R Data Analysis Course – Week 6

Regressions and Correlation

Statistical Analysis

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Common waxbill, Fossey Fund Campus, 2025

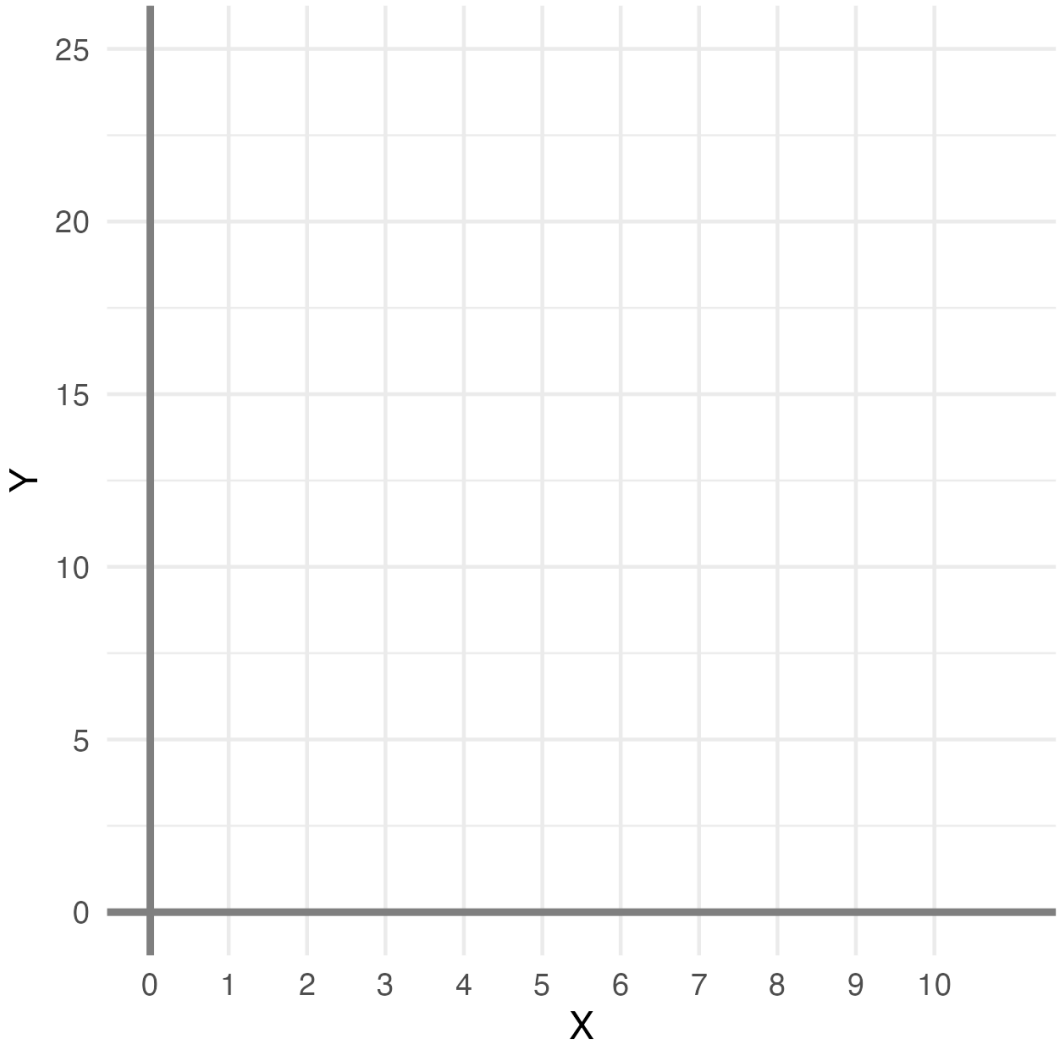
Resources to reinforce your understanding

The Google Drive folder includes:

- Every week: a **complete .Rmd file** with detailed in-line explanations and example code from the lecture
- General: an updated **"Functions Learned So Far"** reference sheet

Every week: I offer help sessions: extra support with your code, project setup, or any course concepts

What is a linear regression?

