Confidence Intervals – 2 Sample Means

1. A group of 32 companies in the insurance industry has a mean annual profit as percent of revenue of 4.4 with a standard deviation of 1.6 while the mean annual profit as a percent of revenue for a group of 40 health care companies was 4.6 with a standard deviation of 1.4. Find a 90% confidence interval for the difference in mean annual profit. At the 90% level of confidence, does it appear that one industry group has a higher profit as a percentage of revenue?

2. A random sample of 45 professional football players indicated the mean height to be 6.18 feet with a sample standard deviation of 0.37 feet. A random sample of 40 professional basketball players indicated the mean height to be 6.45 feet with a standard deviation of 0.31 feet. Find a 95% confidence interval for the difference in mean heights of professional football and basketball players. Does it appear that the average height of football players tends to be shorter than the average height of basketball players?

3. A random sample of 43 eastern colleges hand an average percentage of salary increase for professors of 3.6 with a standard deviation of 1.8. Another random sample of 40 western colleges gave the average percentage of salary increases of professors as 3.3 with a standard deviation of 1.7. Compute a 90% confidence interval for the average difference in percent of salary increase between the eastern and western colleges. Does it appear that the average percentage salary increase for eastern college professors is higher than that for western college professors?

4. A random sample of 38 adult male wolves from the Canadian Northwest Territories gave an average weight of 98 pounds with standard deviation of 6.5 pound. Another sample of 64 adult male wolves from Alaska gave an average weight of 90 pounds with a standard deviation of 7.3 pounds. Find an 95% confidence interval for the difference in mean weight of the Canadian and Alaskan wolves. Does it appear that the average weight of the adult male wolves from Canada is greater than that of the Alaskan wolves?

Difference between two populations proportions

5) Do younger people use Twitter more often than older people? In a random sample of 316 adult Internet users aged 18-29, 26% used Twitter. In a separate random sample of 532 adult Internet users aged 30-49, 14% used Twitter. Construct and interpret a 90% confidence interval for the difference between the true proportions of adult Internet users in these age groups who use Twitter.

6) A surprising number of young adults (ages 19-25) still live in their parents' homes. A random sample by the National Institutes of Health included 2253 men and 2629 women in this age group. The survey found that 986 of the men and 923 of the women lived with their parents. a. Construct and interpret a 99% confidence interval for the difference in the true proportions of men and women aged 19-25 who live in their parents' homes. Does your interval from part (a) give convincing evidence of a difference between the population proportions? **Explain**.

7) Are teens or adults more likely to go to McDonalds weekly? The Pew Internet and American Life Project asked a random sample of 799 teens and a separate random sample of 2253 adults how often they go to McDonalds. In these two surveys,63% of teens and 68% of adults said that they go to McDonalds weekly. Construct and interpret a 90% confidence interval for the difference between adults and teens.

8) Is rap music more popular among young Indians than among young Asians? A sample survey compared 634 randomly chosen Indians aged 15 to 25 with 567 randomly selected Asians in the same age group. It found that 368 of the Indians and 130 Asians listened to rap music every day. Construct and interpret a 95% confidence interval for the difference between the proportions of Indian and Asian young people who listen to rap every day.

Problem 1

	insurance industry μ_1	health care companies μ_2
n	$n_1 = 32$	$n_2 = 40$
$\bar{x}$	$\bar{x}_1 = \mathbf{4.4}$	$\bar{x}_2 = \mathbf{4.6}$
S	$s_1 = 1.6$	$s_2 = 1.4$

At the 90% level of confidence,

$$\mu_1 - \mu_2 = (4.4 - 4.6) \pm E \qquad E = 1.645\sqrt{\frac{1.6^2}{32} + \frac{1.4^2}{40}} = 1.18158$$

$$\mu_1 - \mu_2 = -0.2 \pm 1.18158 \qquad -0.7908 < \mu_1 - \mu_2 < 0.39078$$

Because **one side is negative** then we can conclude **that**
one industry group **does not** have a higher profit as a percentage of revenue

