Session 2: Basics of R continued

Overview

Statistics and plots for categorical data

Statistics and plots for quantitative data

Generating random data and probability functions

For loops

Writing functions

Categorical data

Categorical data

A categorical variable assigns each observation to one of *k* groups

- Main statistic: the count/proportion in each category

```
# Get information about drinking behavior
> drinking_vec <- profiles$drinks

# Create a table showing how often people drink
> drinks_table <- table(drinking_vec)
> drinks_table
```

Relative frequency table

We can create a relative frequency table using the function:

```
> prop.table(my_table)
```

Can you create a relative frequency table for the drinking behavior of the people in the okcupid data set?

```
> drinks_table <- table(profiles$drinks)
> prop.table(drinks_table)
```

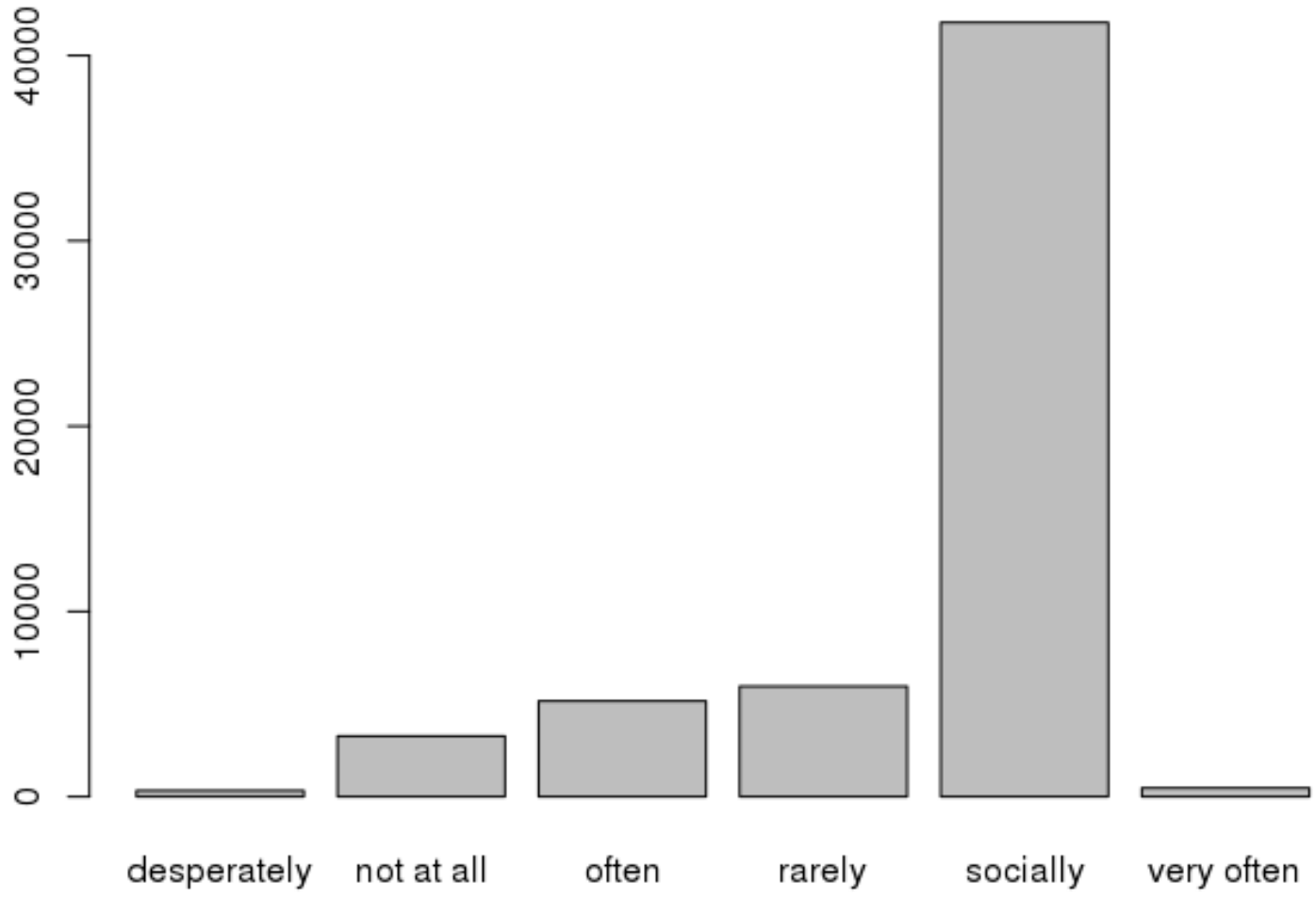
Bar plots (pun intended?)

We can plot the number of items in each category using a bar plot

```
> barplot(my_table)
```

Can you create a bar plot for the drinking behavior of the people in the okcupid data set?

```
> drinks_table <- table(profiles$drinks)
> barplot(drinks_table)
```



What is wrong with this plot?

