Math 165 Test 5 Name: ____________________

1. The average yearly earnings of male college graduates (with at least a bachelor's degree) are \$58500 for men aged 25 to 34. The average yearly earnings of female college graduates with the same qualifications are \$49339. Based on the results below, can it be concluded that there is a difference in mean earnings between male and female college graduates? Use 1% level of significance. Use *P-Value* method.

	Male $\bar{x}_1$	Female $\bar{x}_2$
Sample mean	\$59235	\$52487
Population standard deviation	\$8945	\$10125
Sample size	40	35

① there is a difference in mean earnings between male and female college graduates.

② $H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$ (claim)

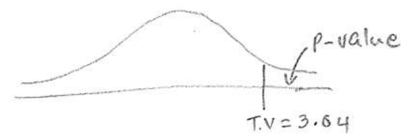
③ Test-Value

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$= \frac{(59235 - 52487) - (0)}{\sqrt{\frac{(8945)^2}{40} + \frac{(10125)^2}{35}}}$$

$$\approx 3.04$$

④ P-Value



p-value $= 2(0.0012) = 0.0024$

⑤ Informal Conclusion

p-value $< \alpha$

reject H_0

⑥ Conclusion

We have enough evidence to support that there is a difference in mean earnings between male and female college graduates.

2. Construct a 99% confidence interval for the difference of the two means for problem 1.

$\alpha = 1 - 0.99 = 0.01$

$\frac{\alpha}{2} = 0.005$

$z_{\frac{\alpha}{2}} = 2.575$

$$E = z_{\frac{\alpha}{2}} \cdot \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

$$= 2.575 \sqrt{\frac{(8945)^2}{40} + \frac{(10125)^2}{35}}$$

$$\approx 5717.05$$

$(\bar{x}_1 - \bar{x}_2) - E < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + E$

$6748 - 5717.05 < \mu_1 - \mu_2 < 6748 + 5717.05$

$1030.95 < \mu_1 - \mu_2 < 12465.05$

3. In an effort to increase production of an automobile part, the factory manager decides to play music in the manufacturing are. Eight workers are selected, and the number of items each produced for a specific day is recorded. After one week of music, the same workers are monitored again. The data are given in the table. At $\alpha = 0.05$, can the manager conclude that the music has increased production?

Worker	1	2	3	4	5	6	7	8
Before	6	8	10	9	5	12	9	7
After	10	12	9	12	8	13	8	10
D_{A-B}	4	4	-1	3	3	1	-1	3

$\bar{D} = 2$

$S_D = 2.1$

① the music has increased production.

② $H_0 : \mu_D = 0$

$H_1 : \mu_D > 0$ (claim)

③ Test-Value

$$t = \frac{\bar{D} - \mu_D}{\frac{S_D}{\sqrt{n}}} = \frac{2 - 0}{\frac{2.1}{\sqrt{8}}} \approx 2.694$$

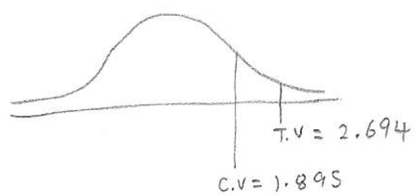
④ Critical Value

$\alpha = 0.05$

$d.f = n - 1 = 7$

$C.V = 1.895$

⑤ Informal Conclusion



Reject H_0.

⑥ Conclusion.

We have enough evidence to support that the music has increased production.

4. Construct a 90% confidence interval for the difference of the two for problem 3.

$\alpha = 1 - 0.90 = 0.10$

$\frac{\alpha}{2} = 0.05$

$d.f = n - 1 = 7$

$t_{\frac{\alpha}{2}} = 1.895$

$$E = t_{\frac{\alpha}{2}} \cdot \frac{S_D}{\sqrt{n}} = 1.895 \cdot \frac{2.1}{\sqrt{8}} \approx 1.407$$

$\bar{D} - E < \mu_D < \bar{D} + E$

$2 - 1.407 < \mu_D < 2 + 1.407$

$0.593 < \mu_D < 3.407$

5. According to the Bureau of Labor Statistic's American Time Use Survey (ATUS), married persons spend an average of 8 minutes per day on phone calls, mail, and e-mail, while single persons spend an average of 14 minutes per day on these same tasks. Based on the following information, is there sufficient evidence to conclude that single persons spend, on average, a greater time each day communicating? Use the 0.05 level of significance.

