Statistics 515 - Fall 2002 - Exam 1 *(slightly modified for Spring 2003 practice)*

Part I: Answer seven of the following eight questions. Five points each.

1) A display is being made to compare the populations of the states by using squares. Mississippi has a population of approximately 3,000,000 and is represented by a square 2cm by 2cm. How long will each side of the square for Pennsylvania (population 12,000,000) be?

2) A data-entry employee is entering a large list of salaries and one of them is mistyped by either adding or deleting 0s from the end. Is this mistake more likely to affect the mean or the median of the salaries?

3) It is often said that a value more than three standard deviations away from the mean is a possible outlier. If the data is approximately normal (or bell-shaped), about what percent of the data will be considered possible outliers?
If the data is skewed, what is the largest percent of the data that could be considered possible outliers?

4) $P(A)=0.6$, $P(B)=0.4$.   If A and B are mutually exclusive, what is $P(A \cap B)$?

5) $P(A)=0.6$, $P(B)=0.4$. If $P(A|B)=0.5$, what is $P(A \cup B)$?

6) Let the random variable X have the following distribution:

x	0	2	6
p(x)	0.5	0.25	0.25

What are the mean and variance of X?

7) X is a normal random variable with $\mu=25$, $\sigma^2=25$, and $\sigma=5$. Find $P(X \leq 30)$.

8) Z is a standard normal random variable. Find z_0 such that $P(Z \geq z_0) = .0778$.

Part II: Answer every part of the next two problems. Twenty points each.

1) For the data set: 10cm   9cm   10cm   17cm   25cm   19cm
answer the following questions, being **sure to use the appropriate units**. You must show all of your work for credit.

a) Find the mean.   b) Find the median.   c) Find the mode.
d) Find the variance.   e) Find the standard deviation

2) Based on past censuses and computer models, it is predicted that a large population is 51% female. A survey of 3,000 randomly chosen residents is conducted. Because the population is large and the residents are randomly chosen, this could be considered a binomial experiment.

a) According to the past information, what is the expected number of females in the 3,000 people surveyed?

b) According to the past information, what is the standard deviation for the number of females in the 3,000 people surveyed?

c) According to the past information, what is the probability that exactly 1,500 of those surveyed will be women? (You do not need to simplify your answer).

d) Assume that the number of women found by doing this experiment is normally distributed with the mean you found in a and the standard deviation you found in b. Estimate the probability that you would observe 1,500 or fewer females? That is, find $P(X \leq 1500)$.

e) One way to check whether we believe a binomial random variable should be (approximately) normally distributed would be to program a computer to repeat the experiment a large number of times. Say we programmed the computer to do this experiment 500 times. What kind of plot would you use to check that the results follow a normal distribution, and what would you look for in that plot?