Labeling plots

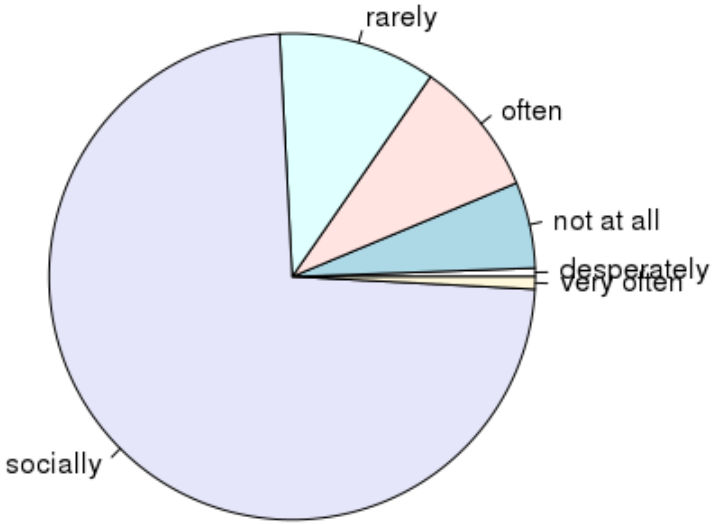
Can you figure out how to label the axes?

```
> barplot(drinks_table,
        ylab = "Count",
        xlab = "Type of drinker",
        main = "Counts of different types of drinkers")
```

Pie charts

We can also use the pie() function to create pie charts

> pie(drinks_table)



Questions?

Quantitative data

Quantitative data: statistics

There are several statistics that describe the central tendency of quantitative data…

- The mean: mean()
- The median: median()

Can you calculate the mean and median of OkCupid user's heights?

Quantitative data: Visualizing heights

Q: How can we visualize the heights in the profiles data frame?

