Notes: MS 204 Chapter 4

Overview

- Inference for a single population mean

An example

The New England Patriots' 2014 Super Bowl title was possibly tainted by a football deflation issue. NFL team footballs are supposed to measure between 12.5 and 13.5 PSI's. We're going to check if the footballs measured at halftime of the Patriots' game against Indianapolis fell more than we expected to.

The sample PSI's recorded were:

11.5, 10.85, 11.15, 10.7, 11.1, 11.6, 11.85, 10.95, 10.5, 10.9

One final catch: given the game conditions, physicists identified that balls could be expected to drop by about 0.8 PSI's (12.5 to 11.7)

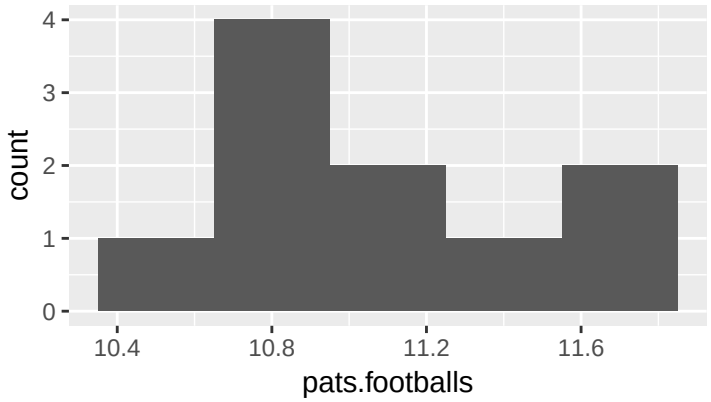
```
library(tidyverse)
library(oilabs)
library(mosaic)
pats.footballs <- c(11.5, 10.85, 11.15, 10.7, 11.1, 11.6, 11.85, 10.95, 10.5, 10.9)
mean(pats.footballs)
```

```
## [1] 11.11
```

```
sd(pats.footballs)
```

```
## [1] 0.4241331
```

```
qplot(pats.footballs, binwidth = 0.3)
```



Inference for a single population mean

parameter

point estimate

population

Inference

Central limit theorem for sample means

t distribution

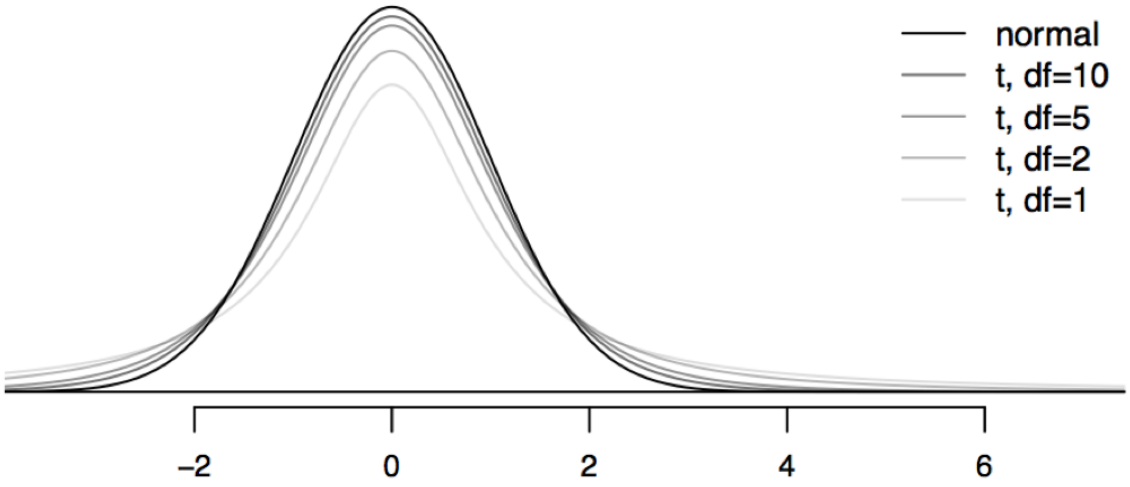


Figure 1: normal versus t(df) curves

Assumptions?

Hypothesis test

Do these data provide convincing evidence that the average Patriots football fell below the 11.7 threshold?

Confidence interval

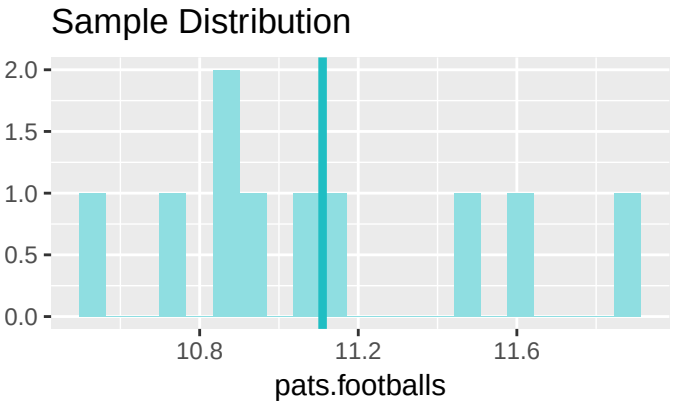
```
qt(0.025, df = 9)
```

```
## [1] -2.262157
```

Code

```
data.patriots <- data.frame(pats.footballs)
inference(pats.footballs, data = data.patriots, statistic = "mean",
          type = "ci", method = "theoretical")
```

```
## Single numerical variable
## n = 10, y-bar = 11.11, s = 0.4241
## 95% CI: (10.8066 , 11.4134)
```




```
inference(pats.footballs, data = data.patriots, statistic = "mean",
          type = "ht", alternative = "less", method = "theoretical", null = 11.7)
```

```
## Single numerical variable
## n = 10, y-bar = 11.11, s = 0.4241
## H0: mu = 11.7
## HA: mu < 11.7
## t = -4.399, df = 9
## p_value = 9e-04
```