Problem 2

	football players μ_1	basketball players μ_2
n	$n_1 = 45$	$n_2 = 40$
$\bar{x}$	$\bar{x}_1 = \mathbf{6.18}$	$\bar{x}_2 = \mathbf{6.45}$
S	$s_1 = 0.37$	$s_2 = 0.31$

At the 95% level of confidence,

$$\mu_1 - \mu_2 = (6.18 - 6.45) \pm E \qquad E = 1.96\sqrt{\frac{0.37^2}{45} + \frac{0.31^2}{40}} = 0.1446$$

$$\mu_1 - \mu_2 = -.27 \pm 0.1446 \qquad -0.4146 < \mu_1 - \mu_2 < -0.1254$$

$$0.1254 < \mu_2 - \mu_1 < 0.4146$$

Because **both sides are positive** then we can conclude **that**
average height of **basketball players** μ_2 is higher than **football player** μ_1.

Problem 3

	eastern college μ_1	western colleges μ_2
n	$n_1 = 43$	$n_2 = 40$
$\bar{x}$	$\bar{x}_1 = \mathbf{3.6}$	$\bar{x}_2 = \mathbf{3.3}$
S	$s_1 = 1.8$	$s_2 = 1.7$

At the 90% level of confidence,

$$\mu_1 - \mu_2 = (3.6 - 3.3) \pm E \qquad E = 1.645\sqrt{\frac{1.8^2}{43} + \frac{1.7^2}{40}} = 0.6319$$

$$\mu_1 - \mu_2 = 0.3 \pm 0.6319 \qquad -0.3319 < \mu_1 - \mu_2 < 0.9319$$

Because **one side is negative** then we can conclude **that**
he average percentage salary increase for eastern college professors **is not** higher than that for western college professors?

Problem 4

	Canadian Northwest μ_1	Alaska μ_2
n	$n_1 = 38$	$n_2 = 64$
$\bar{x}$	$\bar{x}_1 = \mathbf{98}$	$\bar{x}_2 = \mathbf{90}$
S	$s_1 = 6.5$	$s_2 = 7.3$

At the 95% level of confidence,

$$\mu_1 - \mu_2 = (98 - 90) \pm E \qquad E = 1.96\sqrt{\frac{6.5^2}{38} + \frac{7.3^2}{64}} = 2.733$$

$$\mu_1 - \mu_2 = 8 \pm 2.733 \qquad 5.2669 < \mu_1 - \mu_2 < 10.733$$

Because **both sides are positive** then we can conclude **that**
that the average weight of the adult male wolves from Canada is greater than that of the Alaskan wolves.

Problem 5

	aged 18-29	aged 30-49
	$n_1 = 316$	$n_2 = 532$
	$\hat{p}_1 = 0.26$	$\hat{p}_2 = 0.14$

At the 90% level of confidence,

Point estimate $= \hat{p}_1 - \hat{p}_2 = 0.26 - 0.14 = 0.12$

$$E = 1.96\sqrt{\frac{0.26(1-0.26)}{316} + \frac{0.14(1-0.14)}{532}} = 1.96\sqrt{.001452 + 0.000226} = 0.0803 = 8.03\%$$

$P_1 - P_2 = 0.12 \pm 0.0803 = 12\% \pm 8.03\%$ **Answer** $3.97\% < P_1 - P_2 < 20.03\%$

Problem 6

	Men	Women
lived with their parents	$x_1 = 986$	$x_2 = 923$
	$n_1 = 2253$	$n_2 = 2629$
	$\hat{p}_1 = 986 / 2253 = 0.4376$	$\hat{p}_2 = 923 / 2629 = 0.3511$

At the 90% level of confidence, **Point estimate** $= \hat{p}_1 - \hat{p}_2 = 0.4376 - 0.3511 = 0.0865$

$$E = 2.5787\sqrt{\frac{0.4376(1-0.4376)}{2253} + \frac{0.3511(1-0.3511)}{2629}} = 0.0361 = 3.61\%$$

$P_1 - P_2 = 0.0865 \pm 0.0361 = 8.65\% \pm 3.61\%$ **Answer** $5.05\% < P_1 - P_2 < 12.26\%$

Because **both sides are positive** then we can conclude **that**
give convincing evidence of a difference between the population proportions