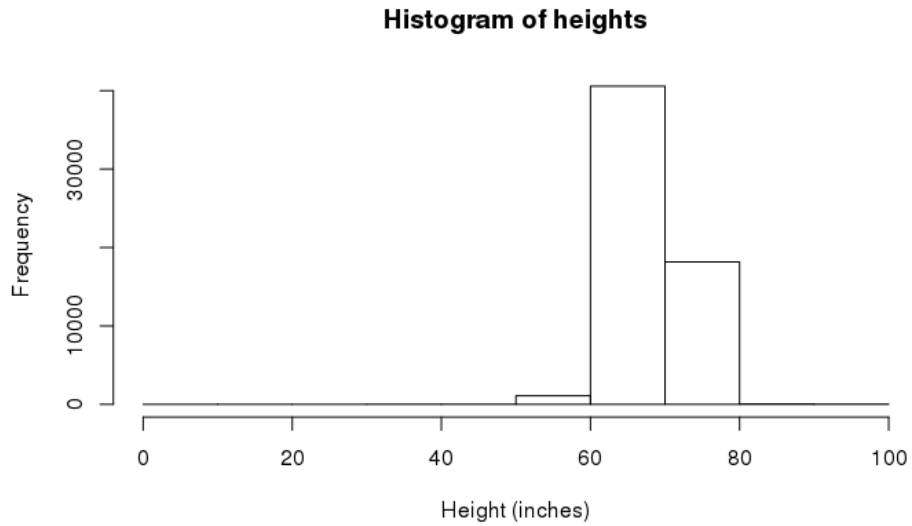
Visualizing heights

We can create histograms in R using the hist() function

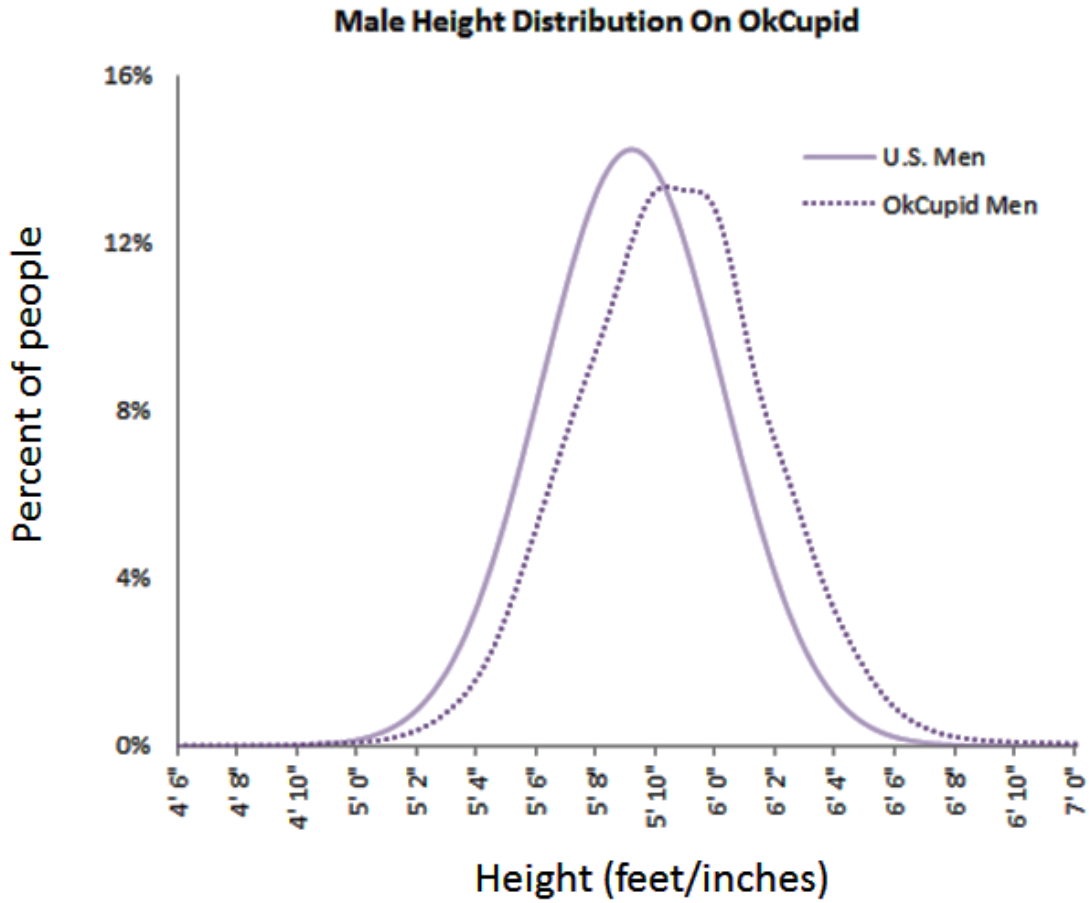
Can you create a histogram of heights?

> hist(profiles$height)

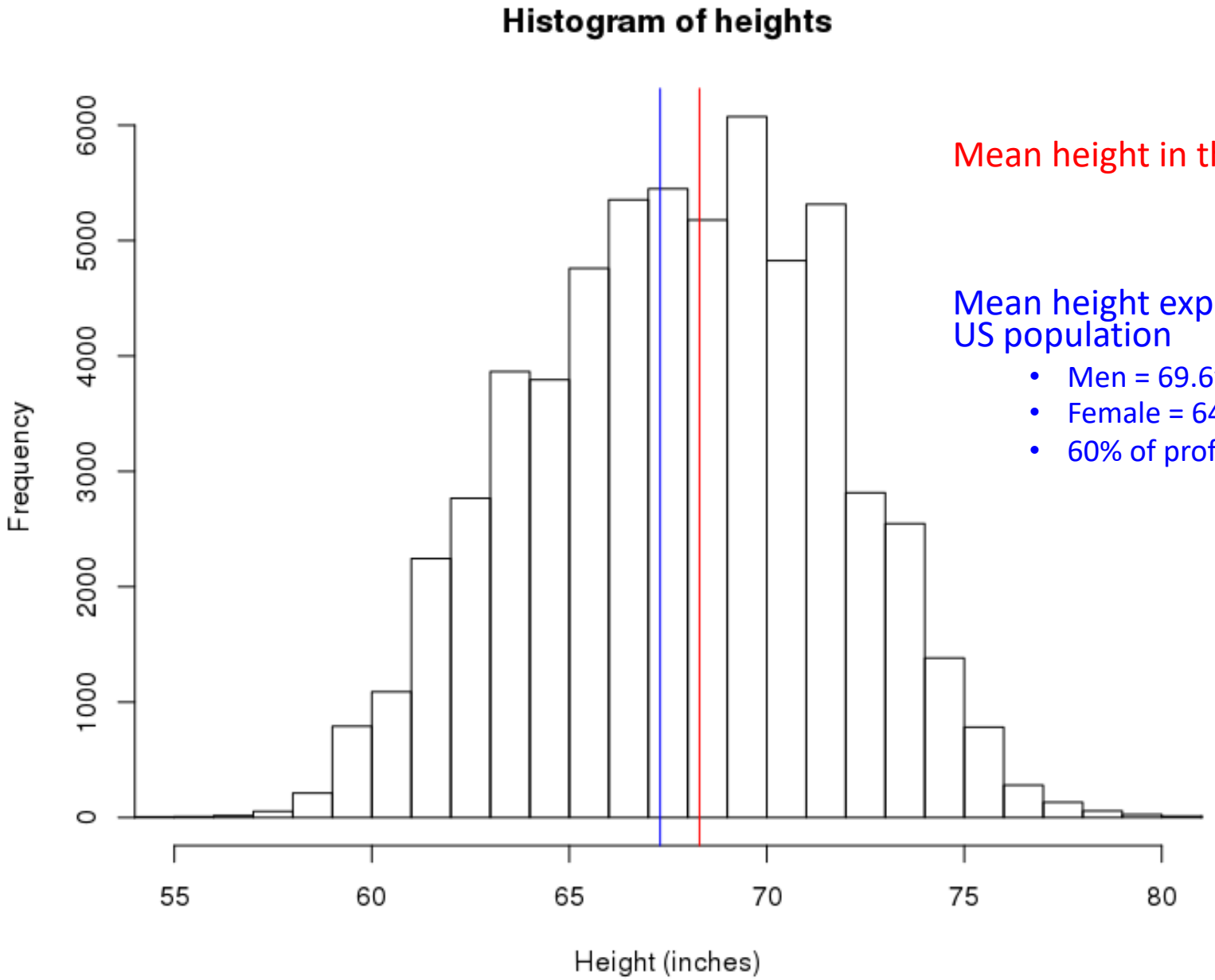
> hist(profiles$height, breaks = 50)



