Lecture/text homework assignment # 7

Note: Please circle your answers when appropriate!

1) 14 chicks were feed soybeans for six weeks after hatching. Their weight in grams is given below:

														$\bar{y}$	s
243	230	248	327	329	250	193	271	316	267	199	171	158	248	246.43	54.129

a) Calculate a 90% CI for the weight of these chicks.

b) Calculate a 99% CI for the change in blood pressure.

c) Now conduct a one sample *t*-test using $\mu = 284$, and $\alpha = .10$. Are the results consistent with (a)? ***Why or why not?***

d) Finally, conduct a one sample *t*-test using $\mu = 284$, and $\alpha = .001$. Are the results consistent with (b)? ***Why or why not?***

(Make sure you answer the part in bold for (d) and (e). See also problem 5)

2) Here are the white blood cell counts of 7 patients (cells / mm^3):

8023 6212 7520 8158 7326 7955 7380

(a) Test H_0: $\mu = 7510.571$ Use $\alpha = 0.05$.

(b) Repeat, but now test H_0: $\mu = 8267$ Again, use $\alpha = 0.05$

(c) Finally repeat (b) except use $\alpha = 0.01$.

(d) What happened as you went from b to c (**explain!**).

(e) As you make α smaller does it become easier or more difficult to reject H_0? ***Why?*** ***Make sure you understand this!***

(f) What happens to the probability of a type II error as you make α smaller?

3) Let's investigate the white blood cells from problem 2 some more:

(a) Test H_0: μ = 10,271 using $\alpha = 0.001$ *(that's not a typo).*

(b) Figure out the *p*-value. To do this, take the t^* value that you calculated in (a) and use R:

```
pt(absolute-value-of-your-t*, df, lower.tail = FALSE)*2
```

*Since it's a two sided test, you need to multiply by 2 at the end. We'll talk more about this in lecture when we do one sided tests; for now just realize that without the "***2**" at the end R gives you a one sided p-value.*

For example, if your $t^* = -4.65$ and you have 67 degrees of freedom you would do:

```
pt(4.65,67,lower.tail = FALSE)*2
```

and you would get back 1.609352e-05

(c) Is the *p-value* smaller than α?

(d) ***Why is this (c) important (see also part (a))?***

It is essential that you understand question (c)!

(e) What is the smallest value of α for which you would reject the H_0? *Hint*: this will not be a "standard" value of α. The correct answer here is a value that is not only small, but totally absurd).

Another hint: think about the relationship of *p*-values to α. ***As mentioned in (d) it is very important that you understand the connection between α and p-values.***

(f) For which of the following values of α would you reject? **Why** (see (c & d))?

i) .10 ii) .05 iii) .01 iv) .001 v) .0000001

(note that no one in their right mind would actually use α = .0000001)

4) Let's examine the relationship between CI's and hypothesis tests:

Hint: you need to think about how/when confidence levels and hypothesis tests are equivalent. In particular, what happens to a CI as you change the confidence level (when does it get bigger? smaller?)? See also question 1.

(a) You calculate a 90% confidence interval for μ and come up with (12, 21). If you test H_0: $\mu = 10$ and use $\alpha = 0.1$, will you reject H_0? ***Why or why not?***

(b) Now you calculate a 95% CI for μ and come up with (34, 76). If you test H_0: $\mu = 83$ and use $\alpha = 0.1$, will you reject H_0? ***Why or why not?***

(c) You calculate a 98% CI for for μ and come up with (1.28, 3.32). If you test H_0: $\mu = 3.46$ and use $\alpha = .01$, will you reject H_0? ***Why or why not?***

(d) You calculate a 99% CI for for μ and come up with $(-11, 14)$. If you test H_0: $\mu = 13$ and use $\alpha = .05$, will you reject H_0? ***Why or why not?***

5) (a) Suppose you test a new medication and you fail to reject the null hypothesis (you conclude it does not work). What kind of error could you have made? ***Why?***

(b) Suppose you test a new medication and reject the null hypothesis (you conclude the medicine works). What kind of error could you have made? ***Why?***

6) (a) If you make α too big (e.g., $\alpha = 0.25$ (incidentally, you should *never* use $\alpha > 0.1$)), what kind of error are you more likely to make (type I or type II)? ***Why?***

(b) If you make α too small (e.g., $\alpha = 0.00000001$), what kind of error are you more likely to make? ***Why?***

Be prepared to discuss these problems in recitation Wednesday, June 24th. As usual, problems not discussed in recitation are due at the end of class.