Theodore Jagodits/ MA 331/ HW#4

I pledge that I have abided by the Stevens Honor System.

MA331 HW #4 3/1/2020

6.99

a) $H_0 = \mu = 2403.7$ $H_A = \mu > 2403.7$

$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$ $\sigma = 880$

a) $z = \frac{2453.7 - 2403.7}{880/\sqrt{100}} = .568$

$P(x > .568) = .285$

b) $z = \frac{2453.7 - 2403.7}{880/\sqrt{500}} = 1.27$

$P(x > 1.27) = .102$

c) $z = \frac{2453.7 - 2403.7}{880/\sqrt{2500}} = 2.8409$

$P(x > 2.8409) = 0.0023$

6.120

a) reject H_0 when $x \leq 2$ so type I

for $p_0 = .1 + .1 + .2 = .4$ error is p_0

$p_1 = .2 + .2 + .2 = .6$ is correct

but we accept p_1

$P(\text{Type I}) = 1 - .4 = .6$

b) $P(\text{Type II}) = 1 - .6 = .4$

7.22 $H_0: \mu = 8$ $H_A: \mu > 8$ $n = 16$ $t = 2.15$

a) d.f. = n − 1 = 16 − 1 = 15

b) for 2.15, the value that bracket it are:
2.13 ($p = .025$) and 2.249 ($p = .2$)

c) falls in between: $P(.25 < x < .2)$

d) at $\alpha = .05$) ~~p value~~ = .0241 which means its significan since $p < .05$
at $\alpha = .01$ it is not significant since $p \nless .01$

e) $p = .0241$
steps on TI83 calc → ttest → tcdf
→ (−1000, 2.15, 15) ✓ = .0241

7.23 two sided
$H_0: \mu = 40$ $H_A: \mu \neq 40$ $n = 27$ $t = 2.01$

a) df = 27 − 1 = 26

b) from ~~t~~ table D: [1.706, 2.056]

c) $2P(.05 \leq x \leq .025)$

$P = .025 \leq x \leq .0125$

d) ~~a~~ at $\alpha = .05$, no it is significant since $p \nless .05$
at $\alpha = .01$ it is not since $p \nless .01$

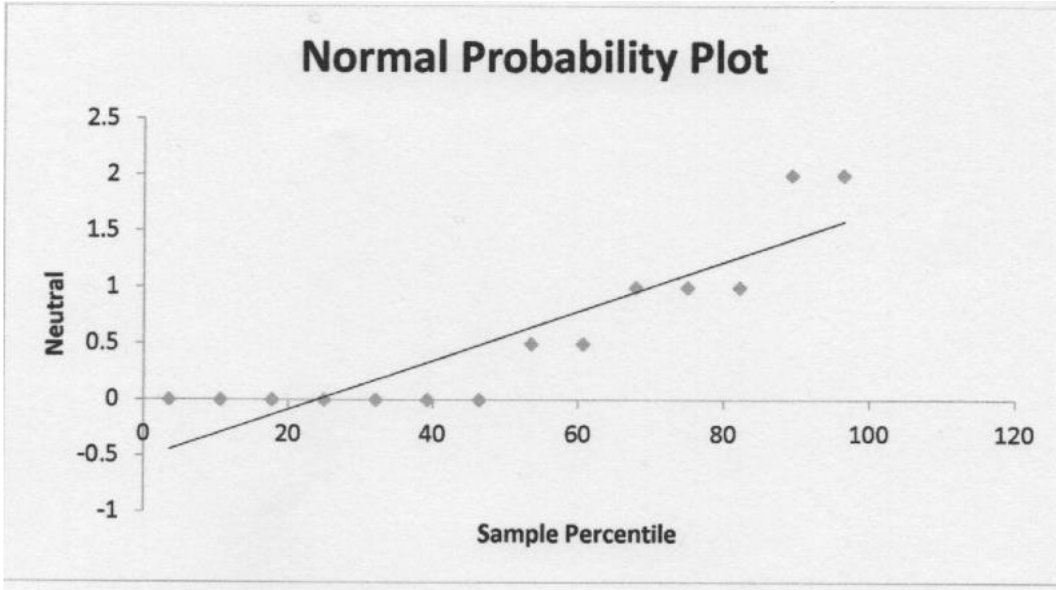
e) $p = .054$ ~~does not~~ is not significant at .05

