Solutions

(1) **Paired by Location**

$\bar{d} = 1.58 \quad s_d \approx 0.817$

$df = n - 1 = 4$

$\alpha = 0.05$

$t_{\alpha/2} = 2.776$

$$\bar{d} \pm t_{\alpha/2} \frac{s_d}{\sqrt{n}}$$

$$1.58 \pm 2.776 \left(\frac{0.817}{\sqrt{5}}\right)$$

$$\boxed{0.6 \le \mu_1 - \mu_2 \le 2.6}$$

(2) $n < 30$ ✓

Differences must be normally distributed ✓

* PAIRED BY LOCATION *

(3) 1) $H_0: \mu_1 - \mu_2 = 0$ $H_a: \mu_1 - \mu_2 > 0$

$\boxed{\text{right-tailed}}$

2) Assumptions:

$n < 30$ ✓

differences are normally distributed ✓

3) $n = 5$ $\bar{d} = 1.58$ $s_d \approx 0.817$

$t = \dfrac{\bar{d} - D_0}{s_d/\sqrt{n}}$ D_0 comes from H_0:

$\mu_1 - \mu_2 = 0 \leftarrow D_0$

$= \dfrac{1.58 - 0}{(0.817/\sqrt{5})}$

≈ 4.324

4) $df = 4$ $\boxed{\text{right-tailed}}$

$\alpha = 0.05$

$t_\alpha = 2.132$

0.05

$t_\alpha = 2.132$

5) Reject H_0.

$\mu_1 - \mu_2 > 0$ or $\mu_1 > \mu_2$

6) p-value?

?

4.324

$t_{0.01}$ $t_{0.005}$

$df = 4$ $\boxed{3.747 \uparrow 4.604}$ $\boxed{0.005 < p < 0.01}$

4.324

④ * INDEPENDENT SAMPLES *

1) $H_0: \mu_1 - \mu_2 = 0$ $\quad H_a: \mu_1 - \mu_2 \neq 0$

$\boxed{\text{two-tailed}}$

2) Assumptions: $n_1 < 30$ or $n_2 < 30$ ✓

both populations normal ✓

$\dfrac{\text{larger } s^2}{\text{smaller } s^2} \le 3$ ✓

3) $$t = \frac{\bar{x}_1 - \bar{x}_2 - D_0}{\sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$s^2 = \frac{9s_1^2 + 9s_2^2}{18} = 0.031$$

D_0 comes from H_0:

$\mu_1 - \mu_2 = 0 \leftarrow D_0$

$$= \frac{59.646 - 59.627 - 0}{\sqrt{0.031\left(\frac{1}{10} + \frac{1}{10}\right)}}$$

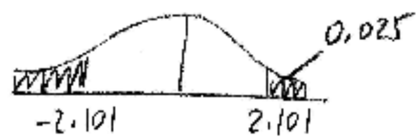
≈ 0.241

4) $\boxed{\text{two-tailed}}$

$df = n_1 + n_2 - 2 = 18$

$\alpha = 0.05$

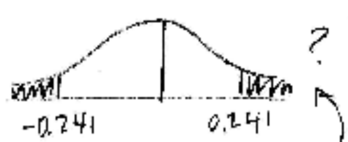
$t_{\alpha/2} = 2.101$



5) Don't reject H_0.

$\mu_1 - \mu_2 = 0$ or $\mu_1 = \mu_2$

6) p-value?



	$t_{0.1}$
$df = 18$	$\boxed{1.330}$

0.241

area > 0.1

$\boxed{p > 0.2}$

(5) * INDEPENDENT SAMPLES *

$df = n_1 + n_2 - 2 = 18$

$\alpha = 0.01$

$t_\alpha = 2.552$

$s^2 = \frac{9(0.027) + 9(0.035)}{18}$

$= 0.031$

99% UCB for $\mu_1 - \mu_2$:

$$\bar{x}_1 - \bar{x}_2 + t_\alpha \sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$59.646 - 59.627 + 2.552 \sqrt{\left(0.031\left(\frac{1}{10} + \frac{1}{10}\right)\right)}$$

$$\boxed{\mu_1 - \mu_2 \le 0.220}$$

(6) * INDEPENDENT SAMPLES *

$df = n_1 + n_2 - 2 = 18$

$\alpha = 0.05$

$t_\alpha = 1.734$

$s^2 = \frac{9(0.027) + 9(0.035)}{18}$

$= 0.031$

95% LCB for $\mu_1 - \mu_2$:

$$\bar{x}_1 - \bar{x}_2 - t_\alpha \sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$59.646 - 59.627 - 1.734 \sqrt{\left(0.031\left(\frac{1}{10} + \frac{1}{10}\right)\right)}$$

$$\boxed{-0.118 \le \mu_1 - \mu_2}$$

(7) $n_1 < 30$ or $n_2 < 30$ ✓

both populations normal ✓

$\frac{\text{larger } s^2}{\text{smaller } s^2} \le 3$ ✓

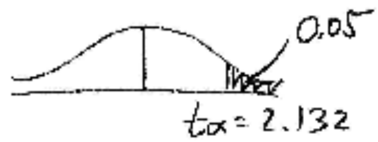
(8) * PAIRED BY WEEK *

$n=5 \quad \bar{d} = 0.008 \quad s_d \approx 0.045$

$df = n-1 = 4$

$\alpha = 0.05$

$t_\alpha = 2.132$



$$\bar{d} + t_\alpha \frac{s_d}{\sqrt{n}}$$

$$0.008 + 2.132 \left(\frac{0.045}{\sqrt{5}}\right)$$

$$\boxed{\mu_1 - \mu_2 \le 0.05}$$

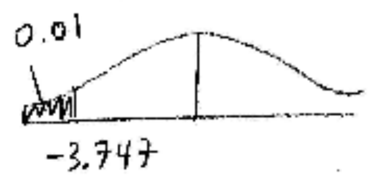
(9) * PAIRED BY WEEK *

$n=5 \quad \bar{d} = 0.008 \quad s_d \approx 0.045$

$df = n-1 = 4$

$\alpha = 0.01$

$t_\alpha = 3.747$



$$\bar{d} - t_\alpha \frac{s_d}{\sqrt{n}}$$

$$0.008 - 3.747 \left(\frac{0.045}{\sqrt{5}}\right)$$

$$\boxed{-0.07 \le \mu_1 - \mu_2}$$

(10) * INDEPENDENT SAMPLES *

$n_1 = 4$ $\bar{x}_1 = 1.3075$ $n_2 = 4$ $\bar{x}_2 = 1.27$

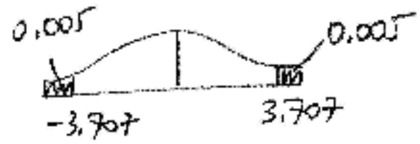
$s_1^2 \approx 0.006$ $s_2^2 = 0.0022$

(Assumptions : $n_1 < 30$ or $n_2 < 30$ ✓
both populations normal ✓
$\frac{\text{larger } s^2}{\text{smaller } s^2} \le 3$ ✓)

$df = n_1 + n_2 - 2 = 6$

$\alpha = 0.01$

$t_{\alpha/2} = 3.707$



$\bar{x}_1 - \bar{x}_2 \pm t_{\alpha/2} \sqrt{s^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$ $s^2 = \frac{3(0.006) + 3(0.0022)}{6}$

$= 0.0041$

$1.3075 - 1.27 \pm 3.707 \sqrt{\left(0.0041\left(\frac{1}{4} + \frac{1}{4}\right)\right)}$

$\boxed{-0.13 \le \mu_1 - \mu_2 \le 0.21}$