Stewart Dulaney
MATH 54
Section 4053
SID: 1545566

HW 5

11.1

1. independent

5. independent, qualitative

$x_1 = 368$, $n_1 = 541$, $x_2 = 351$, $n_2 = 593$

9. Step 0) Conditions: $\hat{p}_1 = \frac{368}{541} = 0.6802$ $\hat{p}_2 = \frac{351}{593} = 0.5919$

① independent simple random sample ✓

② $n_1 \hat{p}_1 (1 - \hat{p}_1) \geq 10$ $n_2 \hat{p}_2 (1 - \hat{p}_2) \geq 10$

$(541)(0.6802)(1 - 0.6802) \geq 10$ $(593)(0.5919)(1 - 0.5919) \geq 10$

$117.68 \geq 10$ ✓ $143.24 \geq 10$ ✓

③ $n \leq 0.05N$ ✓ (assumed)

a) Step 1) $H_0: p_1 = p_2$

$H_1: p_1 > p_2$ (right-tailed)

Step 2) $\alpha = 0.05$

b) Step 3) $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{368 + 351}{541 + 593} = 0.6340$

$$z_0 = \frac{\hat{p}_1 - \hat{p}_2 - (p_1 - p_2)}{\sqrt{\hat{p}(1 - \hat{p})}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{0.6802 - 0.5919 - 0}{\sqrt{0.6340(1 - 0.6340)}\sqrt{\frac{1}{541} + \frac{1}{593}}}$$

$= 3.08$

c) $z_\alpha = z_{0.05} = 1.645$

d) P-value $= P(z > 3.08)$

$= 1 - P(z \leq 3.08)$

$= 1 - 0.9990$

$= 0.001$

Step 4) Classical:

$z_0 > z_\alpha$?

$3.08 > 1.645$

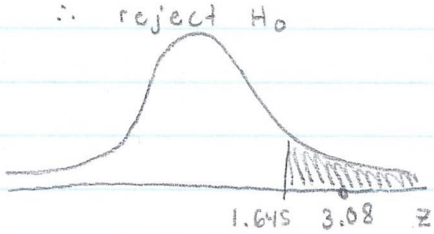
$\therefore$ reject H_0

P-value:

P-value $< \alpha$?

$0.001 < 0.05$

$\therefore$ reject H_0



Step 5) There is sufficient evidence to conclude $p_1 > p_2$.

13. $x_1 = 368$, $n_1 = 541$, $x_2 = 421$, $n_2 = 593$, 90% confidence

Step 1) $\hat{p}_1 = \frac{368}{541} = 0.6802$ $\hat{p}_2 = \frac{421}{593} = 0.7099$

Step 2) Conditions:

① independent simple random sample ✓ (assumed)

② $n_1 \hat{p}_1 (1 - \hat{p}_1) \geq 10$ $n_2 \hat{p}_2 (1 - \hat{p}_2) \geq 10$

$(541)(0.6802)(1 - 0.6802) \geq 10$ $(593)(0.7099)(1 - 0.7099) \geq 10$

$117.68 \geq 10$ ✓ $122.12 \geq 10$ ✓

③ $n \leq 0.05 N$ ✓ (assumed)

Step 3) $z_{\alpha/2} = z_{0.10/2} = z_{0.05} = 1.645$ $\alpha = 1 - 0.90 = 0.10$

Step 4) LB: $(\hat{p}_1 - \hat{p}_2) - z_{\alpha/2} \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

$= (0.6802 - 0.7099) - (1.645)\sqrt{\frac{0.6802(1-0.6802)}{541} + \frac{0.7099(1-0.7099)}{593}}$

$= -0.0747$

UB: $(\hat{p}_1 - \hat{p}_2) + z_{\alpha/2} \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

$= (0.6802 - 0.7099) + (1.645)\sqrt{\frac{0.6802(1-0.6802)}{541} + \frac{0.7099(1-0.7099)}{593}}$

$= 0.0153$

Step 5) We are 90% confident the difference $p_1 - p_2$ is between -0.0747 and 0.0153.

