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## LESSON 15 - HYPOTHESIS TESTING; DEPENDENT SAMPLES

As an example, consider problem 13 on page 467. We will use the P-Value method to test the nutritionist's claim at the 0.10 level of significance. Enter the data into columns C1 and C2 and label them X1 and X2 respectively. Enter  $d$  as the label of C3. Clear the Session Window below the date/time stamp, type your name, Lesson 15, Example, and define the variables as

X1 = a weight before exercise program  
X2 = a weight after exercise program  
 $d = X1 - X2$

To compute  $d = X1 - X2$  click on Calc > Calculator. Select  $d$  into the "Store results in variable:" box and type X1-X2 into the "Expression:" box. When the dialog box looks like the figure on the right, click "OK".

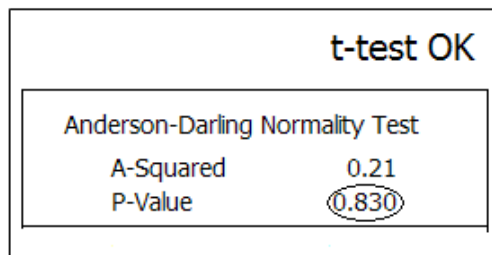
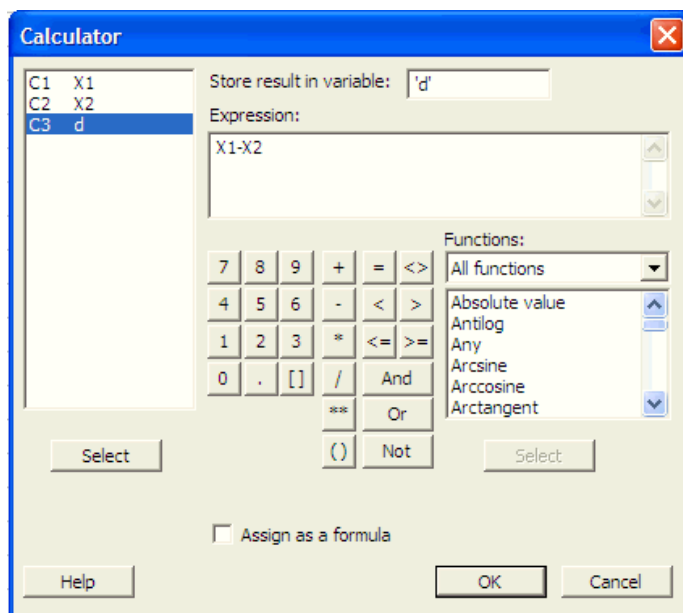
Now display the three columns of data.

Since we have a small sample, we must use the t-test, but we must first make sure that  $d$  is approximately normal so that we can be sure the t-test is appropriate. We use the Anderson-Darling Normality Test on the variable  $d$  as we did in Lesson 13. The figure on the right shows the relevant part of the graphical summary, and we can see that the t-test is OK. When doing the assignment for this lesson you will, of course, print and submit the entire graphical summary page.

The nutritionist's claim is that participants will lose weight with the exercise program. So the claim is that  $\mu_d > 0$ .

Now conduct a t-test on  $d$  the same as we did in Lesson 13. The "Hypothesized mean:" in the "1-Sample t" dialog box will be zero and the "Alternative:" in the "Options:" box will be "greater than." Finally, type in the decision and the conclusion using the P-Value and  $\alpha = 0.1$ .

The session window which results from the above procedures is on the next page.



NOTE: Minitab does have a test called "Paired t" located under Stat > Basic Statistics. It simplifies the work done above, but it does NOT check  $d$  for normality, so the test may not be valid. That is why the procedure described above should be used unless  $d$  is known to be normal.

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Lesson 15  
Example

X1 = a weight before exercise program  
X2 = a weight after exercise program  
 $d = X1 - X2$

### Data Display

Row	X1	X2	d
1	157	150	7
2	185	181	4
3	120	121	-1
4	212	206	6
5	230	215	15
6	165	169	-4
7	207	210	-3
8	251	232	19
9	196	188	8
10	140	138	2
11	137	145	-8
12	172	172	0

### One-Sample T: d

Test of  $\mu = 0$  vs  $> 0$

Variable	N	Mean	StDev	SE Mean	95% Lower Bound	T	P
d	12	3.75	7.84	2.26	-0.31	1.66	0.063

Decision: Since the P-Value = 0.063 < 0.10, reject H0

Conclusion: There is sufficient evidence to support the claim that the exercise program helps participants lose weight.

## MINITAB ASSIGNMENT 15

**See instructions on page 8.**

1. Do problem 15 on page 468 using the procedure outlined above.

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