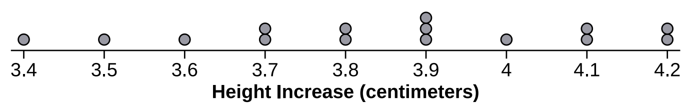
Lesson #56 · Topic 4B · Practice

Answer Key

1. a. Because the data are collected from one sample to estimate the mean for one population.
   b. Because we will be using a t distribution to find the critical value t^* for the interval. We use a t distribution instead of a normal distribution because we don't know the population standard deviation, and therefore must use the sample standard deviation in the calculation.
   c. Because we are constructing a confidence interval, not performing a hypothesis test.
   d. Because the parameter that is being estimated is the population mean, μ .

2. a. Type of study: Observational study
   Variable: Height increase, in centimeters (quantitative)
   b. one-sample t -interval for μ at a 95% confidence level. μ = true mean height increase of all plants in this greenhouse after using the new fertilizer.
   c. $\underline{\text{Random:}}$ Random sample of 15 plants ✓
   $\underline{\text{10\%:}}$ $15 \leq 0.10$(all plants in the large greenhouse) ✓
   $\underline{\text{Normal/Large Sample:}}$ 15 < 30, so we must check the sample data for no strong skewness or outliers. The distribution is not strongly skewed and does not appear to have outliers. ✓



   d. $\bar{x} \pm t^* \left(\frac{s}{\sqrt{n}}\right)$
   $3.853 \pm 2.145 \left(\frac{0.245}{\sqrt{15}}\right)$, df = 14
   (3.72, 3.99)
   e. We are 95% confident the interval from 3.72 cm to 3.99 cm captures the true mean height increase of all plants in this greenhouse after using the new fertilizer.
   f. No, all of the plausible values in the interval are below 4 cm, so the interval does not support the claim that the new fertilizer increases the plant height by 4 cm, on average.

3. a. CLASSIFY:
   Type of study: Observational study
   Variable: Teacher salary in North Carolina (quantitative)

   CHOOSE:
   one-sample t -interval for μ at a 98% confidence level
   $\mu =$ true mean salary for all teachers in North Carolina

   CHECK:
   Random: random sample of 45 North Carolina teachers ✓
   10%: $45 \leq 0.10$ (all teachers in North Carolina) ✓
   Normal/Large Sample: $45 \geq 30$, central limit theorem ✓

   CALCULATE:
   $\bar{x} \pm t^* \left(\frac{s}{\sqrt{n}}\right)$
   $52,509 \pm 2.414 \left(\frac{7,191}{\sqrt{45}}\right), \mathrm{df} = 44$
   $(49,921, 55,097)$

   CONCLUDE:
   We are 98% confident that the interval from \$49,921 to \$55,097 captures the true mean salary for all teachers in North Carolina.

   b. The margin of error would decrease. As the sample size increases, the margin of error decreases.

4. a. The student classified the variable as categorical but the variable, Unit 9 test score is quantitative.
   b. The student should use μ instead of $\bar{x}$ and "all 364 students" instead of "all 34 students"
   one-sample t -interval for μ at a 95% confidence level. μ = true mean Unit 9 Test score for all 364 students at this large high school
   c. The student said the Normal/Large Sample condition was not met due to the low outlier. However, the sample size of 34 is large enough to satisfy the central limit theorem.
   Normal/Large Sample: $34 \geq 30$, central limit theorem ✓
   d. The student uses z^* instead of t^* .
   $\bar{x} \pm t^* \left(\frac{s}{\sqrt{n}}\right)$
   $82.853 \pm 2.035 \left(\frac{15.947}{\sqrt{34}}\right)$
   (77.26, 88.39)
   e. The student combined the confidence interval interpretation and the confidence level interpretation.
   We are 95% confident that the interval from 77.26 to 88.39 captures the true mean Unit 9 Test score for all AP Statistics students at this large high school.

5. A

6. D