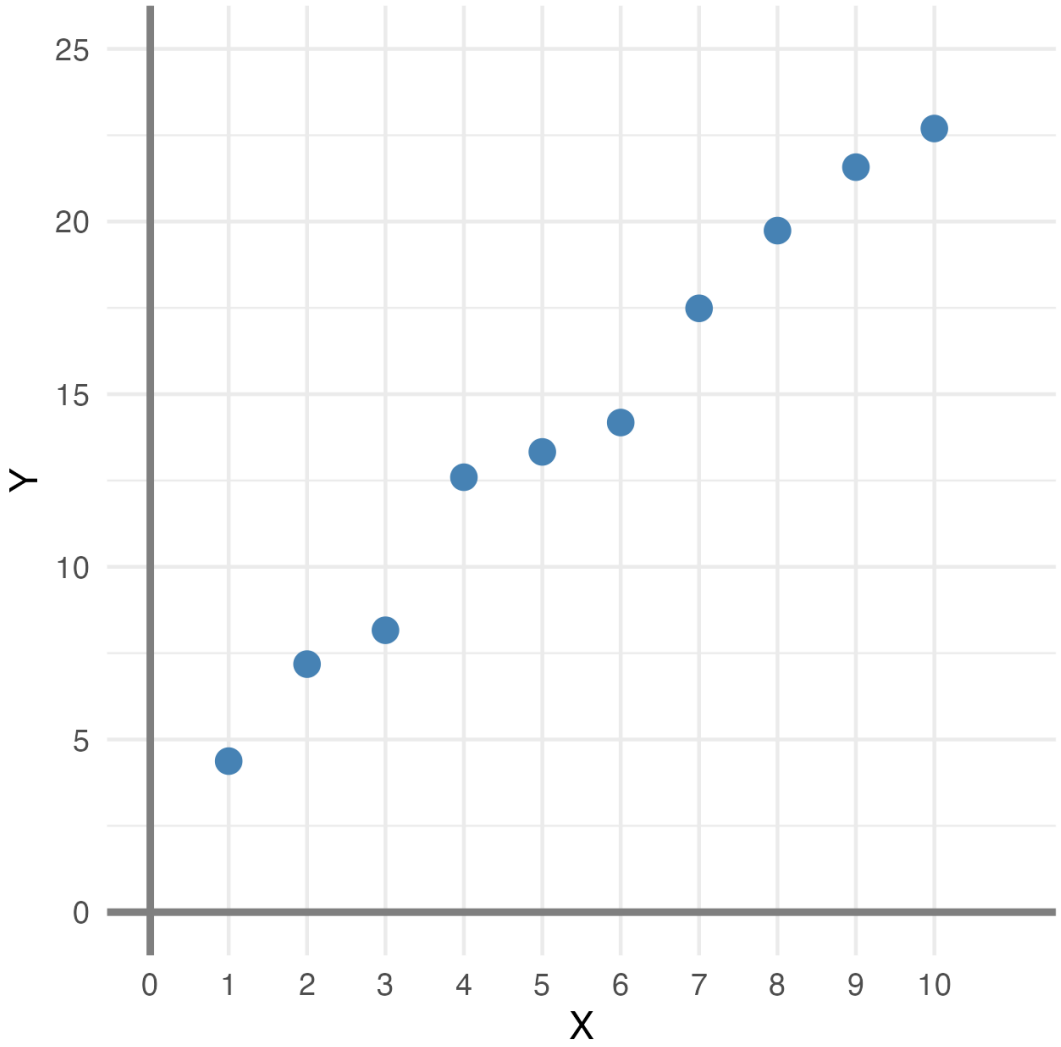


Data

X	Y
9	21.575781
1	4.373546
6	14.179532
7	17.487429
5	13.329508
2	7.183643
3	8.164371
8	19.738325
10	22.694612
4	12.595281

What is a linear regression?

