Stat 145 Homework Solutions: Chapter 13

Problem 13.1

(a) $51 \pm 3 = (48, 51)$

(b) This method produces correct results in 95% of all samples.

Problem 13.3

(a) $\frac{\sigma}{\sqrt{n}} = \frac{60}{\sqrt{1000}} \doteq 1.9$

(b) The following points should be marked on the sketch:

$280 \pm 1(1.9) = 278.1$ and 281.9
$280 \pm 2(1.9) = 276.2$ and 283.8
$280 \pm 3(1.9) = 274.3$ and 285.7

(c) $2(1.9) = 3.8$

(d) Answers will vary.

(e) 95%

Problem 13.5

First calculate $\bar{x}$:

$$\begin{aligned} \bar{x} &= \frac{3.412 + 3.414 + 3.415}{3} \\ &\doteq 3.4137 \end{aligned}$$

A 95% confidence interval for μ is:

$$\begin{aligned} 3.4137 \pm 1.96\left(\frac{0.001}{\sqrt{3}}\right) &\doteq 3.4137 \pm 0.0011 \\ &= (3.4126, 3.4148) \end{aligned}$$

Problem 13.7

(a) An 80% confidence interval for μ is:

$$\begin{aligned} 0.8404 \pm 1.282 \left(\frac{0.0068}{\sqrt{3}} \right) &\doteq 0.8404 \pm 0.0050 \\ &= (0.8354, 0.8454) \end{aligned}$$

(b) A 99.9% confidence interval for μ is:

$$\begin{aligned} 0.8404 \pm 3.29 \left(\frac{0.0068}{\sqrt{3}} \right) &\doteq 0.8404 \pm 0.0129 \\ &= (0.8275, 0.8533) \end{aligned}$$

(c) As the confidence level increases, the width of the confidence interval increases.

Problem 13.9

(a) A 95% confidence interval for μ is:

$$\begin{aligned} 22 \pm 1.96 \left(\frac{50}{\sqrt{1000}} \right) &\doteq 22 \pm 3.1 \\ &= (18.9, 25.1) \end{aligned}$$

(b) A 95% confidence interval for μ is:

$$\begin{aligned} 22 \pm 1.96 \left(\frac{50}{\sqrt{250}} \right) &\doteq 22 \pm 6.2 \\ &= (15.8, 28.2) \end{aligned}$$

(c) A 95% confidence interval for μ is:

$$\begin{aligned} 22 \pm 1.96 \left(\frac{50}{\sqrt{4000}} \right) &\doteq 22 \pm 1.55 \\ &= (20.45, 23.55) \end{aligned}$$

(d) The margins of error are 6.2, 3.1, and 1.55, respectively. As the sample size increases, the margin of error decreases.

Problem 13.11

From the information given in Problem 13.6, it is known that $\sigma = 15$. The desired margin of error is $m = 5$ and the value of z^* for 99% confidence is 2.576. Thus,

$$\begin{aligned} n &= \left(\frac{2.576 \times 15}{5}\right)^2 \\ &\doteq 59.72 \end{aligned}$$

Rounding up to the next highest whole number gives $n = 60$.

Problem 13.15

(a) The mean is $\bar{x} = 30,841$, so a 90% confidence interval for μ is:

$$\begin{aligned} 30841 \pm 1.645\left(\frac{3000}{\sqrt{20}}\right) &\doteq 30841 \pm 1103.5 \\ &= (29737.5, 31944.5) \end{aligned}$$

Problem 13.17

(b) The mean is $\bar{x} = 224.002$, so a 95% confidence interval for μ is:

$$\begin{aligned} 224.002 \pm 1.96\left(\frac{0.060}{\sqrt{16}}\right) &\doteq 224.002 \pm 0.029 \\ &= (223.973, 224.031) \end{aligned}$$

Problem 13.22

From the information given in Problem 13.15, it is known that $\sigma = 3000$. The desired margin of error is $m = 1000$ and the value of z^* for 95% confidence is 1.96. Thus,

$$\begin{aligned} n &= \left(\frac{1.96 \times 3000}{1000}\right)^2 \\ &\doteq 34.57 \end{aligned}$$

Rounding up to the next highest whole number gives $n = 35$.