Name: *Caleb McWhorter — Solutions* **MAT 222**

Quiz 9 **Spring 2017**

Problem 1: A food critic is analyzing how people rate their food. The critic is particularly interested in how the level of comfort, the amount of control in varying the dish, and how natural ingredients are affect the person's rating of the food. Therefore, the researcher runs a one-way ANOVA of the quantitative variable "score" against three qualitative variables: "comfort", "control", and "organic." The results are found below.

Source	DF	SS	MS	F	P
Food	2	5.330	2.665	7.51	0.001
Error	59	20.930	0.3547		
Total	61	26.26			

S = 0.5956 R-Sq = 20.30% R-Sq (adj)=17.59%

Level	N	Mean	StDev
Comfort	22	4.8873	0.5729
Control	20	5.0825	0.6217
Organic	20	5.5835	0.5936

Pooled StDev = 0.5956

Number of data points = 62

(a) Fill in the missing parts in the output above.

(b) State the null and alternative hypotheses for the F-test in the ANOVA table above. State the conclusions of this test using $\alpha = 0.05$.

$$\begin{cases} H_0 : \beta_1 = \beta_2 = \beta_3 = 0 \\ H_a : \text{not all } \beta_i = 0 \end{cases}$$

We have $p = 0.001 < \alpha$. Therefore, we reject the null hypothesis so that at least one β_i is not zero, i.e. there is an association between the person's rating and at least one of the categories.

(c) Using an appropriate contrast, we would like to compare the mean score of the control group with the average of the other groups. Compute the sample contrast, the standard error of the sample contrast, the t-statistic, and its degrees of freedom. State your conclusions

We want to test $\mu_{control} \stackrel{?}{=} \dfrac{\mu_{comfort} + \mu_{organic}}{2}$ so that we use contrast $\psi = 2\mu_{control} - \mu_{comfort} - \mu_{organic}$.

$$\begin{cases} H_0 : \psi = 0 \\ H_a : \psi \neq 0 \end{cases}$$

Then

$$c = 2\overline{x}_{\textit{control}} - \overline{x}_{\textit{comfort}} - \overline{x}_{\textit{organic}} = 2(5.0825) - 4.8873 - 5.5835 = -0.3058$$

$$SE_c = s_p\sqrt{\sum \frac{a_i^2}{n_i}} = 0.5956\sqrt{\frac{2^2}{20} + \frac{(-1)^2}{22} + \frac{(-1)^2}{20}} = 0.323743$$

$$t = \frac{c}{SE_c} = \frac{-0.3058}{0.323743} = -0.944576$$

Using degrees of freedom $N - I = 62 - 3 = 59$*, this gives* $0.15 < p < 0.20$*. Therefore, we fail to reject the null hypothesis. There is not sufficient evidence to suggest that the average rating for control is different than the average of the other factors.*