

**Homework 4**

September 6, 2013

Due: at the start of class on Thursday, September 12/ Friday, September 13

1. Suppose we are selling lemonade during a football game. The lemonade sells for \$18 per gallon but only costs \$3 per gallon to make. If we run out of lemonade during the game, it will be impossible to get more. On the other hand, leftover lemonade has a value of \$1. Assume that we believe the fans would buy 10 gallons with probability  $1/10$ , 11 gallons with probability  $2/10$ , 12 gallons with probability  $4/10$ , 13 gallons with probability  $2/10$ , and 14 gallons with probability  $1/10$ .
  - (a) What is the mean demand?
  - (b) If 11 gallons are prepared, what is the expected profit?
  - (c) What is the best amount of lemonade to order before the game?
  - (d) In what sense is that amount optimal? In other words, what was your objective function?
  - (e) Instead, suppose that the demand was normally distributed with mean 1000 gallons and variance 200 gallons<sup>2</sup>. How much lemonade should be ordered?
2. Suppose that a bakery specializes in chocolate cakes. Assume the cakes retail at \$20 per cake, but it takes \$8 to prepare each cake. Cakes cannot be sold after one week, and they have a negligible salvage value. It is estimated that the weekly demand for cakes is: 15 cakes in 5% of the weeks, 16 cakes in 20% of the weeks, 17 cakes in 25% of the weeks, 18 cakes in 25% of the weeks, 19 cakes in 10% of the weeks, and 20 cakes in 10% of the weeks. How many cakes should the bakery prepare each week? What is the bakery's expected optimal weekly profit?
3. A camera store specializes in a particular popular and fancy camera. Assume that these cameras become obsolete at the end of the month. They guarantee that if they are out of stock, they will special-order the camera and promise delivery the next day. In fact, what the store does is to purchase the camera from an out of state retailer and have it delivered through an express service. Thus, when the store is out of stock, they actually lose the sales price of the camera and the shipping charge, but they maintain their good reputation. The retail price of the camera is \$550, and the special delivery charge adds another \$50 to the cost. At the end of each month, there is an inventory holding cost of \$25 for each camera in stock (for doing inventory etc). Wholesale cost for the store to purchase the cameras is \$400 each. (Assume that the order can only be made at the beginning of the month.)
  - (a) Assume that the demand has a discrete uniform distribution from 10 to 15 cameras a month (inclusive). If 12 cameras are ordered at the beginning of a month, what are the expected overstock cost and the expected understock or shortage cost? What is the expected total cost?
  - (b) What is optimal number of cameras to order to minimize the expected total cost?
  - (c) Assume that the demand can be approximated by a normal distribution with mean 1000 and standard deviation 100 cameras a month. What is the optimal number of cameras to order to minimize the expected total cost?