CHAPTER 11— ANSWERS TO EXERCISES

1.

$\bar{Y}_1 = 2.875$	$\bar{Y}_2 = 2.250$	$\bar{Y}_3 = 2.00$	$\bar{Y}_4 = 1.375$
$\sum Y_1 = 23$	$\sum Y_2 = 18$	$\sum Y_3 = 16$	$\sum Y_4 = 11$
$\sum Y_1^2 = 71$	$\sum Y_2^2 = 44$	$\sum Y_3^2 = 38$	$\sum Y_4^2 = 17$
$n_1 = 8$	$n_2 = 8$	$n_3 = 8$	$n_4 = 8$
$\bar{Y} = 2.125$			
$N = 32$			

$$SSB = 8(2.875 - 2.125)^2 + 8(2.250 - 2.125)^2 + 8(2.00 - 2.125)^2 + 8(1.375 - 2.125)^2$$
$$= 8(.5625) + 8(.015625) + 8(.015625) + 8(.5625)$$
$$= 4.5 + .125 + .125 + 4.5$$
$$SSB = 9.25$$

$$df_b = 4 - 1$$
$$df_b = 3$$

$$\text{Mean square between} = 9.25/3 = 3.08$$

$$SSW = (71 + 44 + 38 + 17) - \left[(23^2/8) + (18^2/8) + (16^2/8) + (11^2/8)\right]$$
$$= 170 - (66.125 + 40.5 + 32 + 15.125)$$
$$= 170 - 153.75$$
$$SSW = 16.25$$

$$df_w = 32 - 4$$
$$= 28$$

$$\text{Mean square within} = 16.25/28 = 0.58$$

$$F = 3.08/0.58$$
$$= 5.31$$

Decision: If we set alpha at .05, F critical would be 2.95 ($df_1 = 3$ and $df_2 = 28$). Based on our F obtained of 5.31, we would reject the null hypothesis and conclude that at least one of the means is significantly different than the others. Upper-class respondents rate their health the

highest (1.375), followed by middle- and working-class respondents (2.00 and 2.25, respectively) and lower-class respondents (2.875) on a scale where 1 = *excellent*, 4 = *poor*.

2.

$\bar{Y}_1 = 2.50$	$\bar{Y}_2 = 2.50$	$\bar{Y}_3 = 1.33$
$\sum Y_1 = 15$	$\sum Y_2 = 15$	$\sum Y_3 = 8$
$\sum Y_1^2 = 43$	$\sum Y_2^2 = 41$	$\sum Y_3^2 = 12$
$n_1 = 6$	$n_2 = 6$	$n_3 = 6$
$\bar{Y} = 2.11$		
$N = 18$		

Mean square between : $5.47/2 = 2.735$

$$SSB = 6(2.50-2.11)^2 + 6(2.50-2.11)^2 + 6(1.33-2.11)^2$$
$$= .91 + .91 + 3.65$$
$$= 5.47$$
$$df_b = k - 1 = 3 - 1 = 2$$

Mean square within : $10.33/15 = .689$

$$SSW = (43 + 41 + 12) - (15^2/6 + 15^2/6 + 8^2/6)$$
$$= 96 - (37.5 + 37.5 + 10.67)$$
$$= 96 - 85.67 = 10.33$$
$$df_w = 18 - 3 = 15$$
$$F = 2.735/.6892 = 3.968 = 3.97$$

Decision: If alpha was set at .05, F critical could be 3.68 ($df_1 = 2$ and $df_2 = 15$). Based on our F obtained of 3.97, we would reject the null hypothesis and conclude that at least one of the means is significantly different than the others. As educational attainment increases, the perception of health care quality increases (the average score declines). Respondents with a high school degree or some college report an average of 2.50, while those with a college degree have a lower average score of 1.33.

3.

$\bar{Y}_1 = 1.6$	$\bar{Y}_2 = 1.4$	$\bar{Y}_3 = 0.6$
$\sum Y_1 = 16$	$\sum Y_2 = 14$	$\sum Y_3 = 6$
$\sum Y_1^2 = 30$	$\sum Y_2^2 = 24$	$\sum Y_3^2 = 8$
$n_1 = 10$	$n_2 = 10$	$n_3 = 10$
$\bar{Y} = 1.2$		
$N = 30$		

$$SSB = 10(1.6-1.2)^2 + 10(1.4-1.2)^2 + 10(0.6-1.2)^2$$
$$= 10(0.16) + 10(0.04) + 10(0.36)$$
$$= 1.6 + 0.4 + 3.6$$
$$= 5.6$$
$$df_b = 3-1$$
$$= 2$$