$x_1 = 107$, $n_1 = 710$, $x_2 = 67$, $n_2 = 611$

17. Step 0) Conditions:

① independent samples and completely randomized experiment w/ two levels of treatment ✓ (Prevnar, control vaccine)

② $\hat{p}_1 = \frac{107}{710} = 0.1507$ $\hat{p}_2 = \frac{67}{611} = 0.1097$

$(710)(0.1507)(1 - 0.1507) \geq 10$ $(611)(0.1097)(1 - 0.1097) \geq 10$

$90.87 \geq 10$ ✓ $59.67 \geq 10$ ✓

③ $n_1 \leq 0.05 N_1$ $n_2 \leq 0.05 N_2$

✓ b/c at least 100,000 infants age 2 months old

Step 1) $H_0: p_1 = p_2$

$H_1: p_1 > p_2$ (right-tailed)

Step 2) $\alpha = 0.05$

Classical Step 3) $\hat{p} = \frac{107 + 67}{710 + 611} = 0.1317$

$$z_0 = \frac{0.1507 - 0.1097}{\sqrt{0.1317(1-0.1317)}\sqrt{\frac{1}{710} + \frac{1}{611}}} = 2.20$$

$z_\alpha = z_{0.05} = 1.645$

Step 4) $z_0 > z_\alpha$?

$2.20 > 1.645$

$\therefore$ reject H_0

Step 5) There is sufficient evidence to conclude a higher proportion of subjects in group 1 experienced fever as a side effect than subjects in group 2.

21. $x_1 = 181$, $n_1 = 1205$, $x_2 = 143$, $n_2 = 1097$

Step 1) $\hat{p}_1 = \frac{181}{1205} = 0.1502$ $\quad \hat{p}_2 = \frac{143}{1097} = 0.1304$

Step 2) Conditions:

1. independent simple random sample ✓
2. $(1205)(0.1502)(1-0.1502) \geq 10$ $\quad (1097)(0.1304)(1-0.1304) \geq 10$

   $153.81 \geq 10$ ✓ $\quad 124.40 \geq 10$ ✓
3. $n_1 \leq 0.05 N_1$ ✓ b/c at least 1 million males

   $n_2 \leq 0.05 N_2$ ✓ b/c at least 1 million females

Step 3) 95% $\rightarrow \alpha = 1 - 0.95 = 0.05$

$z_{0.05/2} = z_{0.025} = 1.96$

Step 4) LB: $(0.1502 - 0.1304) - (1.96)\sqrt{\frac{0.1502(1-0.1502)}{1205} + \frac{0.1304(1-0.1304)}{1097}}$

$= -0.0086$

UB: $(0.1502 - 0.1304) + (1.96)\sqrt{\frac{0.1502(1-0.1502)}{1205} + \frac{0.1304(1-0.1304)}{1097}}$

$= 0.0482$

Step 5) We are 95% confident that the difference in the proportion of males and females that have at least one tattoo is between -0.0086 and 0.0482.

$H_0: p_m = p_f$

$H_1: p_m \neq p_f$

Because the interval includes zero, we do not reject the null hypothesis. There is no significant difference in the proportion of males and females that have tattoos.

$x_1 = 50,\ n_1 = 1655,\ x_2 = 31,\ n_2 = 1652$

25. a) completely randomized experiment

b) response variable: whether experienced dry mouth or not; qualitative with two possible outcomes

c) explanatory variable: type of drug; two levels: Clarinex or placebo

d) Double-blind means that neither the subject nor the individual monitoring the subject knows which treatment the subject is receiving (Clarinex or placebo).

e) (1) So there is a baseline group against which to judge the Clarinex group

(2) To eliminate any effect due to psychosomatic behavior

f) Step 0) Conditions:

1. independent samples and completely randomized experiment w/ two levels of treatment ✓ (Clarinex, Placebo)

2. $\hat{p}_1 = \frac{50}{1655} = 0.0302 \qquad \hat{p}_2 = \frac{31}{1652} = 0.0188$

