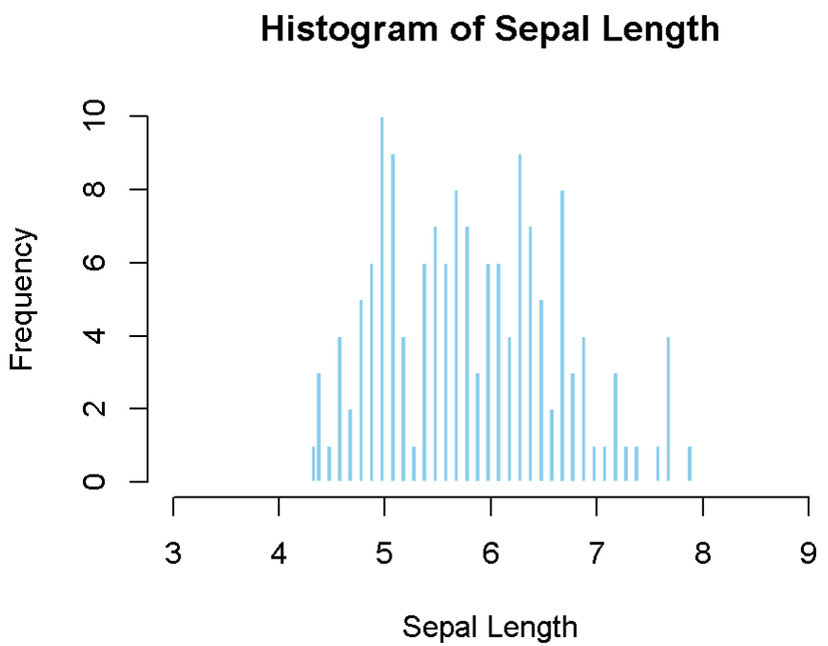
Let’s Do Some Visualization

Base R Graphics: Histogram

An important decision for histograms is this number (or width) of bins

Specified with the `breaks` argument



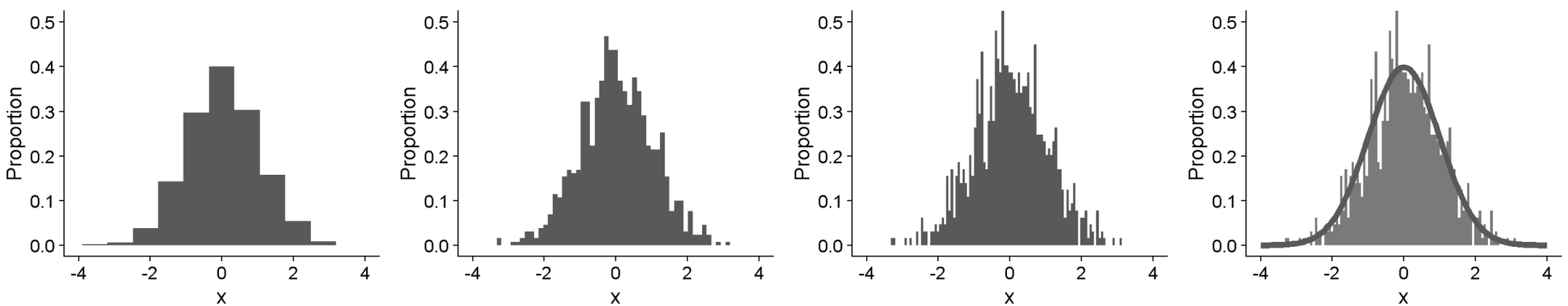


Let’s Do Some Visualization

Base R Graphics: Histogram

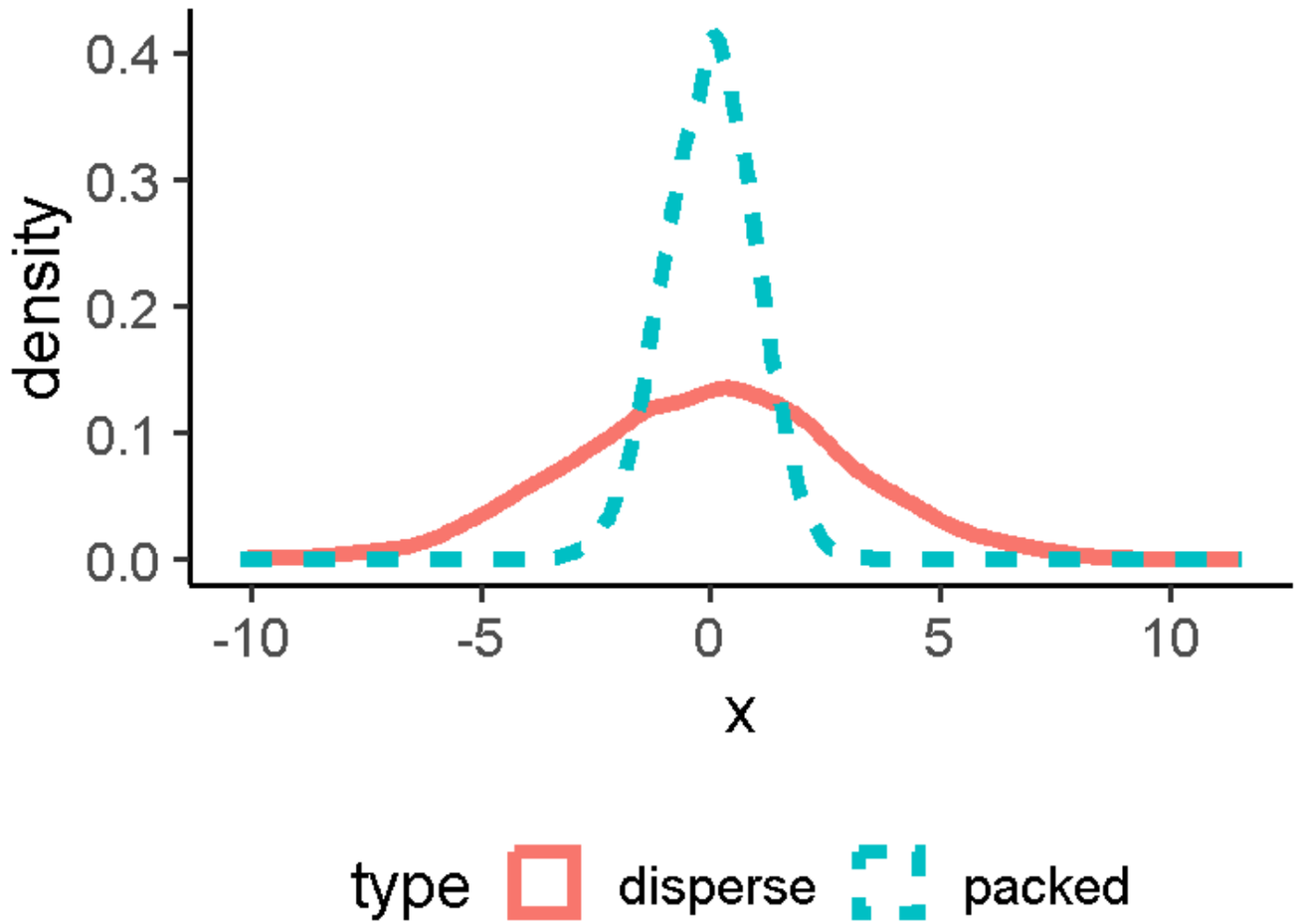
If we could make the bins infinitesimally small, we could get a probability density function (PDF)

Plot Code



Visualizations: Histogram

Can describe a distribution by its “dispersion”



Assignment 2

- Basic R functions
- Descriptive statistics