Mean square between $= 5.6/2 = 2.8$

$$SSW = (30+24+8) - (16^2/10) + (14^2/10) + (6^2/10)$$
$$= 62 - (25.6 + 19.6 + 3.6)$$
$$= 62 - 48.8$$
$$= 13.2$$
$$df_w = 30-3$$
$$df_w = 27$$

Mean square within $= 13.2/27 = 0.488889$

$$F = 2.8/0.49$$
$$= 5.71$$

Decision: If we set alpha at .01, F critical would be 5.49 ($df_1 = 2$ and $df_2 = 27$). Based on our F obtained of 5.71, we would reject the null hypothesis and conclude that at least one of the means is significantly different than the others. Respondents with no degree rate their church attendance highest (1.6), followed by respondents with a secondary degree (1.4) and then respondents with a university degree (0.6).

6.

a.

$\bar{Y}_1 = 4.29$	$\bar{Y}_2 = 2.29$	$\bar{Y}_3 = 3.14$
$\sum Y_1 = 30$	$\sum Y_2 = 16$	$\sum Y_3 = 22$
$\sum Y_1^2 = 134$	$\sum Y_2^2 = 44$	$\sum Y_3^2 = 84$
$n_1 = 7$	$n_2 = 7$	$n_3 = 7$
$\bar{Y} = 3.24$		
$N = 21$		

$$SSB = 7(4.29-3.24)^2 + 7(2.29-3.24)^2 + 7(3.14-3.24)^2$$
$$= 7(1.10) + 7(0.90) + 7(0.01)$$
$$= 7.70 + 6.30 + 0.07$$
$$= 14.07$$
$$df_b = 3-1$$
$$df_b = 2$$

Mean square between = 14.07/2 = 7.035

$$SSW = (134 + 44 + 84) - \left[(30^2/7) + (16^2/7) + (22^2/7)\right]$$
$$= 262 - (128.57 + 36.57 + 69.14)$$
$$= 262 - 234.28$$
$$SSW = 27.72$$

$$df_w = 21 - 3$$
$$df_w = 18$$

Mean square within = 27.72/18 = 1.54

$$F = 7.035/1.54$$
$$F = 4.57$$

Decision. If we set alpha at .05, F critical would be 3.55 ($df_1 = 2$ and $df_2 = 18$). Based on our F obtained of 4.57, we would reject the null hypothesis and conclude that at least one of the means is significantly different from the others. On average, white respondents have the highest number of school days missed in the past 4 weeks (4.29), followed by Hispanic respondents (3.14), and then black respondents (2.29).

b. If alpha were changed to .01, F critical would be 6.01. We would fail to reject the null hypothesis at this alpha level.

5.

$\bar{Y}_1 = 0.8$	$\bar{Y}_2 = 1.75$	$\bar{Y}_3 = 3.20$
$Y_1 = 4$	$Y_2 = 7$	$Y_3 = 16$
$\sum Y_1^2 = 6$	$\sum Y_2^2 = 15$	$\sum Y_3^2 = 54$
$n_1 = 5$	$n_2 = 4$	$n_3 = 5$
$\bar{Y} = 1.93$		
$N = 14$		

$$SSB = 5(.8 - 1.93)^2 + 4(1.75 - 1.93)^2 + 5(3.20 - 1.93)^2$$
$$= 5(1.2769) + 4(.0324) + 5(1.6129)$$
$$= 6.3845 + 0.1296 + 8.0645$$
$$SSB = 14.58$$

$$df_b = 3 - 1$$
$$df_b = 2$$

Mean square between = 14.58/2 = 7.29

$$SSW = (6+15+54) - \left[(4^2/5) + (7^2/4) + (16^2/5)\right]$$
$$= 75 - (3.2 + 12.25 + 51.2)$$
$$= 75 - 66.65$$
$$SSW = 8.35$$

$$df_w = 14 - 3$$
$$df_w = 11$$

Mean square within = $8.35/11 = 0.76$

$$F = 7.29/0.76$$
$$F = 9.59$$

Decision. If we set alpha at .05, F critical would be 3.98 ($df_1 = 2$ and $df_2 = 11$). Based on our F obtained of 9.59, we would reject the null hypothesis and conclude that at least one of the means is significantly different from the others. The average number of moving violations is the highest for large-city respondents (3.2); medium-sized city residents are next (1.75), followed last by small-town respondents (0.8).

6.