$(1655)(0.0302)(1-0.0302) \geq 10 \qquad (1652)(0.0188)(1-0.0188) \geq 10$

$48.47 \geq 10$ ✓ $\qquad 30.47 \geq 10$ ✓

3. $n_1 \leq 0.05 N_1 \qquad n_2 \leq 0.05 N_2$

✓ b/c more than 10 million Americans are allergy sufferers

Step 1) $H_0: p_1 = p_2$

$H_1: p_1 > p_2$ (right-tailed)

Step 2) $\alpha = 0.05$

P-value

Step 3) $\hat{p} = \frac{50 + 31}{1655 + 1652} = 0.0245$

$$z_0 = \frac{0.0302 - 0.0188}{\sqrt{0.0245(1-0.0245)}\sqrt{1/1655 + 1/1652}}$$

$= 2.12$

P-value $= P(z > 2.12) = 1 - P(z \leq 2.12)$

$= 1 - 0.9830$

$= 0.017$

Step 4) P-value $< \alpha$?

$0.017 < 0.05$

$\therefore$ reject H_0

Step 5) There is sufficient evidence to conclude that the proportion of individuals experiencing dry mouth is greater for those taking Clarinex than for those taking a placebo.

g) The difference in sample proportions is 0.0114 (0.0302 vs. 0.0188). This is a small difference (about 1 in 100) and no reason to avoid Clarinex (and suffer from allergies) simply to avoid a potential dry mouth. The statistical significance is partially due to the large sample size (which was necessary to be able to use the normal model).

29.

1.2 1. <

5. a) $H_0: \mu_d = 0$

$H_1: \mu_d > 0$

b) Step 0) Conditions:

① matched-pairs design experiment ✓

② sample data are dependent ✓

③ differences are normally distributed w/ no outliers ✓ (given)

④ $n \leq 0.05N$ ✓ b/c at least 100,000 10 month old babies

Step 1) $H_0: \mu_d = 0$

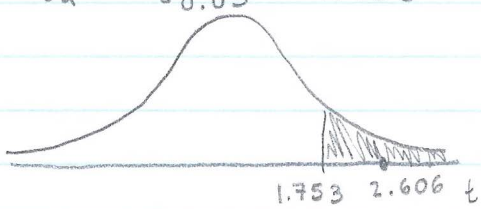
$H_1: \mu_d > 0$ (right-tailed)

Classical Step 2) $\alpha = 0.05$

Step 3) $\bar{d} = 1.14$ $\quad s_d = 1.75$ $\quad df = 16 - 1 = 15$

$$t_0 = \frac{\bar{d} - \mu_d}{s_d/\sqrt{n}} = \frac{1.14 - 0}{1.75/\sqrt{16}} = 2.606$$

$t_\alpha = t_{0.05} = 1.753$



Step 4) $t_0 > t_\alpha$?

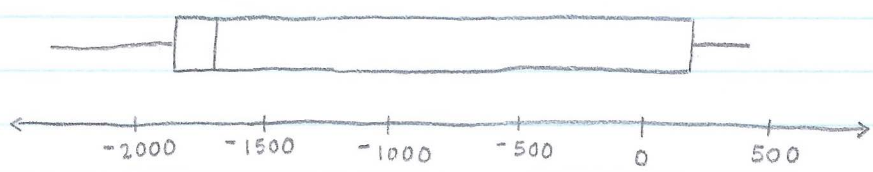
$2.606 > 1.753$

$\therefore$ reject H_0

Step 5) There is sufficient evidence to conclude that the difference in the amount of time the baby will watch the hinderer toy versus the helper toy is greater than 0 at the 0.05 level of significance.

