Class Activity #9

Name: _____

1. There are two different grades.
Grade one has sample size m=129, sample mean $\bar{x}$ =107.6 and sample standard deviation s_1 =1.3.
Grade two has sample size n=129, sample mean $\bar{y}$= 123.6 and sample standard deviation s_2 = 2.0.

(a) What is the standard error of $(\bar{x}-\bar{y})$, i.e., se$(\bar{x}-\bar{y})$?

$$\sqrt{\frac{(1.3)^2}{129}+\frac{(2.0)^2}{129}} = 0.210$$

(b) Calculate the 90% confidence interval $(\mu_1 - \mu_2)$

$$(\bar{x}-\bar{y}) \pm (1.645)\, se(\bar{x}-\bar{y}) = (-16) \pm (1.645)(0.210)$$
$$= (-16) \pm (0.35)$$

(c) Interpret the above results.

We're confident.

(d) If the sample sizes are changed to m=12 and n=10, what is the standard error of $(\bar{x}-\bar{y})$, i.e., se$(\bar{x}-\bar{y})$? Calculate the 99% confidence interval of $(\mu_1 - \mu_2)$

$$\sqrt{\frac{(1.3)^2}{12}+\frac{(2.0)^2}{10}} = \sqrt{0.1408+0.4} = 0.7354$$
$$(\bar{x}-\bar{y}) \pm (t_{0.005,\ 12+10-2})\, se(\bar{x}-\bar{y}) = (-16) \pm (2.845)(0.7354)$$
$$= (-16) \pm 2.0922$$

2. There are two different groups.
Grade one has sample size m=4, sample mean $\bar{x}$ =13.90 and sample standard deviation s_1 =1.225.
Grade two has sample size n=4, sample mean $\bar{y}$= 12.20 and sample standard deviation s_2 = 1.010.

(e) What is the pooled standard error of $(\bar{x}-\bar{y})$?

$$S_p^2 = \frac{4-1}{4+4-2}(1.225)^2 + \frac{4-1}{4+4-2}(1.010)^2 = 1.260 \qquad S_p = 1.1227$$
$$se(\bar{x}-\bar{y}) = (1.1227)\sqrt{\frac{1}{4}+\frac{1}{4}} = 0.794$$

(f) Calculate the 95% pooled confidence interval for $(\mu_1 - \mu_2)$

$$df = 4+4-2 = 6$$
$$t_{0.025,6} = 2.447$$
$$(\bar{x}-\bar{y}) \pm (t_{0.025,6})\, S_p \sqrt{\frac{1}{m}+\frac{1}{n}}$$
$$= (13.90-12.20) \pm (2.447)(1.1227)\sqrt{\frac{1}{4}+\frac{1}{4}}$$
$$= (1.7) \pm (1.945)$$

3. It is thought that the front cover and the nature of the first question on mail surveys influence the response rate. The article "The Impact of Cover Design and First Question on Response Rates for a Mail Survey of Skydivers" tested this theory by experimenting with different cover designs. One cover was plain; the other used a picture of a skydiver. The researchers speculated that the return rate would be lower for the plain cover.

Cover Plain: Number Sent is 207, Number Returned is 104;
Cover Skydiver: Number sent is 213, Number Returned is 109.

Does this data support the researchers' hypothesis? Test the relevant hypothesis under 0.10 level by first calculating a p-value.

(1) $H_0: p_1 - p_2 = 0$
$H_a: p_1 - p_2 < 0$

(2) $$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1-\hat{p})\left(\frac{1}{m} + \frac{1}{n}\right)}}$$

$$= \frac{\left(\frac{104}{207}\right) - \left(\frac{109}{213}\right)}{\sqrt{\left(\frac{104+109}{207+213}\right)\left(1 - \frac{104+109}{207+213}\right)\left(\frac{1}{207} + \frac{1}{213}\right)}}$$

$$= -0.1910$$

(3) P-value > 0.10

Fail to reject.

(4) Inconclusive.