Points only = *scatterplot*



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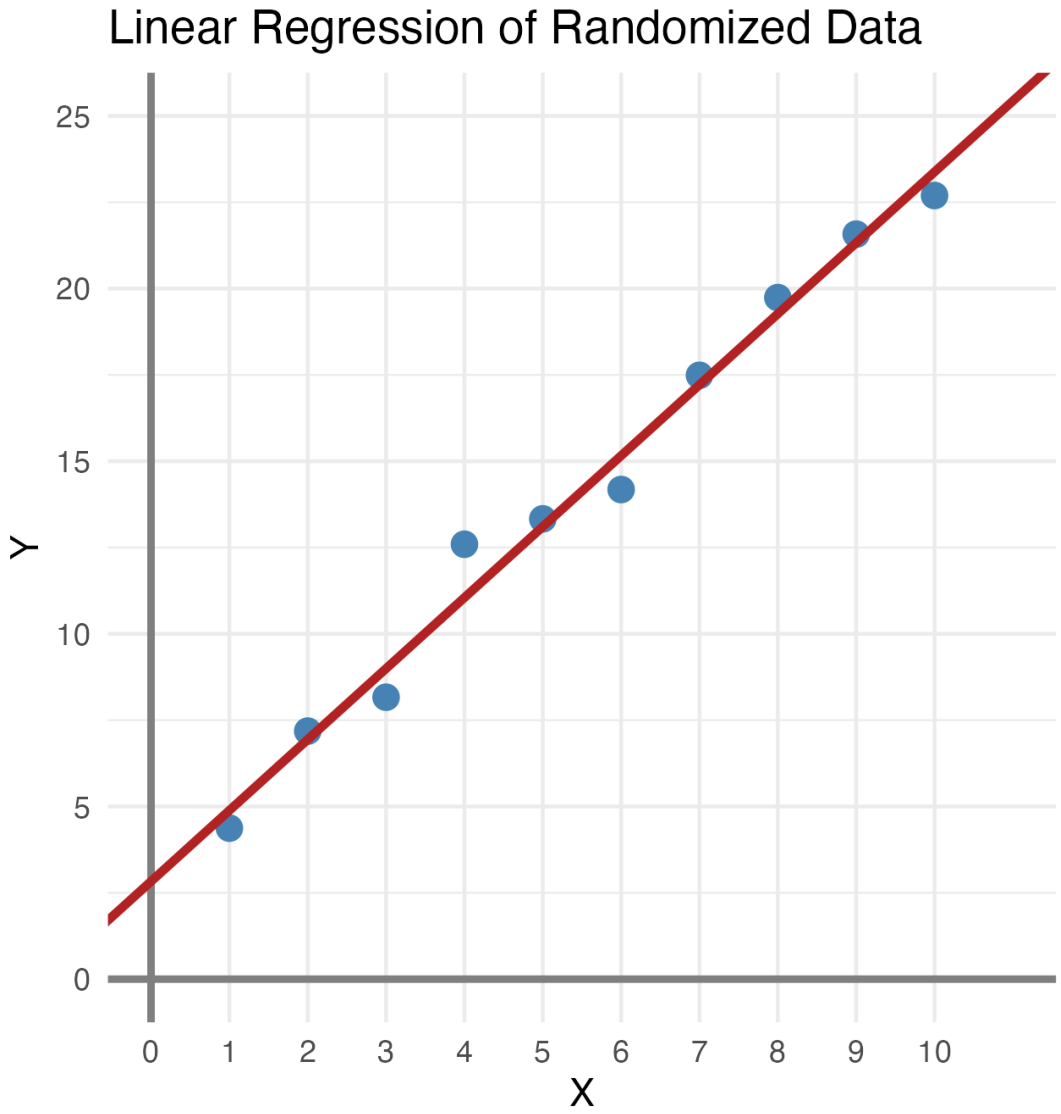

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Linear Regressions

- A method for **quantifying relationships** between two continuous variables

$$Y = a + bX$$

- a = intercept (predicted Y when X = 0)
- b = slope (change in Y for each 1-unit change in X)

Regression line: a straight line that best represents the data, positioned so that the points are, on average, as close to the line as possible.

