Stat 145 Homework Solutions: Chapter 18

Problem 18.1

(a) The population is all college students and p is the proportion of all college students who say they pray at least once in a while.

(b) The value of $\hat{p}$ is:

$$\hat{p} = \frac{107}{127} \doteq 0.8425$$

Problem 18.3

(a) The mean is 0.5 and the standard deviation is:

$$\sqrt{\frac{0.5(1-0.5)}{14941}} = 0.004$$

(b) The probability is:

$$\begin{aligned} P(0.49 \leq \hat{p} \leq 0.51) &= P\left(\frac{0.49-0.5}{0.00409} \leq \frac{\hat{p}-0.5}{0.004} \leq \frac{0.51-0.5}{0.004}\right) \\ &= P(-2.5 \leq Z \leq 2.5) \\ &= .9938 - .0062 \\ &= .9876 \end{aligned}$$

Problem 18.7

The sample is not a simple random sample.

Problem 18.9

The value of $\hat{p}$ is:

$$\hat{p} = \frac{427}{427 + 2733} \doteq 0.135$$

A 99% confidence interval for p is:

$$\begin{aligned} 0.135 &\pm 2.576\sqrt{\frac{0.135(1-0.135)}{3160}} \\ 0.135 &\pm 0.01566 \end{aligned}$$

Problem 18.11

(a) The population is much larger than 10 times the sample, and the sample counts of successes and failures are both at least 15.

(b) The value of $\hat{p}$ is:

$$\hat{p} = \frac{692}{1048} \doteq 0.66$$

A 95% confidence interval for p is:

$$\begin{aligned} 0.66 &\pm 1.96\sqrt{\frac{0.66(1-0.66)}{1048}} \\ 0.66 &\pm 0.0287 \end{aligned}$$

Problem 18.17

The sample size should be:

$$n = \left(\frac{1.645}{0.04}\right)^2 (0.75)(1-0.75) \doteq 317.11$$

Use a sample size of $n = 318$.

Problem 18.19

The value of $\hat{p}$ is:

$$\hat{p} = \frac{692}{1048} \doteq 0.66$$

The hypotheses are:

$$H_0 : p = 0.5$$
$$H_A : p > 0.5$$

The value of the test statistic is:

$$\begin{aligned} z &= \frac{0.66 - 0.5}{\sqrt{\frac{0.5(1-0.5)}{1048}}} \\ &= 10.36 \end{aligned}$$

The P-value is:

$$P = P(Z \geq 10.36) \doteq 0$$

The P-value is essentially 0. This is very strong evidence that more than half of all teens have a TV in their room.

Problem 18.21

The population is much larger than 10 times the sample, and the sample counts of successes and failures are both at least 15.

The value of $\hat{p}$ is:

$$\hat{p} = \frac{606}{1318} \doteq 0.46$$

A 99% confidence interval for p is:

$$\begin{aligned} 0.46 &\pm 2.576\sqrt{\frac{0.46(1-0.46)}{1318}} \\ 0.46 &\pm 0.035 \end{aligned}$$

Problem 18.23

The value of $\hat{p}$ is:

$$\hat{p} = \frac{225}{512} \doteq 0.44$$

The hypotheses are:

$$H_0 : p = 0.5$$
$$H_A : p < 0.5$$

The value of the test statistic is:

$$\begin{aligned} z &= \frac{0.44 - 0.5}{\sqrt{\frac{0.5(1-0.5)}{512}}} \\ &= -2.72 \end{aligned}$$

The P-value is:

$$P = P(Z \leq -2.72) = .0033$$

This is very strong evidence that fewer than half of all adults favor increased use of nuclear power.

Problem 18.31

The value of $\hat{p}$ is:

$$\hat{p} = \frac{750}{1785} \doteq 0.42$$

A 99% confidence interval for p is:

$$\begin{aligned} 0.42 &\pm 2.576\sqrt{\frac{0.42(1-0.42)}{1785}} \\ 0.42 &\pm 0.03 \end{aligned}$$

Problem 18.33

The sample size should be:

$$n = \left(\frac{2.576}{0.01}\right)^2 (0.5)(1 - 0.5) \doteq 16589.44$$

Use a sample size of $n = 16,590$.

Using $p^* = 0.5$ is reasonable because the confidence interval in 18.31 leads us to believe the true value of p is between 0.39 and 0.45.