In Class Exercise #13: Hypothesis Testing

1. Socially Conscious Stocks

Are stocks of companies that tout their socially conscious credentials priced differently? One measure of value is the P/E, or price-to-earnings, ratio. High P/E ratios may indicate a stock is overpriced. For the S&P stock index of all major stocks, the mean P/E ratio is 19.4. A random sample of 36 socially conscious stocks gave a P/E ratio mean of 17.9, with a standard deviation of 5.2. Does this indicate that the mean P/E ratio of all socially conscious stock is different (either way) from the mean P/E ratio of the S&P stock index? Use $\alpha = 5\%$

(a) State the null and alternate hypotheses.

$$H_0 : \mu = 19.4 \qquad H_1 : \mu \neq 19.4$$

(b) What sampling distribution will you use? Check its requirements.
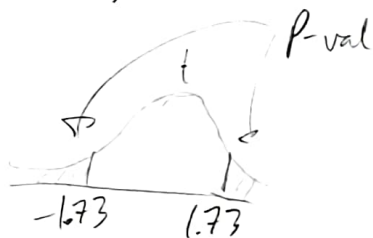
t-dist   Have s, $n = 36 \geq 30$ ✓

X is not normal ✗

(c) Find or estimate the P-value. Sketch the sampling distribution and show the area corresponding to the P-value.

$d.f. = n-1 = 35$

(use 30 in table)

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{17.9 - 19.4}{5.2/\sqrt{36}} \approx -1.7308$$

P-val: $1.697 < t < 2.042$

$0.10 > P_{val} > 0.05$ (two tailed)

$P_{val} > \alpha$ do not reject H_0

-1.73   1.73

(d) Conclude the test, and interpret your answer.

At 5% significance level, we don't reject the null hypothesis that socially conscious companies have an average P/E ratio different than the S&P.

2. Avalanches

Slab avalaches are a specific type of snow avalanche. Slab avalaches studies in Canada have a thickness that is approximately normally distributed with mean 67 cm and a standard deviation of 10.6 cm. A sample of 16 slab thicknesses in Vail, Colorado gives a mean of 61.8 cm. Is the mean slab thickness in Vail different from that of Canada? Use $\alpha = 1\%$

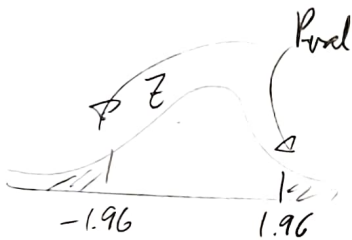(a) State the null and alternate hypotheses.

$$H_o : \mu = 67 cm \qquad H_1 : \mu \neq 67 cm$$

(b) What sampling distribution will you use? Check its requirements.

normal dist. Have σ, $\bar{X}$ is approx normal ✓

$$n = 16 \times 30 \quad \bar{X}$$

(c) Find or estimate the P-value. Sketch the sampling distribution and show the area corresponding to the P-value.

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}} = \frac{61.8 - 67}{10.6 / \sqrt{16}} \approx -1.9622$$

P-val

$$P_{val} = (1 - 0.9750) \times 2 = 0.05 > \alpha$$

do not reject t ...

$-1.96 \qquad 1.96$

(d) Conclude the test, and interpret your answer.

At a 1% significance level, we do not reject the null hypothesis that Vail has the same average slab thickness as Canada

3. Athlete Graduation Rate

Women athletes at the University of Colorado have historically had a graduation rate of 67%. Over the past several years, a random sample of 38 women athletes at the school showed that 21 eventually graduated. Does this indicate that the proportion of women athletes who graduate from the UofC is now less than it was before? Use a 5% level of significance.

(a) State the null and alternate hypotheses.
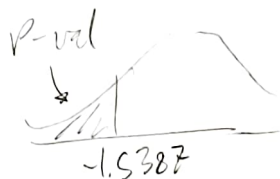
$$H_0 : p = 0.67 \qquad H_1 : p < 0.67$$

(b) What sampling distribution will you use? Check its requirements.

normal dist: $np = 38(0.67) = 25.46 > 5$ ✓

since binomial with $nq = 38(0.33) = 12.54 > 5$ ✓

(c) Find or estimate the P-value. Sketch the sampling distribution and show the area corresponding to the P-value.

$$\hat{p} = \frac{r}{n} = \frac{21}{38} \approx 55.26\%$$

$$z = \frac{\hat{p} - p}{\sqrt{pq/n}} = \frac{\frac{21}{38} - 0.67}{\sqrt{(0.67)(0.33)/38}} \approx -1.5387$$

P-val

-1.5387

$$P\text{-val} = P(z < -1.54) = 1 - 0.9382 = 0.0618 > \alpha$$

do not reject

(d) Conclude the test, and interpret your answer.

At a 5% significance level, we do not reject the null hypothesis, which says that 67% of women athletes graduate