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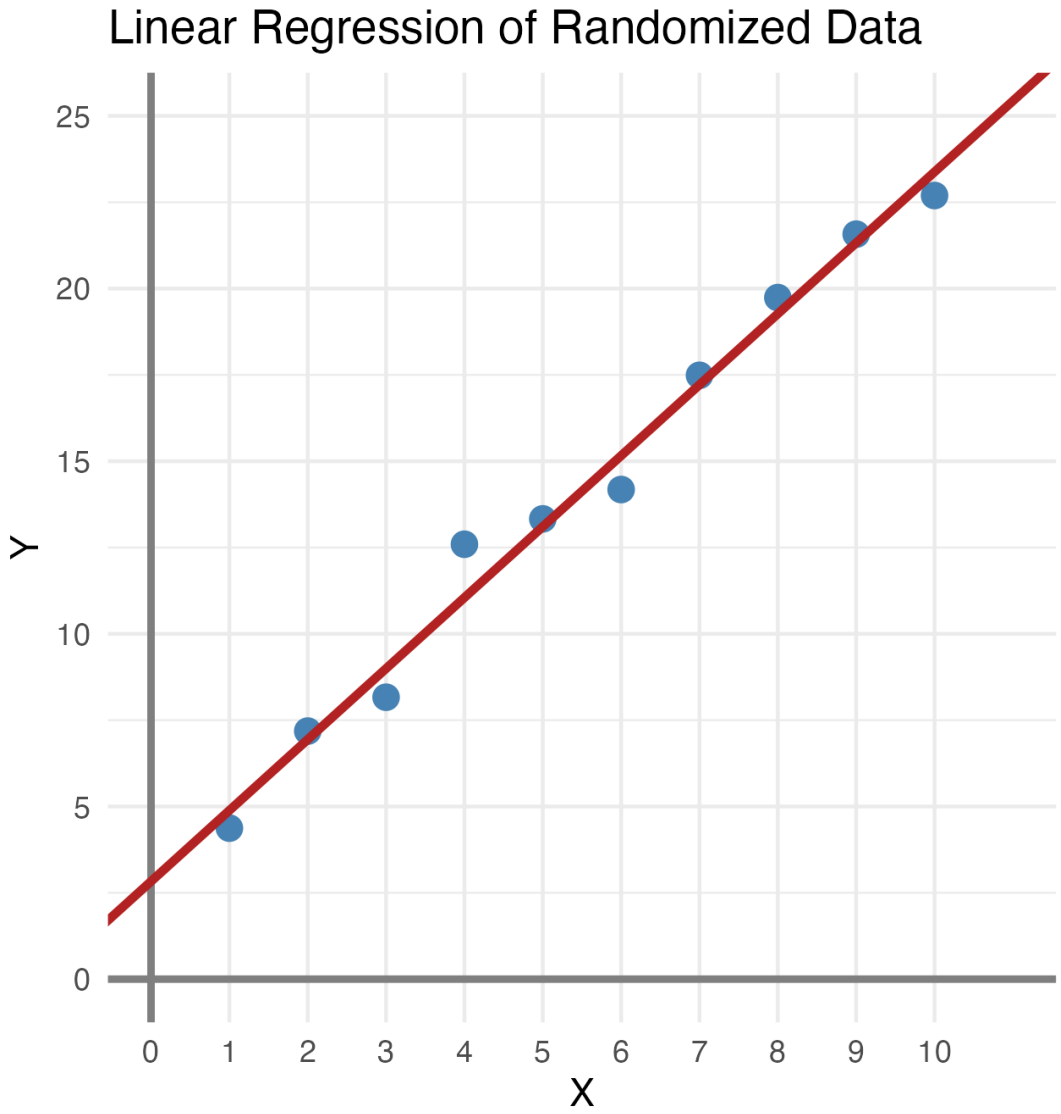

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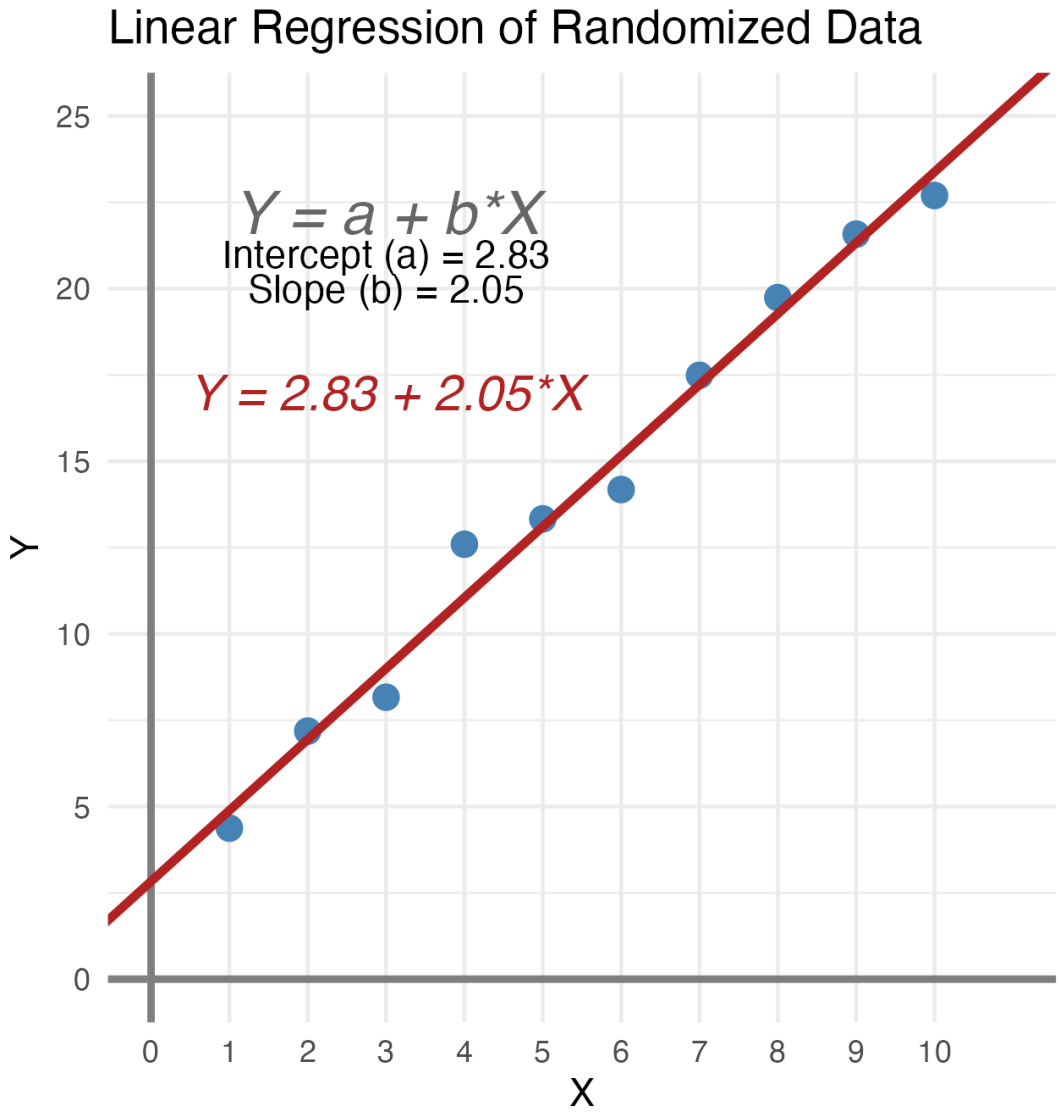