9. a) These are matched pairs b/c the car and the SUV were involved in the same collision

b)



The median of the differences is well to the left of 0 suggesting that SUVs do have a lower repair cost.

c) Step 0) Conditions:

① matched-pairs design experiment ✓

② sample data are dependent ✓

③ differences are normally distributed w/ no outliers ✓ (given)

④ $n \leq 0.05N$ ✓ b/c at least 1,000 collisions w/ SUV and car

P-value

Step 1) $H_0: \mu_d = 0$

$H_1: \mu_d < 0$ (left-tailed)

Step 2) $\alpha = 0.05$

Step 3) $\bar{d} = {}^-1117.1429$ $\quad S_d = 1100.6213$ $\quad df = 7-1 = 6$

$$t_0 = \frac{{}^-1117.1429}{1100.6213/\sqrt{7}} = {}^-2.685$$

$$\text{P-value} = P(t < {}^-2.685)$$

$$= P(t > 2.685) \text{ by symmetry of t-Distribution}$$

$$2.612 < t_0 < 3.143$$

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

Step 4) P-value < α ?

Max (P-value) = 0.0199 < 0.05

∴ reject H_0

Step 5) There is sufficient evidence to conclude the repair cost for the car is higher at the $\alpha = 0.05$ level of significance.

13. Step 1) $\bar{d} = 1.3333$ $\quad S_d = 1.5$ $\quad d_i$ = diamond - steel

Step 2) Conditions:

① matched-pairs design experiment ✓

② sample data are dependent ✓

③ differences are normally distributed w/ no outliers ✓ (given)

④ $n \leq 0.05$ ✓ b/c at least 200 specimens

Step 3) $\alpha = 1 - 0.95 = 0.05$ $\quad df = 9-1 = 8$

$$t_{\alpha/2} = t_{0.05/2} = t_{0.025} = 2.306$$

Step 4) LB : $\bar{d} - t_{\alpha/2}\left(\frac{s_d}{\sqrt{n}}\right) = 1.3333 - (2.306)\left(\frac{1.5}{\sqrt{9}}\right) = 0.1803$

UB : $\bar{d} + t_{\alpha/2}\left(\frac{s_d}{\sqrt{n}}\right) = 1.3333 + (2.306)\left(\frac{1.5}{\sqrt{9}}\right) = 2.4863$

Step 5) We are 95% confident that the difference in hardness reading is between 0.1803 and 2.4863.

$H_0 : \mu_d = 0$

$H_1 : \mu_d \neq 0$ (two-tailed)

B/c the interval does not include 0, we reject the null hypothesis. There is sufficient evidence to conclude that the two indenters produce different hardness readings.

17. a) Drivers and cars behave differently, so this reduces variability in mpg attributable to the car and the driver's driving style.

b) Driving conditions also affect mpg. By conducting the experiment on a closed track, driving conditions are constant.

c) Neither variable is normally distributed b/c $0.877 < 0.923$ and $0.879 < 0.923$

d) $0.966 > 0.923$

The difference in mileage appears to be approximately normal

e) Step 0) Conditions :

① matched-pairs design experiment ✓

② sample data are dependent ✓

③ differences are normally distributed ✓ w/ no outliers ✓ (assumed)

④ $n \leq 0.05N$ ✓ b/c at least 1 million drivers

P-value Step 1) $H_0 : \mu_d = 0$ d_i = 92 octane − 87 octane

$H_1 : \mu_d > 0$

Step 2) $\alpha = 1 - 0.95 = 0.05$

Step 3) P-value = 0.141

Step 4) P-value $< \alpha$?

$0.141 \not< 0.05$

$\therefore$ do not reject H_0

Step 5) There is not sufficient evidence to conclude the mileage from 92 octane is greater than the mileage from 87 octane.

We would expect to get the results we obtained or a more extreme difference in about 14 out of 100 samples if the statement in the null hypothesis were true. Our results are not unusual. Therefore, do not reject H_0.

