Stat. Inf. II: Assignment 1

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Reading:

a. Read the remaining Sections in Chapter 9: 9.3, 9.5 and 9.6. And, read the final section about errors and power on the R handout for inference about a proportion.

Problem 2:

1. Write a *prop.sample.size()* function that will output the sample size needed for a one-sample proportion test to achieve

- a desired margin of error (argument #1)
- for a given confidence level (argument #2)

in the "worst-case scenario" (as was explained in class). What was meant by the "worst-case scenario"?

Solution 1.

We recall that

$$m = z_{1-\alpha/2} \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}.$$

We wish to compute the desired sample size given margin of error m and confidence level $1 - \frac{\alpha}{2}$.

In particular, we wish to account for the "worst-case scenario", where the standard error is maximized by our choice of $\hat{p}$.

```
prop.sample.size <- function(m, conf) {
  n <- (qnorm(conf)^2 * 0.5^2)/(m^2)
  response <- c("The sample size for a one-sample proportion test with a desired margin of error", m, "
  return(response)
}
```

For example, suppose $m = 0.4$, and the given confidence level is 0.995. Then,

```
prop.sample.size(0.4, .995)
```

```
## [1] "The sample size for a one-sample proportion test with a desired margin of error"
## [2] "0.4"
## [3] " and given confidence level"
## [4] "0.995"
## [5] " is "
## [6] "10.3670259390956"
```

2. use your *prop.sample.size()* from part 1 to do exercise 8.50 from the Agresti book.

How many businesses fail? A study is planned to estimate the proportion of businesses started in the year 2006 that failed within five years of their start-up. How large a sample size is needed to guarantee estimating this proportion correct to within

a. 0.10 with probability 0.95?

```
prop.sample.size(0.10, 0.95)
```

```
## [1] "The sample size for a one-sample proportion test with a desired margin of error"
## [2] "0.1"
## [3] " and given confidence level"
## [4] "0.95"
## [5] " is "
## [6] "67.6385863523852"
```

b. 0.05 with probability 0.95?

```
prop.sample.size(0.05, 0.95)
```

```
## [1] "The sample size for a one-sample proportion test with a desired margin of error"
## [2] "0.05"
## [3] " and given confidence level"
## [4] "0.95"
## [5] " is "
## [6] "270.554345409541"
```

c. 0.05 with probability 0.99?

```
prop.sample.size(0.05, 0.99)
```

```
## [1] "The sample size for a one-sample proportion test with a desired margin of error"
## [2] "0.05"
## [3] " and given confidence level"
## [4] "0.99"
## [5] " is "
## [6] "541.189443105434"
```

d. Compare sample sizes for parts a and b, and b and c, and summarize the effects of decreasing the margin of error and increasing the confidence level.

3. Write a *mean.sample.size()* function that will output the sample size needed for a one-sample mean test to achieve

- a desired margin of error (argument #1)
- for a given confidence level (argument #2)
- for a given standard deviation (argument #3)

Proceed to use that function in order to do exercise 8.53 from the Agresti book.