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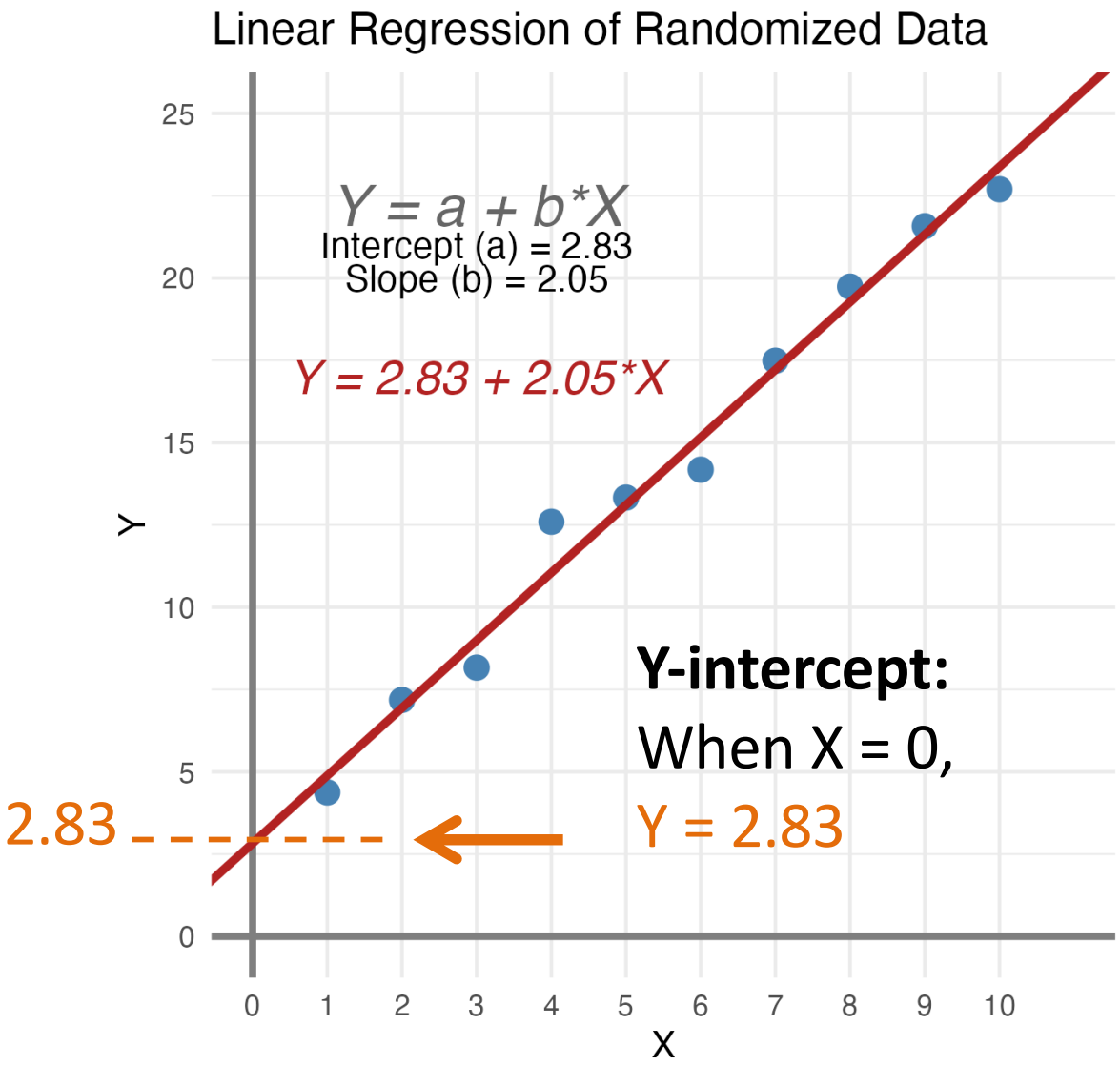

