Day 10: In-Class Activities

1. $$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}} = \frac{19 - 20}{\sqrt{25} / \sqrt{9}} = 0.6$$

p-value $= 2 \cdot (1 - .7257) = .055$

~~Defin~~

Not enough evidence to support Ha. Accept Ho

2. a The sample mean $\bar{x}$ is 12.70

$s = 2.15$

$n = 39$

With 39 samples and 38 degrees of freedom, we can approximate a z-distribution using CLT we ~~assume the~~ sample is ~~normally distributed~~

$$\left[\bar{x} \pm 1.96 \cdot \frac{s}{\sqrt{n}} \right] = \left[12.03, 13.37 \right]$$

b. $\alpha = 0.05$

$$z = \frac{\bar{X} - \mu}{s/\sqrt{n}} = -2.03$$

$$p = (1 - .9783) = .0217$$

$p < \alpha$, so reject H_0

c. Male: $\bar{X}_m = 11.92$ Female: $\bar{X}_f = 13.95$

$S_m = 1.41$ $S_f = 2.49$

$n_m = 19$ $n_f = 20$

$$\bar{X}_{diff} = \bar{X}_m - \bar{X}_f = -1.53$$

$$S_{diff} = \sqrt{\frac{S_m^2}{n_m} + \frac{S_f^2}{n_f}} = 0.644$$

$$\bar{X}_{diff} \pm 1.96 \cdot S_{diff} = [-2.79, -0.27]$$ ← males cut shorter strings

d. Confidence interval for $\dfrac{\sigma^2_{male}}{\sigma^2_{female}} = \left[\dfrac{1}{F_{\alpha/2}(n_m, n_f)} \cdot \dfrac{S^2m}{S^2f}, F_{\alpha/2}(\cancel{n_f}, n_m) \cdot \dfrac{S^2_m}{S^2_F}\right]$

Let $\alpha = 0.05$
$\alpha/2 = 0.025$

$$= \left[\frac{1}{2.46} \cdot \frac{1.41}{2.49}, 2.46 \cdot \frac{1.41}{2.49}\right]$$

$$= [0.23, 1.39]$$

$\dfrac{\sigma^2 m}{\sigma^2 f} = 1$ is within confidence interval for $\dfrac{\sigma^2 m}{\sigma^2 f}$; ~~is~~ ~~within~~

thus, H_0 is accepted.

e. Assume samples are large enough to approximate normal by CLT.

$\bar{X}_{diff} = 0$ is outside confidence interval, so reject H_0

Male strings are shorter.

3 a. We assume the sample mean is approximately normally distributed because $n = 84$ by CLT.

b. $$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{5}{\sqrt{4.167^2 + 5.63}}$$

$$= \frac{5}{3.13}$$

$$= 1.60$$

Because there is 82 degrees of freedom, we can assume normal distribution and use the Z-tables.

~~$p \approx 0.9$~~

~~$p = 1 - 0.9 = 0.1$~~

$p = \underset{\uparrow \text{ two-sided}}{2} \cdot (1 - Z_{1.6}) = 0.11$

c. ~~Reject~~ Accept null hypothesis at 95% significance because $p > \alpha$

4. a. We again assume sample mean is approx normally distributed by CLT since sample is large.

b. $$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{238 - 223}{\sqrt{\frac{35^2}{30} + \frac{34^2}{23}}} = \frac{15}{9.54} = 1.57$$

Because there are 51 degrees of freedom, we can assume normal and use the z-distribution

p-value $(z = 1.57) = 1 - .9418 = \cancel{0.8}\ 0.0582$

one-sided test

Since $|p| > |\alpha|$, we ~~rej~~ accept H_0