College Prep Stats
After Spring Break Review (9.2 ~ 9.3)

1. A poll found that 43% of 658 male voters and 46% of 717 female voters support a particular candidate. Conduct a hypothesis test whether this candidate has equal levels of support between male and female voters.

Check Requirements:
poll = SRS, male and female are independent
$658 * 0.43 = 282.94 \approx 283 > 5$, $283 / 658 \approx 0.43009$, $282 / 658 \approx 0.42857$,
$x_1 = 283$, $658 - 283 = 375 > 5$,
$717 * 0.46 = 329.82 \approx 330 > 5$, $330 / 717 \approx 0.46025$, $329 / 717 \approx 0.45886$,
$x_2 = 330$, $717 - 330 = 387 > 5$,

$H_0: \quad p_1 = p_2 \qquad H_1: \quad p_1 \neq p_2$

$\alpha = 0.05$

$$\bar{p} = \frac{283+330}{658+717} = 0.445818, \qquad \bar{q} = 0.554182$$

$$z = \frac{p_1 - p_2}{\sqrt{\bar{p}\bar{q}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \frac{0.43-0.46}{\sqrt{0.445818*0.554182\left(\frac{1}{658}+\frac{1}{717}\right)}} = -1.1239$$

P-Value = 0.2610 > 0.05 Fail to reject H_0

The is not sufficient evidence to warrant rejection of the claim that this candidate has equal levels of support between male and female voters.

2. 68% of students at a university live on campus. Two simple random samples found that 30 of 45 male students and 38 of 55 of female students live on campus. At the 0.05 level of significance, is there sufficient evidence to support the claim that a difference exists between the proportions of male and female students who live on campus?

Check Requirements:
SRS, male and female are independent
$x_1 = 30 > 5$, $45 - 30 = 15 > 5$,
$x_2 = 38 > 5$, $55 - 38 = 17 > 5$,

$H_0: \quad p_1 = p_2 \qquad H_1: \quad p_1 \neq p_2$

$\alpha = 0.05$

$\bar{p} = \frac{30+38}{45+55} = 0.68, \qquad \bar{q} = 0.32$

$$z = \frac{p_1 - p_2}{\sqrt{\bar{p}\bar{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{\frac{30}{45} - \frac{38}{55}}{\sqrt{0.68 * 0.32\left(\frac{1}{45} + \frac{1}{55}\right)}} = -0.2585$$

P-Value = 0.7960 > 0.05 Fail to reject H_0

There is not sufficient sample evidence to support the claim that a difference exists between the proportions of male and female students who live on campus.

3. A study of cats and dogs found that 31 of 50 cats and 23 of 45 dogs slept more than 10 hours per day. At the 0.05 level of significance, is there sufficient evidence to conclude that a difference exists between the proportions of cats and dogs that sleep more than 10 hours per day?

Check Requirements:
study = SRS, cat and dog are independent
$x_1 = 31 > 5$, $50 - 31 = 19 > 5$,
$x_2 = 23 > 5$, $45 - 23 = 22 > 5$,

$H_0: \quad p_1 = p_2 \qquad H_1: \quad p_1 \neq p_2$

$\alpha = 0.05$

$\bar{p} = \frac{31+23}{50+45} = 0.568421, \qquad \bar{q} = 0.431579$

$$z = \frac{p_1 - p_2}{\sqrt{\bar{p}\bar{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} = \frac{\frac{31}{50} - \frac{23}{45}}{\sqrt{0.568421 * 0.431579\left(\frac{1}{50} + \frac{1}{45}\right)}} = 1.0699$$

P-Value = 0.2847 > 0.05 Fail to reject H_0

There is not sufficient sample evidence to support the claim that a difference exists between the proportions of cats and dogs that sleep more than 10 hours per day.

4. Mauricio Cruz, a wine merchant for Cruz's Spirits Emporium, wants to determine if the average price of imported wine is less than the average price of domestic wine. He took two simple random samples and obtained the data shown in the table below.

Imported Wine	Domestic Wine
$\bar{X}_1 = \$7.03$	$\bar{X}_2 = \$9.78$
$s_1 = \$2.31$	$s_2 = \$3.62$
$n = 35$	$n = 38$

Perform a hypothesis test to Mauricio's thought.

Check Requirements:
SRS, imported wine and domestic wine are independent
$n_1 = 35 > 30$, $n_2 = 38 > 30$

$H_0: \ \mu_1 = \mu_2 \qquad H_1: \ \mu_1 < \mu_2$

$\alpha = 0.05$

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{7.03 - 9.78}{\sqrt{\frac{2.31^2}{35} + \frac{3.62^2}{38}}} = -3.8996$$

P-Value = 0.0001176 < 0.05 Reject H_0

The sample data support the claim that the average price of imported wine is less than the average price of domestic wine.

5. A local charity believes they receive more money from people in the River Heights neighborhood than from people in the Lakeview neighborhood. They conducted a survey of simple random sample of 40 people selected form each neighborhood and recorded the results. At $\alpha = 0.01$, is their hypothesis correct?

River Heights	Lakeview
$\bar{X}_1 = \$35/\text{person}$	$\bar{X}_2 = \$25/\text{person}$
$s_1 = \$5/\text{person}$	$s_2 = \$8/\text{person}$
$n = 40$	$n = 40$

Check Requirements:
SRS, the neighborhoods are independent
$n_1 = 40 > 30$, $n_2 = 40 > 30$

$H_0: \quad \mu_1 = \mu_2 \qquad H_1: \quad \mu_1 > \mu_2$

$\alpha = 0.01$

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{35 - 25}{\sqrt{\frac{5^2}{40} + \frac{8^2}{40}}} = 6.7040$$

P-Value $\approx 0 < 0.01$ Reject H_0

The sample data support the claim that they receive more money from people in the River Heights neighborhood than from people in the Lakeview neighborhood.

6. A pharmaceutical company is testing the effectiveness of a new drug for lowering cholesterol. As part of this trial, they wish to determine whether there is a difference between the effectiveness for women and men. At $\alpha = 0.05$, perform a hypothesis for the pharmaceutical company.

	Women	**Men**
Sample size	40	40
Mean effectiveness	6.4	6.7
Sample variance	3.6	2.6

Check Requirements:
trial = SRS, man and woman are independent
$n_1 = 40 > 30$, $n_2 = 40 > 30$

$H_0: \quad \mu_1 = \mu_2 \qquad H_1: \quad \mu_1 \neq \mu_2$

$\alpha = 0.05$

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{6.4 - 6.7}{\sqrt{\frac{3.6}{40} + \frac{2.6}{40}}} = -0.7620$$

P-Value = 0.4484 > 0.05 Fail to reject H_0

There is not sufficient sample evidence to support the claim that there is a difference between the effectiveness for women and men.