Week #6

- What are the steps in hypothesis testing? Give an example and relate each step to the concepts we've learned so far in the course (population, sample, parameter, statistic, sampling distribution of the mean, null and alternate hypotheses, critical values, etc.)
- Draw a null distribution and illustrate the relationship between the critical values, the rejection region, and α
- Draw an alternate distribution and illustrate the relationship between the critical values, the rejection region, β, and power
- How are α and β each affected by change in the critical values, effect size, and standard error?
- How do we control Type I and Type II error, respectively? Why don't we make $\alpha = 0$?
- H_0 and H_1 must be exhaustive (one must be true) and mutually exclusive (they can't both be true). Come up with some invalid hypotheses. Here's an example to get you started:
  - $H_0 : \mu_1 = \mu_2$
  - $H_1 : \mu_1 > \mu_2$
- Why do we need hypothesis testing? Why can't we just draw a sample from the population and estimate the parameter by the sample statistic?
- Give an example of a finding which is statistically significant but practically insignificant. When might this occur?
- What is the goal of a confidence interval?
- Give an example of a research question where a nondirectional test would be appropriate, then reframe it so that a directional test would be appropriate

Z-tests

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}}$$

$z_{\text{crit}} =$ the z score with $\alpha/2$ above it

$$z_{\text{obs}} = \frac{\bar{X} - \mu}{\sigma_{\bar{X}}}$$

$$CI_y = \bar{X} \pm (\sigma_{\bar{X}} \times z_y)$$

$z_y =$ the z score with $(100 - y)/100$ above it

Critical *z* values

z	Area between mean and z	Area above z
1.645	0.45	0.05
1.96	0.475	0.025
2.576	0.495	0.005

Question #1

Researchers draw a sample of 6 with a mean of 7.67. The population standard deviation is known to be 2.49. Test H_0 : $\mu = 6$ at an α of 0.1, state your decision, and calculate a 90% confidence interval.

$\sigma_{\bar{X}} = 2.49/\sqrt{6} = 1.02$

$z_{\text{obs}} = (7.67 - 6)/1.02 = 1.64$

$z_{\text{crit}} = \pm 1.64$

Reject because $1.64 =< -1.64$

$z_{90} = 1.64$

$CI_{90} = 7.67 \pm (1.02 \times 1.64) = [6,\ 9.34]$

Question #2

Researchers draw a sample of 6 with a mean of 6.33. The population standard deviation is known to be 3.81. Test H_0 : $\mu = 6$ at an α of 0.05, state your decision, and calculate a 95% confidence interval.

Question #3

Researchers draw a sample of 6 with a mean of 4.83. The population standard deviation is known to be 4.23. Test H_0 : $\mu = 4$ at an α of 0.05, state your decision, and calculate a 95% confidence interval.

Question #4

Researchers draw a sample of 8 with a mean of 6.5. The population standard deviation is known to be 1.04. Test H_0 : $\mu = 3$ at an α of 0.1, state your decision, and calculate a 90% confidence interval.

Question #5

Researchers draw a sample of 6 with a mean of 6.33. The population standard deviation is known to be 3.74. Test H_0 : $\mu = 10$ at an α of 0.1, state your decision, and calculate a 90% confidence interval.

Question #6

Researchers draw a sample of 8 with a mean of 6.88. The population standard deviation is known to be 4.75. Test H_0 : $\mu = 3$ at an α of 0.01, state your decision, and calculate a 90% confidence interval.

Question #7

Researchers draw a sample of 10 with a mean of 4.6. The population standard deviation is known to be 2.59. Test H_0 : $\mu = 2$ at an α of 0.1, state your decision, and calculate a 95% confidence interval.

Question #8

Researchers draw a sample of 7 with a mean of 6.71. The population standard deviation is known to be 1.83. Test H_0 : $\mu = 8$ at an α of 0.05, state your decision, and calculate a 90% confidence interval.

Question #9

Researchers draw a sample of 6 with a mean of 4.17. The population standard deviation is known to be 1.1. Test H_0 : $\mu = 3$ at an α of 0.01, state your decision, and calculate a 90% confidence interval.

Question #10

Researchers draw a sample of 8 with a mean of 4.5. The population standard deviation is known to be 2.23. Test H_0 : $\mu = 5$ at an α of 0.05, state your decision, and calculate a 90% confidence interval.

Question #11

Researchers draw a sample of 6 with a mean of 4.17. The population standard deviation is known to be 1. Test H_0 : $\mu = 6$ at an α of 0.1, state your decision, and calculate a 90% confidence interval.