Lab in Human Cognition - Gureckis   **Exercise 1**
In this exercise, you will use Excel to generate a description of some data.

Step 1 - Do together
Use Excel to generate a set of 25 random values. Label them at the top as "Data"

Step 2 - Do together
Your goal is to compute the following "descriptive statistics" about the data:

          mean, median, sum of squared deviations, std. dev, variance,
          Q1 value, Q3 value, Max, Min

You should do this two ways, first by hand by computing sums and deviations. Second, using
excel's built in functions. Make sure the values match. For help, below is a cheat-sheet of
excel functions.

Function	Excel Function Name
mean	=AVERAGE(DATA)
median	=MEDIAN(DATA)
std. dev.	=STDEV(DATA)
quartile	=QUARTILE(DATA, Q) where Q = 1,2,3,4
max	=MAX(data)
min	=MIN(data)

Step 3 - on your own
Create a second set of data (labeled Data 2), which is a copy of Data above but + 10 to each
value. Which values will change and which won't? Recompute the descriptive statistics by hand
and using excel's builtin functions. Make sure the values match. Were you right? Which were
wrong? Think about why.

Step 4 - one your own
Create a fourth set of data (labeled Data 2), which is a copy of Data above but times 4 to each
value. Which values will change and which won't? Is is different from step 3? Recompute the
descriptive statistics by hand and using excel's built-in functions. Make sure the values match.
Were you right? Which were wrong? Think about why.

Bonus:
Generate a new set of Data (3). However make it so that the mean of the data is 10.
Recompute all the standard measures on it. Describe how you did this.

Step 5 - Do together
Use Excel to generate a set of 25 random values. Label them at the top as "Data 1". Make the mean=0 and std. dev. = 10. Remember you can do this with =NORMINV(DATA(), 0, 10). Create a second set of 25 values labeled "Data 2" make the mean=10 and std. dev.=10.

Step 6 - Do together
Compute the following statistical descriptions of the data:

    mean, median, std. dev

Using functions in excel. For help, below is a cheat-sheet of excel functions.

Function	Excel Function Name
mean	=AVERAGE(DATA)
median	=MEDIAN(DATA)
std. dev.	=STDEV(DATA)

Step 7 - Together
For each column, we want to test the null hypothesis that the true mean is zero. To do this in excel, we first need to convert the mean we computed for each column into a mean. Remember the equation for the t-value is

$$t = (mean - null\ hypothesis) / (std.\ dev./ SQRT(N))$$

where here our null hypothesis is that mean true mean is zero. Once we have our t-value you can convert this into a probability using

$$= TDIST(t\text{-}value, degrees\ of\ freedom, tails)$$

where degrees of freedom is N-1 and tails = 2 (we want the two-tailed test).

Step 8 - Repeat
Repeat this on the second column

Step 9 - Compute a paired t-test
To compute the paired t-test we want to do a t-test (as before) but on the difference scores between the two condition. To do this, we first compute the difference from column 1 to column 2 as a new data set (labeled Data 3). Then we repeat the mean/std. dev./t- calculations again using the null hypothesis of zero (that the true difference is zero).