Name: _Caleb McWhorter — Solutions_

MAT 222
Fall 2019   _"Clark Kent is Superman's critique on the whole human race."_
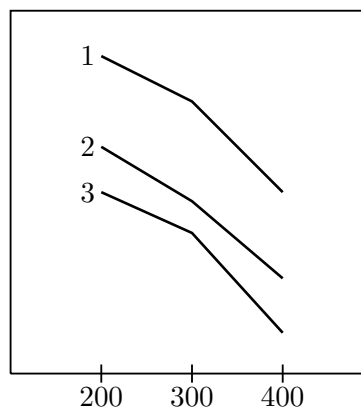**Homework 10**   _— Bill, Kill Bill: Volume 2_

Problem 1: An ANOVA F-test is a generalization of what kind of test?

An ANOVA F-test is a generalization of a two-sample t-test.

Problem 2: Suppose one is testing the hypothesis $H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4$ for an ANOVA F-test. If one reject the null hypothesis, does this mean all the means μ_i are distinct? Explain.

No. The alternative is that not all the μ_i are the same. So at least one of the means is different than at least one of the others.
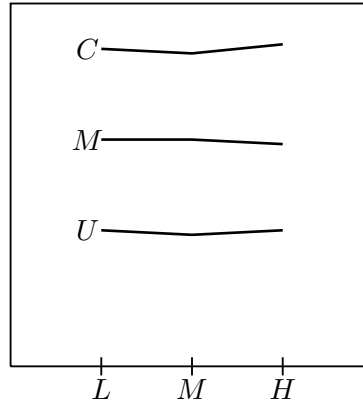
Problem 3: Suppose you are comparing the average cooking time for 3 brans of ovens at temperatures of $200°$F, $300°$F, and $400°$F. Below is an interaction plot for a two-way ANOVA analysis.

Does the plot indicate an interaction between oven temperature and brand of oven? Explain. Which of the following effects are important: oven brand, temperature, oven brand and temperature, or neither. Explain.

Each of the line segments between each of the temperatures are approximately parallel, so there does not appear to be an interaction between oven temperature and oven brand. Notice at each of the temperatures, the average cooking time of each oven is different, so oven brand seems significant. Furthermore, the average cooking time at each temperature for each oven is different, so temperature seems significant.

Problem 4: Suppose you are comparing the average tax rate of 3 different countries: the United States, Canada, and Mexico, by income level: low, middle, and high. The interaction plot for a two-way ANOVA test is shown below.

Does the plot indicate an interaction between country and income level? Explain. Which of the following effects are important: country, income level, country and income level, or neither. Explain.

Each of the line segments between each of the income levels are approximately parallel, so there does not appear to be an interaction between country and income level. Notice fixing a country, the average tax rates are all approximately equal. Therefore, it does not appear income level is significant. However, observe that for each of the income levels, the average tax rate seems to be different for each country. Therefore, it would appear country is a significant factor.

Problem 5: Which of the following are contracts? Indicate the ψ which are contrasts by placing a checkmark next to the ψ.

(a) _____ : $\psi := 2\mu_1 + \mu_2 - 2\mu_3$

(b) ____✓____ : $\psi := \mu_1 - 0.5\mu_2 - 0.5\mu_3$

(c) ____✓____ : $\psi := 3\mu_1 - 2\mu - 2\mu_3 + \mu_4$

(d) _____ : $\psi := \mu_1 - \mu_2 + \mu_3 + \mu_4 - \mu_5$

Problem 6: Construct a contrast from $\mu_2 = \dfrac{\mu_1 + \mu_3}{2}$. What are a_1, a_2, and a_3 for your contrast?

We have $2\mu_2 = \mu_1 + \mu_3$ so that $2\mu_2 - \mu_1 - \mu_3 = 0$. Then $\psi = 2\mu_2 - \mu_1 - \mu_3$ is a possible contrast. For this choice, we have $a_1 = -1$, $a_2 = 2$, and $a_3 = -1$.