Math140: Statistics
Outside Assignment 1: Numbers

These outside assignments should augment the course covering topics not directly addressed by the book. Most will be very basic. In general, they should take you well under an hour to complete. Please answer the questions in each assignment and turn in you answers on the due date.

People that can't read or write are said to be *illiterate*. Similarly, people that can't deal adequately with numbers are often described as being *innumerate*. Just as reading is more than sounding out letters, numeracy is more than basic arithmetic. The first two assignments are designed to make sure you are comfortable dealing with and interpreting numbers.

Typically, when we see a number we attach a level of precision to a number without giving it much thought. When we read in the newspaper that the average salary for a physician in family practice is $200,000 a year, we don't attach much accuracy to the number. We wouldn't be surprised to learn the real number was $185,000 or $220,000. If the number given is $204,000 a year, however, we would interpret that number to be much more precise. While not exact, we wouldn't expect it to be off by more than a $1000 or so. We judge the accuracy by the least significant non-zero digit. The 4 in $204,000 leads us to believe the accuracy of the value is around $1000, the place value of the 4.

While numerate people question number with too little accuracy, big round numbers, they also question numbers with too much accuracy. If the salary of physicians is reported to be $204,327.19, we become skeptical. It is doubtful that an average salary could be measured so closely.

This can manifest itself in many different ways. In the nineteenth century, the German scientist Carl Wunderlich found that normal body temperature was about 37 degrees Celsius. Converting to Fahrenheit, this gives the familiar 98.6 degrees. But notice that we have gone from two to three significant digits when we convert from Celsius to Fahrenheit. What would have been interpreted as between 36 and 38 degrees is now seen as being between 98.5 and 98.7 degrees. In fact, more recent studies puts average body temperature closer to 98.2 degrees. (It actually varies depending on time-of-day, age, race, and gender.) Notice that if you convert 98.2 back to Celsius (36.8), it falls within the original range although it is clearly not between 98.5 and 98.7.

Another problem is that people often make up and use numbers when they want to convey general impressions. When I say, "95% of students turn their assignments on time", I really don't have hard numbers. I just mean that the vast majority of students turn in their assignments on time. Moreover, if I say about two out of three and you write 66.7%, we suddenly have assigned three-digit accuracy to what may be little more than a

general impression. Of course, the more numerate individual will immediately recognize 66.7% as two thirds and will take the number with a grain of salt.

(As an aside, there is an old joke that 82% of all statistics are made up on the spot. So where do you think the 82% came from?)

Yet another problem is that statistics take on a life of their own often out-living their relevancy even if once correct. Most societal measurements change, often rapidly. What was true 10 years ago may no longer be true.

There are many other problems, but this is enough for now. To become numerate, you need to get into the habit of questioning numbers and applying common sense. When you see number, asks questions like: how could that have been measured? Is the implied precision is reasonable? Does this number make sense today or is this old information old information?

Here are a couple of items to practice on. Write a brief comment (two or three sentences) about each of the following:

1. In a recent speech, Eric Schlosser remarked that "When you get a fast-food hamburger today, it probably has pieces of a thousand or more different cattle ..."

2. In a recent interview, Marion Nestle stated that "There are 76 million cases of food poisoning each year in the US".