STAtistics / Mr. Hansen Name: ___________________________
HW due 2/27/2012

1. Recruit 2 volunteers, preferably members of your household who have a large age difference, but 2 friends or strangers on the street will do if you cannot pin down anyone in your house. Write their names here, with the older one first:

_________________________________ _________________________________

2. Define μ_1 and μ_2 here. *Hint:* These are the true mean drop times, in seconds.

Let μ_1 = ____

Let μ_2 = ____

I am going to write your null and alternative hypotheses. For practice, you must rewrite them below, using correct notation. Yes, I realize that this is busywork. No, I do not feel guilty. Yes, you need to practice doing this. No, I am not being cruel.

H_0: $\mu_1 = \mu_2$
H_a: $\mu_1 \neq \mu_2$

Note: If you prefer, you can write the alternative hypothesis in a "one-tailed" form if you can reasonably predict that subject 1 will be slower:

H_a: $\mu_1 > \mu_2$ [sometimes written as $\mu_1 - \mu_2 > 0,$ which is of course equivalent]

Now it's your turn to write H_0 and H_a. Note that we use a colon after the H_0 or H_a.

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3. Practice holding a ruler vertically by the 12-inch end. The test subject should place his or her thumb and index finger at the 0-inch end, holding those fingers flush with the bottom of the ruler but not touching the ruler. The thumb should be on the side of the ruler that is numbered in the units that you wish to use (either inches or centimeters, your choice). At a random time not communicated to the test subject, drop the ruler so that the subject has to catch it by pinching thumb and index finger together. Practice doing this several times until both you and the subject are comfortable with the procedure. Write the number of practice tests for each subject here:

# of practice tests for subject 1 = _____ ; # of practice tests for subject 2 = _____

4. Gather at least 10 data points for each subject, and record these measurements in the table below. Each time, record the ruler reading (in inches or centimeters, your choice) at which the top of the subject's *thumb* comes to rest. Centimeters may be slightly easier, since you can avoid fraction-to-decimal conversions, but inches are fine, too. If the subject is not paying attention and misses the ruler altogether, record "N/A" in your data log, but do not count that as one of the 10 data points.

Trial #	Subject 1	Subject 2	Units (indicate **inches** or **cm**)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

5. Store your ruler readings for subject 1 in L_3 (note: not L_1) and your ruler readings for subject 2 in L_4 (note: not L_2). Compute sample mean and sample s.d. for list 3 and for list 4 (using STAT CALC 1 2nd 3 ENTER, then STAT CALC 1 2nd 4 ENTER), and record those statistics below. Use correct notation! The first 2 symbols are provided for you.

   $\bar{x}_3$ = ______________________

   s_3 = ______________________

   ____ = ______________________

   ____ = ______________________

6. If the drop distance equals d, then the drop time equals $\sqrt{\frac{2d}{g}}$, where g represents the gravitational constant for Washington, DC, which is 385.8888 inches/sec^2 or 980.16 cm/sec^2. Convert your ruler "drop distances" to "drop times" by using the formulas below for both of your test subjects:

   For inches:

   2nd [SQUARE ROOT SYMBOL] (2*L_3/385.8888) STO L_1 ENTER
   2nd [SQUARE ROOT SYMBOL] (2*L_4/385.8888) STO L_2 ENTER

   For centimeters:

   2nd [SQUARE ROOT SYMBOL] (2*L_3/980.16) STO L_1 ENTER
   2nd [SQUARE ROOT SYMBOL] (2*L_4/980.16) STO L_2 ENTER

There is nothing to record in your HW log for step 6. Just write 2 check marks here to indicate that you did the conversion for both test subjects: _____ _____

7. Record the sample mean and sample s.d. of drop time for each subject. Use correct notation!

____ = ____________________

____ = ____________________

____ = ____________________

____ = ____________________

8. Punch buttons on your calculator (STAT TESTS 4) to perform a 2-sample *t* test to see whether there is statistically significant evidence to reject H_0. Report the *P*-value, and write a conclusion in the context of the problem. Use $\alpha = 0.05$. (In other words, you will need a *P*-value of less than 0.05 in order to claim statistical significance.)

Note: **Throughout the entire year, always choose "Pooled:No" when running statistical tests.**

For example, if my test subject 1 (Dad) has a mean drop time of 0.1499 seconds and a sample s.d. of 0.021883 seconds, and if my test subject 2 (Skeeter) has a mean drop time of 0.1554 seconds and a sample s.d. of 0.012795 seconds, then my *P*-value for a 2-tailed test is 0.503. Conclusion: There is no evidence ($t = -0.686$, $n_1 = n_2 = 10$, df = 14.51, $P = 0.503$) that the true mean ruler drop times for Dad and Skeeter are unequal.

If Dad's sample mean had been 0.1613 seconds with a sample s.d. of 0.03488, and if Skeeter's sample mean had been 0.13245 seconds with a sample s.d. of 0.01664, then my conclusion would be different. Conclusion: There is good evidence ($t = 2.36$, $n_1 = n_2 = 10$, df = 12.895, $P = 0.035$) that the true mean ruler drop times for Dad and Skeeter are unequal.

P = ________________

Conclusion in context:

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9. In the second example above, can I say that there is good evidence that Dad's true mean drop time is greater than Skeeter's? Explain briefly.

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