Suggested Solution for Chapter 7 Homework

Section 7-2:

2. Accept the claim: The die is fair, since for a fair die it is very likely that 1 occurs 9 times in 60 rolls.

4. Reject the claim that the roulette wheel is fair since if the roulette is fair, then it is unlikely for 7 to occur each time in seven consecutive trials.

6. **Claim:** Yuri has powers of mental telepathy.

Conclusion: There is not sufficient evidence to support this claim.

8. **Claim:**The Salk vaccine is effective in preventing polio.

Conclusion: The sample results support this claim.

10. $H_0 : \mu \geq \$60,000$ vs $H_1 : \mu < \$60,000$.

12. $H_0 : p \geq 0.05$ vs $H_1 : P < 0.05$.

14. $H_0 : p = 0.24$ vs $H_1 : P \neq 0.24$.

16. $H_0 : \sigma \leq \$3000$ vs $H_1 : \sigma > \$3000$.

18. This is a two-tailed test, $\alpha = 0.01$, so the right tail area at the critical value is $\alpha/2 = 0.005$. Therefore the area under the standard normal density curve, between 0 and the CV is $0.5 - 0.005 = 0.495$. From Table A-2, C.V.=± 2.575.

20. This is a left-tailed test, $\alpha = 0.05$, so the left tail area at the critical value is $\alpha = 0.05$. Therefore the area under the standard normal density curve, between 0 and the CV is $0.5 - 0.05 = 0.45$. From Table A-2 and by symmetry of the standard normal density curve, C.V.=-1.645.

22. Since the alternative hypothesis is $H_1 : \mu < 98.6$, this is a left-tailed test, $\alpha = 0.10$, so the left tail area at the critical value is $\alpha = 0.10$. Therefore the area under the standard normal density curve, between 0 and the CV is $0.5 - 0.10 = 0.40$. From Table A-2 and by symmetry of the standard normal density curve, C.V.=-1.28

24. Since the null hypothesis is $H_0 : \mu \geq 56.7$, this is a left-tailed test, $\alpha = 0.02$, so the left tail area at the critical value is $\alpha = 0.02$. Therefore the area under the standard normal density curve, between 0 and the CV is $0.5 - 0.02 = 0.48$. From Table A-2 and by symmetry of the standard normal density curve, C.V.=-2.05

26. T.S. is

$$z = \frac{\bar{x} - 0.21}{s/\sqrt{n}} = \frac{0.83 - 0.21}{0.24/\sqrt{32}} = -2.65$$

32. $H_0 : \mu = 98.2$

Conclusion: There is not sufficient evidence to warrant rejection of the claim that the mean body temperature of health adults is equal to 98.2.

34. **Type I error:** Reject the claim(null hypothesis H_0) that the mean is less than or equal to \$20,000 when this claim is actually true.

Type II error: Fail to Reject the claim(null hypothesis H_0) that the mean is less than or equal to \$20,000 when this claim is actually false.

Section 7-3.

2. Using Table A-2, P-value=$2 \times (0.5 - 0.4772) = 0.0456$.

4. Using Table A-2, P-value=$0.5 - 0.4904 = 0.0096$.

6. a) T.S. is

$$z = \frac{69.6 - 69.0}{3.0/\sqrt{50}} = 1.41$$

b) C.V. is (see Exercise 18 of 7-2)

$$z = \pm 2.575$$

c) Using Table A-2, P-value=$2 \times (0.5 - 0.4207) = 0.1586$.

d) **Conclusion:** No sufficient evidence to reject the claim that the mean height is equal to 69.0 in.

