Exploring numerical data

Chapter 5

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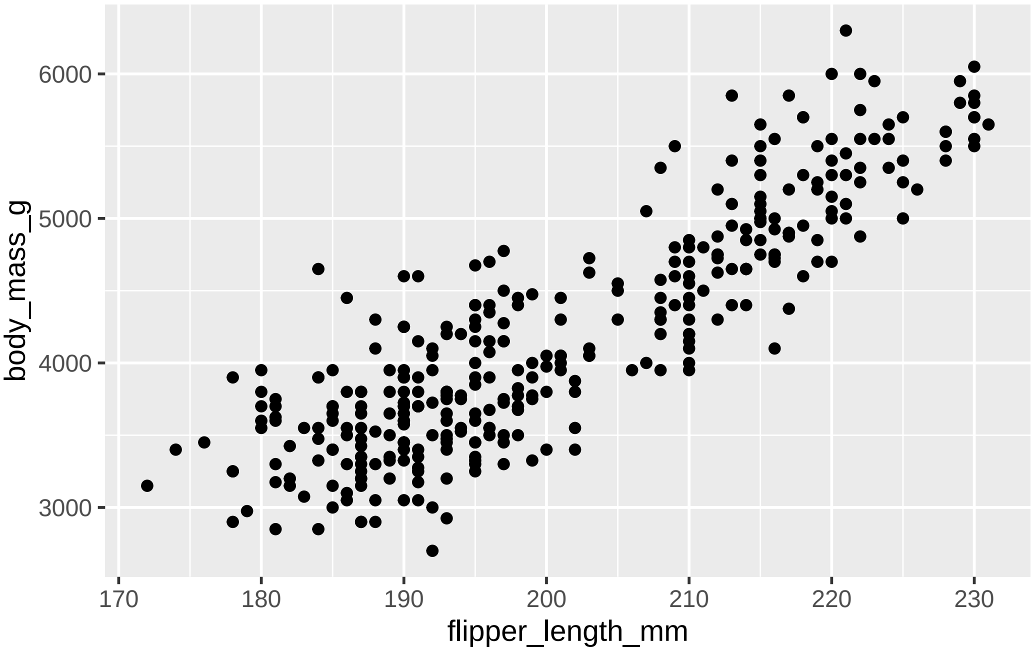
In groups