OkCupid users are taller than the average person



Can we see this in the profiles data?



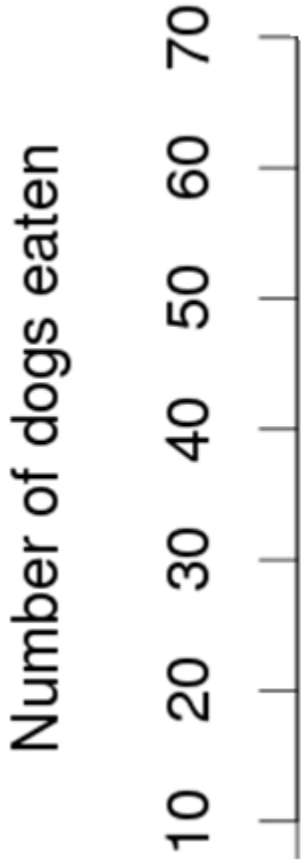
Mean height in the profiles data

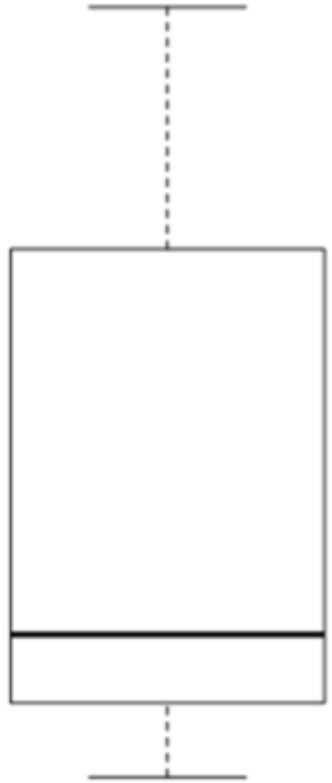
Mean height expected based on US population