10. T.S. is $z = \frac{12.19-12}{0.11/\sqrt{36}} = 10.364$. $\alpha = 0.02$, Two-tailed test, C.V.=± 2.33.

16. T.S. is $z = \frac{22.1-24}{8.6/\sqrt{70}} = -1.848$, Using Table A-2, P-value=0.0322.

22. Using Excel Workbook CONTININE.XLS and the Excel functions AVERAGE and STDEV on values of NOETS, we can calculate the sample mean $\bar{x} = 0.405$, and the sample standard deviation $s = 1.212904$. Thus the T.S. is

$$z = \frac{0.405 - 0}{1.212904/\sqrt{50}} = 2.3611,$$

$\alpha = 0.005$, C.V.=2.575, P-value=0.0091

Section 7-4:

2. $n = 20, \bar{x} = 70.0, s = 2.6$, TS is $t = \frac{70-68}{2.6/\sqrt{20}} = 3.440$. From Table A-3, DF=19, $\alpha = 0.01$, the CV is $t = \pm 2.861$. Since $TS > CV$, we reject the null hypothesis $H_0 : \mu = 68$ in favor of the alternative hypothesis $H_1 : \mu \neq 68$.

6. Since TS=3.440 is greater than CV of significance level $\alpha - 0.01$, from Table A-3, P-value< 0.01.

10.

$$H_0 : \mu = 98.6 \text{ vs } H_1 : \mu \neq 98.6.$$

Since $n > 30$ TS $z = \frac{\bar{x}-\mu_0}{s/\sqrt{n}} = \frac{98.27-98.6}{0.65/\sqrt{35}} = -3.004$. $\alpha = 0.05$, CV=± 1.96. Since $|TS| > |CV|$, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1.

12. Effectiveness of SAT Training Course

$$H_0 : \mu \leq 1017 \text{ vs } H_1 : \mu > 1017.$$

$\bar{x} = 1040, n = 20 < 30, s = 207$, TS is

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{1040 - 1017}{207/\sqrt{20}} = 0.4969.$$

$\alpha = 0.05$, CV=$\pm$1.729. Since $TS < CV$, we fail to reject the null hypothesis H_0. That is the sample results do not support the claim that Wolfson students have a mean score greater than 1017. Yes there is a better way to design the experiment: randomly select two groups of students, then let one group of students take Wolfson course prior to taking the SAT, and the other group do not take Wolfson course prior to taking the SAT,then compare the mean SAT scores of the two groups.

14. Effects of Hypnotism

$$H_0 : \mu \geq 10 \text{ vs } H_1 : \mu < 10.$$

$\alpha = 0.01, n = 16, \bar{x} = 8.33, s = 1.96$, TS is

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{8.33 - 10}{1.96/\sqrt{16}} = -3.408.$$

CV=$\pm - 2.602$. Since $TS < CV$, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1.

16. Mean Time for Four-Year degree

$$H_0 : \mu \leq 5 \text{ vs } H_1 : \mu > 5.$$

$\alpha = 0.1, n = 80 > 30, \bar{x} = 5.15, s = 1.68$, TS is

$$z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{5.15 - 5}{1.68/\sqrt{80}} = 0.7986.$$

From Table A-2, CV=1.28. Since $TS < CV$, we fail to reject the null hypothesis H_0.

Section 7-5.

2. Percentage of Telephone Users

$$H_0 : p \leq 0.35 \text{ vs } H_1 : p > 0.35.$$

$\alpha = 0.01, n = 4276, \hat{p} = 4019/4276 = 94\%$, TS is

$$z = \frac{\hat{p} - p_0}{\sqrt{p_0 q_0/n}} = \frac{0.94 - 0.35}{\sqrt{(0.35)(0.65)/4276}} = 80.887.$$

From Table A-2, CV=2.33. Since $TS > CV$, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1.

10. Drug Testing for Adverse Reactions

$$H_0 : p \leq 0.05 \text{ vs } H_1 : p > 0.05.$$

$\alpha = 0.01, n = 221, \hat{p} = 3.2\%$, TS is

$$z = \frac{\hat{p} - p_0}{\sqrt{p_0 q_0 / n}} = \frac{3.2\% - 5\%}{\sqrt{(0.05)(0.95)/221}} = -1.228.$$

From Table A-2, CV=−2.33. Since $TS > CV$, we fail to reject the null hypothesis H_0.

12. Smoking and College Education

$$H_0 : p \leq 0.27 \text{ vs } H_1 : p > 0.27.$$

$\alpha = 0.01, n = 785, \hat{p} = 18.3\%$, TS is

$$z = \frac{\hat{p} - p_0}{\sqrt{p_0 q_0 / n}} = \frac{18.3\% - 27\%}{\sqrt{(0.27)(0.73)/785}} = -5.49.$$

From Table A-2, CV=−2.33. Since $TS < CV$, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1.

