Probability Distributions

PSYC 2020-A01 / PSYC 6022-A01 | 2025-09-12 | Lab 4

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Outline

- Assignment 2 Review
- Probability Distributions Review
- *Z*-Scores in R
- Generating Data
- R Packages
- Reading Files

Learning objectives:
R: Packages, reading files, generating data

Statistics: Probability distributions

Extra Credit Reminder!

posit::conf(2025) is only a few days away!

Assignment 2 Review

Placeholder for Assignment 2 mistakes

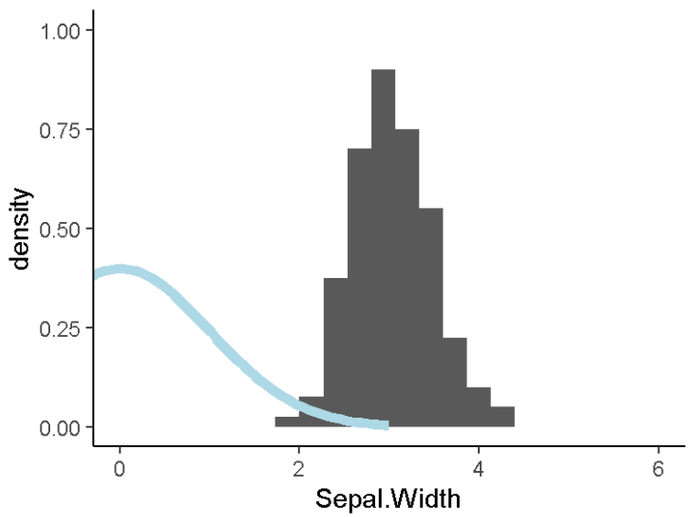
Probability Distributions Review

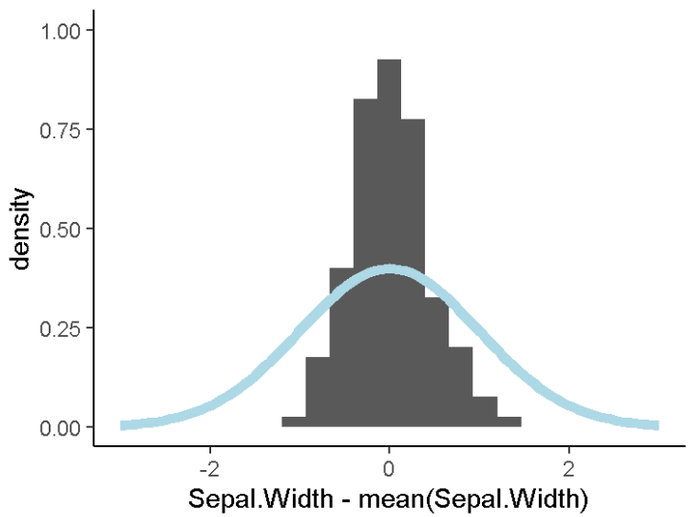
Placeholder for lecture content review

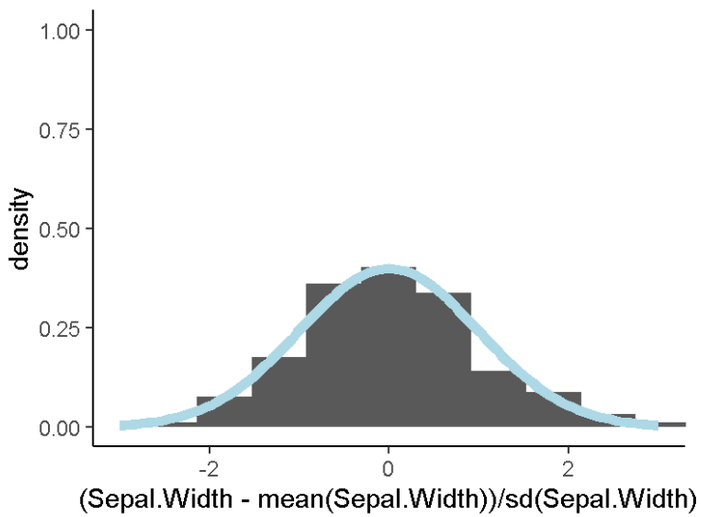
Z-Scores

To "*Z*-score" or "standardize" your data

- Transform a variable such that the mean is zero and the standard deviation is one
- Matches the mean and SD of a "standard" normal distribution, $N(0, 1)$







Z-Scores

Why standardize?