- Men = 69.6”
- Female = 64”
- 60% of profiles are men

abline() adds lines to plots

Box plots can also visualize quantitative data





Maximum value that is not an outlier

Q_3

Median

Q_1

Minimum value that is not an outlier

R: `boxplot(v)`

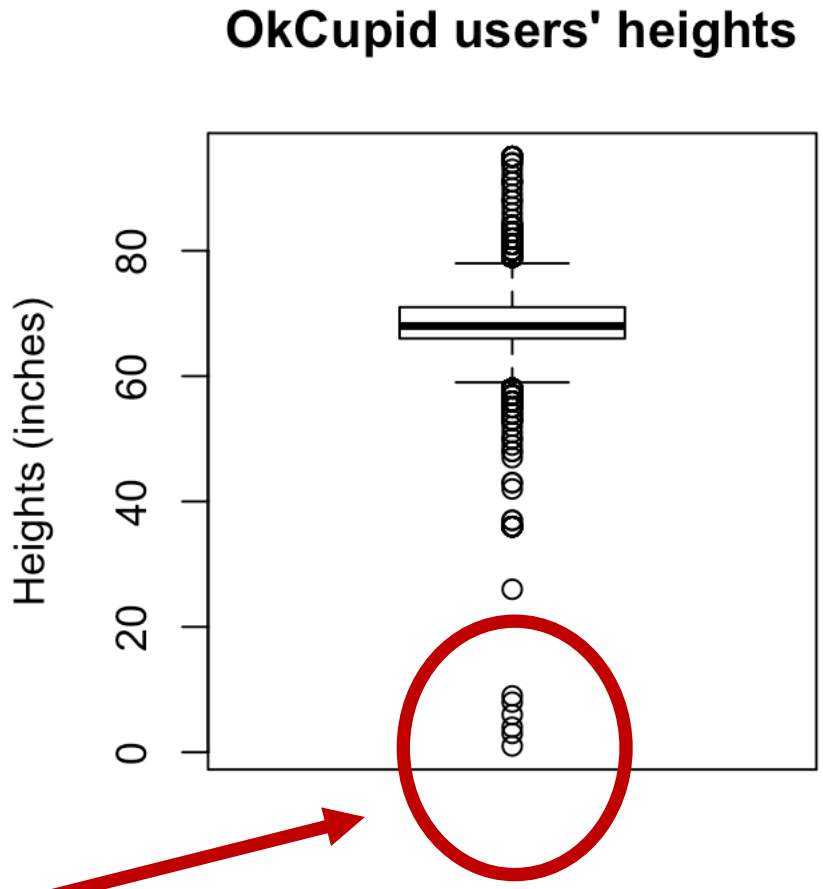
Outliers

Outliers on boxplots are values that are more than 1.5 * IQR

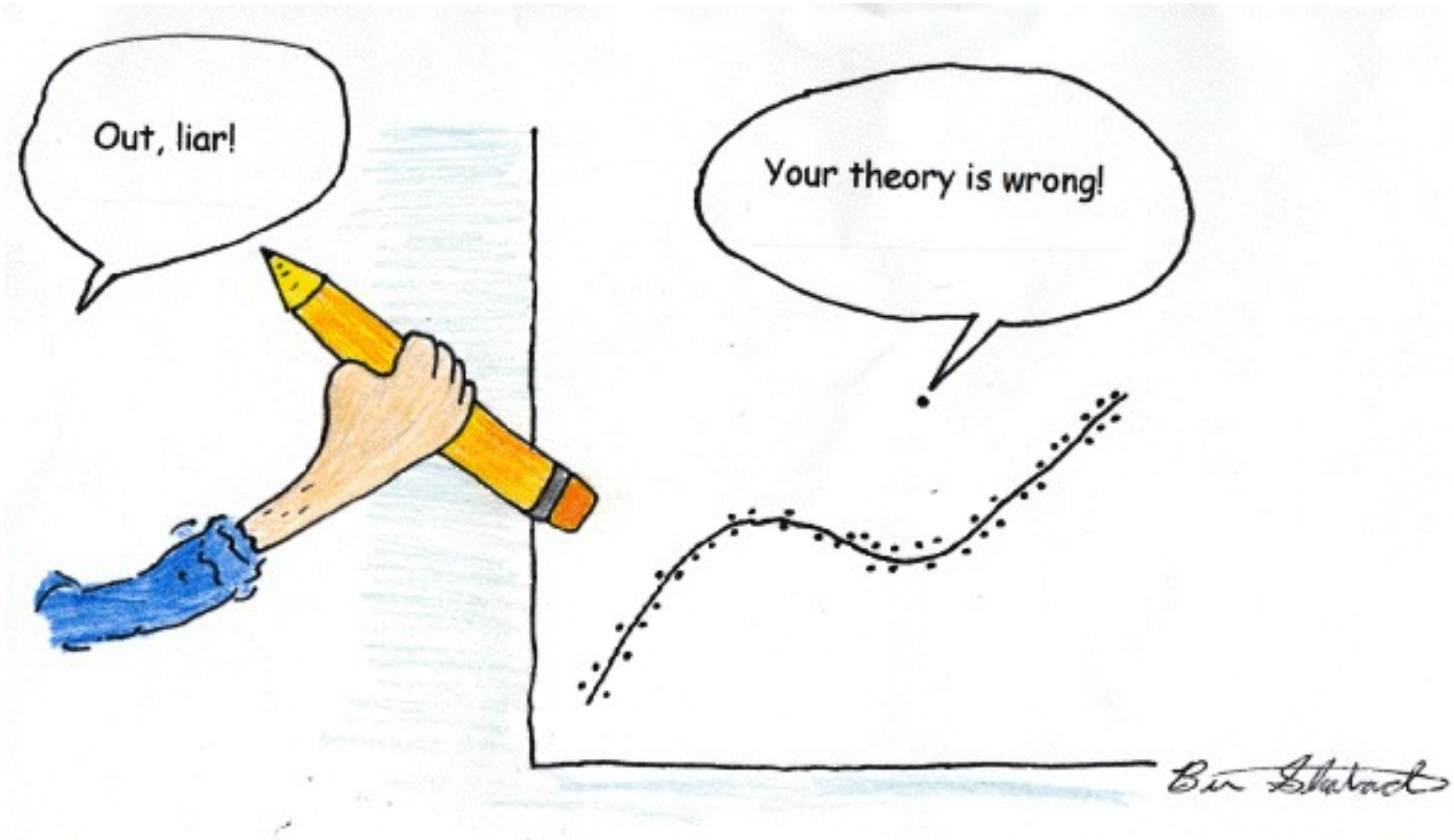
What should we do if we have outliers?

Investigate!

- If there are due to an error, remove them
- **If not, need to account for them**



People under 20” tall?