18. Interpreting Calculator Display

$$H_0 : p \geq 0.5 \text{ vs } H_1 : p < 0.5.$$

$n = 1998, \hat{p} = 0.4799799$, TS is

$$z = \frac{\hat{p} - p_0}{\sqrt{p_0 q_0 / n}} = \frac{0.47997998 - 0.5}{\sqrt{(0.5)(0.5)/1998}} = -1.789749481.$$

P-value=0.0367470453< 0.05. At significance level $\alpha = 0.05$, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1. The sample data support the executive's claim.

Section 7-6.

2. Finding Critical Value

a. $H_1 : \sigma < 1.22$, $n = 23, \alpha = 0.025$, This is a left-tailed test, the area to the right of the critical value is $1 - \alpha = 1 - 0.025 = 0.975$, DF=23-1. Using Table A-4, $CV = 10.982$.

b. $H_1 : \sigma > 92.5$, $n = 12, \alpha = 0.10$, This is a right-tailed test, the area to the right of the critical value is $\alpha = 0.10$, DF=12-1=11. Using Table A-4, $CV = 17.275$.

c. $H_0 : \sigma = 0.237$, $n = 16, \alpha = 0.05$, This is a two-tailed test, the areas to the right of the critical values are $\alpha/2 = 0.025$ and $1 - \alpha/2 = 0.975$, DF=16-1=15. Using Table A-4, the critical values are $CV = 6.262$ and $CV = 27.488$.

4. Test Claim about Variation

$$H_0 : \sigma \leq 5 \text{ vs } H_1 : \sigma > 5.$$

$n = 16, s = 8.0$, TS is

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(16-1)(8^2)}{5^2} = 38.4.$$

$\alpha = 0.01$, This is a right-tailed test, Using Table A-4, CV=30.578. Since TS>CV, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1.

6. Random Generation of Data

$$H_0 : \sigma = 15 \text{ vs } H_1 : \sigma \neq 15.$$

$n = 50, s = 16.3$, TS is

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(50-1)(16.3)^2}{15^2} = 57.861.$$

$\alpha = 0.10$, This is a two-tailed test, Using Table A-4, CV: $\chi^2_L = 34.764, \chi^2_R = 67.505$(approximately). Since χ^2_L <TS< χ^2_R, we fail to reject the null hypothesis H_0. This sample actually does come from a population with a standard deviation equal to 15. This result say that the sample standard deviation among the generated sample values is within the range of usual values of sample standard deviation.

10. Bank Customer Waiting Times

$$H_0 : \sigma \geq 6.2 \text{ vs } H_1 : \sigma < 6.2.$$

$n = 25, s = 3.8$, TS is

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(25-1)(3.8)^2}{6.2^2} = 9.016.$$

$\alpha = 0.05$, This is a left-tailed test, Using Table A-4, CV: $\chi^2 = 13.848$. Since TS< χ^2, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1. The sample result support the claim that a single line causes lower variation among waiting times. Most of the customers would have approximately the same waiting times. On average, a single line does not result in a short wait.

16. Supermodel Heights Heights of randomly selected supermodels:(Talor, Harlow, Milder, Gogg, Evangelista, Avermann, Schiffer, MacPherson, Turlington, Hall, Crawford, Campbell, Herzigova, Seymour, Banks, Moss, Mazza, Hume)

71, 71, 70, 69, 69.5, 70.5, 71, 72, 70, 70, 69, 69.5, 69, 70, 70, 66.5, 70, 71

$$H_0 : \sigma \geq 2.5 \text{ vs } H_1 : \sigma < 2.5.$$

$n = 18, \bar{x} = 69.94444, s = 1.186801$, TS is

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(18-1)(1.186801)^2}{2.5^2} = 3.83111.$$

$\alpha = 0.05$, This is a left-tailed test, Using Table A-4, CV: $\chi^2 = 8.672$. Since TS$< \chi^2$, we reject the null hypothesis H_0 in favor of the alternative hypothesis H_1. The sample result support the claim that heights of female super-models have lower variation.