

Name: _____

1. Problem

An experiment has $n_1 = 3$ plants in the treatment group and $n_2 = 6$ plants in the control group. After some time, the plants' heights (in cm) are measured, resulting in the following data:

	value1	value2	value3	value4	value5	value6
sample 1:	1.07	0.98	1			
sample 2:	1.86	2.77	2.8	1.91	2.37	2.21

- (a) Determine degrees of freedom.
- (b) Determine t^* for a 99% confidence interval.
- (c) Determine SE .
- (d) Determine a lower bound of the 99% confidence interval of $\mu_2 - \mu_1$.
- (e) Determine an upper bound of the 99% confidence interval of $\mu_2 - \mu_1$.
- (f) Determine $|t_{obs}|$ under the null hypothesis $\mu_2 - \mu_1 = 0$.
- (g) Determine a lower bound of the two-tail p -value.
- (h) Determine an upper bound of two-tail p -value.
- (i) Do you reject the null hypothesis with a two-tail test using a significance level $\alpha = 0.01$? (yes or no)

1. (a)

					2
--	--	--	--	--	---

 .

0	0	0
---	---	---

(b)

					9
--	--	--	--	--	---

 .

9	2	0
---	---	---

(c)

					0
--	--	--	--	--	---

 .

1	6	8
---	---	---

(d)

				-	0
--	--	--	--	---	---

 .

3	6	7
---	---	---

(e)

					2
--	--	--	--	--	---

 .

9	6	7
---	---	---

(f)

					7
--	--	--	--	--	---

 .

7	2	0
---	---	---

(g)

					0
--	--	--	--	--	---

 .

0	1	0
---	---	---

(h)

					0
--	--	--	--	--	---

 .

0	2	0
---	---	---

(i)

no

1. Solution

These data are unpaired. We might as well find the sample means and sample standard deviations (use a calculator's built-in function for standard deviation).

$$\bar{x}_1 = 1.02$$

$$\bar{x}_2 = 2.32$$

$$s_1 = 0.0473$$

$$s_2 = 0.407$$

We make a conservative estimate of the degrees of freedom using the appropriate formula.

$$df = \min(n_1, n_2) - 1 = \min(3, 6) - 1 = 2$$

We use the t table to find t^* such that $P(|T| < t^*) = 0.99$

$$t^* = 9.92$$

We use the SE formula for unpaired data.

$$SE = \sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}} = \sqrt{\frac{(0.0473)^2}{3} + \frac{(0.407)^2}{6}} = 0.168$$

We find the bounds of the confidence interval.

$$CI = (\bar{x}_2 - \bar{x}_1) \pm t^* SE$$

$$CI = (-0.367, 2.967)$$

We find t_{obs} .

$$t_{\text{obs}} = \frac{(\bar{x}_2 - \bar{x}_1) - (\mu_2 - \mu_1)_0}{SE} = \frac{(2.32 - 1.02) - 0}{0.168} = 7.72$$

We find $|t_{\text{obs}}|$.

$$|t_{\text{obs}}| = 7.72$$

We use the table to determine bounds on p -value. Remember, $df = 2$ and $p\text{-value} = P(|T| > |t_{\text{obs}}|)$.

$$0.01 < p\text{-value} < 0.02$$

We should consider both comparisons to make our decision.

$$|t_{\text{obs}}| < t^*$$

$$p\text{-value} > \alpha$$

Thus, we retain the null hypothesis. Also notice the confidence interval does contain 0.

- (a) 2
- (b) 9.92
- (c) 0.168
- (d) -0.367
- (e) 2.967
- (f) 7.72
- (g) 0.01
- (h) 0.02
- (i) no