$\bar{Y}_1 = 2.86$	$\bar{Y}_2 = 1.57$	$\bar{Y}_3 = 2.50$
$\sum Y_1 = 20$	$\sum Y_2 = 11$	$\sum Y_3 = 15$
$\sum Y_1^2 = 62$	$\sum Y_2^2 = 19$	$\sum Y_3^2 = 41$
$n_1 = 7$	$n_2 = 7$	$n_3 = 6$
$\bar{Y} = 2.30$		
$N = 20$		

$$SSB = 7(2.86 - 2.30)^2 + 7(1.57 - 2.30)^2 + 6(2.50 - 2.30)^2$$
$$= 7(.31) + 7(.53) + 6(.04)$$
$$= 2.17 + 3.73 + .24$$
$$SSB = 6.14$$

$$df_b = 3 - 1$$
$$df_b = 2$$

Mean square between = $6.14/2 = 3.07$

$$SSW = (62 + 19 + 41) - \left[(20^2/7) + (11^2/7) + (15^2/6)\right]$$
$$= 122 - (57.14 + 17.29 + 37.50)$$
$$= 122 - 111.93$$
$$SSW = 10.07$$

$$df_w = 20 - 3$$
$$df_w = 17$$

$$\text{Mean square within} = 10.07/17 = 0.59$$

$$F = 3.07/.59$$
$$F = 5.20$$

Decision. If we set alpha at .05, F critical would be 3.59 ($df_1 = 2$ and $df_2 = 17$). Based on our F obtained of 5.20, we would reject the null hypothesis and conclude that at least one of the means is significantly different from the others. A lower mean score indicates a higher rating of the importance of American ancestry for "truly being American". The lowest score was for black respondents (1.57). Black respondents indicated on average that having American ancestry was between "very important" and "fairly important." The highest score was for whites; a mean score of 2.86 is closer to "not very important" on the 4-point scale.

7. For each sociocultural resource, we would reject the null hypothesis. For social support, the obtained F ratio is 12.17, $p < .001$. Whites report the highest level of social support (2.85) while Non-Cuban Hispanics have the lowest (2.58). For religious attendance, the obtained F ratio is 56.43, $p < .001$. Church attendance is highest for African Americans and Non-Cuban Hispanics in the sample (3.94 and 3.37 on the 5-point scale).

8. The model for HELPWRLD is not significant (.098 > .05). We fail to reject the null hypothesis of no difference.

   The model for HELPUSA is significant (.028 < .05). The model reveals that rating how important it is to help Americans who are worse off than yourself is highest for Democrats (6.15), followed by Independents (5.94) and Republicans (5.76).

9. Based on alpha = .01, we reject the null hypothesis of no difference. The average donation amount does vary by educational degree. The group with the highest average donation amount is graduate degree ($5590.61) followed by bachelor degree ($3397.40). The group with the lowest donation amount was less than high school graduates ($593.85).

10. Yes, there is a significant difference in e-mail hours per week by educational attainment. The model is significant at the .003 level (< alpha). As educational attainment increases, so does the amount of e-mail hours. The group with the least amount of e-mail hours per week is less than high school (1.72 hours). The graduate group has the highest amount of e-mail hours per week (11.13 hours).

11.

    a. Yes, agreement to the statement does vary by how satisfied the individual is with his or her financial situation. The ANOVA model is significant at the .003 level (< .01 alpha). All group means are between agree (2) or neither (3), but the group most likely to agree with the statement is the group which is not at all satisfied with their financial situation. This group's mean score is 2.72, between agree and neither. For the satisfied and more or less satisfied with their financial situation, average scores are slightly above 3—neither agree or disagree.

    b. Eta-squared is 14.662/501.637 = .029 = .03. Only 3% of the variation in IMMJOBS can be explained by satisfaction with finances.

12.

    a. We can reject the null hypothesis of no difference. There is a relationship between social class and ethical consumerism. Middle- and upper-class individuals indicated higher

agreement to the BUYPOL statement. The obtained *F* test is 2.838, significant at the .038 level (< .05).

b. Eta-squared is 25.338/1055.074 = .024 = .02. Only 2% of the variance in BUYPOL can be explained by social class.

c. If alpha was set at .01, we would fail to reject the null hypothesis of no difference. The significance of the F obtained is greater than alpha (.038 > .01).