11.3 1. a) Step 0) Conditions:

① simple random sample ✓

② samples are independent ✓

③ populations normally distributed ✓ (given)

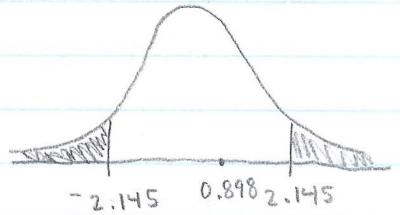
④ $n_1 \leq 0.05 N_1$, $n_2 \leq 0.05 N_2$ ✓ (assumed)

Step 1) $H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$ (two-tailed)

Step 2) $\alpha = 0.05$

Classical Step 3) $t_0 = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}}} = \dfrac{(15.3 - 14.2) - 0}{\sqrt{\dfrac{(3.2)^2}{15} + \dfrac{(3.5)^2}{15}}} = 0.898$



$t_{\alpha/2} = t_{0.05/2} = t_{0.025} = 2.145$

$df = 15 - 1 = 14$

$-t_{\alpha/2} = -2.145$

Step 4) $t_0 < -t_{\alpha/2}$ or $t_0 > t_{\alpha/2}$?

$0.898 \not< -2.145$ $0.898 \not> 2.145$

$\therefore$ do not reject H_0

Step 5) There is not sufficient evidence to conclude the population means are different at the $\alpha = 0.05$ level of significance.

b) Step 1) $\bar{x}_1 = 15.3$, $s_1 = 3.2$, $\bar{x}_2 = 14.2$, $s_2 = 3.5$

Step 2) Conditions:

① simple random sample ✓

② samples are independent ✓

③ populations normally distributed ✓ (given)

④ $n_1 \leq 0.05 N_1$, $n_2 \leq 0.05 N_2$ ✓ (assumed)

Step 3) $t_{\alpha/2} = t_{0.05/2}$ $\quad\alpha = 1 - 0.95 = 0.05$

$= t_{0.025} = 2.145$ $\quad df = n_1 - 1 = 15 - 1 = 14$

Step 4) LB: $(\bar{x}_1 - \bar{x}_2) - t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = (15.3 - 14.2) - (2.145)\sqrt{\frac{(3.2)^2}{15} + \frac{(3.5)^2}{15}}$

$= -1.5265$

UB: $(\bar{x}_1 - \bar{x}_2) + t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = (15.3 - 14.2) + (2.145)\sqrt{\frac{(3.2)^2}{15} + \frac{(3.5)^2}{15}}$

$= 3.7265$

Step 5) We are 95% confident the difference in population means $\mu_1 - \mu_2$ is between -1.5265 and 3.7265.

5. Step 0) Conditions:

1. simple random sample ✓
2. samples are independent ✓
3. populations normally distributed ✓
4. $n_1 \leq 0.05N_1$, $n_2 \leq 0.05N_2$ ✓ (assumed)

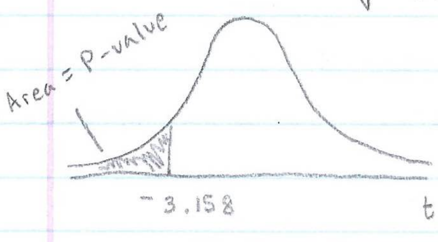
Step 1) $H_0: \mu_1 = \mu_2$

$H_1: \mu_1 < \mu_2$ (left-tailed)

Step 2) $\alpha = 0.02$

P-value

Step 3) $t_0 = \dfrac{(103.4 - 114.2)}{\sqrt{\frac{(12.3)^2}{32} + \frac{(13.2)^2}{25}}} = -3.158$ $\quad df = n_2 - 1 = 25 - 1 = 24$



P-value $= P(t < -3.158)$

$= P(t > 3.158)$ by symmetry of t-Dist.

$3.091 < t_0 < 3.467$

$0.001 < \text{P-value} < 0.0025$

Step 4) P-value $< \alpha$?

Max(P-value) $= 0.0025 < 0.02$

$\therefore$ reject H_0

Step 5) There is sufficient evidence to conclude $\mu_1 < \mu_2$ at the $\alpha = 0.02$ level of significance.

