Regression Lines differ by sample (Chapter 20)

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Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fifth Edition of *Intro Stats* (2018) by De Veaux, Velleman, and Bock. This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at http://nhorton.people.amherst.edu/is5.

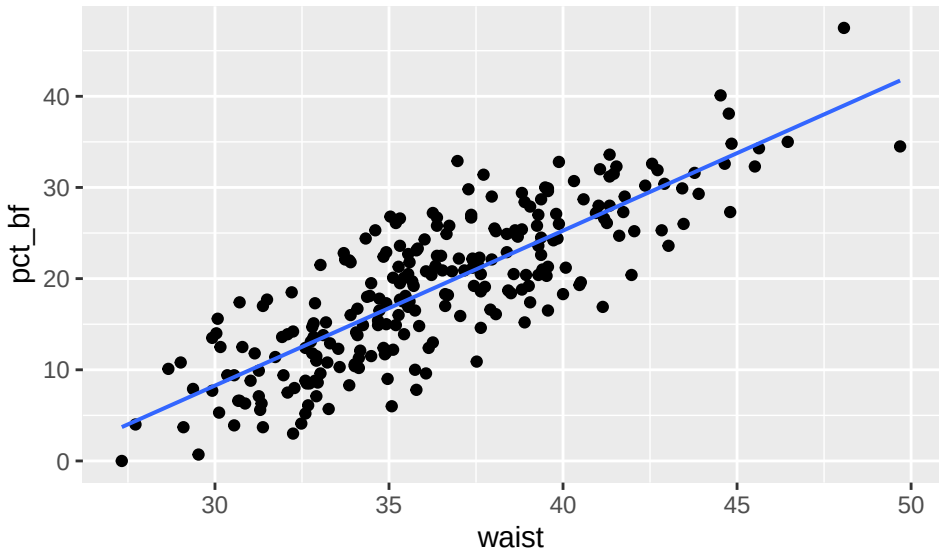
This work leverages initiatives undertaken by Project MOSAIC (http://www.mosaic-web.org), an NSF-funded effort to improve the teaching of statistics, calculus, science and computing in the undergraduate curriculum. In particular, we utilize the `mosaic` package, which was written to simplify the use of R for introductory statistics courses. A short summary of the R needed to teach introductory statistics can be found in the mosaic package vignettes (https://cran.r-project.org/web/packages/mosaic). A paper describing the mosaic approach was published in the *R Journal*: https://journal.r-project.org/archive/2017/RJ-2017-024.

Chapter 20: Inferences for Regression

```
library(mosaic)
library(readr)
library(janitor)
BodyFat <- read_csv("http://nhorton.people.amherst.edu/is5/data/Bodyfat.csv") %>%
  janitor::clean_names()
```

By default, `read_csv()` prints the variable names. These messages have been suppressed using the `message=FALSE` code chunk option to save space and improve readability. Here we use the `clean_names()` function from the `janitor` package to sanitize the names of the columns (which would otherwise contain special characters or whitespace).

```
gf_point(pct_bf ~ waist, data=BodyFat) %>%
  gf_lm()
```



