Section 8-3 Inferences about Two Means: Matched Pairs

1. The sample data consist of matched pairs.
2. The samples are simple random samples.
3. If the number of pairs of sample data is small ($n \le 30$), then the population of differences in the paired values must be approximately *normally distributed.*

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Notation for Matched Pairs

μ_d = mean value of the differences d for the population of paired data

$\bar{d}$ = mean value of the differences d for the paired sample data (equal to the mean of the $x - y$ values)

s_d = standard deviation of the differences d for the paired sample data

n = number of pairs of data.

Test Statistic $$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}}$$

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Critical Values

If $n \le 30$, critical values are found in Table A-3 (t-distribution).

If $n > 30$, critical values are found in Table A- 2 (normal distribution).

Confidence Intervals

$$\bar{d} - E < \mu_d < \bar{d} + E$$

where $E = t_{\alpha/2} \frac{s_d}{\sqrt{n}}$

degrees of freedom = n -1

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How Much Do Male Statistics Students Exaggerate Their Heights?

Ex1a) Using the following data (except the outlier) test the claim that male statistics students do exaggerate by reporting their heights much greater than their actual measured heights. Use a .05 significance level.

Student												
Reported Height	68	74	82.25	66.5	69	68	71	70	70	67	68	70
Measured Height	66.8	73.9	74.3	66.1	67.2	67.9	69.4	69.9	68.6	67.9	67.6	68.8
Difference	1.2	0.1	7.95 ↑	0.4	1.8	0.1	1.6	0.1	1.4	-0.9	0.4	1.2

We will use a graphing calculator to find our data:

- Enter L_1 as the reported heights and L_2 as the measured heights.
- $L_1 - L_2 \rightarrow L_3$ arrow is under STO above ON button.
- Stats, calculate, 1- var stats, enter
- 1-var stats L_3 and you get data.

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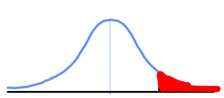
1. group #1 is the recorded heights
   group #2 is the measured heights
   group 1 > greater 2
   group 1 - group 2 > 0
   $\mu_d > 0$

   $H_0: \mu_d \le 0$ $H_1: \mu_d > 0$

$\bar{d} = 0.672727$
s = 0.825943
n = 11
$t_{\alpha/2} = 2.228$

2. Test statistics: $t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}}$ $\frac{.672727 - 0}{\frac{.825943}{\sqrt{11}}} = 2.701$

3. Critical Value:



1.812

4. Conclusion: Reject Null. There is sufficient evidence to support that the males exaggerated their heights.

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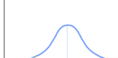
$\bar{d} = 0.672727$
s = 0.825943
n = 11
$t_{\alpha/2} = 2.228$

$E = t_{\alpha/2} \frac{s_d}{\sqrt{n}}$

$E = (2.228)\left(\frac{0.825943}{\sqrt{11}}\right)$

= 0.554841



$\bar{d} - E < \mu_d < \bar{d} + E$

$0.12 < \mu_d < 1.23$

the interval does not contain 0, the true value of μ_d is significantly different from 0. There is sufficient evidence to support the claim that there is a difference between the reported heights and the measured heights of male statistics students.

On a graphing calculator:

- stats
- scroll over to tests
- #8 TInterval test
- Data
- L_3
- C-level .95
- Calculate

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Ex1b)

SAT before course:	700	840	830	860	840	690	830	1180	930	1070
SAT after course:	720	840	820	900	870	700	800	1200	950	1080

Is there sufficient evidence to conclude the course is effective in raising in raising scores? Use a .05 for α.

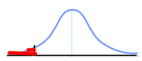
1. group 2 > group 1
-group 1 + group 2 > 0
group 1 - group 2 < 0
$H_0: \mu_d \geq 0$ $H_1: \mu_d < 0$

2. Test statistics:

$\bar{d} = -11$
s = 20.24845673
n = 10

$$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}} \qquad \frac{-11 - 0}{\frac{20.24845673}{\sqrt{10}}} = -1.718$$

3. critical value:



-1.833

4. conclusion: fail to reject: There is not sufficient evidence to support $\mu_d < 0$. Test scores are not improving.

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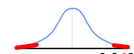
Ex1b continued) Determine a 95% confidence interval estimate between the before and after SAT scores.

$$E = t_{\alpha/2} \frac{s_d}{\sqrt{n}}$$

$\bar{d} = -11$
s = 20.24845673
n = 10

$$\frac{2.262\,(20.24845673)}{\sqrt{10}}$$

14.5



-2.262   2.262

$$\bar{d} - E < \mu_d < \bar{d} + E$$

$-11 - 14.5 < \mu_d < -11 + 14.5$
$-25.5 < \mu_d < 3.5$

The confidence interval contains 0, so there isn't a significant difference between the two groups means.

In graphing calculator run a t-test and see if it is the same answer?

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