- Today's homework: section 5.10, #1, 2, 5a,b

Scatterplots

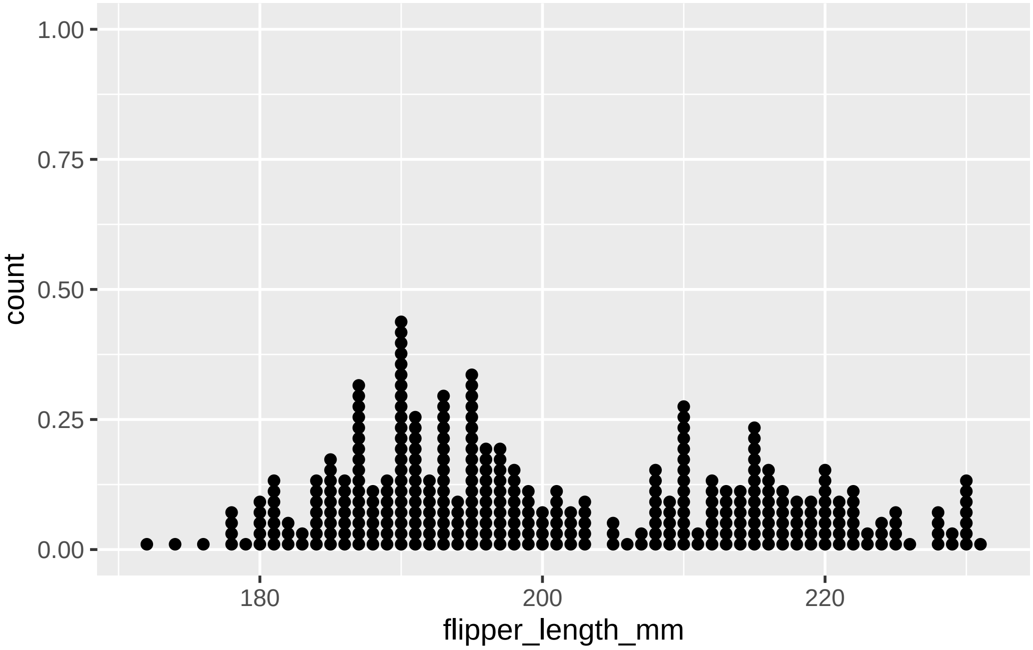
Compare **two** numerical variables



Dot Plot

Visualize the *distribution* of **one** numerical variable

```
ggplot(data = penguins,
       mapping = aes(x = flipper_length_mm)) +
  geom_dotplot(dotsize=0.75, binwidth=1)
```



flipper_length_mm

```
penguins |> count(flipper_length_mm) |> print(n=20)
```

```
# A tibble: 56 x 2
   flipper_length_mm     n
               <int> <int>
 1               172     1
 2               174     1
 3               176     1
 4               178     4
 5               179     1
 6               180     5
 7               181      7
 8               182      3
 9               183      2
10               184      7
11               185      9
12               186      7
13               187     16
14               188      6
15               189      7
16               190     22
17               191     13
18               192      7
19               193     15
20               194      5
# i 36 more rows
```

Mean (average) flipper length?

```r
mean(penguins$flipper_length_mm, na.rm = TRUE)
```

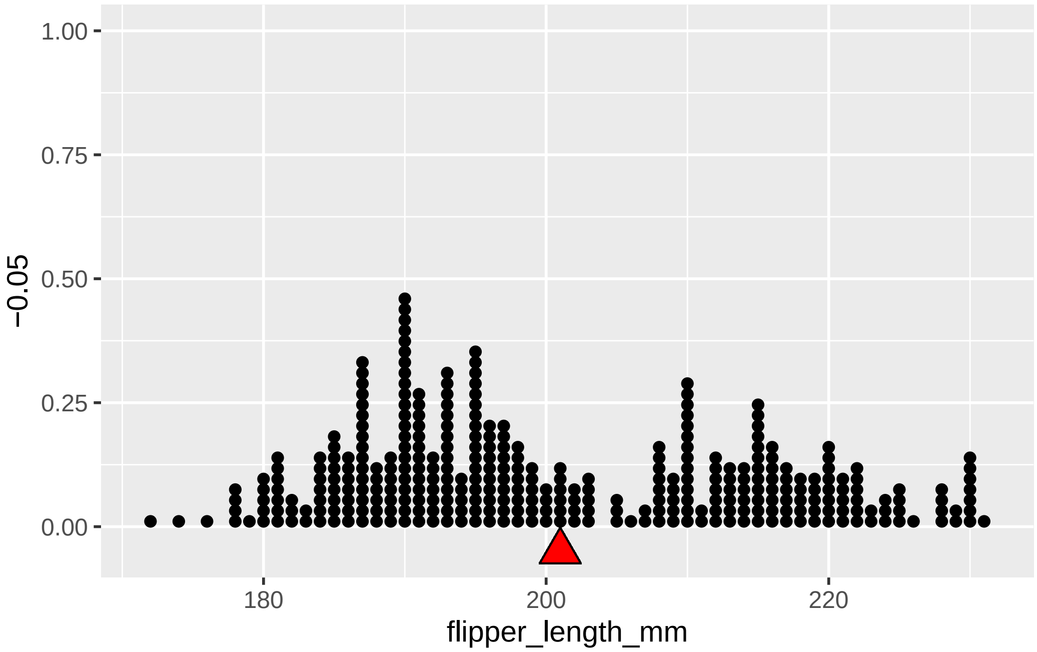
```
[1] 200.9152
```

```r
penguins |>
  summarize( mean = mean(flipper_length_mm, na.rm = TRUE))
```

```
# A tibble: 1 x 1
   mean
  <dbl>
1  201.
```

Visualize the Mean

A measure of **center** of a distribution.