Random Matters: Slopes Vary

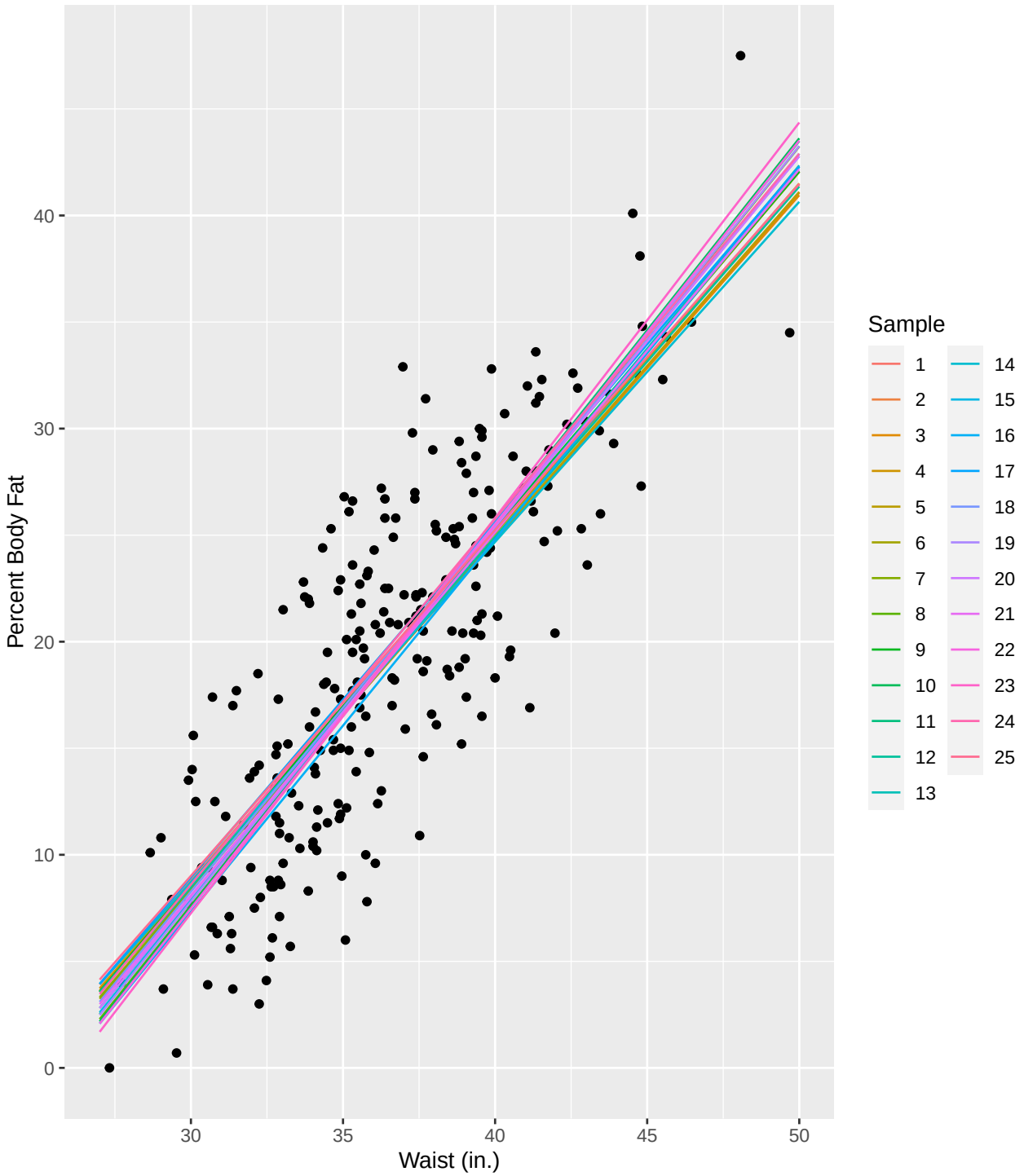
```
origsample <- lm(pct_bf ~ waist, data = BodyFat)

msummary(origsample)
```

```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -42.73413    2.71651  -15.73   <2e-16 ***
## waist         1.69997    0.07431   22.88   <2e-16 ***
##
## Residual standard error: 4.713 on 248 degrees of freedom
## Multiple R-squared:  0.6785, Adjusted R-squared:  0.6772
## F-statistic: 523.3 on 1 and 248 DF,  p-value: < 2.2e-16
```

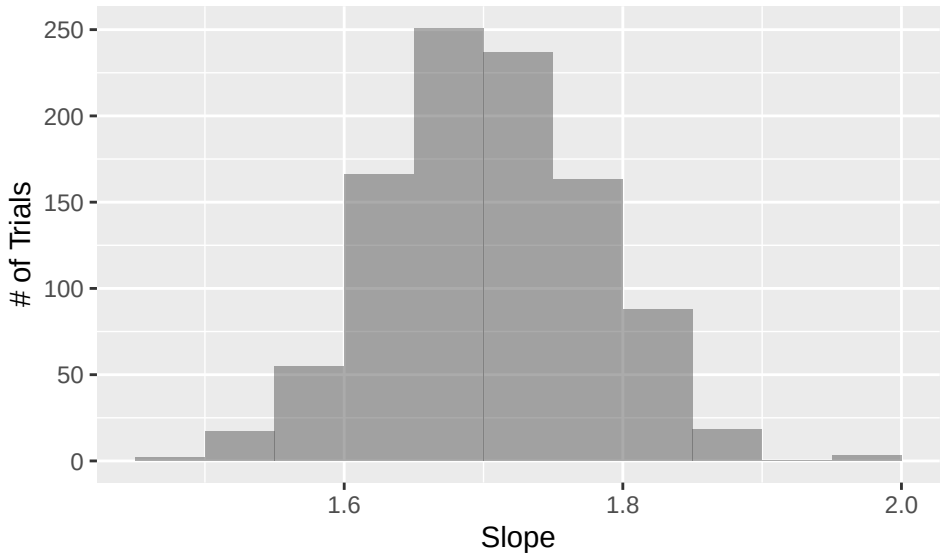
```
numsamp <- 25 # It's too messy to do any more than 25
slopesdata <- do(numsamp) * lm(pct_bf ~ waist, data = resample(BodyFat))
```

For more information about `resample()`, refer to the resample vignette in mosaic.

```
slopesdata <- slopesdata %>%
  mutate(at27 = Intercept + waist * 27, at50 = Intercept + waist * 50, color = as.factor(1:25))
# Figure 20.4, page 644
gf_point(pct_bf ~ waist, data = BodyFat) %>%
  gf_segment(at27 + at50 ~ 27 + 50, data = slopesdata, color = ~color) %>%
  gf_labs(color = "Sample", x = "Waist (in.)", y = "Percent Body Fat")
```




```
numsamp <- 1000 # To see the shape of the histogram
slopesdata <- do(numsamp) * lm(pct_bf ~ waist, data = resample(BodyFat))
# Figure 20.5
gf_histogram(~waist, data = slopesdata, binwidth = .05, center = .025) %>%
  gf_labs(x = "Slope", y = "# of Trials")
```



For the histogram, we use 1,000 trials.