1. (Ch. 14) Suppose a researcher conducts a factorial experiment in which factor A consists of 3 levels and factor B consists of 2 levels and she discovers a significant interaction. She analyzes the simple effects and finds that the simple effects of factor A are significant at level b_1; moreover, further analysis of simple comparisons reveals that the difference between the means at levels a_1b_1 and a_2b_1 is statistically significant. She also finds that the corresponding simple effect and simple comparison are not significant at level b_2 and stops the analysis at this point.

   What exactly can she conclude from this analysis? What additional analyses would you suggest she perform in order to complete her attempt to uncover the factors involved in the significant interaction? For each analysis you propose, indicate clearly why it is necessary and what information it will provide.

2. (Ch. 14) Suppose you had a two-factor experiment with A represented by 3 levels - a control group and two drug dosage levels - and B represented by two age groups. Suppose, further, that the results of the analysis suggested the simple effects should be examined. Present a set of MRC coding vectors sufficient to analyze the simple effect of A at level b_1.

3. (Ch. 14-15)

a. Define simple effects.
b. Define simple comparisons.
c. When interaction is present, are we interested in the main effects? Why or why not?
d. When interaction is present, are we interested in the simple effects? Why or why not?
e. Define an interaction contrast.

4. Suppose you come across the following results from a 2 x 2 factorial experiment:

	a_1	a_2
b_1	3	8
b_2	2	5

   The researchers report that the difference between the means of 3 and 8 is significant, while the difference between the means of 2 and 5 is not and conclude, therefore, that an interaction exists. Do you agree with this conclusion? Explain.

5. (Ch. 15) Consider the hypothetical results of the two factorial experiments given below:

	a_1	a_2
b_1	12	8
b_2	8	12

	a_1	a_2
b_1	14	7
b_2	9	9

Clearly both experiments exhibit an interaction. What other effects would you expect to find? Which example has the larger interaction? Explain.

6. (Ch. 15) Consider an experiment in which two groups of young hyperactive boys - one that was classified as "aggressive" and the other as "nonaggressive" - were compared under three different conditions: a placebo condition and two dosages of the drug methylphenidate (low and moderate). Each boy received all three treatment conditions (placebo, low, and moderate) - a different one each week; a counterbalancing scheme was used to eliminate general practice effects. The dependent variable consisted of the number of aggressive acts (either verbal or physical) each boy exhibited during the observation periods. The following means were obtained:

	Placebo	Low	Moderate
Aggressive	6.5	2.0	1.3
Nonaggressive	1.5	0.4	0.6

The researcher expected the drug to reduce the number of aggressive acts for both groups of boys, but more so for the aggressive group. His statistical analysis revealed a nonsignificant interaction between the three conditions and the two groups of boys; he concluded that his hypothesis was not supported.

Do you agree with this conclusion? Explain. How would you analyze the experiment? Be explicit - that is, indicate exactly what tests you would conduct and what each one might tell you.

7. (Ch. 15) Two research teams are interested in determining whether tars placed on the backs of rats cause cancer. One research team designs an experiment with a = 2 conditions, which includes one experimental group and one control group. The other team designs a more ambitious experiment with a = 7 conditions, which includes the same experimental group and six different control conditions (including the one created by the first team). Both teams include a second independent variable (two types of diets), creating a 2 x 2 design for the first team and a 7 x 2 design for the second team. For the purpose of this problem, we will assume that there are no differences among the different control conditions introduced in the second experiment and that sample size is s = 50 for each combination of drug and diet in the two experiments.

Let's assume that the analysis of the data from the first experiment produces a significant interaction, with an F of 4.05 ($F_{crit.}$ = 3.92). Suppose the other research team used an omnibus F test to analyze the A x B interaction. Do you think that their F will be significant? Explain. Is

there a better way for the second team to evaluate their primary research hypothesis? Explain your answer.

8. (Ch. 14-15) You have been exposed (some might say overexposed) to two different approaches to the analysis of interaction observed with an A x B factorial design - the analysis of simple effects and the analysis of interaction constrasts. Describe the two approaches, emphasizing the logic behind them and indicating what may be learned from them.

9. (Ch. 16)

    i.   Why is the Treatments x Subjects interaction used as an error term in the single-factor, within-subjects design?

    ii.   What would be the consequences of treating this design for analysis purposes as a between—subjects design? Explain.

    iii.   Why is it generally necessary to obtain separate error terms to evaluate analytical comparisons when the independent variable(s) involved are within-subjects factors?

10. (Ch. 16) Explain thoroughly, carefully, and clearly why the single-factor within-subjects design is more powerful in detecting treatment effects than its completely randomized counterpart.

11. (Ch. 17) Why are there two error terms in the omnibus analysis of the mixed factorial design we have considered in this course? Be sure to describe in words exactly what the two error terms are and to explain why they are both needed for the overall statistical analysis.

12. (Ch. 17) Suppose you have a design in which there are three different groups of subjects, a_l, a_2, and a_3, and four levels of treatments, b_1, b_2, b_3, and b_4. Each subject receives all four of the B treatments in conjunction with one of the three A treatments. Show a set of MRC coding vectors sufficient for the omnibus analysis of this design (that is, vectors for the main effects, interaction, and subject effects). (Please assume that there are 3 subjects randomly assigned to each level of factor A.)

13. (Ch. 17) Describe an experiment from your research field that would be an ideal candidate for a mixed factorial design. Be sure to explain why the mixed design is appropriate. What steps would you take to control practice effects and to avoid differential carryover effects?

14. (Ch. 16-17) Suppose you are planning a factorial design consisting of two independent variables. What types of considerations would warrant (a) a completely randomized design, (b) a "pure" within-subjects design, and (c) a mixed factorial design? What are the advantages and disadvantages of each type of design?