13.

a. $df_b = k - 1 = 5 - 1 = 4$; $df_w = N - k = 254 - 5 = 249$

b. We would reject the null hypothesis for the three models. Students' perception of mentoring does vary by racial/ethnic identity. The most significant model is for the statement, "There are peer mentors who can advise me." Native American students have the highest level of agreement, followed by African American students. The lowest average score is for Asian students. The model for "I mentor other students" is significant at the .006 level. Native American students have the highest level of agreement, followed by African American students. The lowest average score is for Asian students. Finally, the model for "There are persons of color in administrative roles from whom I would seek mentoring at this institution" is significant at the .008 level. Native American students have the highest average level of agreement, followed by multiethnic students. The lowest score was reported by Hispanic students.

SPSS SOLUTIONS

Note: For all of these exercises, the Descriptives option was selected.

1.

b. *F* obtained is 18.436 significant at the .000 level. We reject the null hypothesis and conclude that one of the means is significantly different. For men (as it was for women in the SPSS Demonstration), as educational attainment increases, so does the age when one's first child is born. The oldest first-time fathers are those with a bachelor's degree (30.10), followed by men with a graduate degree (29.73). The youngest first-time fathers were those with a high school degree (22.79).

Descriptives

agekdbrn R'S AGE WHEN 1ST CHILD BORN

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0 LT HIGH SCHOOL	52	22.79	4.791	.664	21.45	24.12	15	40
1 HIGH SCHOOL	226	25.23	6.237	.415	24.41	26.04	16	52
2 JUNIOR COLLEGE	26	25.77	5.928	1.163	23.37	28.16	16	40
3 BACHELOR	83	30.10	6.166	.677	28.75	31.44	17	57
4 GRADUATE	59	29.73	6.870	.894	27.94	31.52	16	47
Total	446	26.48	6.610	.313	25.86	27.09	15	57

ANOVA

agekdbrn R'S AGE WHEN 1ST CHILD BORN

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2785.559	4	696.390	18.436	.000
Within Groups	16657.670	441	37.772		
Total	19443.229	445			

2. The model for men only: The *F* obtained is 6.999 ($p = .000$). We would reject the null hypothesis and note that as social class increases, so does the age when first child was born. The youngest average age was 24.87 for lower-class men; the oldest average age was 31.87 for upper-class men.

Descriptives[a]

agekdbrn R'S AGE WHEN 1ST CHILD BORN

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1 LOWER CLASS	38	24.87	6.196	1.005	22.83	26.90	16	47
2 WORKING CLASS	200	25.51	6.385	.451	24.62	26.40	15	52
3 MIDDLE CLASS	192	27.40	6.345	.458	26.49	28.30	16	48
4 UPPER CLASS	15	31.87	9.731	2.513	26.48	37.26	20	57
Total	445	26.48	6.615	.314	25.87	27.10	15	57

a. sex RESPONDENTS SEX = 1 MALE

ANOVA[a]

agekdbrn R'S AGE WHEN 1ST CHILD BORN

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	883.151	3	294.384	6.999	.000
Within Groups	18547.972	441	42.059		
Total	19431.124	444			

a. sex RESPONDENTS SEX = 1 MALE

The model for women only: *F* obtained is 15.086 ($p = .000$). We would reject the null hypothesis and conclude that one of the means is significantly different. Based on the Descriptives table, we know that the same pattern exists for women as it does for men—as social class increases, so does the age when respondent's first child was born.

Comparing men and women, we can see that across all social classes, women are younger than men when their first child is born. For women, the average age when a first child is born is 23.15 years; for men, the average age is 26.48 years.

Descriptives[a]

agekdbrn R'S AGE WHEN 1ST CHILD BORN

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1 LOWER CLASS	76	20.41	4.227	.485	19.44	21.37	14	36
2 WORKING CLASS	311	22.50	5.295	.300	21.91	23.09	15	40
3 MIDDLE CLASS	262	24.56	5.752	.355	23.86	25.26	15	45
4 UPPER CLASS	18	25.61	7.188	1.694	22.04	29.19	17	40
Total	667	23.15	5.599	.217	22.73	23.58	14	45

a. sex RESPONDENTS SEX = 2 FEMALE

ANOVA[a]

agekdbrn R'S AGE WHEN 1ST CHILD BORN

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1334.189	3	444.730	15.086	.000
Within Groups	19544.905	663	29.479		
Total	20879.094	666			

a. sex RESPONDENTS SEX = 2 FEMALE

3. For all respondents: *F* obtained is 2.750 ($p = .027$). Since *p* is smaller than alpha = .05, we reject the null hypothesis and conclude that there is a difference between means. Ideal number of children is highest for those with less than a high school degree (3.73), lowest for those with a junior college degree (2.88).

