CHAPTER 8— ANSWERS TO EXERCISES

1.

a. H_0: $\mu = 13.5$ years; H_1: $\mu < 13.5$ years.

b. The Z value obtained is –4.19. The p value for a Z of –4.19 is less than .001 for a one-tailed test. This is less than the alpha of .01, so we reject the null hypothesis and conclude that the doctors at the HMO do have less experience than the population of doctors at all HMOs.

2.

a. The obtained Z test is –2.33.

$$Z = \frac{.43 - .50}{.03} = -2.33$$

The probability of obtaining this Z-test statistic is .0198 (.0099 × 2), less than our alpha level. We reject the null hypothesis and conclude that there is a significant difference in the proportion of homeowners between first-generation and second-generation Hispanic Americans. There is a lower proportion of home ownership among first-generation Hispanic Americans than second-generation Hispanic Americans (.43 – .50 = .07).

b. The obtained Z test is 3.50.

$$Z = \frac{.58 - .51}{.02} = 3.50$$

The probability of obtaining this Z-test statistic is .0004 (.0002 × 2), less than our alpha level. We reject the null hypothesis and conclude that there is a significant difference in the proportion of homeowners between first-generation and second-generation Asian Americans. First-generation Asian Americans have a higher proportion of homeownership than second-generation Asian Americans (.58 – .51 = .07).

3.

a. Two-tailed test, $\mu \neq$ \$53,657; null hypothesis, $\mu =$ \$53,657

b. One-tailed test, $\mu > 3.2$; null hypothesis, $\mu = 3.2$

c. One-tailed test, $\mu_1 < \mu_2$; null hypothesis, $\mu_1 = \mu_2$

d. Two-tailed test, $\mu_1 \neq \mu_2$; null hypothesis, $\mu_1 = \mu_2$

e. One-tailed test, $\mu_1 > \mu_2$; null hypothesis, $\mu_1 = \mu_2$

f. One-tailed test, $\mu_1 < \mu_2$; null hypothesis, $\mu_1 = \mu_2$

4.

a. The research hypothesis is $\pi_1 \neq \pi_2$, the null hypothesis is $\pi_1 = \pi_2$

b.

$$Z = \frac{.34 - .41}{.02} = -3.50$$

$$S_{p_1 - p_2} = \sqrt{\frac{.34(1-.34)}{1799} + \frac{.41(1-.41)}{1001}} = \sqrt{.0003664} = .019 = .02$$

We would reject the null hypothesis. Our probability of our Z obtained of –3.50 is less than our alpha of .05 (and less than .0002, from Appendix A). The proportion of white respondents who support the tactic of bringing people of different racial backgrounds together to talk about race is lower than the proportion of black respondents. The difference of .07 (.41 – .34) is significant at the .05 level.

5.

a. Research hypothesis, $\mu = 37.2$; null hypothesis, $\mu = 37.2$

b. The t obtained is –29.36 and its p level is <.001 (it is greater than the last reported t critical of 3.291).

$$t = \frac{37.2 - 50.12}{17.07 / \sqrt{1490}} = \frac{-12.92}{.44} = -29.36$$

c. We conclude that we can reject the null hypothesis in favor of the research hypothesis. There is a difference between the mean age of the GSS sample and the mean age of all American adults. Relative to age, the GSS sample is not representative of all American adults (the GSS sample is significantly older).

6.

a. The research hypothesis is $\pi_1 \neq \pi_2$, the null hypothesis is $\pi_1 = \pi_2$

b.

Step 1.

Independent random samples of $N_1 > 50$ and $N_2 > 50$ are used.

The level of measurement of the variable is nominal.

Step 2.

The research hypothesis is $\pi_1 \neq \pi_2$, the null hypothesis is $\pi_1 = \pi_2$

Alpha = .05

Step 3.

We would use the Z statistic for a difference between proportions.

Step 4.

$$Z = \frac{.44 - .30}{.06} = 2.33$$

$$S_{p_1 - p_2} = \sqrt{\frac{.44(1-.44)}{88} + \frac{.30(1-.30)}{245}} = \sqrt{.0037} = .06$$

Step 5.