7.71

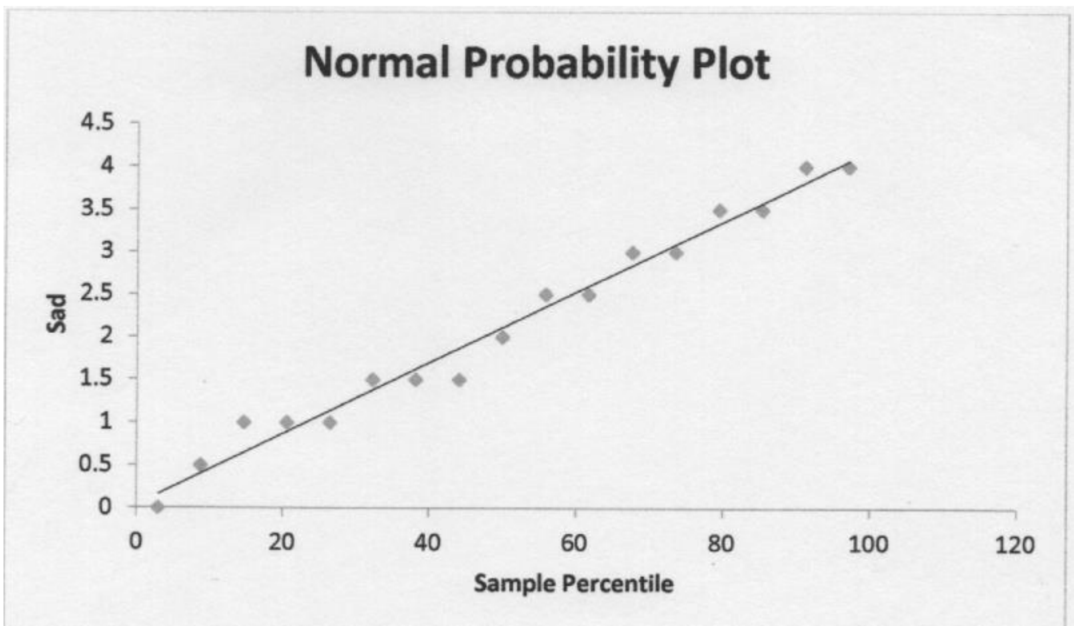
a) t sampling would be good since both samples are small and follow a t-distribution, not following a z-distribution. Also the t method works better since we have an unknown standard deviation.

b) above

c) $H_0: \mu_1 = \mu_2$ ⇒ there is no significant difference of the mean price of purchasing insulated water bottles
$H_A: \mu_1 \neq \mu_2$ ⇒ there is sufficient significant difference in the mean price.



for 7.71a



for 7.71a

Neutral Prices	
Sample Size	14
Mean	0.57
Standard Deviation	0.734

Sad Prices	
Sample Size	17
Mean	2.12
Standard Deviation	1.24

for 7.71b

d) $\bar{x}_1$ = avg. price for neutral group
$\bar{x}_2$ = avg price sad group

$\alpha = .05$

$df = \min\{13, 16\}$
$= 13$

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{.57 - 2.12}{\sqrt{\frac{(.73)^2}{14} + \frac{(1.24)^2}{17}}} = -4.31$$

$$PVal = 2P(t > -4.31) = 1 - 2P(t \leq -4.31) = .000$$

Since the Pvalue is very small compared to the significance level .05, we reject the H_0. Therefore we can conclude that there is sufficient difference in the mean price between the neutral and sad group.

e) 95% CI

$$(\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n}} = (.571 - 2.118) \pm 2.16 \sqrt{\frac{.73^2}{14} + \frac{1.24^2}{17}}$$

$1.547 \pm .776$

$= 95\%$ CI : $(-2.323, -.771)$

7.89

a) $H_0: \mu_{breastfed} = \mu_{formula}$ = breastfed baby and formula fed babies level of hemoglobin are the same

