Math 160 H

THIRD HOUR EXAM

NAME_____

General Notes:

1. Show work. A correct answer without supporting work may not be given credit.
2. Look over the test first, and then begin.
3. Calculators are permitted on this exam, but only for basic arithmetic (i.e., no statistical calculations)

Friday, April 16, 2010
100 pts.

I. Binomial distributions

1. (10 pts.) What is the binomial setting? That is, what should be true before we decide that the binomial distribution is the correct one to use in a given setting?

2. (10 pts.) Sketch a histogram of B(4, 0.3) (you may use table C to avoid calculations).

3. (20 pts.) An experiment always results with success or failure, with the probability of success at $p = 0.3$ and the probability of failure at $q = 0.7$. All experiments are independent of each other

a. What is the probability of observing 7 or more successes in 10 experiments? (Use table C)

This question asks about the mean and standard deviation of a proportion in multiple binomial trials. Suppose that we perform this 10-experiment trial over and over again, each time measuring the **proportion** of success in each 10-experiment group of trials.

b. On the average, what proportion of successes would we see in our 10-experiment trials? i.e., what is the expected value of the proportion of successes in 10 experiments? Please give your answer as a number.

c. What is the standard deviation of that proportion? Please give your answer in a form that can be entered into a basic calculator.

II. Sampling distributions, the Central Limit Theorem, and confidence intervals.

1. (20 pts.) Suppose that we know (I'm making some of these numbers up) that the weight of a honey bee follows a normal distribution with an average weight of 118.3 mg and a standard deviation of 4 mg.

   a. What is the likelihood that a single bee weighs in at 122.3 mg or greater?

   b. What is the likelihood that a group of 9 bees have an average weight of 122.3 mg or greater?

   c. Suppose now that we don't know the average weight of a bee, but we collect a 25 bee sample and discover the average weight of the bees in the sample to be 122.3 mg. Give a 0.95 (95%) confidence interval for the average weight of a bee, both as an interval (low, high) and also expressed as a margin of error.

2. (5 pts.) Our assumptions in question (1) above are that the weights of worker bees (the most common sort of honeybee) follows a normal distribution. In fact, we don't need this assumption if our samples are "large enough". What theorem tells us this?

3 (10 pts.) When we describe something as a 0.95 or 95% confidence interval for a population parameter, just what to we mean?

III. . Hypothesis testing (5 pts. each)

Entering first-year students are to take a test to help in academic advising. The expected average on the test is thought to be 400, but we don't really know for sure. Surprisingly, we do know that the standard deviation is 100. We collect a SRS of 100 students and give them the test. The average score in this group is 425, and we begin to suspect that the population average score on this test is **different** from 400.

1. State the null and alternative hypotheses in this case

2. Is this a one-sided or a two-sided test? Why?

(Problem III continued)

3. Calculate the z statistic for this sample assuming the null hypothesis.

4. Using table A, and assuming the null hypothesis, what is the likelihood (probability) of finding this or a more extreme sample? (this is the P value)

5. Do we reject the null hypothesis at the $\alpha = 0.05$ level? At the $\alpha = 0.005$ level? Why or why not?