14.01, 2007 Fall
Problem Set 6
Due: October 26th

1. Please write your name, the name of your TA, and your section/recitation time (e.g. MWF 10am, or F 1 pm) on top of your solutions.

2. Problem sets are due IN SECTION/RECITATION. Late Problem sets will not be accepted under any circumstances.

Questions:

1. Are the following statements true, false? Please give an explanation.

   (a) (7 points) Although a profit maximizing firm in a competitive industry may earn negative profits in the short run, producer surplus will always be non-negative.

   (b) (7 points) For a given technology and input prices, the long run average and marginal costs are always below the short run average and marginal costs (respectively) for any level of output.

   (c) (7 points) Long-run market supply curves are always flat at prices equal to minimum average cost.

   (d) (7 points) Consumers are always made worse off by government policies that generate dead weight losses.

2. For the production function $Q = K + 3L$, (a) say what returns to scale it exhibits, (b) say what economies of scale it exhibits.

3. Green Giant Inc. is willing to hire anybody to work in its fields and grow beans for a wage of $10 per hour. Luke has his own farm where he grows beans with droids and labor. Droid services cost $10 per hour. The production function is: $q = F(K, L) = \sqrt{KL}$, where K represents droid hours and L represents Luke's own labor in hours.

   (a) (8 points) Assume Luke decides to produce $q = 10,000$. How much labor and capital will he employ?

1

(b) (7 points) Assume that in the short run, Luke has already paid for $10,000$ hours of droid services. Find the total cost, average cost and marginal cost functions (in terms of output q).

(c) (7 points) With the same assumptions as in the previous question, suppose that the market price for beans is equal to $100. Find Luke's farm's short-run bean output. Is there a bean price low enough so that Luke will stop producing in the short run? If so, find it. Do the same for the long run.

(d) (6 points) Without doing any computation, describe the shapes of the long run average and marginal cost curves. How do they relate to each other?

4. There is a single production technology available to firms that might choose to operate in the market for hammers. The cost function associated with this technology is given by $C(q) = 3 + 3q^2$, for any q > 0, but the costs of production are equal to zero if $q = 0$. That is $C(0) = 0$.

(a) (4 points) Find the average cost and marginal cost functions.

(b) (7 points) If the price of hammers is p, find the supply curve of a single firm, for all possible prices $p > 0$.

For parts (c) and (d) : Suppose that there is free entry into the hammer market, and the cost functions of firms don't change. The market demand for hammers is given by $D(p) = 600 - 50p$.

(c) (7 points) What is the long-run price in the market and how much does each firm produce at this price?

(d) (7 points) How many total firms are in the market?

5. (7 points) Assume that the market demand and supply for X is

$$Q_d = 150 - 50P_x,$$
$$Q_s = 60 + 40P_x.$$

If the government sets a price floor of $10, what is the change in consumer surplus? How much is the resulting deadweight loss to society?

2