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Regression Statistics

`lm(data, y ~ x)`

"given X, what is Y?"

Model outputs:

- **Coefficients** → slope and intercept
- **Standard errors** → uncertainty around estimates
- **p-values** → are relationships statistically significant?
- **R^2** → how much of Y's variation is explained by X
  - i.e., a "goodness of fit" statistic

```
model <- lm(y ~ x, data = my_dataset)
summary(model)
```

"given x, what is y?"

```
Call:
lm(formula = y ~ x, data = my_data)

Residuals:
    Min      1Q  Median      3Q     Max
-0.9800 -0.6410  0.2338  0.2678  1.5452

Coefficients:
            Estimate Std. Error t value     Pr(>|t|)
(Intercept)  2.83118    0.55270   5.122     0.000904 ***
x            2.05473    0.08908  23.067 0.0000000132 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8091 on 8 degrees of freedom
Multiple R-squared:  0.9852,    Adjusted R-squared:  0.9833
F-statistic: 532.1 on 1 and 8 DF,  p-value: 0.00000001324
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model <- lm(y ~ x, data = my_dataset)
summary(model)
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"given x, what is y?"

Our model, evaluated as ***Y = a + bX***

```
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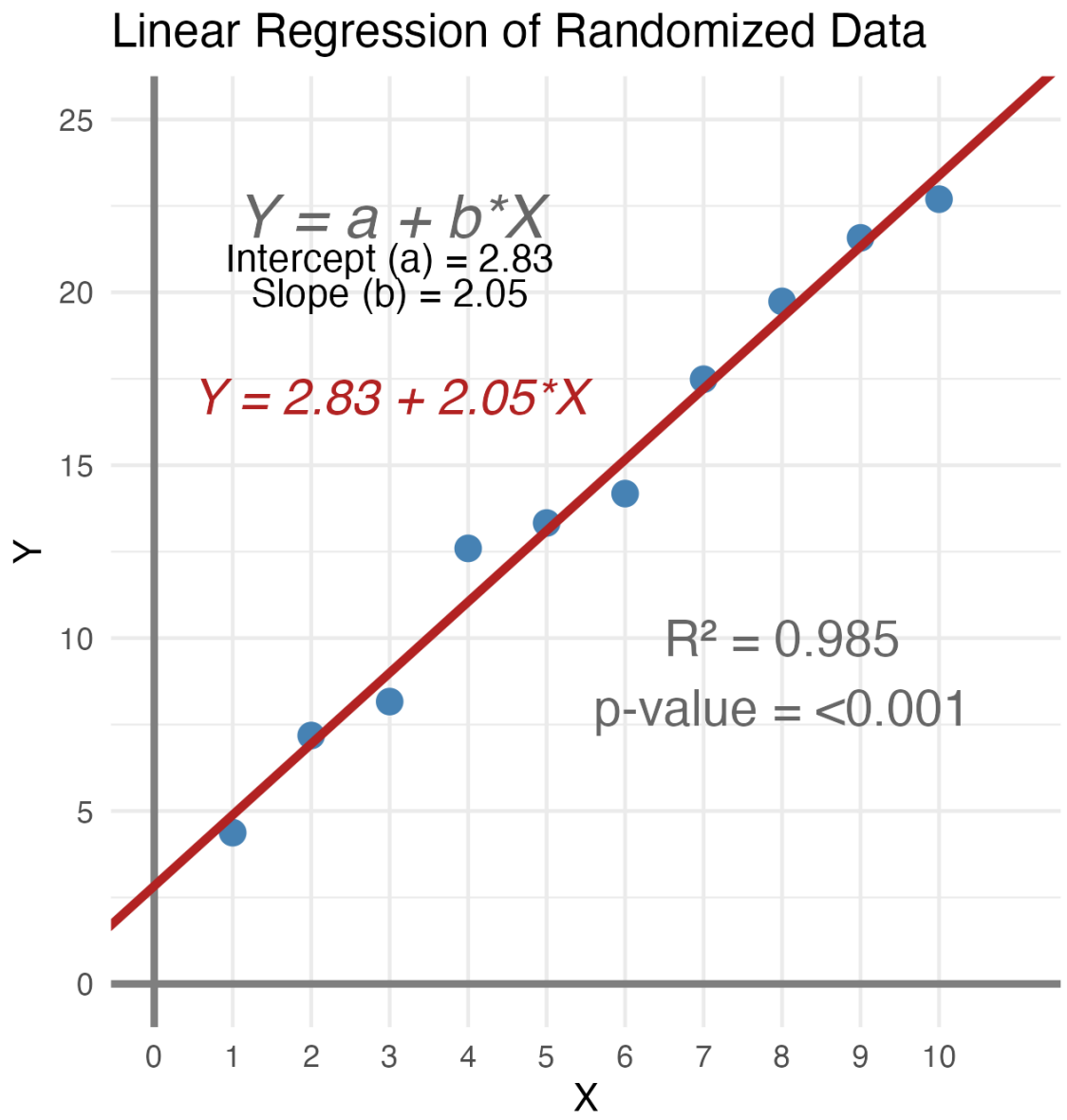
Regression coefficients (Intercept) = ***a***, x = ***b***

