**College Prep Stats**
**Extra Practice 8.4 and 8.5**

1. **Sitting Height** A student of the author measured the sitting heights of 36 male classmate friends, and she obtained a mean of 92.8 cm. The population of males has sitting heights with a mean of 91.4 cm and a standard deviation of 3.6 cm (based on anthropometric survey data from Gordon, Churchill, et al.). Use a 0.05 significance level to test the claim that males at her college have a mean sitting height different from 91.4 cm. Is there anything about the sample data suggesting that the methods of this section should not be used?

Requirement check: Since the student only selected the male classmate friends, she used "Convenience Sampling" method. The requirement of "SRS" is not satisfied. So we should not do the test because the result is not valid.

2. **Cans of Coke** A simple random sample of 36 cans of regular Coke has a mean volume of 12.19 oz (based on Data Set 17 in Appendix B). Assume that the standard deviation of all cans of regular Coke is 0.11 oz. Use a 0.01 significance level to test the claim that cans of regular Coke have volumes with a mean of 12 oz, as stated on the label. If there is a difference, is it substantial?

Requirement check: SRS, standard deviation of all cans => $\sigma = 0.11$, $n = 36 > 30$

$H_0: \mu = 12$ $H_1: \mu \neq 12$ $$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{12.19 - 12}{\frac{0.11}{\sqrt{36}}} = 10.3636$$ *P-value* $\approx 0 < 0.01$, reject $H_0$

There is sufficient evidence to warrant rejection of the claim that cans of regular Coke have volumes with a mean of 12 oz, as stated on the label. The difference has statistical significance but not much practical significance.

3. **Garbage** The totals of the individual weights of garbage discarded by 62 households in one week have a mean of 27.443 lb (based on Data Set 22 in Appendix B). Assume that the standard deviation of the weights is 12.458 lb. Use a 0.05 significance level to test the claim that the population of households has a mean less than 30 lb, which is the maximum amount that can be handled by the current waste removal system. Is there any cause for concern?

Requirement check: SRS (Data Set 22 in Appendix B), standard deviation of the weights => $\sigma = 12.458$, $n = 62 > 30$

$H_0: \mu = 30$ $H_1: \mu < 30$ $$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{27.443 - 30}{\frac{12.458}{\sqrt{62}}} = -1.6161$$ *P-value* $\approx 0.0530 > 0.05$, fail to reject $H_0$

There is not sufficient sample evidence to support the claim that the population of households has a mean less than 30 lb. It is possible that the population mean of waste of households has a mean of 30 lb or more. The current waste removal system could be danger of being overloaded.

4. **FICO Credit Scores** A simple random sample of FICO credit rating scores is obtained, and the scores are listed below. As of this writing, the mean FICO score was reported to be 678. Assuming the standard deviation of all FICO scores is known to be 58.3, use a 0.05 significance level to test the claim that these sample FICO scores come from a population with a mean equal to 678.

714 751 664 789 818 779 698 836 753 834 693 802

Requirement check: SRS , standard deviation of all FICO scores => $\sigma = 58.3$, $n = 12 < 30$

The requirement of "Normal Distribution" or "$n > 30$" is not satisfied. So we should not do the test because the result is not valid.

5. **Do the Screws Have a Length of 3/4 in.?** A simple random sample of 50 stainless steel sheet metal screws is obtained from those supplied by Crown Bolt, Inc., and the length of each screw is measured using a vernier caliper. The lengths are listed in Data Set 19 of Appendix B. The sample mean length is 0.7468 in. and sample standard deviation of all such lengths is 0.0123 in. Use a 0.05 significance level to test the claim that the screws have a mean length equal to 3/4 in. (or 0.75 in.), as indicated on the package labels. Do the screw lengths appear to be consistent with the package label?

Requirement check: SRS, sample standard deviation => $s = 0.0123$, $n = 50 > 30$

$H_0: \ \mu = 0.75 \qquad H_1: \ \mu \neq 0.75 \qquad t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{0.7468 - 0.75}{\frac{0.0123}{\sqrt{50}}} = -1.8396$   *P-value* $\approx 0.0719 > 0.05$, fail to reject $H_0$

There is not sufficient evidence to warrant rejection of the claim that the screws have a mean length equal to 3/4 in. The screw lengths appear to be consistent with the package label.

6. **Power Supply** Data Set 13 in Appendix B lists measured voltage amounts supplied directly to the author's home. The Central Hudson power supply company states that it has a target power supply of 120 volts. Those home voltage amounts have a sample mean is 123.6625 volts and assuming that the standard deviation of all voltage amounts is 0.24 V, test the claim that the mean voltage is 120 volts. Use a 0.01 significance level.

Requirement check: SRS(Data Set 13 in Appendix B), standard deviation of all sample voltage amounts => $s = 0.24$, $n = 40 > 30$

$H_0: \ \mu = 120 \qquad H_1: \ \mu \neq 120 \qquad t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{123.6625 - 120}{\frac{0.24}{\sqrt{40}}} = 96.5153$   *P-value* $\approx 0 < 0.01$, reject $H_0$

There is sufficient evidence to warrant rejection of the claim that the mean home voltage is 120 volts.

7. The high school athletic director is asked if football players are doing as well academically as the other student athletes. We know from a previous study that the average GPA for the student athletes is above 3.10. After an initiative to help improve the GPA of student athletes, the athletic director took a simple randomly samples of 40 football players and finds that the average GPA of the sample is 3.18 with a sample standard deviation of 0.54. Is there a significant improvement? Use a 0.05 significance level.

Requirement check: SRS, sample standard deviation => $s = 0.54$, $n = 40 > 30$

$H_0: \ \mu = 3.10 \qquad H_1: \ \mu > 3.10 \qquad t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{3.18 - 3.10}{\frac{0.54}{\sqrt{40}}} = 0.9370$   *P-value* $\approx 0.1773 > 0.05$, fail to reject $H_0$

There is not sufficient evidence to support the claim that the mean GPA for the student athletes is above 3.10.

8. Duracell manufactures batteries that the CEO claims will last an average of 300 hours under normal use. A researcher randomly selected 35 batteries from the production line and tested these batteries. The tested batteries had a mean life span of 270 hours with a standard deviation of 50 hours. Do we have enough evidence to suggest that the claim of an average lifetime of 300 hours is false?

Requirement check: SRS(researcher), sample standard deviation => $s = 50$, $n = 35 > 30$, choose $\alpha = 0.05$

$H_0: \ \mu = 300 \qquad H_1: \ \mu \neq 300 \qquad t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{270 - 300}{\frac{50}{\sqrt{35}}} = -3.5496$   *P-value* $\approx 0.0012 < 0.05$, reject $H_0$

There is sufficient evidence to warrant rejection of the claim that the battery mean lifetime of 300 hours. We do have enough evidence to suggest that the claim of an average lifetime of 300 hours is false.