Out, liar!
Your theory is wrong!

CitiBike data

Let's look at the bike share data from NYC

> load('daily_bike_totals.rda')

CitiBike analysis

What does each case correspond to?

We can use the dim() function to get how many cases and variables there are

- How many are there?

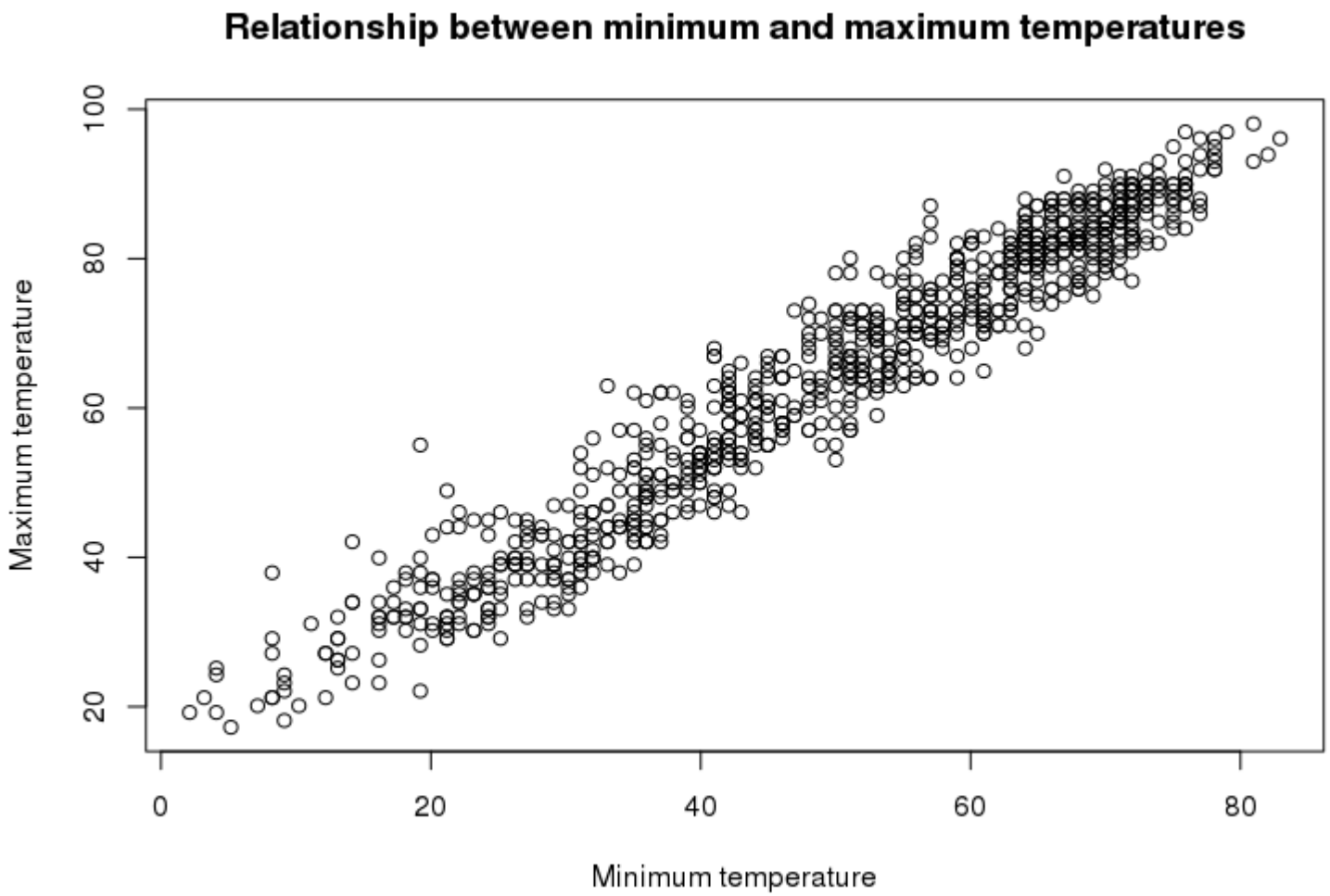
Scatter plots

We can use the plot(x, y) function to create scatter plots

Can you create a scatter plot of the relationship between the minimum and maximum temperatures?

```
> plot(bike_daily_data$min_temperature,
       bike_daily_data$max_temperature,
       xlab = "Minimum temperature",
       ylab = "Maximum temperature",
       main = "Relationship between min and temp")
```

