

## STAT 217: Interaction vs Additive Models Worksheet 9/28

Suppose a statistics teacher gave an essay final to his class. He randomly divides the classes in half such that half the class writes the final with a blue-book and half with notebook computers. In addition the students are partitioned into three equal size groups, no typing ability, some typing ability, and highly skilled at typing. Answers written in blue-books will be transcribed to word processors and scoring will be done blindly. Not with a blindfold, but the instructor will not know the method or skill level of the student when scoring the final. The dependent measure will be the score on the essay part of the final exam. Use the following R output to answer the questions.

```
anova(lm.int)
```

Analysis of Variance Table

Response: y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
ability	2	97.3	48.7	15.93	0.00042
method	1	14.2	14.2	4.65	0.05195
ability:method	2	1.8	0.9	0.29	0.75271
Residuals	12	36.7	3.1		

1. First, test for an interaction.

(a) Write the hypotheses to test for an interaction in this example.

(b) Report the test statistic and the distribution it follows under the null hypothesis.

(c) Report the p-value and your decision (Hint: Decision=reject or fail to reject).

(d) What is your conclusion?

(e) Would you choose an additive model or an interaction model for inference? Why?

(f) What is the total sample size? Show how you figured it out.

(g) How many students are in each treatment group? Is the design balanced?

2. Now test for the effect of `method`.

```
lm.add <- lm(y~ability+method, data=data)
Anova(lm.add)

## Anova Table (Type II tests)
##
## Response: y
##           Sum Sq Df F value    Pr(>F)
## ability      97.3  2    17.72 0.00015
## method       14.2  1     5.18 0.03910
## Residuals    38.4 14
```

- (a) Write the hypotheses to test for the effect of `method`.
- (b) Report the test statistic and the distribution it follows under the null hypothesis.
- (c) Report the p-value and your decision.
- (d) What is your conclusion?

```
summary(lm.add, show.signif.stars=FALSE)
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.1111	0.7812	1.422	0.1768
abilitynone	2.3333	0.9567	2.439	0.0287
abilitysome	5.6667	0.9567	5.923	3.72e-05
methodcomputer	1.7778	0.7812	2.276	0.0391

3. Use the output above to estimate the mean test score for every treatment group.

4. Interpret the estimate in the `methodcomputer` row of the output above.