Calculuating the Mean

Sample mean $\overline{x}$

$$\overline{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

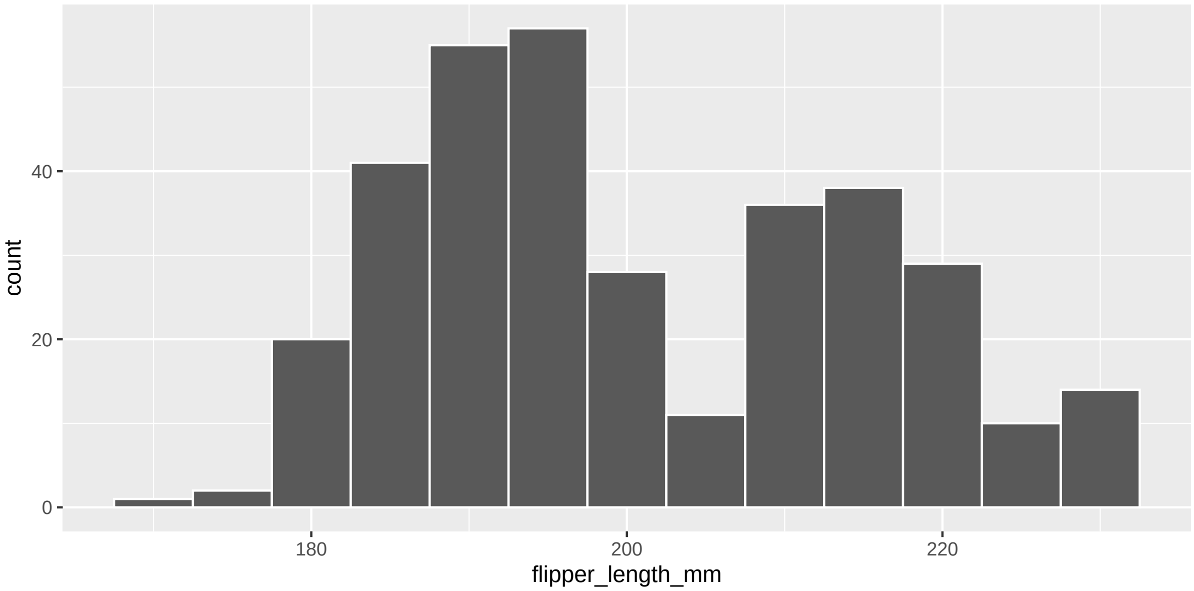
Population mean μ (Greek letter "mu")

$$\overline{x} \approx \mu$$

Question: what is the average age of the people in this room?

