IS606 Homework 5

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5.6 Working Backwards, Part II (p257)

A 90% confidence interval for a population mean is (65, 77). The population distribution is approx. normal and the population standard deviation is unknown. This confidence interval is based on a simple random sample of 25 observations. Calculate the sample mean, the margin of error and the sample standard deviation.

First we can work out the sample mean, by finding the mid point of the confidence interval range. We also get the T * SE segment of the confidence interval equation out of these computations.

```
n <- 25
diff <- 77 - 65
marginOfError <- diff / 2

mean56 <- 65 + marginOfError
mean56
```

```
## [1] 71
```

Next we need to resolve the t value for a 90% confidence interval of n=25, df=24. We use the `qt` function to look up the t value in the t distribution for the $1 - \alpha/2 = 0.95$ where $\alpha = 1 - CI = 0.10$:

```
df <- n - 1
t <- qt(.95, df)
t
```

```
## [1] 1.710882
```

With the t value, we can separate the standard error:

```
SE <- marginOfError / t
SE
```

```
## [1] 3.506963
```

With the standard error and the number of cases we can back into the sample standard deviation:

```
sdSample <- SE * sqrt(n)
sdSample
```

```
## [1] 17.53481
```

5.14 SAT Scores (p259)

SAT Scores of students at an Ivy League college are distributed with a standard deviation of 250 points. Two statistitcs students, Raina and Luke, want to estimate the average SAT score of students at this college as part of a class project. They want their margin of error to be no more than 25 points.

a) Raina wants to use a 90% confidence interval. How large of a sample should she collect? Using the normal distribution Z score, we can compute the sample size needed as follows:

```
mE <- 25
S <- 250
z <- qnorm(0.95)
z
```

```
## [1] 1.644854
```

```
n <- ((S * z) / mE)^2
n
```

```
## [1] 270.5543
```

b) Luke wants to use a 99% confidence interval. Without calculating the actual sample size, determine whether his sample should be larger or smaller than Raina's, and explain your reasoning. In order to achieve a 99% confidence interval while maintaining the margin of error of 25 points, a larger sample size will be needed sufficient to offset the increased Z score associated with the 99% CI.

```
z <- qnorm(0.995)
z
```

c) Calculate the minimum required sample size for Luke.

```
## [1] 2.575829
```

```
n <- ((S * z) / mE)^2
n
```

```
## [1] 663.4897
```

5.20

5.32

5.48