9. a) observational b/c the researcher did not influence the data

b) ① Treat the data as a simple random sample ✓

② The samples are obtained independently ✓

③ The sample sizes are large ✓ ($n_1 \geq 30$ and $n_2 \geq 30$)

④ Each sample is small relative to the population size ✓

($n_1 \leq 0.05 N_1$ and $n_2 \leq 0.05 N_2$ b/c at least 100,000 people get on and off planes each year)

c) Step 0) Conditions:

✓ (part b)

Step 1) $H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$ (two-tailed)

Step 2) $\alpha = 0.05$

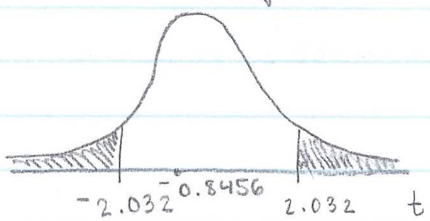
Classical

Step 3) $t_0 = \dfrac{(260 - 269)}{\sqrt{\dfrac{53^2}{35} + \dfrac{34^2}{35}}} = -0.8456$

$df = n_1 - 1 = 35 - 1 = 34$

$t_{\alpha/2} = t_{0.05/2} = t_{0.025} = 2.032$

$-t_{\alpha/2} = -2.032$



Step 4) $t_0 < -t_{\alpha/2}$ or $t_0 > t_{\alpha/2}$?

$-0.8456 \not< -2.032$ $\quad$ $-0.8456 \not> 2.032$

$\therefore$ do not reject H_0

Step 5) There is not sufficient evidence at the $\alpha = 0.05$ level of significance to conclude individuals walk at different speeds depending on whether they are departing or arriving.

13. a) Ramp Meters On:

$Q_1 = 31$

$M = 42$

$Q_3 = 48$

$IQR = Q_3 - Q_1 = 48 - 31 = 17$

$LF = Q_1 - 1.5(IQR) = 31 - 1.5(17) = 5.5$

$UF = Q_3 + 1.5(IQR) = 48 + 1.5(17) = 73.5$

Ramp Meters Off:

$Q_1 = 26$

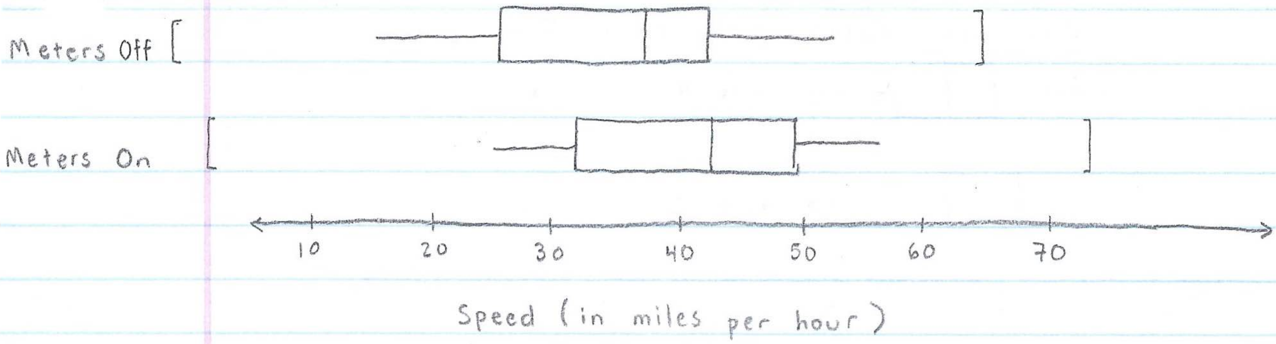
$M = 37$

$Q_3 = 41$

$IQR = 41 - 26 = 15$

$LF = 26 - 1.5(15) = 3.5$

$UF = 41 + 1.5(15) = 63.5$



There are no outliers. The speed w/ the meters on appears to be higher than the speed with the meters off.

b) Step 0) Conditions:

① simple random sample ✓

② samples obtained independently ✓

③ populations normally distributed ✓ (given)

④ $n_1 \leq 0.05 N_1$ $n_2 \leq 0.05 N_2$ ✓ b/c at least 100,000 cars on freeways w/ and w/o meters