p-value

Adj. R^2 - the proportion of variance in ***Y*** explained by the predictor (***X***)

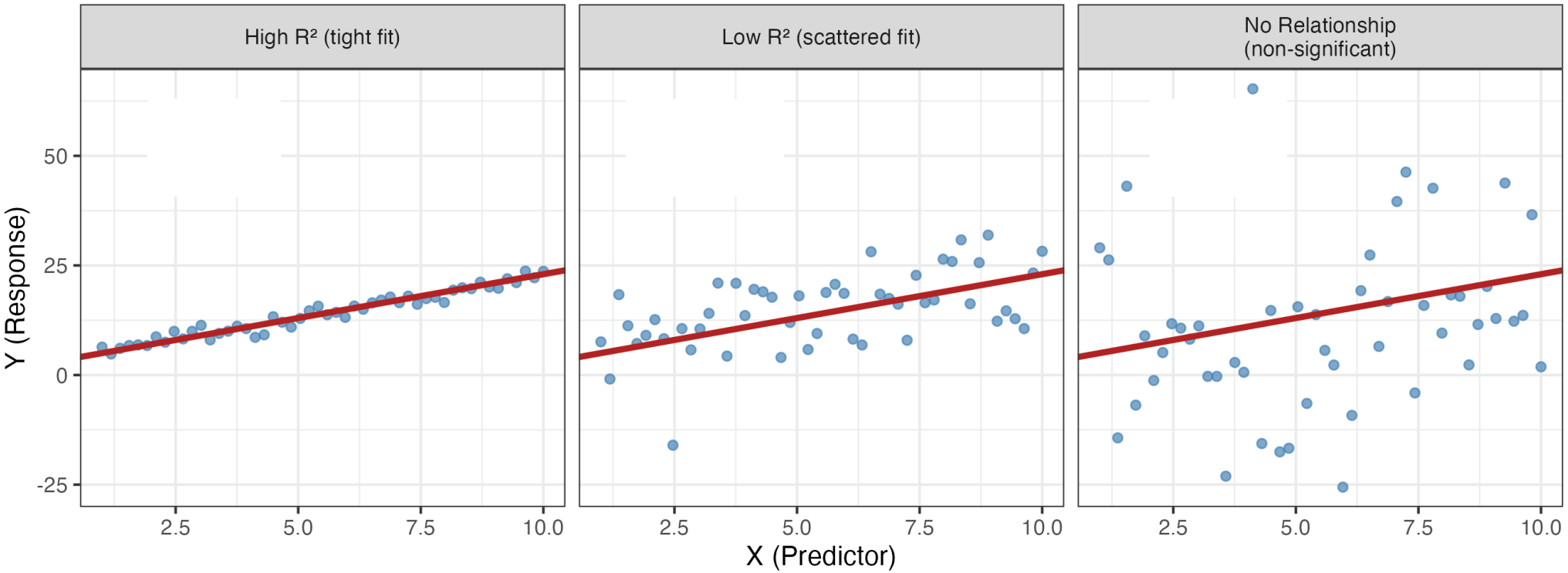
Regression Statistics



When $R^2 = 1$, every point falls exactly on the modeled line

A ***p-value*** < 0.05 means that ***X*** has a statistically significant relationship with ***Y***, and the result is unlikely to be caused by random chance alone

How well do the data fit?



