Extra problem sheet for mean and standard deviation

1. Find the expected value and standard deviation of the number of red lights the driver in problem 4.3#4 must stop for.

2. Find the expected value and standard deviation of the number of defects in the Lexus model described in problem 4.3#8

3. For the typist described in problem 4.3#9, find the expected number of errors and the standard deviation.

4. A bicycle shop will be offering 2 specially priced children's models at a sidewalk sale. The basic model will sell for $120, and the deluxe model for $150. Past experience indicates that sales of the basic model will have a mean of 5.4 bikes with standard deviation 1.2, and sales of the deluxe model will have mean 3.2 bikes with standard deviation 0.8. The cost of setting up for the sidewalk sale is $200, and the numbers of each type of bike sold are independent.

a. Define random variables and use them to express the bicycle shop's net income.
b. What is the mean of the net income?
c. What is the standard deviation of the net income?

5. A farmer has 100 lbs of apples and 50 lbs of potatoes for sale. The market price for apples (per lb) is a random variable with mean 0.5 dollars and standard deviation 0.2 dollars. Similarly, for a pound of potatoes, the mean price is 0.3 dollars and standard deviation 0.1 dollars. It also costs him 2 dollars to bring all the apples and potatoes to the market. The market is busy with eager shoppers, so we can assume that he will be able to sell all his produce.

a. Define your random variables, and use them to express the farmer's net income.
b. Find the mean and standard deviation of the net income.
c. What assumptions are necessary for finding the mean? the SD?

6. The amount of cereal that can be poured into a small bowl varies with mean 1.5 ounces and standard deviation 0.3 ounces. A large bowl holds a mean of 2.5 ounces with standard deviation of 0.4 ounces. You open a new box of cereal and pour one large and one small bowl.

a. What are the mean and standard deviation of the total amount of cereal in the two bowls?
b. How much more cereal do you expect to be in the large bowl? What is the standard deviation of this difference?
c. The amount of cereal the manufacturer puts in the boxes is a random variable with mean 16.3 ounces, and standard deviation 0.2 ounces. Find the expected amount of cereal left in the box, and the standard deviation.

7. You play two games against the same opponent. The probability you win the first game is 0.4. If you win the first game, the probability you also win the second is 0.2. If you lose the first game, the probability that you win the second one is 0.3.

a. Are the two games independent? Explain your answer.
b. What is the probability you win both games?
c. What is the probability you lose both games?
d. Let random variable X be the number of games you win. Find the probability distribution of X.
e. What are the expected value and standard deviation of X?

8. In problem 5.2#8, find the expected number of defective batteries, and the standard deviation.

9. In problem 6.1#6, suppose the amounts of cereal in both size bowls are normally distributed. You pour a small and a large bowl.

a. What is the probability you poured out more than 4.5 ounces of cereal in the two bowls together?
b. What is the probability the small bowl contains more cereal than the large one?

10. Cereal again . . . refer to 6.1#6&9. Suppose you pour 5 small bowls, and 4 large ones. Let $\bar{x}$ represent the mean amount in the large bowls, and $\bar{y}$ represent the mean of small bowls. Let random variable $D = \bar{x} - \bar{y}$ represent the amount by which the large bowl's average exceeds that for the small bowls. Since the amounts are normally distributed, we may assume that the difference D is also normally distributed. What is the probability that the large bowls average at least 0.5 ounces more than small ones?

11. Suppose that IQ's of Cornell students are normally distributed with a mean of 130 and standard deviation 12 points. Also suppose that IQ's of students from Nameless University (no one mentioned Harvard) are normally distributed with mean 120 and standard deviation 10. We select one student at random from each school. Find the probability that the CU student's IQ is at least 5 points higher.

12. See problem 11 above. We randomly choose 3 students from Cornell and 5 from Nameless. Let $\bar{x}$ represent the mean IQ of the Cornell sample, and $\bar{y}$ represent the mean IQ of the Nameless sample. Let random variable $D = \bar{x} - \bar{y}$ represent the amount by which the Cornell group's mean IQ is higher.

a. Find the expected value (mean) and standard deviation of this difference, D.
b. What is the probability that the Cornell group's average IQ is at least 5 points higher than that of the Nameless group?