Histogram

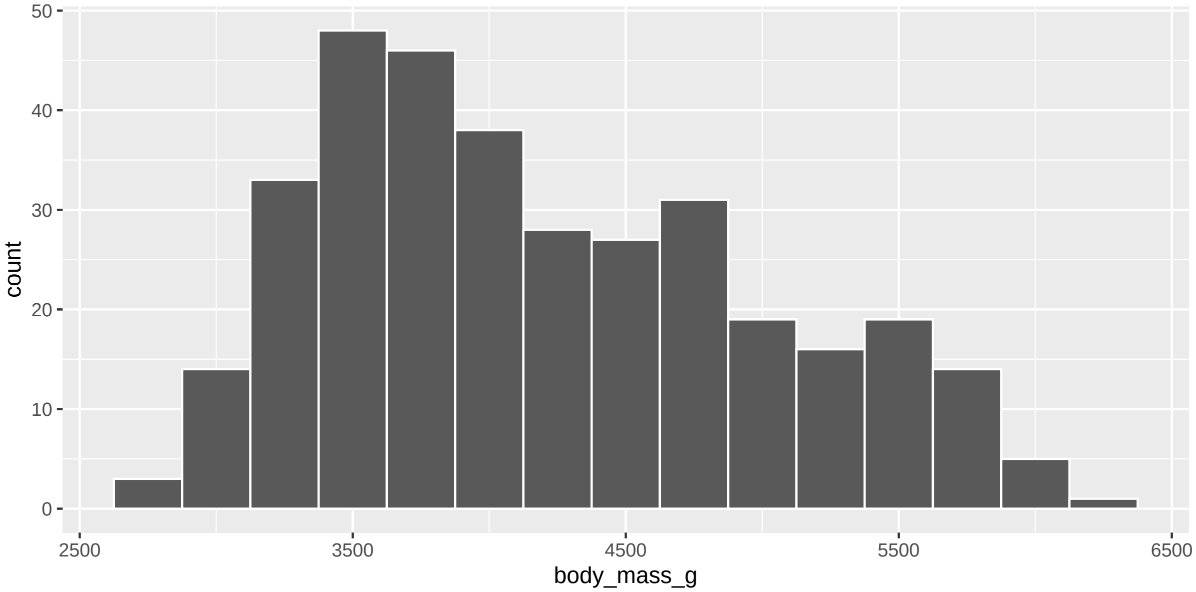
```
ggplot(data = penguins,
       mapping = aes(x = flipper_length_mm)) +
  geom_histogram(binwidth = 5, color="white" )
```



This distribution is **bimodal** and **right skewed**

Body Mass

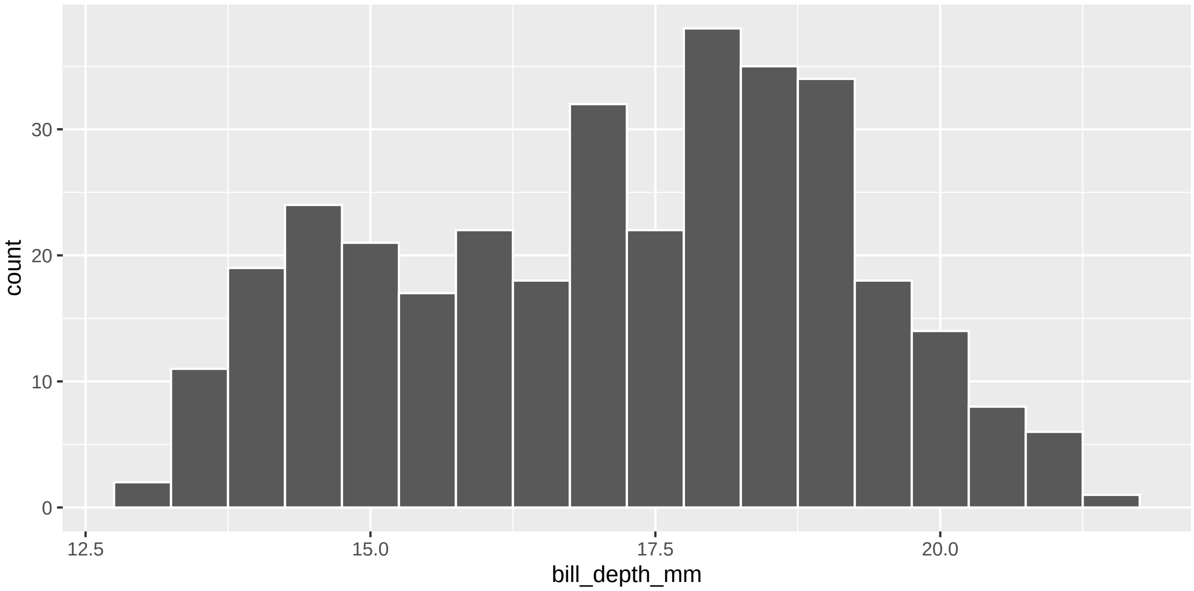
```
ggplot(data = penguins,
       mapping = aes(x = body_mass_g)) +
  geom_histogram(binwidth = 250, col="white")
```