Our obtained Z is 2.33. The probability of 2.33 is .02 (.0099 × 2), less than our alpha of .05. We reject the null hypothesis of no difference and conclude that there is a significant difference in the proportion of community service volunteers among college and high school graduates. There is a higher proportion of community volunteers among college graduates than high school graduates (.14 = .44 – .30)

7.

a. The appropriate test statistic is *t* test for sample means.

b.

$$t = \frac{2.35 - 3.05}{.18} = -3.89$$

$$\text{Standard error} = \sqrt{\frac{188(1.21)^2 + 60(1.05)^2}{(189+61)-2}}\sqrt{\frac{189+61}{(189)(61)}} = (1.17)(.15) = 0.18$$

The *t* obtained of –3.89 is greater than *t* critical of –1.645. We reject the null hypothesis of no difference. College graduates are more likely to indicate that being Christian is "not very important," whereas high school graduates indicate that being Christian is "fairly important."

c. For a two-tailed test, the *t* critical would be 1.96. The *t* obtained is still greater. We would reject the null hypothesis of no difference.

8.

$$Z = \frac{.48 - .36}{.07} = 1.71$$

$$S_{p_1 - p_2} = \sqrt{\frac{.48(1-.48)}{338} + \frac{.36(1-.36)}{59}} = \sqrt{.0046} = .07$$

We reject the null hypothesis. The probability of the obtained *Z* is .0436 < .05. A higher proportion of native-born respondents (.48) indicated that it was "very important" to be born in this country to be an American than the proportion of foreign-born respondents (.36). The difference of .12 or 12% is significant.

9.

a. "Less than" indicates a one-tailed test.

b. *Z* = –5.00 with a significance of less than .0001. We can reject the null hypothesis and conclude that the proportion of males who believe in the historical importance of the election of a woman as president is significantly less than the proportion of women who believe the same.

$$Z = \frac{.55 - .65}{.02} = -5.0$$

c. The significance of –5.00 is less than .01 (.0001 < .01). The decision to reject the null hypothesis does not change.

10. We reject the null hypothesis. The *t* obtained of –2.918 is significant at the .004 level, less than our alpha of .05 (two-tailed test). Black students are more likely to try alcohol earlier than white students, 7.04 versus 7.81 grade level.

11. Older individuals, aged 50 to 59 years, gave more money in the past year than younger adults aged 30 to 39 years. However, the difference in giving is not significant. The *t* obtained is –.800 (equal variances assumed) with a probability of .425 (>.05 alpha).

12.

a. On average females spend more hours per week on social media. The group's mean score is 5.05, corresponding to the category 6–9 hours. The average score for males is 3.60, corresponding to the 1–2 hour category.

b. Based on the *t* obtained of –5.828, we reject the null hypothesis. The probability of –5.828 is .0000 (less than the alpha of .05). On average, females spend more hours per week using social media than males.

c. If alpha was changed to .01, our Step 5 decision would not change. The probability of the *t* obtained is less than .01. We would reject the null hypothesis.

13.

a. Yes, there is a significant difference between the average number of relaxation hours for married men and women. Married women have significantly less relaxation hours per day than men in the GSS 2014 sample, a difference of .68 hours (3.56 – 2.88). The *t* obtained of 2.225 is significant at the .025 level (less than our alpha of .05).

b. If alpha was changed to .01, we would fail to reject the null hypothesis of no difference. The probability of the *t* obtained is .025 > .01.

SPSS SOLUTIONS

1. With a statistic of 7.425 and *p* value of .000, we find that Americans (included in the GSS2014 survey) use the Internet more than 7 hours per week. The mean WWWHR is 11.97 hours.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
wwwhr WWW HOURS PER WEEK	540	11.97	15.568	.670

One-Sample Test

	Test Value = 7					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
wwwhr WWW HOURS PER WEEK	7.425	539	.000	4.974	3.66	6.29

2. We reject the null hypothesis. The *t* obtained is –2.765, significant at the .006 level (< alpha). Individuals with less than a high school degree use the Internet 6.82 hours per week, compared with 12.62 hours for those with bachelor's degrees.