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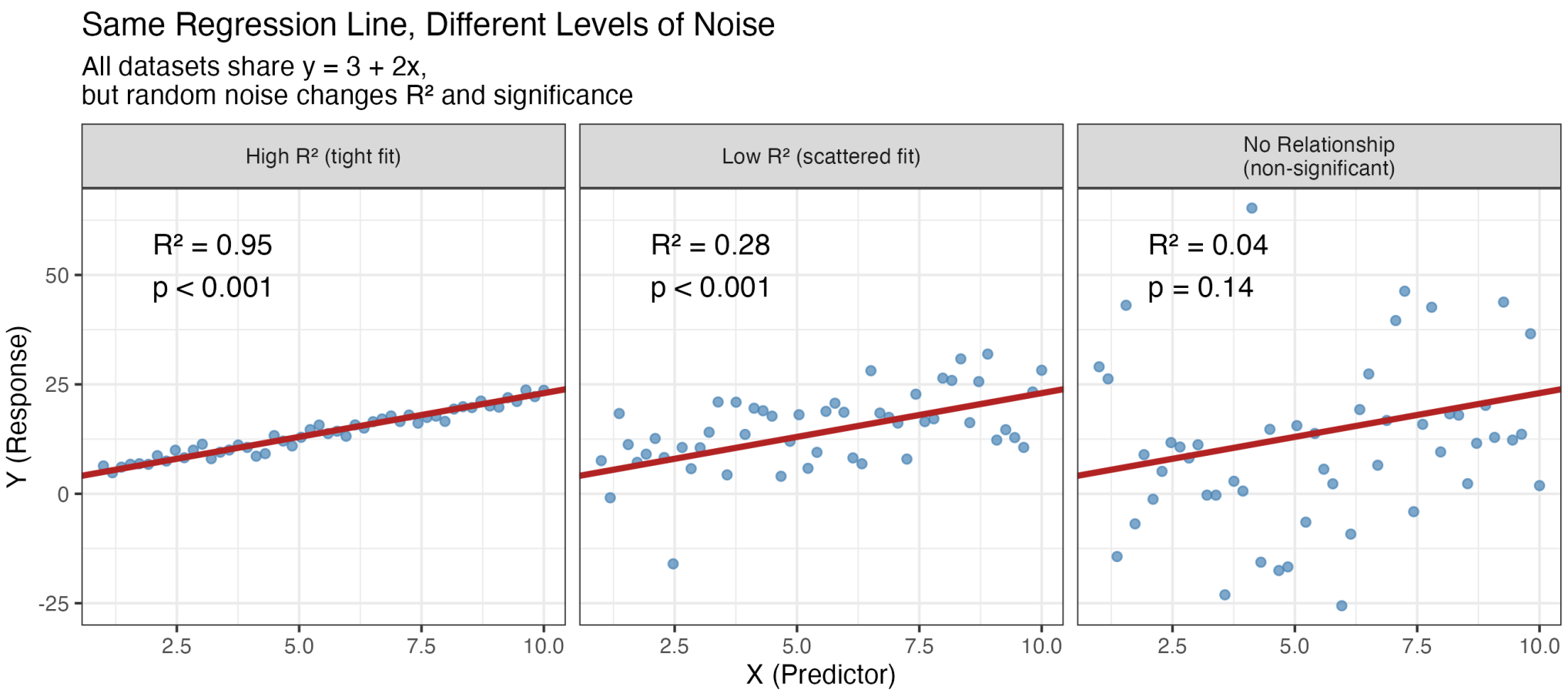

Highly significant, Very good fit

Highly significant, Slightly weaker fit

Not significant, Poor fit

Skills Learning

code-along lecture

Skills Application

Laboratory exercise

Week 6 - Skills Application

Download **Skills Application Instructions** from *Google Drive folder* > *Week 6*

If you are working on **your own** dataset:

- Keep working on your ***Lastname_Firstname_Data.Rmd***

If you are working on **sample** dataset:

- create a Markdown file just for this week.
- Name it: ***Lastname_Firstname_Week6.Rmd*** **in `/Week 6`**

In your new Markdown file: Use code blocks (Ctrl+Alt+i) to load packages, import dataset into the environment, and save data as an object (e.g., `*data <-* `). Then follow ***instructions***.