	μ_1 Single	μ_2 Married
Sample mean	16.7 minutes	12.5 miutes
Sample Variance	8.41	10.24
Sample size	26	20

① single persons spend a greater time each day communicating.

② $H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 > \mu_2$ (claim)

③ Test-Value

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$= \frac{(16.7 - 12.5) - 0}{\sqrt{\frac{8.41}{26} + \frac{10.24}{20}}}$$

$$\approx 4.595$$

④ Critical-Value

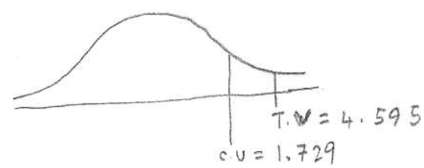
$\alpha = 0.05$

$d.f = n-1$

$= 19$

$C.V = 1.729$

⑤ Informal Conclusion



reject H_0

⑥ Conclusion

We have enough evidence to support that single persons, on average, spends a greater time each day communicating.

6. Construct 90% confidence interval for the difference of the two means for problem 6.

$\alpha = 1 - 0.90 = 0.10$

$\frac{\alpha}{2} = 0.05$

$d.f = n-1$

$= 19$

$t_{\frac{\alpha}{2}} = 1.729$

$$E = t_{\frac{\alpha}{2}} \cdot \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$= 1.729 \cdot \sqrt{\frac{8.41}{26} + \frac{10.24}{20}}$$

$$\approx 1.580$$

$(\bar{x}_1 - \bar{x}_2) - E < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + E$

$4.2 - 1.58 < \mu_1 - \mu_2 < 4.2 + 1.58$

$2.62 < \mu_1 - \mu_2 < 5.78$

7. In a sample of 200 men, 130 said they use seat belts. In a sample of 300 women, 63 said they used seat belts. Test the claim that women are more safety-conscious than ~~wo~~men, at $\alpha = 0.01$.

women	men	
$\hat{p}_1 = \frac{63}{300}$	$\hat{p}_2 = \frac{130}{200}$	$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$
$= 0.21$	$= 0.65$	$= \frac{63 + 130}{300 + 200}$
$\hat{q}_1 = 0.79$	$\hat{q}_2 = 0.35$	$= 0.386$
$n_1 = 300$	$n_2 = 200$	$\bar{q} = 0.614$

① women are more safety-conscious than men.

② $H_0 : p_1 = p_2$

$H_1 : p_1 > p_2$ (claim)

③ Test-value

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\bar{p}\bar{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$= \frac{(0.21 - 0.65) - (0)}{\sqrt{(0.386)(0.614)\left(\frac{1}{300} + \frac{1}{200}\right)}}$$

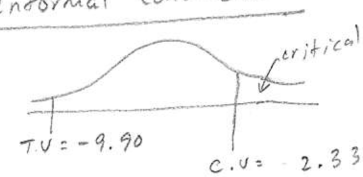
$$\approx -9.90$$

④ Critical value.

$\alpha = 0.01$

C.V $= 2.33$

⑤ Informal Conclusion.



do not reject H_0.

⑥ Conclusion

We do not have enough evidence to conclude that women are more safety-conscious than men.

8. Construct a 98% confidence interval for the true difference in the proportion for problem 7.

$\alpha = 1 - 0.98 = 0.02$

$\frac{\alpha}{2} = 0.01$

$z_{\frac{\alpha}{2}} = 2.33$

$$E = z_{\frac{\alpha}{2}} \cdot \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

$$= 2.33 \sqrt{\frac{(0.21)(0.79)}{300} + \frac{(0.65)(0.35)}{200}}$$

$$\approx 0.10$$

$$(\hat{p}_1 - \hat{p}_2) - E < p_1 - p_2 < (\hat{p}_1 - \hat{p}_2) + E$$

$$-0.44 - 0.10 < p_1 - p_2 < -0.44 + 0.10$$

$$-0.54 < p_1 - p_2 < -0.34$$