Puts variables on the same (interpretable) scale

Helps manage very large or very small numbers

Z-Scores in R

Need to:

1. Take out the mean
2. Scale by the standard deviation

```
data$variable_z <- (data$variable - mean(data$variable)) /
sd(data$variable)
```

R Code | Start Over | Run Code

```
1  # let's z-score Petal.Length
```

Can check to make sure things look right

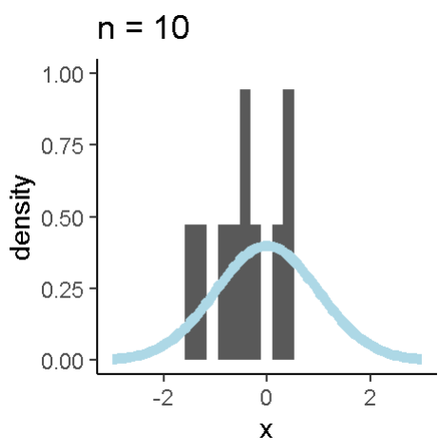
Generating Normal Data

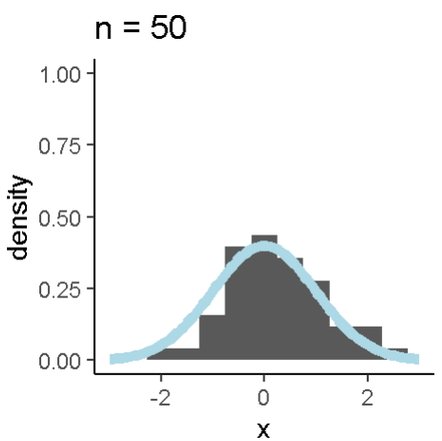
Sometimes, we want to simulate data

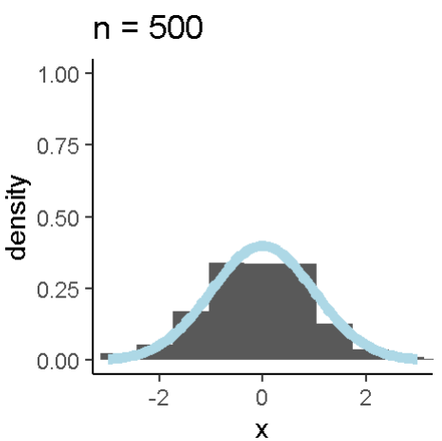
- Demonstration
- Comparison
- Sanity check

To generate data drawn from a normal distribution, we can use `rnorm(n, mean, sd)`

- `n` = number of draws
- `mean` = desired mean of distribution
- `sd` = desired SD of distribution







Generating Normal Data

R Code | Start Over | Run Code

```
1  # let's generate some data and then plot it
```

Probabilities of Normal Values

Within a normal distribution, we can check the probability of a given value and the value at a given probability

Probability of a Value

`pnorm(q)`
- `q` = value (or vector of values)

```
1 pnorm(0)
```

```
[1] 0.5
```

```
1 pnorm(1)
```

```
[1] 0.8413447
```

```
1 pnorm(c(-3, 3))
```

```
[1] 0.001349898 0.998650102
```

Value at a Probability

`qnorm(p)`
- `p` = probability (or vector of probabilities)

```
1 qnorm(.5)
```

```
[1] 0
```

```
1 qnorm(.9)
```

```
[1] 1.281552
```

```
1 qnorm(c(.025, .975))
```

```
[1] -1.959964  1.959964
```

Packages in R

Base R has a lot of great stuff, but *packages* made by the community have even more great stuff

Packages in R

Steps of using an R package:

1. Installing

`install.packages(package)`

- `package` = (character) package name

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

Only have to do this once

Packages in R

Steps of using an R package:

2. Loading

`library(package)`
- `package` = (not character) package name

At the top of your file

```
1  library(rio)
```

Better if you use many functions from that package in your script

`package::package_function()`

```
1  rio::import()
```

Better if you use only a few functions from that package

Or if you want to be more specific
- Sometimes a function from one package will overwrite a function from a different package, and this calls the specific one

Packages in R

Steps of using an R package:

3. Using

If you use `library()`, you can then call the function with just its name

```
1  import()
```

Reading Files

So far, we've only used preloaded data in R

We need to learn how to import data into R!

1. Downloading

First, we need to download the file and move it to our working directory (or a folder within our working directory)

Reading Files

2. Reading

Base R

`read()` function family

Depends on your file type

`read.csv(file)` probably most common
- `file` = name of or path to file

File in working directory

```
read.csv("tour_de_france.csv")
```

File in subfolder

```
read.csv(here::here("Lab 4",
                    "tour_de_france.csv"))
```

`rio` Package

```
rio::import(here::here("Lab 4",
                       "tour_de_france.csv"))
```

Make sure to assign the data to a variable to keep it!

```
1  head(tdf_data)
```

	V1	year	winner_avg_speed	total_distance	winner	winner_nationality	starting_city
1	1	1903	25.68	2,428.00	Maurice Garin	France	Paris
2	2	1904	25.27	2,420.00	Henri Cornet	France	Paris
3	3	1905	27.11	2,994.00	Louis Trousselier	France	Paris
4	4	1906	24.46	4,545.00	Rene Pottier	France	Paris
5	5	1907	28.47	4,488.00	Lucien Petit-Breton	France	Paris
6	6	1908	28.74	4,488.00	Lucien Petit-Breton	France	Paris

Lab 4 Assignment!

Don’t forget to sign up for posit::conf(2025) if you want to complete the extra credit assignment.