Group Statistics

	degree RS HIGHEST DEGREE	N	Mean	Std. Deviation	Std. Error Mean
wwwhr WWW HOURS PER WEEK	0 LT HIGH SCHOOL	50	6.82	9.304	1.316
	3 BACHELOR	107	12.62	13.379	1.293

Independent Samples Test

		Levene's Test for Equality of Variances		t-		
		F	Sig.	t	df	Sig. (2-tailed)
wwwhr WWW HOURS PER WEEK	Equal variances assumed	5.379	.022	-2.765	155	.006
	Equal variances not assumed			-3.142	132.332	.002

3. We reject the null hypothesis for the AGE model (equal variances assumed). The *t* obtained is –2.785 (p = .006). Obama voters were significantly younger than Romney voters (51.31 vs. 55.19 years).

The education and income models are not signficant. We fail to reject the null hypothesis.

Group Statistics

	PRES12 VOTE OBAMA OR ROMNEY	N	Mean	Std. Deviation	Std. Error Mean
age AGE OF RESPONDENT	1 Obama	351	51.31	16.526	.882
	2 Romney	229	55.19	16.187	1.070
educ HIGHEST YEAR OF SCHOOL COMPLETED	1 Obama	352	14.39	2.834	.151
	2 Romney	230	14.53	2.559	.169
Nrincome06 Recoded Rincome06 Interval	1 Obama	223	50633.4081	38865.2728	2602.61117
	2 Romney	144	56593.7500	43635.1477	3636.26231

Independent Samples Test

		Levene's Test for Equality of Variances		t-t			
		F	Sig.	t	df	Sig. (2-tailed)	
age AGE OF RESPONDENT	Equal variances assumed	.163	.687	-2.785	578	.006	
	Equal variances not assumed			-2.798	494.568	.005	
educ HIGHEST YEAR OF SCHOOL COMPLETED	Equal variances assumed	3.002	.084	-.605	580	.546	
	Equal variances not assumed			-.618	523.669	.537	
Nrincome06 Recoded Rincome06 Interval	Equal variances assumed	2.714	.100	-1.366	365	.173	
	Equal variances not assumed			-1.333	279.750	.184	

4.

Group Statistics

	god RS CONFIDENCE IN THE EXISTENCE OF GOD	N	Mean	Std. Deviation	Std. Error Mean
age AGE OF RESPONDENT	3 SOME HIGHER POWER	173	48.55	16.620	1.264
	6 KNOW GOD EXISTS	859	51.64	16.701	.570
educ HIGHEST YEAR OF SCHOOL COMPLETED	3 SOME HIGHER POWER	175	15.05	3.092	.234
	6 KNOW GOD EXISTS	864	13.28	3.052	.104
Nrincome06 Recoded Rincome06 Interval	3 SOME HIGHER POWER	122	54657.7869	44599.3667	4037.83694
	6 KNOW GOD EXISTS	494	41979.2510	34514.2870	1552.87118

Independent Samples Test

		Levene's Test for Equality of Variances		t-te			
		F	Sig.	t	df	Sig. (2-tailed)	
age AGE OF RESPONDENT	Equal variances assumed	.032	.859	-2.219	1030	.027	
	Equal variances not assumed			-2.226	247.028	.027	
educ HIGHEST YEAR OF SCHOOL COMPLETED	Equal variances assumed	.059	.808	6.968	1037	.000	
	Equal variances not assumed			6.908	247.513	.000	
Nrincome06 Recoded Rincome06 Interval	Equal variances assumed	15.136	.000	3.415	614	.001	1
	Equal variances not assumed			2.931	158.588	.004	1

Based on alpha = .05, we would reject all null hypotheses.

For AGE, those who believe in some higher power are younger than those who know God exists (48.55 vs. 51.64). The *t* obtained is –2.219, significant at the .027 level. (Equal variances assumed.)

For EDUC, those who believe in some higher power are more educated than those who know God exists (15.05 vs. 13.28 years). The *t* obtained is 6.968, significant at the .000 level. (Equal variances assumed.)

For NRINCOME06, those who believe in some higher power have more income than those who know God exists (54,657.37 vs. 41,979.25). The *t* obtained is 2.931, significant at the .004 level. (Equal variances not assumed.)