Lab #10: Continuous Variables (1 sample) Key

1) Standard Deviation measures variability in a distribution of scores. Standard Error measures sampling error or the amount of error we can expect as a result of using statistics to estimate parameters. It is the standard deviation of the sampling distribution of the mean.

2) **a.** $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{N}} = \frac{12}{\sqrt{10}} = \frac{12}{3.162} = 3.795$

b. $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{N}} = \frac{12}{\sqrt{25}} = \frac{12}{5.000} = 2.4$

c. $\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{N}} = \frac{12}{\sqrt{75}} = \frac{12}{8.660} = 1.386$

Thus, the standard error decreases as the sample size increases.

3) **1. <u>Research Question</u>**

Is the current P300 class superior to past P300 classes?

2. <u>Hypotheses</u>

	Symbols	Words
H_O	$\mu=70$	Current P300 class is similar.
H_A	$\mu\neq70$	Current P300 class is different.

3. <u>Assumptions</u>

1. Population of past P300 students has $\mu=70$ and $\sigma=9$ (i.e., Ho).
2. Sample is randomly selected.
3. Population is normal.

4. <u>Decision Rules</u>

Our alpha level is .05, $Z_{crit} = 1.96$

If $Z_{obs} \leq -1.96$ or $Z_{obs} \geq 1.96$, then reject H_O.

If $Z_{obs} > -1.96$ and $Z_{obs} < 1.96$, then do not reject H_O.

5. <u>Computation</u>

The mean of the current P300 class is higher than the mean of previous P300 classes, that is, 78.6 is greater than 70.

$$Z = \frac{\bar{X} - \mu}{\frac{\sigma}{\sqrt{N}}} = \frac{78.6 - 70}{\frac{9}{\sqrt{24}}} = \frac{8.6}{\frac{9}{4.899}} = \frac{8.6}{1.837} = 4.681$$

6. <u>Decision</u>

Since 4.681 (Z_{obs}) $\geq$ 1.96 (Z_{crit}) we reject H_O and assert the alternative. The current P300 class is superior in comparison to past P300 classes.

4) a.

1. **Research Question**
   Do current running backs (RBs) and past RBs have similar length careers?

2. **Hypotheses**

	Symbols	Words
H_O	μ=6.3	Today's RBs have similar length careers.
H_A	$\mu\neq$6.3	Today's RBs do not have similar length careers.

3. **Assumptions**
   a. Population of past RBs have a μ=6.3 & σ=0.76 (i.e., the null).
   b. Sample is randomly selected.
   c. Population is normal.

4. **Decision Rules**
   Our alpha level is .05, Z_{crit} = 1.96
   If $Z_{obs} \leq$ -1.96 or $Z_{obs} \geq$ 1.96, then reject H_O.
   If Z_{obs} > -1.96 and Z_{obs} < 1.96, then do not reject H_O.

5. **Computation**
   The mean of the past RBs career length is greater than the mean of current RBs career length, that is, 6.3 is greater than 4.5.

$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{N}}} = \frac{4.5 - 6.3}{\frac{.76}{\sqrt{300}}} = \frac{-1.8}{\frac{.76}{17.321}} = \frac{-1.8}{.044} = -41.022$$

6. **Decision**
   Since -41.022 (Z_{obs}) $\leq$ -1.96 (Z_{crit}) we reject H_O and assert the alternative. Current NFL RBs have shorter careers than past RBs.

4) b. The violence may have contributed to the shorter careers, but since we did not do an experiment, we cannot make any statements about causality.

5) 1. Research Question
Are current MLB players' homerun totals different than past players'?

2. Hypotheses

	Symbols	Words
H_O	μ=30	Today's MLB players have similar homerun totals.
H_A	$\mu\neq$30	Today's MLB players have different homerun totals.

3. Assumptions
a. Past population of MLB players have a homerun μ=30 & σ=4 (i.e., the null).
b. Sample is randomly selected.

c. Population is normal.

4. **Decision Rules**
Our alpha level is .05, Z_{crit} = 1.96
If $Z_{obs} \leq -1.96$ or $Z_{obs} \geq 1.96$, then reject H_O.
If $Z_{obs} > -1.96$ and $Z_{obs} < 1.96$, then do not reject H_O.

5. **Computation**
The mean of the past MLB players' homerun tally is less than the mean of current MLB players' homerun totals, that is, 30 is less than 35.8.

$$Z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{N}}} = \frac{35.8 - 30}{\frac{4}{\sqrt{10}}} = \frac{5.8}{\frac{4}{3.162}} = \frac{5.8}{1.265} = 4.585$$

6. **Decision**
Since 4.585 (Z_{obs}) > 1.96 (Z_{crit}) we reject H_O. Current MLB players' homerun totals are significantly higher than homerun totals for MLB players of the past.