Homework Assignment 3
Group homework (up to four members per group)
due in class on Tuesday, 02/11/2014

STA 371G, Statistics and Modeling, Spring 2014

List of Group Members ($\leq$ 4):

Problem 1 (2 points)

Read the report of Anzalone Liszt Grove Research on the NSA Surveillance Programs (http://www.algpolling.com/#!memos/cjna): "The public strongly supports... This memo is based on the results of a national poll conducted by Anzalone Liszt Grove Research. The poll of N=803 adults was conducted November 11-17, 2013. At least 30% of all interviews were conducted via cell phone and interviews were conducted in English and Spanish. The margin of error for the poll is plus or minus 3.5 percentage points at the 95% level of confidence."

(a) Can you explain why the margin of error for the poll is $\pm 3.5\%$ at the 95% level of confidence? (hint: the value of $p(1-p)$ is largest when $p = 0.5$)

(b) If Anzalone Liszt Grove Research conducts another poll of $N = 8,000$ adults, what would be the margin of error at the 95% level of confidence?

Problem 2 (1 point)

A manufacturer of automobile batteries claims that the distribution of the lifetimes of its best battery has a mean of 54 months and a standard deviation of 6 months. Suppose a consumer group decides to check the claim by purchasing a sample of 50 of these batteries and subjecting them to tests that determine their lifetimes. Assuming the manufacturer's claim is true, what is the probability that the consumer group's sample has a mean lifetime of 52 months or less?

Problem 3 (1 point)

A soft drink machine is regulated so that the amount dispensed is normally distributed with mean $\mu = 7.00$ ounces and standard deviation $\sigma = 0.50$ ounces. If samples of nine cups are taken, what is the probability that the mean of a particular sample falls between 6.90 and 7.05 ounces?

Problem 4 (6 points)

Read the "Amore Frozen Foods, UVA-QA-0317" case in the course packet.

The primary question to answer in the case is: Should Mr. Jenkins lower the fill target to 8.22 ounces per pie from the current target of 8.44 ounces per pie?

The information given below is obtained from the case and will be helpful in answering the above question.

Information given in the case:

1. The filling device fills to target with a standard deviation of 0.22 ounces and the amounts are normally distributed.

2. The five sample pies' weights are independent.

3. The production rate is 1,000 dozen pies every 20 minutes.

4. The monthly production is 60 20-minutes batches so annual production is $60 \times 12 = 720$ batches.

5. Rejected batches are first sold at the Thrift Store and then donated to charity once the Thrift Store demand has been filled.

6. The Thrift Store demand is 60 dozen pies per week.

7. The price of pies sold at wholesale is $4.50 per dozen.

8. The price of pies sold at the Thrift Store is $3.60 per dozen.

9. The cost of ingredients at the 8.44 ounce target fill rate is $1.82 per dozen pies. The cost of ingredients at the 8.22 ounce target fill rate is proportional (i.e. (8.22/8.44)$1.82 = $1.77 per dozen pies).

10. The cost of packaging is $0.62 per dozen pies.

11. The cost of labor and overhead is $0.56 per dozen pies.

FDA Approved Weight Control System

The FDA approved weight control system for Amore Frozen Foods specifies that a 20 minute batch must be rejected if the average of five sample pies taken at the beginning of the batch run is less than eight ounces.

If the fill target is 8.22 *ounces, answer the following questions:*

(a) What is the probability that a given batch will be rejected?

(b) How many batches over the course of a year do you expect to be accepted and how many do you expect to be rejected?

(c) What is the expected annual revenue that will be obtained from selling the accepted batches at wholesale?

(d) What is the expected annual revenue that will be obtained from selling pies at the Thrift Store?

(e) How many pies do you expect to be donated annually to charity?

(f) What are the annual ingredient costs? What are the annual packaging costs? What are the annual labor and overhead costs?

(g) What is the expected profit?

If the fill target is 8.44 ounces, answer the following questions:

(h) For practical purposes, why is the probability essentially zero that an individual batch will be rejected? (You should do a probability calculation to answer this question.)

(i) What is the expected annual revenue that will be obtained from selling the accepted batches at wholesale?

(j) What is the expected annual revenue that will be obtained from selling pies at the Thrift Store?

(k) How many pies do you expect to be donated annually to charity?

(l) What are the annual ingredient costs? What are the annual packaging costs? What are the annual labor and overhead costs?

(m) What is the expected profit?

What is your recommendation to Mr. Jenkins regarding the appropriate fill target? Why?

Do you have any suggestions regarding the setting of the fill target to improve profits even further?

Table 1: Table To Summarize Annual Revenues, Costs and Profits For 8.22 and 8.44 Ounce Fill Targets

	8.22 Ounce Target	8.44 Ounce Target
Wholesale Revenue		
Thrift Store Revenue		
Revenue		
Ingredient Cost		
Packaging Cost		
Labor and Overhead Costs		
Total Costs		
Profit		