Lesson #60 · Topic 4C · Practice

Answer Key

1. No, the conditions have not been met. The selection of delivery orders cannot be considered a random sample because they came from 10 consecutive orders placed by Irmgard from a single location, rather than a random sample of orders from a variety of locations. Her sample is not representative of the population.

2. a. $H_0 : \mu = 5.1,\ H_a : \mu > 5.1$ where $\mu =$ true mean word length of all German words.

   b. $t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{5.874 - 5.1}{\frac{1.402}{\sqrt{85}}} = 5.090, \mathrm{df} = 84$

   p -value $= 1.078 \times 10^{-6} \approx 0$

   c. Assuming H_0 is true $(\mu = 5.1)$, there is an $\approx$ 0 probability of getting an $\bar{x}$ of 5.874 or greater purely by chance. Because $0 < 0.05$, we reject H_0 and we *do* have convincing statistical evidence that the average word length is greater for German words than for English words.

3. a. CLASSIFY:
   Type of study: Observational study
   Variable: Length of shower (minutes) (quantitative)

   CHOOSE:
   one-sample t -test for μ at $\alpha = 0.05$
   $\mu =$ true mean shower length for all teens at Faruk's high school
   $H_0 : \mu = 8, H_a : \mu \neq 8$

   CHECK:
   <u>Random</u>: the 45 teens were randomly selected ✓
   <u>10%</u>: $45 \leq 0.10$ (all teens at Faruk's high school) ✓
   <u>Normal/Large Sample</u>: $45 \geq 30$, central limit theorem ✓

   CALCULATE:
   $t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{10.1 - 8}{\frac{7.5}{\sqrt{45}}} = 1.878, \mathrm{df} = 44$
   p -value = 0.067

   CONCLUDE:
   Assuming H_0 is true $(\mu = 8)$, there is a 0.067 probability of getting an $\bar{x}$ of 10.1 or more extreme in either direction purely by chance. Because $0.067 > 0.05$, we fail to reject H_0 and we do *not* have convincing statistical evidence that the average shower length for teens at Faruk's school is different than the average given by the CDC.

   b. Yes, the hypothesis test failed to reject H_0 $(\mu = 8)$ at $\alpha = 0.05$, so 8 is a plausible value contained in the corresponding 95% confidence interval for μ .

4.
   a. 5%
   b. 5%
   c. The significance level tells what percentage of tests will reject H_0 , even when it is true. The confidence level tells what percentage of intervals will include H_0 as a plausible value, when it is true. Subtracting the confidence level from 100 gives the significance level, as a percentage. Both a confidence interval and hypothesis test will result in the same decision about H_0 , for corresponding confidence and significance levels.
   d. This is a Type I error because even though H_0 is true, we rejected it based on the data.

5. D

6. C