

Biostatistics

Math 322 — Spring 2009

Homework 11 — Due 04/17

Problem 1 (Problems 11.17 – 11.19 in the book)

Suppose we are interested in the relation between carbonmonoxide concentration and the density of cars in a geographic area. The number of cars per hour (to the nearest 500 cars per hour) and the concentratio of carbon monoxide (CO) in parts per million at a particular street corner are measured, and the data are grouped by cars per hour. The data are given in Table 11.19.

Table 11.19: CO concentration and car density at a particular street corner

Cars/hour	CO concentrations				# samples
1000	9.0	6.8	7.7		3
1500	9.6	6.8	11.3		3
2000	12.3	11.8			2
3000	20.7	19.2	21.6	20.6	4

- Is the CO concentration related to the number of cars per hour?
- What is the average CO concentration if 2500 cars per hour are on the road?
- What is the standard error for the average CO concentration over a large number of days when 2500 cars per hour are on the road?

Problem 2 (Problems 11.36 – 11.40 in the book)

Data relating mortality from lung cancer to average cigarette consumption (lb/person) for females in England and Wales over a 40-year period are given in Table 11.22 in the book (page 549 in the book, available as a computer readable file on http://www.math.wustl.edu/~hjelle/m322/m322_090417table2.txt).

- Compute the correlation between 5-year lung-cancer mortality and annual cigarette consumption when each is expressed in the \log_{10} scale.
 - Test this correlation for statistical significance.

- b) 1. Fit a regression line relating 5-year lung-cancer mortality to annual cigarette consumption.
2. To test the significance of this regression line, is it necessary to perform any additional tests other than those in a)? If so, perform them.
3. What is the expected lung-cancer mortality rate with an annual cigarette consumption of 1 lb/person?

Problem 3 (Problems 11.42 – 11.44 in the book)

Refer to the data in Table 3.10 (page 73 in the book). Another method for relating measures of reactivity for the automated and manual blood pressures is the correlation coefficient. Suppose the correlation coefficient relating these two measures of reactivity is 0.19, based on 79 people having reactivity measured by each type of blood-pressure monitor.

- a) What is the appropriate procedure to test if there is a relationship between reactivity as measured by the automated and manual monitors? Conduct the test procedure. What do the results mean, in words?
- b) Provide a 95% confidence interval for the correlation coefficient between these two measures of reactivity.

Problem 4 (Problems 11.87 – 11.89 in the book)

A 65-year-old woman with low bone density in 1992 was treated with alendronate through the year 1999. Bone density was measured irregularly over the period. The results for change in bone density of the lumbar spine are shown in Table 11.26 (page 552 in the book, available as a computer readable file on http://www.math.wustl.edu/~hjelle/m322/m322_090417table4.txt).

- a) What is the estimated rate of increase in bone density of the lumbar spine *per year*? What is the standard error of the estimated rate of increase *per year*?
- b) Provide a significance test to assess whether the mean bone density has significantly changed over time.
- c) The normal change in bone density over time from age 40 to age 80 is a decrease of 0.15 gm/cm^2 . Does the rate of change in this woman differ significantly from the expected age-related change?