Step 1) $H_0: \mu_1 = \mu_2$

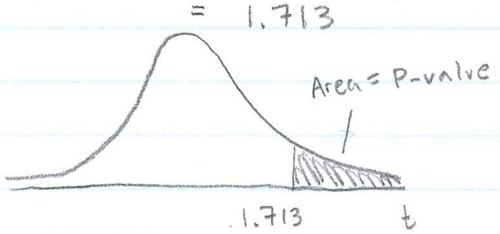
$H_1: \mu_1 > \mu_2$ (right-tailed)

Step 2) $\alpha = 0.10$

P-value   Step 3) $t_0 = \dfrac{(40.6667 - 34.5333)}{\sqrt{\dfrac{10.0404^2}{15} + \dfrac{9.5608^2}{15}}}$ $\bar{x}_1 = 40.6667$, $s_1 = 10.0404$

$\bar{x}_2 = 34.5333$, $s_2 = 9.5608$

$= 1.713$ P-value $= P(t > 1.713)$



$df = n_1 - 1 = 15 - 1 = 14$

$1.345 < t_0 < 1.761$

$0.05 <$ P-value < 0.10

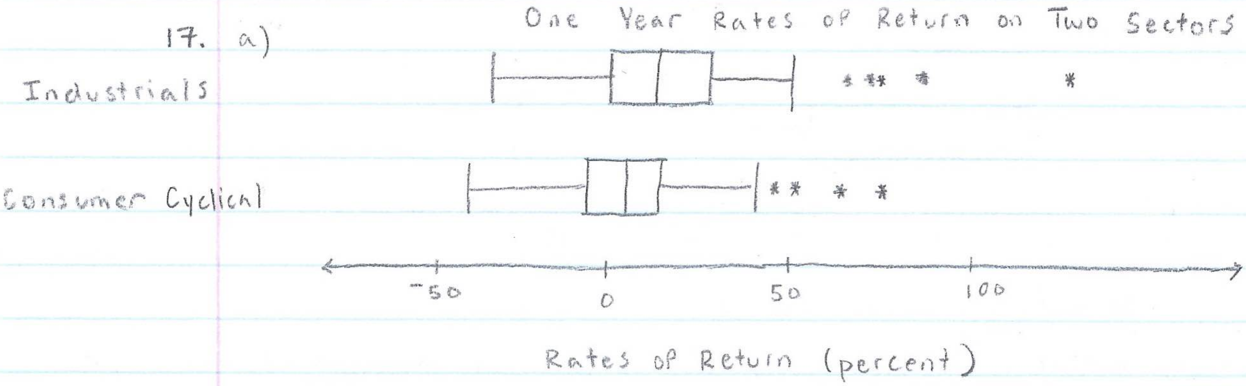
Step 4) P-value $< \alpha$?

Max (P-value) $= 0.0999 < 0.10$

$\therefore$ reject H_0

Step 5) There is sufficient evidence at the $\alpha = 0.10$ level of significance to conclude the ramp meters are effective in maintaining a higher speed on the freeway.

17. a)



Industrial stocks appear to have a higher median rate of return.

b) ① Treat each sample as a simple random sample ✓

② Each sample is obtained independently of the other ✓

③ Each sample size is large ✓ ($n_1 \geq 30$ and $n_2 \geq 30$)

④ Each sample size is small relative to the size of its population ✓

The response variable is quantitative and there are two groups to compare.

c) Step 0) Conditions:

✓ (part b)

Step 1) $H_0: \mu_{cc} = \mu_I$

$H_1: \mu_{cc} \neq \mu_I$ (two-tailed)

Step 2) $\alpha = 0.05$

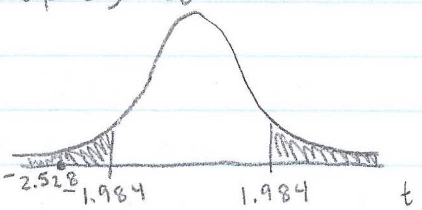
Classical

Step 3) $t_0 = -2.528$

df = 100

$t_{\alpha/2} = t_{0.05/2} = t_{0.025} = 1.984$

$-t_{\alpha/2} = -1.984$



Step 4) $-2.528 < -1.984$ or $-2.528 \not> 1.984$?

