MAT 105 - Homework 10
Due Thursday, 4/7/16, in class

1. Let $X = N(1, 4)$. Find the 75% confidence interval for X.

2. A softball player brags that he is a .300 hitter, but at the end of the season he only got 21 hits in 84 bats. Is this just bad luck? To decide, find the probability of getting 21 hits or fewer in 84 bats if his hitting probability is $p = 0.3$.

3. On each bet, a gambler loses \$1 with probability 0.7, loses \$2 with probability 0.2 and wins \$10 with probability 0.1. Estimate the probability that the gambler will be losing money at the end of 100 bets.

4. You are taking a poll to forecast the outcome of an election. How many people do you have to poll so that with probability .95 your estimate will not differ from the true outcome by more than 2% (that is, the margin of error in the 95% confidence interval is at most 2%)?

5. We want to test if a coin is fair. We decide to toss the coin 100 times and set up the decision rule:

   "if we get between 40 and 60 heads (inclusive), the coin is fair."

   (a) What can you say about the fairness of the coin if the experiment returns

   (i) 53 heads (ii) 60 heads (iii) 37 heads

   (b) Find the probability of Type 1 error; that is, the probability that we get under 40 heads or over 60 heads, when the coin is indeed fair.

   (c) Find the probability of Type 2 error; that is, find the probability that we get between 40 and 60 heads (inclusive), when the coin is biased

   (i) with probability of heads being 0.6
   (ii) with probability of heads being 0.7

6. In 1998 as an advertising campaign, the Nabisco Company announced a "1000 Chips challenge" claiming that every 18-ounce bag of Chips Ahoy cookies contained at least 1000 chocolate chips. Statistics students at the Air Force Academy purchased 16 bags of cookies and obtained the following counts for the number of chocolate chips:

1087	1121	1132	1135	1191	1200	1214	1219
1244	1258	1270	1295	1325	1345	1356	1419

   (a) Find the average and the standard deviation for the number of chocolate chips in a bag of Chips Ahoy (hint: see notes from the beginning of the semester.)

   (b) Using the result from (a), write the 99% confidence interval for the number of chocolate chips in a bag of cookies.

7. Part of the probability folklore is the idea that if you spin a penny, the result is heads about 30% of the time. To test this hypothesis, Sally Sievers from the 1999 probability class at Wells College spun 650 pennies and got 321 heads. What is the probability that we would get at least 321 heads if the probability of heads is indeed "p=0.3". Does this support the hypothesis?

8. It is commonly presumed that an unborn child has 50% chance of being female. But is this really the case? According to the Central Bureau of Statistics in the Netherlands, during a 3 year period, there were 585,609 children born of which 286,114 were girls.

   (a) What is the 99% confidence interval for the percentage of female births?

   (b) If p =probability that a newborn is female, let H_0 : "$p = 0.5$" and H_1 : "$p \neq 0.5$". Test the hypothesis H_0 with a level of significance $\alpha = 0.01$.

EXTRA CREDIT: Suppose we take a poll of 2,500 people. What percentage should the leader have for us to be 99% confident that the leader will be the winner?