

Name: _____

1. Problem

An experiment has $n_1 = 6$ 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:	0.98	1.03	1.12	1.02	1.3	1.02
sample 2:	1.18	1.34	1.19	1.13	1.22	1.22

- (a) Determine degrees of freedom.
- (b) Determine t^* for a 98% confidence interval.
- (c) Determine SE .
- (d) Determine a lower bound of the 98% confidence interval of $\mu_2 - \mu_1$.
- (e) Determine an upper bound of the 98% confidence interval of $\mu_2 - \mu_1$.
- (f) Determine $|t_{\text{obs}}|$ 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 $\alpha = 0.02$? (yes or no)

1. (a)

					5
--	--	--	--	--	---

 .

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

(b)

					3
--	--	--	--	--	---

 .

3	6	0
---	---	---

(c)

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

 .

0	5	6
---	---	---

(d)

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

 .

0	5	8
---	---	---

(e)

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

 .

3	1	8
---	---	---

(f)

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

 .

3	1	8
---	---	---

(g)

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

 .

0	5	0
---	---	---

(h)

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

 .

1	0	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).

$$\bar{x}_1 = 1.08$$

$$\bar{x}_2 = 1.21$$

$$s_1 = 0.118$$

$$s_2 = 0.0703$$

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

$$df = \min(n_1, n_2) - 1 = \min(6, 6) - 1 = 5$$

We use the t table to find t^* such that $P(|T| < t^*) = 0.98$

$$t^* = 3.36$$

We use the SE formula for unpaired data.

$$SE = \sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}} = \sqrt{\frac{(0.118)^2}{6} + \frac{(0.0703)^2}{6}} = 0.056$$

We find the bounds of the confidence interval.

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

$$CI = (-0.058, 0.318)$$

We find t_{obs} .

$$t_{\text{obs}} = \frac{(\bar{x}_2 - \bar{x}_1) - (\mu_2 - \mu_1)_0}{SE} = \frac{(1.21 - 1.08) - 0}{0.056} = 2.32$$

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

$$|t_{\text{obs}}| = 2.32$$

We use the table to determine bounds on p -value. Remember, $df = 5$ and $p\text{-value} = P(|T| > |t_{\text{obs}}|)$.

$$0.05 < p\text{-value} < 0.1$$

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) 5
- (b) 3.36
- (c) 0.056
- (d) -0.058
- (e) 0.318
- (f) 2.318
- (g) 0.05
- (h) 0.1
- (i) no