

## Statistics 101 – Homework 4

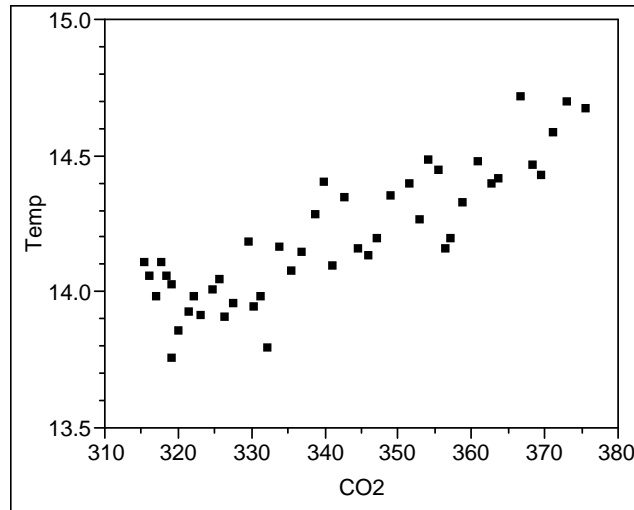
### Solution

#### Assignment:

1. Do the following problems from the text, *Intro Stats*, 3<sup>rd</sup> Edition. If you have an earlier edition of the text, check with someone who has the 3<sup>rd</sup> Edition to make sure you do the correct problems.
  - a) Chapter 7 – problems 3, 4, 5, 6, 11, 12, 25, and 26.

**If you have questions about the problems in the book, see your course instructor.**

2. Global warming is a hot topic these days. One of the factors that may explain increases in global temperatures is the amount of carbon dioxide in the atmosphere. Annual atmospheric carbon dioxide (CO<sub>2</sub>) concentrations measured as parts per million by volume (ppmv) are derived from air samples collected at Mauna Loa Observatory in Hawaii. Additionally the annual average global temperatures (degrees Celsius) are recorded. The data plotted below are for years from 1958 through 2003.



- a) Answer the questions Who? and What? for this problem.

**Who? Years, the measurements are taken every year.**

**What? CO<sub>2</sub> concentration (ppmv)**

**Average global temperature (degrees Celsius)**

- b) The value of the correlation for these data is most likely to be?  
-0.95   -0.67   -0.31   +0.03   +0.55   +0.86  
Explain the reason for your choice.

**There is a positive relationship between CO<sub>2</sub> and temperature. It looks like it is a fairly strong positive relationship because the points are pretty tightly clustered. The most likely value is +0.86.**

- c) Write a sentence or two explaining what this correlation means for these data. Write about CO<sub>2</sub> concentrations and global temperatures rather than about correlation coefficients.

**In general, above average CO<sub>2</sub> concentrations are associated with above average temperatures and below average CO<sub>2</sub> concentrations are associated with below average temperatures.**

- d) If the temperature were recorded in degrees Fahrenheit rather than degrees Celsius, how would the correlation change? Explain your answer.

**The correlation would not change because the correlation is not affected by a change of scale.**

- e) A news reporter looking at these data writes; “It is clear that increasing CO<sub>2</sub> in the atmosphere causes global temperature to increase.” Explain why this is not an appropriate conclusion from these data alone.

**Although this is a tempting conclusion, remember correlation is not causation. We have simply observed the CO<sub>2</sub> concentration and temperature. There could be other explanations for the correlation. We need additional information and subject matter knowledge (about climate change) that is not provided in this data alone.**

3. On homework 2 you used JMP to look at the horsepower for a sample of 57 cars selected from the 2004 model year. In addition to horsepower, the city mpg is given for each of the 57 cars. We wish to examine the association between city mpg and horsepower. You can find the JMP data table on the course website.

- a) Which variable would you use for the explanatory variable and which for the response? Explain your choice.

**The horsepower would be the explanatory variable and city mpg the response variable. Horsepower indicates how powerful the engine in the car is. One would expect that larger horsepower cars would get a lower city mpg.**

- b) Use Analyze – Fit Y by X to obtain a plot of the horsepower and city mpg data. Describe the direction, form and strength of the association.

**The association is negative, above average horsepower tends to be associated with below average city mpg and below average horsepower tends to be associated with above average city mpg.**

**The form is fairly linear although there is a slight curve, a steeper drop for smaller horsepower and a shallower drop for higher horsepower.**

**The strength would be moderate to strong.**

- c) Use Analyze – Multivariate Methods – Multivariate to obtain the correlation between horsepower and city mpg. What is the value of the correlation?

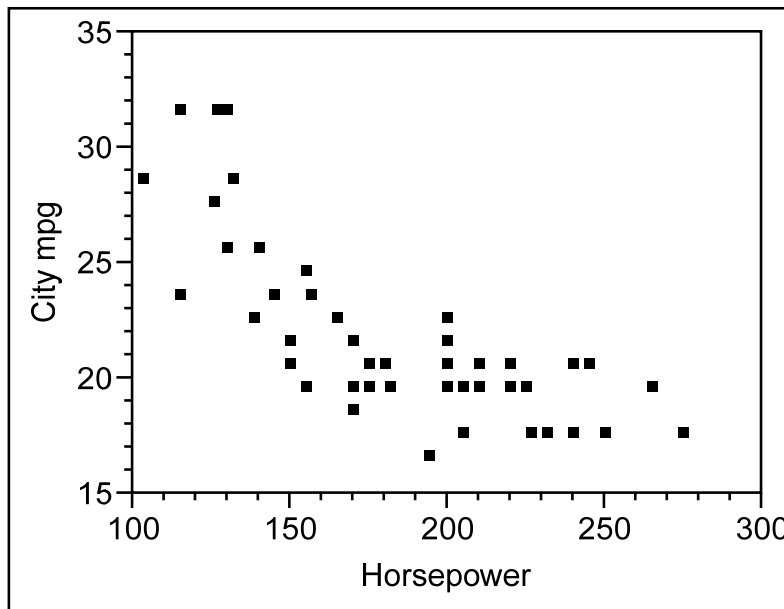
**The correlation between horsepower and city mpg is – 0.7541.**

- d) Write a few sentences about what the plot and the correlation indicate about fuel economy.

**Cars with higher horsepower tend to have lower fuel economy and cars with lower horsepower tend to have higher fuel economy. The association is somewhat linear and moderately strong. One should be careful not to attribute a cause and effect relationship here because there are other factors, e.g. weight of the car that can also influence the fuel economy.**

Be sure to turn in the JMP output from parts b) and c).

**Bivariate Fit of City mpg By Horsepower**



**Multivariate Correlations**

	<b>Horsepower</b>	<b>City mpg</b>
<b>Horsepower</b>	1.0000	-0.7541
<b>City mpg</b>	-0.7541	1.0000

### Scatter plot Matrix