Descriptives

chldidel IDEAL NUMBER OF CHILDREN

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0 LT HIGH SCHOOL	118	3.73	2.198	.202	3.33	4.13	0	8
1 HIGH SCHOOL	493	3.14	1.940	.087	2.96	3.31	0	8
2 JUNIOR COLLEGE	85	2.88	1.769	.192	2.50	3.26	1	8
3 BACHELOR	196	3.30	2.216	.158	2.99	3.61	0	8
4 GRADUATE	113	3.14	2.150	.202	2.74	3.54	0	8
Total	1005	3.22	2.045	.065	3.09	3.34	0	8

ANOVA

chldidel IDEAL NUMBER OF CHILDREN

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	45.698	4	11.425	2.750	.027
Within Groups	4155.014	1000	4.155		
Total	4200.712	1004			

4. The model for DEGREE and BUYPOL is significant. The obtained *F* ratio is 7.259, significant at the .000 level. The importance of buying products for political reasons is highest for those with a bachelor's (5.34) or graduate degree (5.33). Men and women with a high school degree rate the importance of buying products for political reasons the lowest (4.00).

   The model for RACE and BUYPOL is not significant. We cannot reject the null hypothesis of no difference.

Descriptives

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0 LT HIGH SCHOOL	65	4.00	1.953	.242	3.52	4.48	1	7
1 HIGH SCHOOL	216	4.97	1.732	.118	4.74	5.20	1	7
2 JUNIOR COLLEGE	26	4.77	1.986	.390	3.97	5.57	1	7
3 BACHELOR	94	5.34	1.411	.146	5.05	5.63	1	7
4 GRADUATE	55	5.33	1.334	.180	4.97	5.69	2	7
Total	456	4.94	1.723	.081	4.78	5.10	1	7

ANOVA

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	81.677	4	20.419	7.259	.000
Within Groups	1268.604	451	2.813		
Total	1350.281	455			

Descriptives

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1 WHITE	340	4.93	1.714	.093	4.75	5.11	1	7
2 BLACK	64	5.08	1.505	.188	4.70	5.45	1	7
3 OTHER	52	4.83	2.027	.281	4.26	5.39	1	7
Total	456	4.94	1.723	.081	4.78	5.10	1	7

ANOVA

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.923	2	.962	.323	.724
Within Groups	1348.358	453	2.977		
Total	1350.281	455			

5. The models for RACE and BUYPOL by SEX are not shown here. The models for men and women are not significant.

   The models for DEGREE and BUYPOL by SEX are presented below. Both models are significant, indicating that the importance of buying products for political, ethical, or environmental reasons varies by educational attainment in separate models for men and women.

For both men and women, those with a bachelor's or graduate degree rate the importance of ethical consumerism highest.

Descriptives[a]

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0 LT HIGH SCHOOL	24	3.67	2.180	.445	2.75	4.59	1	7
1 HIGH SCHOOL	104	4.97	1.771	.174	4.63	5.32	1	7
2 JUNIOR COLLEGE	7	3.71	2.059	.778	1.81	5.62	1	6
3 BACHELOR	39	5.10	1.535	.246	4.60	5.60	1	7
4 GRADUATE	22	5.23	1.378	.294	4.62	5.84	2	7
Total	196	4.82	1.807	.129	4.57	5.08	1	7

a. sex RESPONDENTS SEX = 1 MALE

ANOVA[a]

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	49.621	4	12.405	4.036	.004
Within Groups	587.129	191	3.074		
Total	636.750	195			

a. sex RESPONDENTS SEX = 1 MALE

Descriptives[a]

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0 LT HIGH SCHOOL	41	4.20	1.806	.282	3.63	4.77	1	7
1 HIGH SCHOOL	112	4.96	1.703	.161	4.65	5.28	1	7
2 JUNIOR COLLEGE	19	5.16	1.864	.428	4.26	6.06	1	7
3 BACHELOR	55	5.51	1.303	.176	5.16	5.86	1	7
4 GRADUATE	33	5.39	1.321	.230	4.93	5.86	2	7
Total	260	5.03	1.654	.103	4.82	5.23	1	7

a. sex RESPONDENTS SEX = 2 FEMALE

ANOVA[a]

buypol HOW IMPORTANT TO CHOOSE PRODUCTS FOR POL REASONS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	46.365	4	11.591	4.462	.002
Within Groups	662.447	255	2.598		
Total	708.812	259			

a. sex RESPONDENTS SEX = 2 FEMALE