Scatter plots



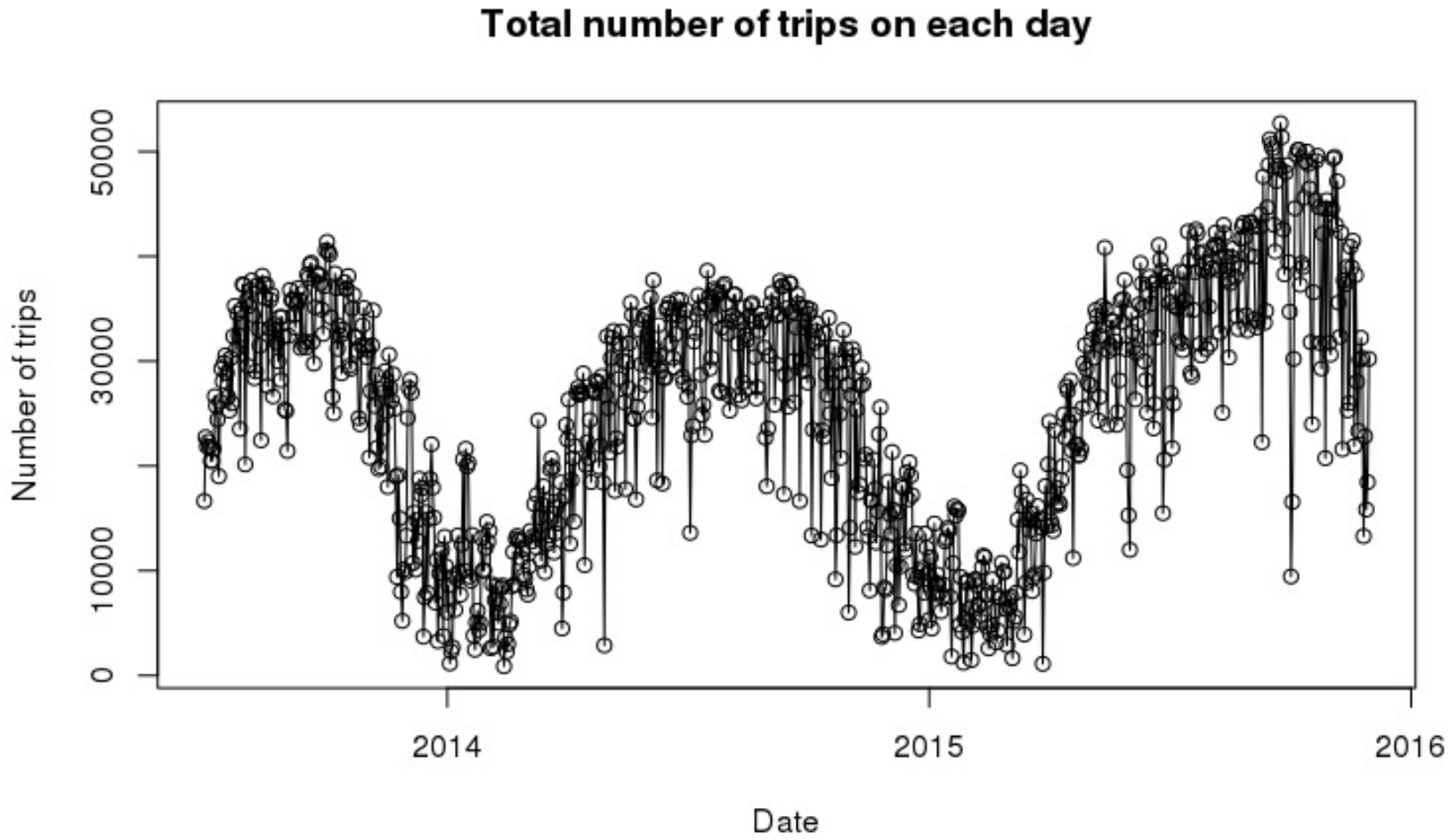
Plotting time series

We can use the plot(x, y) function to plot time series

```
# we can connect the points in a plot using
> plot(x, y, type = 'l')    # connected points
> plot(x, y, type = 'o')   # both points and dots

> plot(bike_daily_data$date,  bike_daily_data$trips,
        type = 'o',
        xlab = "Date",
        ylab = "Number of trips",
        main = "Total number of trips on each day")
```

Plotting time series



Questions?

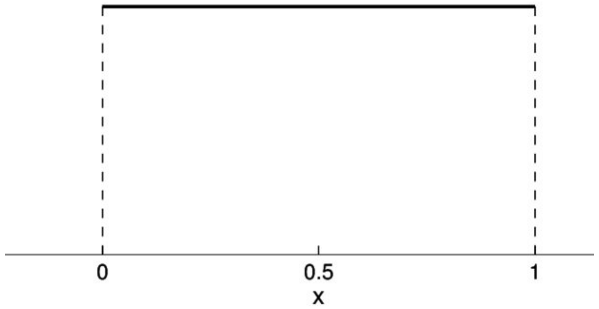
Generating random data

R has built in functions to generate data from different distributions

- All these functions start with the letter ***r***

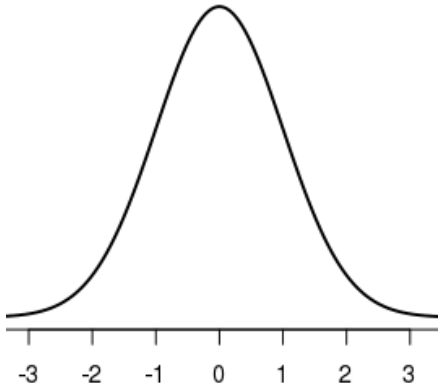
The uniform distribution

```
# generate n = 100 points from U(0, 1)
> rand_data <- runif(100)
> hist(rand_data)
```



