**Statistics 211**
**In-Class Assessments**
Topic: Chapter 5
Date: Oct. 11, 2016

1. Consider a Binomial experiment, with $n$ independent Bernoulli trials each with probability $p$ of success.

   (a) Suppose we wish to test the null hypothesis $H_0 : p = p_0$ vs. the two-sided alternative $H_a : p \neq p_0$. We will test at *significance level* $\alpha$ (what we have also called inference with $(1 - \alpha) \times 100\%$ *confidence*).

      i. Suppose $H_0$ is true. If we use significance level $\alpha = 0.05$, what is the probability we will commit a Type I error due to a p-value less than 0.05?

      ii. Suppose $H_0$ is true. If we use significance level $\alpha = 0.01$, what is the probability we will commit a Type I error due to a p-value less than 0.01?

      iii. For a given alternative value $p_1 \neq p_0$, the *power* of a test (e.g., a bootstrap-based test) is the probability of rejecting $H_0$ due to a p-value less than $\alpha$. Consider two possible alternative values $p_1$ and $p_2$ such that $p_0 < p_1 < p_2$. Which of the following would you expect to be true?

         A. Power to detect $p_1$ = power to detect $p_2 = \alpha$

         B. Power to detect $p_1$ < power to detect $p_2$

         C. Power to detect $p_1$ > power to detect $p_2$

2. Consider a random sample $x_1, x_2, \ldots, x_n$ from a population with <u>median</u> $\theta$. Suppose we wish to test the null hypothesis $H_0 : \theta = 0$ vs. the one-sided alternative $H_a : \theta > 0$. Which of the following shows how to use the bootstrap to compute a p-value? In each, let `x` be the `R` variable containing our $n$ observations.

   (a) Code:

```
med_obs <- median(x)
x_0 <- x - median(x)
med_b <- numeric(B)
for(b in 1:B) {
  med_b[b] <- median(sample(x, replace = TRUE))
}
p_val <- sum(med_b > med_obs) / B
```

   (b) Code:

```
med_obs <- median(x)
x_0 <- x - median(x)
med_b <- numeric(B)
for(b in 1:B) {
  med_b[b] <- mean(sample(x_0, replace = FALSE))
```

```
}
p_val <- sum(med_b > med_obs) / B
```

(c) Code:

```
med_obs <- median(x)
x_0 <- x - median(x)
med_b <- numeric(B)
for(b in 1:B) {
  med_b[b] <- mean(sample(x, replace = TRUE))
}
p_val <- sum(med_b > med_obs) / B
```

(d) Code:

```
med_obs <- median(x)
x_0 <- x - median(x)
med_b <- numeric(B)
for(b in 1:B) {
  med_b[b] <- median(sample(x_0, replace = TRUE))
}
p_val <- sum(med_b > med_obs) / B
```