

Analysis of Variance: Factorial ANOVA

Assignment. Heiman, Chapter 14

Terms you should know.

Factor
.....
.....

Main Effect
.....
.....

Interaction
.....
.....

Sum of Squares

 Between Treatments
.....
.....

 Main Effect
.....
.....

 Interaction
.....
.....

 Within Treatments
.....
.....

Total
.....
.....

Concepts You Should Master

1. How to calculate
 - a. Degrees of freedom.
 - b. Main Effect.
 - c. Interaction.
 - d. Critical value of F.
 - i. At the $p < .05$ level
 - ii. At the $p < .01$ level
2. What are the benefits of doing a factorial design?
3. What is meant by an *interaction*?
4. What are the key assumptions regarding factorial ANOVAs?
5. Polly Annah reported the results of a two-factor experiment using and ANOVA. Polly reported an F-ratio of 12.22 for factor A with $df = 1,33$ and an F-ratio of -12.64 for factor B with $df = 3, 109$. Why can't this be correct?
6. Is it possible to have a factorial design with no main effect but with a significant interaction? Explain.

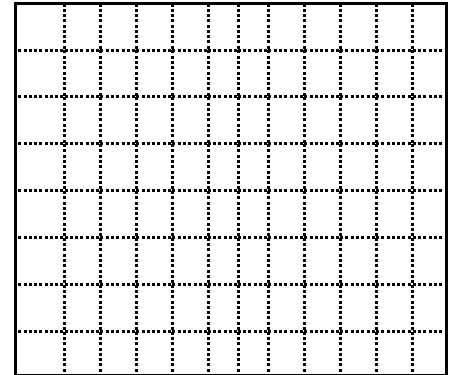
Homework #13: Calculations You Should Master

Name: _____ (This is my work, and my work alone.)

1. Starr Bucke wanted to determine if coffee had an influence on how alert people were 30 minutes after sleeping. Bucke realized that sugar in the coffee might have an impact on the results so he designed a study in which people got low, medium, or strong coffee. He also varied the level of sugar in the coffee. The following table is a summary of her results. Plot the following table and answer the questions.

Mean ratings of coffee based on strength and sugar levels.

	Low Strength	Moderate Strength	High Strength
High Sugar	8.3	10.7	14.4
Low Sugar	12.3	11.4	9.0



- a. Does there appear to be a main effect for sugar level? Why?

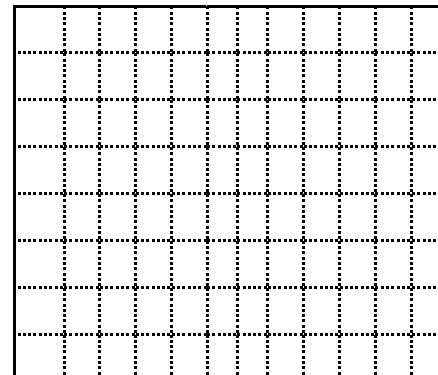
- b. Does there appear to be a main effect for strength? Why?

- c. Does there appear to be an interaction? Why?

- d. How would you interpret this graph based on your answers to these questions?

2. Plot the following table and answer the following questions

Dr. C. Ramme was interested in assessing the effectiveness of study time on performance on a standardized measure of verbal and quantitative reasoning. One group studied for two hours starting two hours before the test, a second group studied two hours starting six hours before the test, and the third group studied two hours starting ten hours before the test. Each group was given a standardized measure of verbal and quantitative reasoning.



Mean scores.

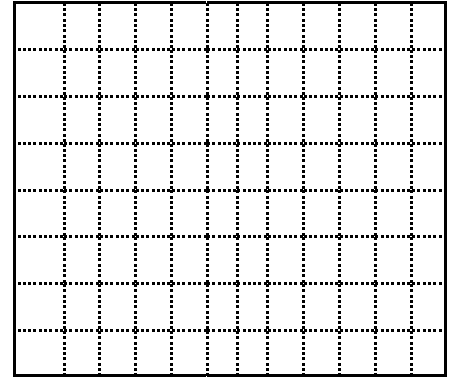
	Two hours	Six hours	Ten hours
Quantitative	44	62	48
Verbal	42	61	50

- What is/are the null hypotheses?
- Do there appear to be main effects? Where and why did you make this decision?
- Does there appear to be an interaction? Why?
- How would you interpret this graph based on your answers to these questions?

3. S. N. Orre wanted to study the effects of water deprivation on the random activity of young and adult rats. After either 6, 12 or 18 hours of deprivation, the rats were placed individually in a small cage and the number of times the rat crossed from one side to the other during a 20-minute period was counted. The scores are summarized below.

Mean number of crossings by condition.

	Six hours	Twelve hours	Eighteen hours
Young	3	7	12
Old	6	6	13



- a. What is/are the null hypotheses?
- b. Complete the ANOVA summary table.

Analysis of variance summary table

Source	SS	df	MS	F
Between Groups				
A. Age	7.50	()		
B. Hours of deprivation	()	()		
AxB interaction	20.00	()		
Within Groups	58.00	24		
Total	432.17	29		

- c. What is the critical value of F for each of the following?
- i. Age
- ii. Hours of Deprivation
- iii. Age x deprivation interaction

- d. What is your conclusion regarding
 - i. Age
 - ii. Hours of deprivation
 - iii. Age x deprivation interaction
 - e. If there is an effect size, how strong is it and how do you interpret it?
4. Using the SPSS data set 1. compute and 2. graph a factorial ANOVA using gender and race as independent variables and Conformity Raw score as the dependent variable.
- a. Is/are there a significant main effect? For which variables.
 - b. Is there a significant interaction? For which variables?
 - c. What is the effect size for the significant results?
 - d. How do you interpret the data?