The normal distribution

```
# generate n = 100 points from N(0, 1)
> rand_data  <- rnorm(100)
> hist(rand_data)
```



Generating random data

If we want the same sequence of random numbers we can set the random number generating seed

```
> set.seed(123)
> runif(100)
```

Q: Why would we want the same sequence of random number?

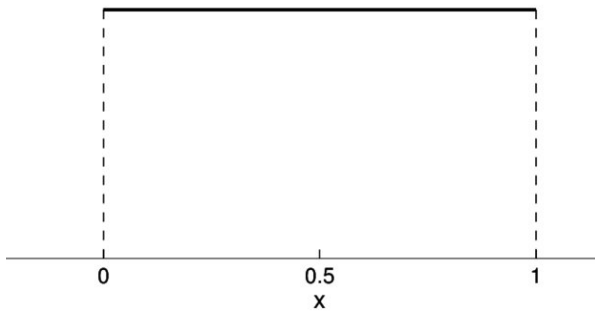
Cumulative distributions

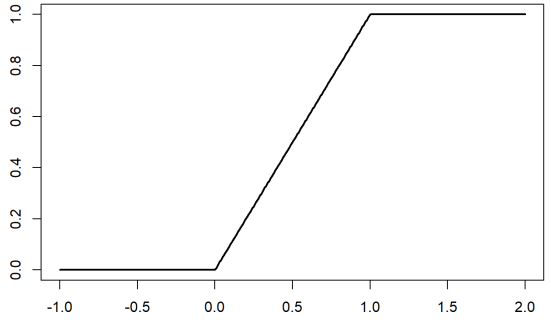
R has built in functions to get probabilities from different distributions

- All these functions start with the letter ***p***

The uniform distribution

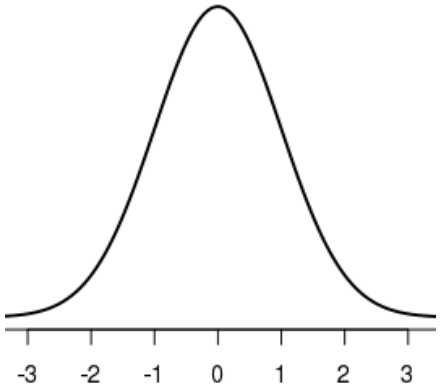
```
# P(X ≤ .25)
    punif(.25)
```

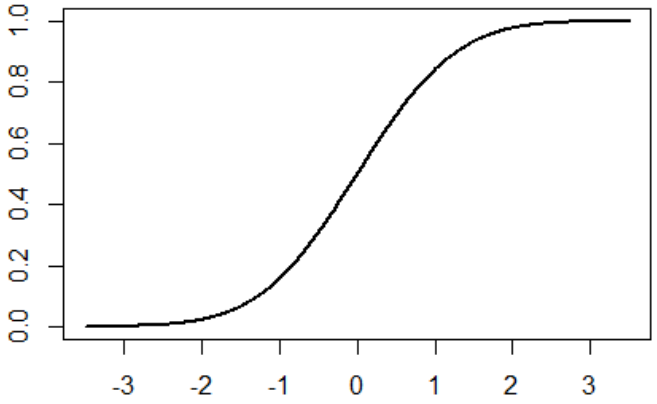




The normal distribution

```
# P(X ≤  2)
    pnorm(2)
```





For loops

For loops are useful when you want to repeat a piece of code many times under similar conditions

The syntax for a for loop is:

```
for (i in 1:100) {
        # do something
}
```

This is repeated 100 times
i is incremented by 1 each time

For loops

For loops are particularly useful in conjunction with vectors…

```
my_results <- NULL      # create an empty vector to store the results
for (i in 1:100) {
        my_results[i] <- i^2
}
```

Using a for loop to Simulate a sampling distribution

```
sampling_dist <- NULL
for (i in 1:1000) {
        rand_data <- runif(100)    # generate n = 100 points from U(0, 1)
        sampling_dist[i] <- mean(rand_data)    # save the mean
}

hist(sampling_dist)          # visualize the sampling distribution
SE <- sd(sampling_dist)    # get the standard error
```

Let's try it in R!

Writing functions

We've used several R functions

Let's explore writing our own functions!