This distribution is **unimodal** and **right skewed**

Bill Depth

```
ggplot(data = penguins,
       mapping = aes(x = bill_depth_mm)) +
  geom_histogram(binwidth = 0.5, col="white")
```



This distribution is **bimodal** and **right skewed**

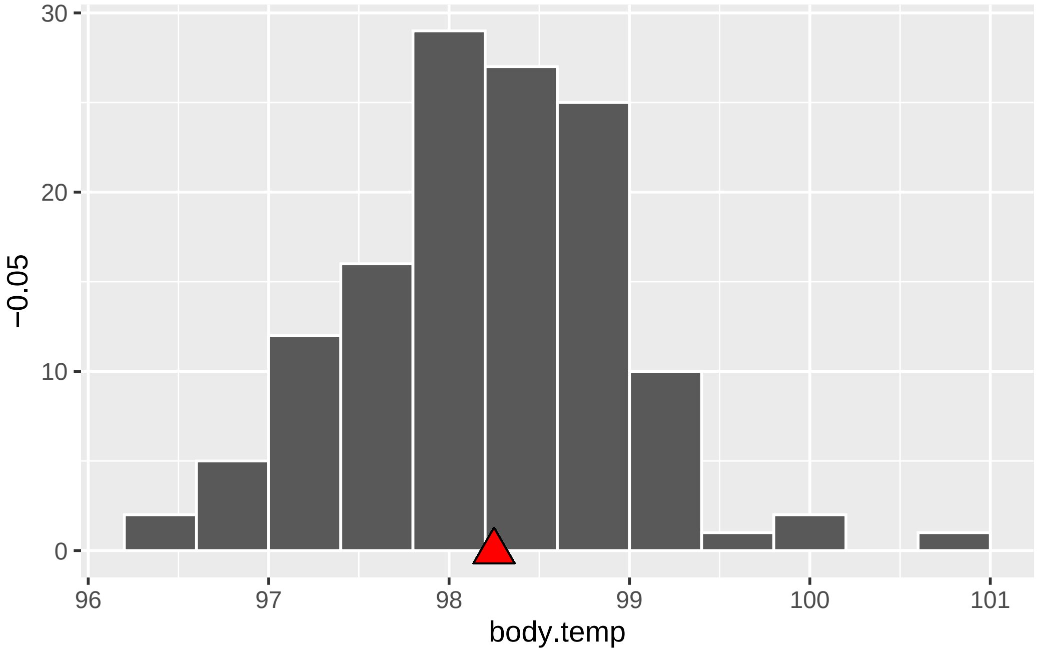
Mean (average) Body Temperature

What do you think it is?

Mean (average) Body Temperature

```r
mean(thermometry$body.temp)
```

```
[1] 98.24923
```



Variance

Measure of *variation* or how *spread out* distribution is. It's the *average squared distance from the mean*.

Sample **variance** is s^2

where s is the sample **standard deviation**

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}}$$

Population variance: σ^2 (Greek letter "sigma")

Standard Deviation

s is the sample **standard deviation**. Represents the typical deviation from the mean

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}}$$

Empirical Rule

Typically, about 68% of the data (observations) lie within one s.d. of the mean.

About 98% of the data lie within two s.d. of the mean.

These percentages are **not** hard and fast rules!

Body Temperature

```
thermometry |>
   summarize( mean = mean(body.temp), sd = sd(body.temp))
```

```
      mean        sd
1 98.24923 0.7331832
```

Using the **empirical rule**, about 68% of observations lie in what range of temperatures?

IQR

```
summary(thermometry$body.temp)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  96.30   97.80   98.30   98.25   98.70  100.80 
```