$\therefore$ reject H_0

Step 5) There is sufficient evidence at the $\alpha = 0.05$ level of significance to conclude that the mean one-year rate of return for consumer cyclical stocks is different from that of industrial stocks.

d) LB : 1.684

UB : 13.976

We are 95% confident the mean difference in rate of return of industrial stocks versus consumer cyclical stocks is between 1.684% and 13.976%. This suggests that the one-year rate of return on industrial stocks was higher than consumer cyclical stocks by somewhere between 1.684% and 13.976% for this time period.

21. a) Step 0) Conditions :

① simple random sample ✓

② samples obtained independently ✓

③ $n_1 \geq 30$ and $n_2 \geq 30$ ✓

④ $n_1 \leq 0.05N_1$ and $n_2 \leq 0.05N_2$ ✓ b/c at least 1 billion men and women

Step 1) $H_0: \mu_M = \mu_W$

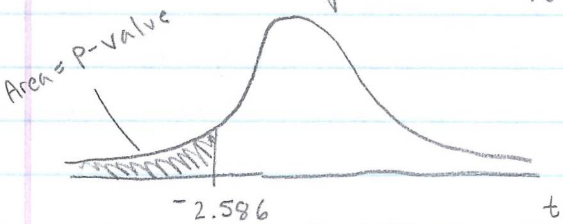
$H_1: \mu_M < \mu_W$ (left-tailed)

b) Step 2) $\alpha = 0.01$

P-value

Step 3) $t_0 = \dfrac{(112.3 - 118.3)}{\sqrt{\dfrac{11.3^2}{51} + \dfrac{14.2^2}{70}}} = -2.586$

$df = n_M - 1 = 51 - 1 = 50$



P-value $= P(t < -2.586)$

$= P(t > 2.586)$ by symmetry of t-Dist.

$2.403 < t_0 < 2.678$

$0.005 <$ P-value < 0.01

Step 4) P-value $< \alpha$?

Max(P-value) $= 0.0099 < 0.01$

$\therefore$ reject H_0.

Step 5) There is sufficient evidence at the $\alpha = 0.01$ level of significance to conclude that the mean step pulse of men is less than the mean step pulse of women.

c) Step 1) $\bar{x}_1 = 112.3$, $s_1 = 11.3$, $\bar{x}_2 = 118.3$, $s_2 = 14.2$

Step 2) Conditions:

✓ (part b)

Step 3) $\alpha = 1 - 0.95 = 0.05$ $\quad df = n_1 - 1 = 51 - 1 = 50$

$t_{\alpha/2} = t_{0.05/2} = t_{0.025} = 2.009$

Step 4) LB: $(112.3 - 118.3) - (2.009)\sqrt{\frac{11.3^2}{51} + \frac{14.2^2}{70}} = -10.6617$

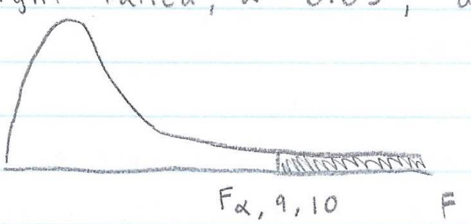
UB: $(112.3 - 118.3) + (2.009)\sqrt{\frac{11.3^2}{51} + \frac{14.2^2}{70}} = -1.3383$

Step 5) We are 95% confident the mean difference in pulse rates of men versus women is between -10.6617 and -1.3383 beats per minute.

We are 95% confident that the mean step pulse of men is between 1.3383 and 10.6617 beats per minute lower than the mean step pulse of women.

25. The sampling method is independent (the freshman cannot be matched to the corresponding seniors). Therefore, the inferential method that may be applied is a two-sample t-test. This comparison, however, has major shortcomings. The goal of the CLA + is to measure gains in critical thinking, analytical reasoning, and so on, as a result of four years of college. The logical design to measure this is as a matched-pairs design where the exam is administered before and after college to the same student.

11.4 1. right-tailed, $\alpha = 0.05$, df numerator = 9, df denominator = 10



$F_{\alpha,9,10} = F_{0.05,9,10} = 3.02$