Chapter 21 - The Simple Regression Model

39. Download Before purchasing videoconferencing equipment, a company ran tests of its current internal computer network. The goal of the tests was to measure how rapidly data moved through the network given the current demand on the network. Eighty files ranging in size from 20 to 100 megabytes (MB) were transmitted over the network at various times of day, and the time to send the files recorded. Formulate the SRM with *Y* given by Transfer Time and *X* given by File Size.

- (a) Is the correlation between file size and transfer time significantly different from zero?
- (b) Estimate the average "setup" time to start the file transfer. This time is used to synchronize the computers making the transfer and is unrelated to file size. Provide an interval suitable for presenting.
- (c) To speed transfers, the company introduced compression software that halves the size of a file when sent over the network. On average, what is the improvement in time when sending a 50-MB file? State your answer as a range.

43. R&D Expenses This data file contains a variety of accounting and financial values that describe 324 companies operating in the information sector in 2010. The largest of these provide telephone services. One column gives the expenses on research and development (R&D), and another gives the total assets of the companies. Both columns are reported in millions of dollars. These data need to be expressed on a log scale; otherwise, outlying companies dominate the analysis. Use the natural logs of both variables rather than the original variables in the data table. (Note that the variables are recorded in millions, so 1,000 =1 billion.)

- (a) What difference in R&D spending (as a percentage) is associated with a 1% increase in the assets of a firm? Give your answer as a range, rounded to meaningful precision.
- (b) Revise your model to use base 10 logs of assets and R&D expenses. Does using a different base for both log transformations affect your answer to part (a)?
- (c) Find a 95% prediction interval for the R&D expenses of a firm with $1 billion in assets. Be sure to express your range on a dollar scale. Do you expect this interval to have 95% coverage?

45. OECD The Organization for Economic Cooperation and Development (OECD) tracks various summary statistics of its member economies. The countries lie in Europe, parts of Asia, and North America. Two variables of interest are GDP (gross domestic product per capita, a measure of the overall production in an economy per citizen) and trade balances (measured as a percentage of GDP). Exporting countries tend to have large positive trade balances. Importers have negative balances. These data are from the 2005 report of the OECD. Formulate the SRM with GDP as the response and Trade Balance as the explanatory variable.

- (a) On average, what is the per capita GDP for countries with balanced imports and exports (i.e., with trade balance zero)? Give your answer as a range, suitable for presentation.
- (b) The foreign minister of Krakozia has claimed that by increasing the trade surplus of her country by 2%, she expects to raise GDP per capita by $4,000. Is this claim plausible given this model?
- (c) Suppose that OECD uses this model to predict the GDP for a country with balanced trade. Give the 95% prediction interval.
- (d) Do your answers for parts (a) and (c) differ from each other? Should they?