Exam #2, Spring 1993

Question 1

There is currently much public debate about the effectiveness of public education. A policy researcher has collected data from a large number of school districts in the United States. The following variables are available for each school district in the study:

SPEND: amount of money spent per pupil

URBRUR: indicator of whether school is primarily urban (U) or rural (R)

HONORS: indicator of whether school has differentiated classes at each grade level. Levels of this variable are no differentiation (N), some honors classes (H), or complete tracking (T).

SAT: the median SAT score for the district

Specify the MODEL C and MODEL A comparisons you would use to answer each of the following questions. If you construct new variables, be sure to define them. Unless otherwise indicated, use the simplest comparison, not necessarily the most powerful comparison to answer the question.

1. Do urban districts have different SAT scores than rural districts?

2. If school districts were equated on spending per pupil, would there be a difference between urban and rural performance on the SAT?

3. Is the relationship between spending per pupil and SAT performance the same for urban and rural districts?

4. Does having differentiated classes of any type affect median SAT performance? (Include a full set of codes for differentiated classes in your model comparison.)
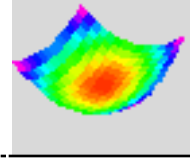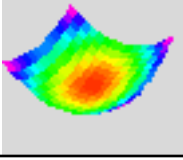
5. Does the relationship between differentiated classes and SAT performance depend on whether the district is urban or rural?

6. Controlling for per-pupil spending, what is the answer to the previous question?

7. Can we reject the assumption of homogeneity of regression which underlies our test of the previous question?

In 1986 a number of school districts adopted a mandatory minimum curriculum for high school graduation, but others did not. For each district we have the variables:

SPEND86: per pupil spendng in 1985
SPEND91: per pupil spending in 1991 (corrected for inflation to 1985 values)

SAT86: median SAT score in 1986
SAT91: median SAT score in 1991

MAND: an indicator of whether a mandatory minimum curriculum was adopted (Y for yes and N for no)

8. Regardless of implementation of the mandatory minimum curriculum, is there an increase in SAT scores from 1986 to 1991?

9. Did implementation of the mandatory minimum curriculum affect the magnitude of the change in SAT scores? (Use difference or change scores rather than an ANCOVA analysis.)

10. Did the effect of the minimum curriculum on SAT change differ for urban versus rurual districts?
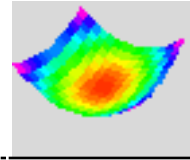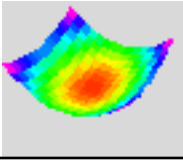
11. Controlling for changes in per-pupil spending, did implementation of the mandatory minimum curriculum affect the change in SAT scores?

12. Do the data suggest that there would be an overall change in SAT scores if there were no change in per-pupil spending (ignore the mandatory curriculum for this analysis).

Question 2

To assess factors affecting the quality of major universities in the United States, ratings of academic departments at 100 randomly selected universities are examined as a function of characteristics of the universities. More specifically, at each of the randomly selected universities, the quality of one physical science, one social science, and one humanities department is assessed. (Assume that quality ratings are measured validly and reliably.) The researchers are interested in differences as a function of whether the university is a public institution or a private one and as a function of its age. Age is represented as a two level variable, classifying universities as old or relatively young.

A. Write out rows of the source table for a full analysis of variance of the data that results from this survey of 100 universities. For each row, you should indicate the source of the sum of squares and the associated degrees of freedom. Make sure that your source table allows tests of effects due to discipline, public versus private status, and age of the university, and their interactions. Please confine yourself to one-degree-of-freedom tests in this source table and substantively indicate the comparisons represented by the rows of the table..

B. Indicate in this source table the row that would yield the F* statistic for testing whether private universities on average have higher rated departments than public ones.
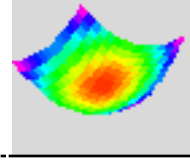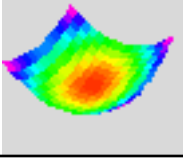
C. Write out the models C and A that you would use to answer the question of whether universities put more emphasis on developing the quality of their physical science departments, compared to their social science and humanities departments, when they are young compared to when they are older. (Make sure that you tell us about the definition of all variables in the two models you specify.)

D. Suppose that the private universities tend to be older than the public ones. Discuss the effects of this relationship on the analysis you have outlined and what steps you would take to overcome any problems it poses.

E. The following values are the cell means that result from the cross classification of the schools by age, public versus private, and physical science departments versus the other two types (averaging across the social science and humanities departments):

	AGE			
	OLD		YOUNG	
	Public	Priv.	Public	Priv.
Dept. Type:				
Physical Sci.	8	7	7	3
Other	8	7	4	2

   1. What is the SSR associated with the AGE difference in these data, assuming that there are an equal number of universities in the four cells that result from the crossing of age and whether it is public or private.?

   2. Graph the cell means and provide an interpretation of the triple interaction among the three factors in the design, assuming that it is reliable