Problem Set #1

1. The excel file accompanying this homework contains a table of temperature data for Cheyenne, Wyoming. The second column presents the average temperature during the month of January for each year from 1895-2002. The third column presents the average temperature during the month of July for each year.

The data were obtained from the following website. If you are interested, you can try looking at data for other cities.

http://lwf.ncdc.noaa.gov/oa/climate/research/cag3/city.html

Using only graphical methods (do not try to do any fancy statistical analysis at this time), examine these two time series. Hint: try drawing some line graphs using Excel’s chart making tools---try looking at the overall average of the time series as well as the average for each year----try looking at 5 or 10 year moving averages if you think there is too much year to year variation to allow you to draw any conclusion.

a. The global warming hypothesis indicates that temperatures (at least globally) have increased over the past 100 years. Based on these data, do you think that average temperatures have increased, decreased, or stayed the same in Cheyenne?

b. Are there any differences between what has happened in January and what has happened in July? Are there any implications?

2. The Director of MBA Career Services at a major midwestern business school is interested in determining what influences placement success for MBA students and has collected data (as shown on the attached spreadsheet table) for a random sample of graduating MBA students. The data is provided in Excel spreadsheet form in the file *mba\_jobs.xls*.

Each row of the table represents 1 student. The interpretations of the column entries are as follows:

**Area:** What functional area (finance, marketing, etc.) the student has concentrated on and in which he or she is seeking full time employment.

**GPA:** The student’s grade point average on a 4.0 basis with 4.0 representing a straight “A” average.

**GMAT Total:** The student’s total score on the Graduate Management Aptitude Test (GMAT) with higher scores representing better performance.

**Avg. Yrs. Exp:** The student’s years of previous full-time work experience.

**Career Change:** A “1” represents a career change---say, a student whose undergraduate degree and work experience are in mechanical engineering who is now seeking a career in investment banking. A “0” represents no career change, say someone whose previous experience is in manufacturing seeking a position in manufacturing.

**Internship:** Whether or not the student had an internship the previous summer that provided work experience relevant to the position the student is now seeking. For example, someone who had an internship in manufacturing but is now looking for a position in investment banking would not have had a relevant internship and would receive a “0” in this column.

**Job Offer:** Students with a “1” have had at least one job offer as of the end of April, while students with a “0” have (as on the end of April) been unsuccessful.

Your assignment is to analyze the data to determine what seem to be the primary determinants of placement success. Which factors, for example, indicate placement success? Are there any factors that seem unrelated to placement success? Are there any factors whose affect on placement success is inter-related. If so, how are they related?

Do NOT use any fancy statistical tools at this point. Instead, confine your analysis to simple procedures such as sorting or filtering the data, tabulating the data in different manners, and generating graphical displays.

**3. Smallpox vaccination**

The origin of smallpox is uncertain, but it is believed to have originated in Africa and then spread to India and China thousands of years ago. The first recorded smallpox epidemic was in 1350 BC during the Egyptian-Hittite war. Smallpox reached Europe between the 5th and 7th centuries and was present in major European cities by the 18th century. Epidemics occurred in the North American colonies in the 17th and 18th centuries. At one time smallpox was a significant disease in every country throughout the world except Australia and a few isolated islands. Millions of people died in Europe and Mexico as a result of widespread smallpox epidemics.

The fall of smallpox began with the realization that survivors of the disease were immune for the rest of their lives. This led to the practice of variolation - a process of exposing a healthy person to infected material from a person with smallpox in the hopes of producing a mild disease that provided immunity from further infection. The first written account of variolation describes a Buddhist nun practicing around 1022 to 1063 AD. She would grind up scabs taken from a person infected with smallpox into a powder, and then blow it into the nostrils of a non-immune person. By the 1700's, this method of variolation was common practice in China, India, and Turkey. In the late 1700's European physicians used this and other methods of variolation, but reported "devastating" results in some cases. Overall, 2% to 3% of people who were variolated died of smallpox.

The next step towards the eradication of smallpox occurred with the observation by English physician, Edward Jenner, that milkmaids who developed cowpox, a less serious disease, did not develop the deadly smallpox. In 1796, Jenner took the fluid from a cowpox pustule on a dairymaid's hand and inoculated an 8-year-old boy. Six weeks later, he exposed the boy to smallpox, and the boy did not develop any symptoms. Jenner coined the term "vaccine" from the word "vaca" which means "cow" in Latin.

If the chance of dying from being vaccinated from the first primitive vaccines were 1 in 200 while the chance of dying from smallpox if you contracted the disease were 1 in 7, should you be vaccinated? Discuss

1. **Absent Minded Professor?**

An absent minded man has 3 sock drawers. He knows he has 2 blue socks in one drawer, 2 red socks in a second drawer, and the third drawer contains one blue and one red sock. The problem is, he doesn’t remember which drawer is which. To solve his conundrum, he picks a drawer at random, closes his eyes, reaches in and draws out a sock at random. Afterwards, he observes that it is a red sock. What is the probability that the single remaining sock in that drawer is red?

1. **An urn problem**

Suppose you have two urns, each containing 10 balls. One urn has 7 blue and 3 red balls, and the second urn has 3 blue and 7 red balls. The urns are opaque and their outside appearance is identical, so we can’t tell which urn is which. Suppose you select an urn at random. You then choose a random ball from the urn and observe it is red. You then replace it, select a random ball from the urn again and observe it is red. Again you replace and select a third ball at random, and it is red. You replace a final time, select a fourth ball at random, and it is red. What is the probability you chose the red-heavy urn? Hint: imagine having 20,000 people performing the same experiment, randomly choosing 1 of the two urns and randomly drawing out 1 of the 10 balls (with replacement) four different times.

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