

Biostatistics II
Worksheet--ANOVA
April 2009

Problem 16.10 (White)

1. Display the ANOVA table.

ANOVA Table

Source	df	SS	MS	F	P-value
Model	<u>2</u>	<u>316.72</u>	<u>158.36</u>	<u>63.60</u>	<u><0.0001</u>
Error	<u>33</u>	<u>82.16</u>	<u>2.4898990</u>		
Total	<u>35</u>	<u>398.8</u>			

2. $H_0: \mu_1 = \mu_2 = \mu_3$

$H_a: \text{Not } H_0$

3. What is the estimate of the variance? 2.4898990

4. Write the lsmeans and the associated standard error of the mean for the 3 groups.

Young (1)	Middle (2)	Elderly (3)
<u>21.5</u>	<u>27.75</u>	<u>21.416</u>
(0.45551244)	(0.45551244)	(0.45551244)

5. Suppose you are interested in two pair wise contrasts. Calculate 90% familywise confidence intervals using the Bonferroni procedure.

$$\mu(\text{Middle}) - \mu(\text{Young}) \quad \underline{6.25} \pm \underline{2.035} \sqrt{2.4898990 \left(\frac{1}{2} + \frac{1}{2} \right)}$$

$$t_{33, 0.975} \quad (\underline{4.9391} \quad , \quad \underline{7.5609})$$

$$\mu(\text{Middle}) - \mu(\text{Elderly}) \quad \underline{6.33} \pm \underline{2.035} \sqrt{2.4898990 \left(\frac{1}{2} + \frac{1}{2} \right)}$$

$$(\underline{5.0224} \quad , \quad \underline{7.6443})$$

What is your conclusion based on these multiple comparisons?

There is sufficient evidence to suggest that the mean cash offer for the middle age group is different than that for the young age group and the elderly age group.

Problem 19.12 (White)

1. Display the ANOVA table.

ANOVA Table

Source	df	SS	MS	F	P-value
Eye	<u>1</u>	<u>54.45</u>	<u>54.45</u>	<u>8.96</u>	<u>0.0086</u>
Gender	<u>1</u>	<u>76.05</u>	<u>76.05</u>	<u>12.52</u>	<u>0.0027</u>
Eye*Gender	<u>1</u>	<u>1.25</u>	<u>1.25</u>	<u>0.21</u>	<u>0.6562</u>
Error	<u>16</u>	<u>97.2</u>	<u>6.075</u>		
Total	<u>19</u>	<u>228.95</u>			

2. Test for the interaction of factors Eye and Gender.

a. H_0 : *There is not interaction between factors Eye and Gender.* H_a : *There is interaction between factors Eye and Gender.*b. Test Statistic = 0.21c. df numerator = 1d. df denominator = 16e. p-value = 0.6562

f. Conclusion.

*There is not sufficient evidence to suggest that there is interaction between factors Eye and Gender.*3. What is the estimate of the variance? 6.075

4. Make a 2 X 2 table of means. Rows are the levels of eye, columns are the levels of Gender.

Under each mean write the standard error of the mean in parentheses.

	Gender = 1	Gender = 2	Marginal (Eye)
Eye = 1	<u>9.2</u> (1.1023)	<u>13.6</u> (1.1023)	<u>11.4</u> (0.7794)
Eye = 2	<u>13.0</u> (1.1023)	<u>16.4</u> (1.1023)	<u>14.7</u> (0.7794)
Marginal (Gender)	<u>11.1</u> (0.7794)	<u>15.0</u> (0.7794)	

5. Suppose that it is determined in Problem 2 that the interaction of Eye and Gender is not significant. Test for the main effect of Gender.

a. $H_0: \mu_{.,1} = \mu_{.,2}$

H(a): *Not H_0*

b. Test Statistic = 12.52

c. df numerator = 1

d. df denominator = 16

e. p-value = 0.0027

f. Conclusion.

There is sufficient evidence to suggest that there is a main effect of Gender, that is, the mean for males is different than the mean for females.

6. Suppose you are interested in two pairwise contrasts. Calculate 90% familywise confidence intervals using the Bonferroni procedure.

$$\mu_{1,} - \mu_{2,} \quad \underline{-3.3} \pm \underline{2.120} \sqrt{6.075\left(\frac{1}{10} + \frac{1}{10}\right)} \quad \underline{(-5.6368, -0.9632)}$$

$$\mu_{.,1} - \mu_{.,2} \quad \underline{-3.9} \pm \underline{2.120} \sqrt{6.075\left(\frac{1}{10} + \frac{1}{10}\right)} \quad \underline{(-6.2368, -1.5632)}$$

$t_{16, 0.975}$

What are your conclusions based on these two familywise intervals?

There is sufficient evidence to suggest that the means for the two levels of the Eye factor are different and that the means for males and females are different.