Assignment #10 — Due Friday, December 9 by 4:00 P.M.

Turn in homework to your TA's mailbox using this sheet as the cover page.

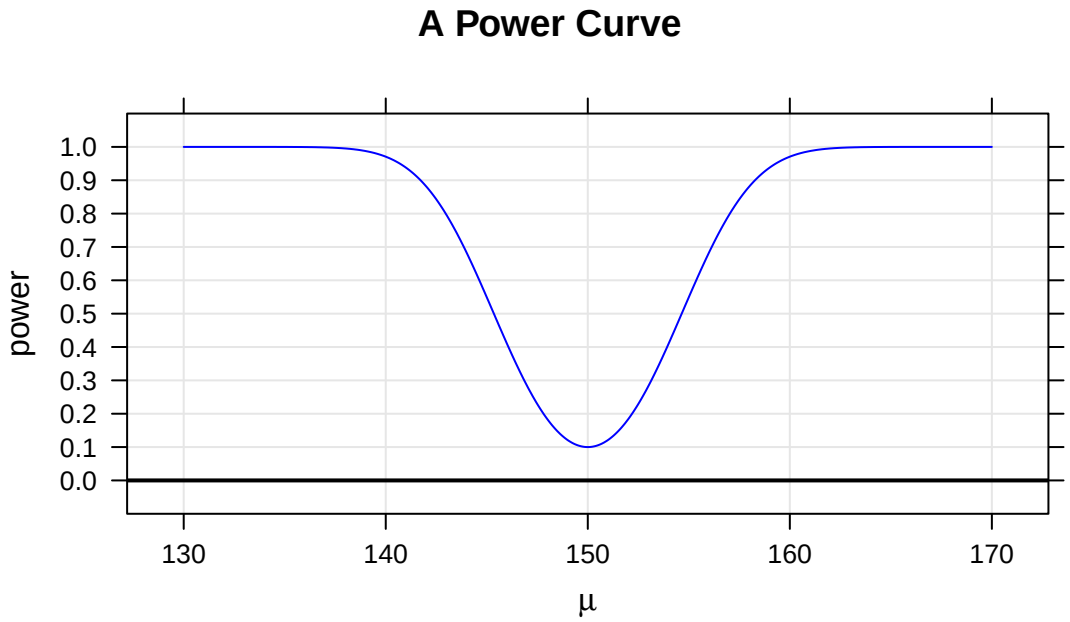
Fill in your name and also circle the *lecture section in which you are registered* and circle the *discussion section you expect to attend* to pick up this assignment.

Name:

Lecture 1 (Hanlon).	**311:** Tu 1:00 - 2:15pm	**312:** Th 8:00 - 9:15am	**313:** We 1:00 - 2:15pm
Lecture 2 (Larget).	**321:** Tu 1:00 - 2:15pm	**322:** We 2:30 - 3:45pm	**323:** We 1:00 - 2:15pm

Please answer the following questions.

1. The following graph shows a power curve for a hypothesis test for which $n = 50$ and $\sigma = 20$.



   (a) What feature of the graph tells you that the null hypothesis is $H_0 : \mu = 150$?
   (b) What feature of the graph tells you that the significance level is $\alpha = 0.10$?
   (c) What feature of the graph tells you that the alternative hypothesis is $H_A : \mu \neq 150$?
   (d) For which values a (as best you can tell from the graph) would the power be about 0.5 if the true value of μ was a?
   (e) Roughly sketch what the power curve would have looked like in comparison to the given graph if instead the alternative hypothesis had been $H_A : \mu < 150$.
   (f) Roughly sketch what the power curve would have looked like in comparison to the given graph if instead $n = 200$.
   (g) Roughly sketch what the power curve would have looked like in comparison to the given graph if instead $\alpha = 0.05$.

2. The following questions concern sample size calculations for achieving a specified power.

   The null hypothesis $H_0: \mu = 100$ for the mean of a single population is to be tested by taking a random sample of size n. We assume that the population standard deviation is $\sigma = 5$. How large should n be if:

   (a) $\alpha = 0.05$, the alternative hypothesis is $H_A: \mu > 100$, and the power when $\mu = 102$ is at least 0.75?
   (b) $\alpha = 0.01$, the alternative hypothesis is $H_A: \mu > 100$, and the power when $\mu = 102$ is at least 0.75?
   (c) $\alpha = 0.05$, the alternative hypothesis is $H_A: \mu \neq 100$, and the power when $\mu = 102$ is at least 0.75?
   (d) $\alpha = 0.05$, the alternative hypothesis is $H_A: \mu > 100$, and the power when $\mu = 102$ is at least 0.90?

3. Consider the data and background for problem 18 on page 353 of the textbook, but answer these questions. The data is also in the file `cichlids.csv`.

   (a) Make a dotplot that shows the hormone GnRH mRNA levels on the same graph, but separately for the two groups based on territorial status. Comment on features in the data and assumptions about t-methods for confidence intervals for differences in population means. (The following snippet of R code may be useful. The argument `pch=16` instructs R to use solid rather than open circles for each point.)

   ```
   > cichlids = read.csv("cichlids.csv")
   > str(cichlids)
   > library(lattice)
   > plot(xyplot(Status ~ mRNA, data = cichlids, pch = 16))
   ```

   (b) Repeat the previous graph, but use the natural logarithm of the mRNA levels of the hormone. Which graph shows less skewness in the samples? (The following snippet of R code may be useful.)

   ```
   > cichlids = read.csv("cichlids.csv")
   > str(cichlids)
   > plot(xyplot(Status ~ log(mRNA), data = cichlids, pch = 16))
   ```

   (c) Construct a 95% confidence interval for the difference in mean GnRH mRNA levels between territorial and nonterritorial cichlids using the raw data.
   (d) Construct a 95% confidence interval for the difference in mean GnRH mRNA levels between territorial and nonterritorial cichlids by first log-transforming the data and then back-transforming the interval so that the interval you find is on the original scale.
   (e) Compare the two intervals. Which is better to use? Briefly defend your choice.