

## Homework Assignment 4      due Thursday 4/4

### Correlation

1. (a) For a representative sample of cars, would the correlation between the age of the car and its gasoline economy (miles per gallon) be positive or negative?
  - (b) The correlation between gasoline economy and income of owner turns out to be positive. How do you account for this positive association?
  - (c) Suppose men always married women who were exactly 8% shorter. What would the correlation between their heights be?
2. A computer program prints out  $r$  for the two data sets shown below. Is the program working correctly? Answer yes or no, and explain briefly.

$$(a) \begin{array}{l} x \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \\ y \quad 2 \quad 1 \quad 4 \quad 3 \quad 7 \quad 5 \quad 6 \end{array} \quad r = 0.8214$$

$$(b) \begin{array}{l} x \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \\ y \quad 5 \quad 4 \quad 7 \quad 6 \quad 10 \quad 8 \quad 9 \end{array} \quad r = 0.7619$$

3. (a) Studies find a negative correlation between hours spent watching television and scores on reading tests. Does watching television make people less able to read? Discuss briefly.
  - (a) In a study of 1993 Math SAT scores, the Educational Testing Service computed the average score for each of the 51 states, and the percentage of the high-school seniors in that state who took the test. (For these purposes, D.C. counts as a state.) The correlation between these two variables was equal to  $-0.86$ .

True or false: test scores tend to be lower in the states where a higher percentage of the students take the test. If true, how do you explain this? If false, what accounts for the negative correlation?

In New York, the average score was 471. But in Wyoming, the average was 507. True or false, and explain: the data show that on average, the schools in Wyoming are doing a better job at teaching math than the schools in New York.

### Prediction through Regression

4. In one study, the correlation between the educational level of husbands and wives in a certain town was about 0.50; both averaged 12 years of schooling completed, with an SD of 3 years.
  - (a) Predict the educational level of a woman whose husband has completed 18 years of schooling.

- (b) Predict the educational level of a man whose wife has completed 15 years of schooling.
- (c) Apparently, well-educated men marry women who are less well educated than themselves. But the women marry men with even less education. How is this possible?
5. A doctor is in the habit of measuring blood pressures twice. He notices that patients who are unusually high on the first reading tend to have somewhat lower second readings. He concludes that patients are more relaxed on the second reading. A colleague disagrees, pointing out that the patients who are unusually low on the first reading tend to have somewhat higher second readings suggesting they get more nervous. Which doctor is right? Or perhaps both are wrong? Explain briefly.
6. Tuddenham and Snyder obtained the following results for 66 California boys at ages 6 and 18 (the scatter plot is football-shaped):

average height at 6 = 3 feet 10 inches,    SD = 1.7 inches  
average height at 18 = 5 feet 10 inches,    SD = 2.5 inches,     $r = 0.8$

- (a) Find r.m.s. error for the regression prediction of height at 18 from height at 6. If a boy is 4 feet at age 6, what is the probability that he will be over 5 feet 10 inches at age 18?
- (b) Find the r.m.s error for the regression prediction of height at 6 from height at 18. If a boy is 6 feet at age 18, what is your guess of his height at 6? His chance of being below 3 feet at age 6?