$H_A: \mu_{breastfed} > \mu_{formula}$ = hemoglobin is higher in breastfed bab than formulas

$$t = \frac{13.3 - 12.4}{\sqrt{\frac{1.7^2}{23} + \frac{1.8^2}{19}}} = 1.654$$

Pval = 0.053

Since the Pvalue is greater then the significance level .05 we fail to reject the H_0. Thus, we can conclude there is no significant evidence to support that the mean hemoglo is higher in breast fed babies

b) $t = (\bar{x}_1 - \bar{x}_2) \pm t^* \sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n}} = (13.3 - 12.4) \pm 2.01 \sqrt{\frac{1.7^2}{23} + \frac{1.8^2}{19}}$

95% CI : $(-.243, 2.04)$

c) The key assumption is that the values a) and b) is correct is that they are independent samples taken from a normal population.

7.102 $n_1 = 1$ $n_2 = 16$ $s_1^2 = 3.5$ $s_2^2 = 9.1$ $\alpha = .05$

a) $H_0 : \theta_1 = \theta_2$

$H_A : \theta_1 \neq \theta_2$

$F = \frac{\text{large variance}}{\text{small variance}}$ $\quad \theta_2 > \theta_1$

$F = \frac{9.1}{3.5} = \boxed{2.6}$ f-test value

b) $F_{(n_2-1,\, n_1-1),\, \alpha}$

$F = (0.05, 15, 10) = 2.85$

FINV in excel

c) Since $2.6 < 2.85$ that means that the statistic value is less than the critical value. Thus we fail to reject the H_0 and we conclude that both population have the same standard deviation.

7.122

a)

N	mean	std. dev.	SE mean
group 1	49.69	2.32	.73
group 2	50.55	1.92	.61

tval = -.9 $\quad var_1 = 2.32^2 = 5.38$

pval = .38 $\quad Var_2 = 1.92^2 = 3.686$

df = 17

Since the Pval is greater than the $\alpha = .05$, we fail to reject the H_0. Thus we can conclude that there is not sufficient evidence that mean is different for the 2 groups

b) $H_0: \mu_d = 0$ $\alpha = .05$
$H_A: \mu_d \neq 0$

	mean	st.dev	se mean
group 1	49.692	2.318	0.733
group 2	50.545	1.924	0.609
diff	-.853	1.269	.401

95% CI: (-1.76, 0.055)

t-val : -2.13
P val : 0.062
$var(diff) = 1.269^2 = 1.611$

Since the Pval is greater than the $\alpha = .05$, we fail to reject the H_0. Thus we can conclude that there is not sufficient evidence to indicate groups are different

c) the 2 tests, the 2 sample t test and the paired t test show no difference between population means

8.71 $n_1 = 60$ $x_1 = 48$ $\hat{p}_1 = \frac{x_1}{n_1} = \frac{48}{60} = .80$

a)
$$SE(\hat{p}_1) = \sqrt{\frac{\hat{p}(1-\hat{p})}{n_1}} = \sqrt{\frac{.8(.2)}{60}} = 0.052$$

$n_2 = 132$ $x_2 = 52$ $\hat{p}_2 = \frac{52}{132} = .3939$

$$SE(\hat{p}_2) = \sqrt{\frac{(.39)(1-.39)}{132}} = 0.042$$

b) 95% CI:
$$(.8 - .3939) \pm 1.96\sqrt{\frac{.8(.2)}{60} + \frac{.3939(.6161)}{132}} = (.275, .537)$$

c) $H_0: P_1 = P_2$ $H_A: P_1 \neq P_2$ $\hat{p} = \frac{x_1 + x_2}{n_1 + n_2} = \frac{48 + 52}{60 + 132} = .521$

$$z = \frac{(\hat{P}_1 - \hat{P}_2) - (P_1 - P_2)}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{.8 - .3939 - 0}{\sqrt{.52(1-.52)\left(\frac{1}{60} + \frac{1}{32}\right)}} = 5.22$$

Since the test statistic is within the rejection region, we reject H_0. We can conclude there is a difference in references to females