Name: _____ Lab Day and Time: _____

Professor Bret Larget | Math 225, *Practice* First Midterm Examination | Spring, 2001

Circle TRUE or FALSE. If the answer is FALSE, explain why. Each is worth two points.

Problem 1: TRUE or FALSE:

An individual's smoking status is labeled as one of "nonsmoker", "light smoker", "heavy smoker", or "former smoker". Smoking status is an example of a categorical variable.

Problem 2: TRUE or FALSE:

The mean number of children among a group of people cannot be 1.5 because the number of children is a discrete variable.

Problem 3: TRUE or FALSE:

If the bars of a histogram range from 0 to 100, the median of the distribution must be about 50.

Problem 4: TRUE or FALSE:

A quartile is a measure of the spread of a distribution.

Problem 5: TRUE or FALSE:

If two events are independent, $P(A \text{ or } B) = 0$.

Problem 6: TRUE or FALSE:

A fair coin is tossed five times. The probability that the sequence of heads and tails is HHTTT is ${}_5C_2 \times (0.5)^2 \times (0.5)^3$.

Problem 7: TRUE or FALSE:

A z-score measures the number of standard deviations an observation is from the mean.

Problem 8: TRUE or FALSE:

A standard error is the standard deviation of a sampling distribution.

Problem 9: TRUE or FALSE:

According to the central limit theorem, the sampling distribution of the sample mean is approximately normal for any population as long as the sample mean is 25 or more.

Problem 10: TRUE or FALSE:

The p-value is the probability that the professor sings in class.

Problem 11:
In the span of one hour at a hospital, seven baby boys are born. An evil nurse removes all of the unique identification tags while the babies are in the nursery. If the seven new mothers choose a baby at random, what is the probability that all the babies and mothers are correctly matched?

Problem 12:
Radionuclide ventriculography is used as a diagnostic test for detecting coronary artery disease. The following data is from a sample of individuals with coronary artery disease and additional control subjects.

	Coronary artery disease		
Test	present	absent	
positive	302	80	382
negative	179	372	551
Total	481	452	933

(a) Find the sensitivity and the specificity of this test for coronary artery disease.

(b) If the population prevalence of coronary artery disease is 0.08 and the sensitivity and specificity of the test are the same in the population as in the sampled data, find the probability of coronary artery disease given a positive test result.

Problem 13:
In a large population, 12.5 percent of all individuals have diabetes.

(a) Seven of these individuals are sampled at random. What is the probability that two or more sampled individuals have diabetes?

(b) Seven hundred of these individuals are sampled at random. What is the probability that eighty or fewer have diabetes? (Use a normal approximation to get a numerical answer.)

Problem 14:
The weight distribution of newborns in the United States is approximately normal with a mean of 128 ounces and a standard deviation of 24 ounces.

(a) What is the probability that a randomly selected newborn weighs less than 120 ounces?

(b) What is the 80th percentile of this distribution?

(c) What is the probability that the sample mean weight of four randomly selected American newborns is less than 120 ounces?

Problem 15:
Mice with only a single X chromosome (XO) are fertile females. Offspring without an X chromosome are not viable. In a cross of an XO female and an XY male, each offspring is either an XX female, an XO female or an XY male with equal probability. In a cross of an XX female with an XY male, off spring are equally likely to be XX females or XY males.

(a) In an XX $\times$ XY cross with six viable offspring, what is the probability that all six offspring are female?

(b) In an XO $\times$ XY cross with six viable offspring, what is the probability that all six offspring are female?

(c) A female mouse is selected at random from an XO $\times$ XY cross and is equally likely to be either XO or XX. This mouse is crossed with an XY male and has six viable offspring, all of whom are female. Given this information, what now is the probability that the first mouse has the XO genotype?

Problem 16:
The population proportion of individuals under 40 diagnosed with lung cancer that survive at least five years is unknown. In a random sample of 260 such patients, thirty survive at least five years.

(a) Give a justification for why statistical inference based on the normal distribution is appropriate.

(b) Give a 95% confidence interval for the population five-year survival rate for this type of patient.

(c) Test the hypothesis that the population five-year survival rate is ten percent versus the alternative that it is higher. State hypotheses, calculate a z test statistic, and report a p-value. Sumarize your findings in the context of the problem.