Chapter 8

Example: The **faithful** dataset of Old Faith Geyser data is used again for this example. Since the population variance of Old Faithful eruption duration is unknown, the t-distribution is used to complete the following hypothesis tests.

Let μ denote the true mean eruption duration of Old Faithful and we want to test $H_0 : \mu = 3$ vs. $H_a : \mu \neq 3$ at $\alpha = 0.05$.

```
t.test(faithful$eruptions,mu = 3)

##
##  One Sample t-test
##
## data:  faithful$eruptions
## t = 7.0483, df = 271, p-value = 1.502e-11
## alternative hypothesis: true mean is not equal to 3
## 95 percent confidence interval:
##  3.351534 3.624032
## sample estimates:
## mean of x
##  3.487783
```

From the output, we see that the p-value is $1.5 \cdot 10^{-11}$. This is less than $\alpha = 0.05$, so we would reject $H_0 : \mu = 3$ and conclude the true mean eruption duration of Old Faithful differs from 3 minutes.

Suppose we want to test $H_0 : \mu = 3.5$ vs. $H_a : \mu < 3.5$ at $\alpha = 0.05$. In other words, we would like to test to see if the mean is less than 3.5 minutes.

```
t.test(faithful$eruptions,mu=3.5,alternative = "less")

##
##  One Sample t-test
##
## data:  faithful$eruptions
## t = -0.17653, df = 271, p-value = 0.43
## alternative hypothesis: true mean is less than 3.5
## 95 percent confidence interval:
##      -Inf 3.602007
## sample estimates:
## mean of x
##  3.487783
```

Here, the p-value is 0.43, so we would fail to reject $H_0 : \mu = 3.5$. In other words, we don't have sufficient evidence to conclude the true mean eruption duration is less than 3.5 minutes.