

STATISTICS Ph.D. QUALIFYING EXAM: TAKE HOME
Due 2PM Fri. January 14, 2005. Return to Donna George in the Dept Office

Directions: The exam has two questions of equal value. Your answer to each problem should be word-processed, double spaced, and should be no longer than four pages. An appendix is allowed for each problem but will be examined only at the discretion of the graders. The better constructed your appendix, the more likely it is to get examined. Please use your ID number (last 4 digits of your Social Security Number) for identification. Do not put your name on the exam.

1. An agronomist has four large pieces of land, l1, l2, l3, l4, l5 on which to examine alfalfa production. Each large piece is subdivided into 3 plots that are randomly assigned to growing one of three varieties of alfalfa, v1, v2, v3. Finally, the land for each variety is subdivided into four pieces to be harvested at different times, t1, t2, t3, t4 determined randomly. Analyze the data.

		l1	l2	l3	l4	l5
v1	t1	2.17	1.88	1.62	1.58	1.66
	t2	1.58	1.26	1.22	1.25	0.94
	t3	2.29	1.60	1.67	1.39	1.12
	t4	2.23	2.01	1.82	1.66	1.10
v2	t1	2.33	2.01	1.70	1.42	1.35
	t2	1.38	1.30	1.85	1.13	1.06
	t3	1.86	1.70	1.81	1.67	0.88
	t4	2.27	1.81	2.01	1.31	1.06
v3	t1	1.75	1.95	2.13	1.31	1.30
	t2	1.52	1.47	1.80	1.01	1.31
	t3	1.55	1.61	1.82	1.23	1.13
	t4	1.56	1.72	1.99	1.51	1.33

2. In this problem, you will examine the relationship between public school expenditures and student performance, as measured by scores on the SAT exam. The question of interest in this case is whether higher spending results in better academic performance, which would then impact the manner in which money is allocated to public schools in the U.S.

The data presented here were extracted from the the 1997 Digest of Education Statistics, an annual publication of the U.S. Department of Education, by D. Guber (University of Vermont). The data are aggregated at the state level, and thus there is one observation in the data set for each state. An EXCEL spreadsheet with the data can be found on the WWW at

<http://www.stat.unm.edu/~bedrick/educ.xls>.

The data set contains the following 8 variables:

Column

- 1 State: Name of state
- 2 Expenditure: Current expenditure per pupil in average daily attendance in public elementary and secondary schools, 1994-95 (in thousands of dollars)
- 3 StTeachRatio: Average pupil/teacher ratio in public elementary and secondary schools, Fall 1994
- 4 Salary: Estimated average annual salary of teachers in public elementary and secondary schools, 1994-95 (in thousands of dollars)
- 5 PctSAT: Percentage of all eligible students taking the SAT, 1994-95
- 6 VerbSAT: Average verbal SAT score, 1994-95
- 7 MathSAT: Average math SAT score, 1994-95
- 8 TotSAT: Average total score on the SAT, 1994-95

Use this data to determine whether higher spending results in better academic performance on the SAT exam, by fitting an appropriate model (or models), including relevant explanatory variables. You may find that some simple graphs will be helpful in thinking about the relationship between educational spending and SAT scores. Summarize your analysis carefully, including sections describing your methods of analysis, your results in technical terms, and your conclusions in layman's terms.