ANSWER KEY

Homework 4
ECON 300.01
Due Date: **by 4pm** on Friday, November 30th, 2012
fix → 32 ~~38~~ Points
Turn your homework into the economics office and make sure they time stamp it

1. (6 points) Suppose that a firm faces a demand curve of $D(P) = 600 - 10P$. The firm's short-run total cost curve is $STC(q) = 49 + 2q + q^2$ and its marginal cost curve is $SMC(q) = 2 + 2q$.

In the short-run, there are 20 identical firms in the industry.

a) Find the market price, firm's quantity, and market (industry) quantity in the short-run.

b) Find profit for the firm. Does the firm make a positive, negative, or zero profit?

2. (6 points) Assume that:

Each individual firm's costs are: $C = 35 + q^2$ and $MC = 2q$.

Market demand is: $Q = 45 - P$

Industry output is: $Q = n * q$, where $n = \#$ of firms.

a) What is the output per firm?

b) What is the equilibrium number of firms in the industry?

c) What is the equilibrium price?

3. (6 points) Assume all firms in the candy industry face the same cost structure. Each firm faces costs, $C = 0.03q^2 - q + 50$, $MC = 0.06q - 1$, where $q = \#$ of candies sold per day.

a) In a long-run equilibrium, how much is each candy store producing?

b) Let the market demand for candy equal $Q_d = 2,500,500 - 250,000P$ What is the equilibrium price and quantity in the long-run?

c) What is the equilibrium number of candy stores in the long run?

remove

test question

~~4. (6 points) Assume there are 100 identical producers in a constant cost bike manufacturing industry. Let the short-run total costs equal $SRTC = 3q^2 + 10$ and the short-run marginal costs equal $SRMC = 6q$, where $q =$ the number of bikes produced. The market demand for bikes is $Q = 150 - P$.~~

~~a) What is the short-run equilibrium price?~~

~~b) What is the long-run equilibrium price?~~

~~c) How many firms entered/exited the market to get to the long-run equilbrium?~~

5. (8 points) The inverse demand curve a monopoly faces is $P = 100 - Q$. The firms cost curve is $C = 10 + 5Q$.

$MR = 100 - 2Q$

$MC = 5$

a) What is the firm's profit maximizing solution (price AND quantity)?

b) What is the firm's economic profit?

c) Graph the marginal revenue, marginal cost, and demand curves, and show the area that represents deadweight loss on the graph.

d) How does your answer to a) and b) change if $C = 100 + 5Q$.

→ have them calculate the DWL.

6. (6 points) (Review for final)

All the workers in a factory have the same utility function $U = x_1 x_2$, earn the same income of 10 and face the same prices $p_1 = 1$ and $p_2 = 1$. Their marginal utilities are: $MU_{x_1} = x_2$ and $MU_{x_2} = x_1$.

a) What is the optimal consumption bundle for each worker? What utility do they obtain?

b) Graph the indifference curve that goes through the optimal consumption bundle. In the same graph draw the budget set.

c) What is the total demand of good x_1 and x_2 if there are 10 workers in the factory?

Homework 4

1. a. First solve for q using P = MC.

$$P = 2 + 2q$$

$$q = \frac{P-2}{2} = \tfrac{1}{2}P - 1 \qquad (1)$$

Now find market output

$$Q = 20\left(\tfrac{1}{2}P - 1\right)$$

$$Q^S = 10P - 20 \qquad (2)$$

Now set $Q^D = Q^S$ and solve for price

$$600 - 10P = 10P - 20$$

$$\frac{620}{20} = \frac{20P}{20}$$

$$P = 31 \qquad (3)$$

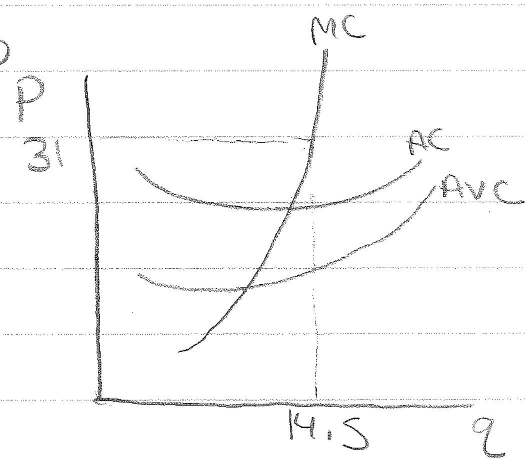
Now plug P (eq. 3) into eq (1) & eq (2) to solve for q^* and Q^*.

$$q = \frac{31-2}{2} = 14.5$$

$$Q = 10(31) - 20 = 290$$

$\therefore$

$$\boxed{\begin{aligned} P^* &= 31 \\ q &= 14.5 \\ Q &= 290 \end{aligned}}$$



b. $\pi = pq - c(q)$

$$\pi = 31(14.5) - 49 - 2(14.5) - (14.5)^2$$

$$\boxed{\pi = 161.25}$$

The firm makes + π.

2. a. 4 equations

(1) $Q = 45 - P \Rightarrow P = 45 - Q^s$ - inverse demand

(2) $Q = nq$ $n = \#$ of firms

(3) $p = 2q$ $P = MC$

(4) $pq - 35 - q^2 = 0$ $= R - C = 0$ or $\pi = 0$.

Step 1: plug eq (2) into eq (1)

$P = 45 - nq$ (1a)

Step 2: plug (1a) into eq (3) & eq (4)

$45 - nq = 2q$ (3a)

$(45 - nq)q - 35 - q^2 = 0$ (4a)

From (3a) solve for n firms.

$45 - nq = 2q$

$\frac{45 - 2q}{q} = \frac{nq}{q}$

$n = \frac{45}{q} - 2$ plug this into (4a)

$\left(45 - \left(\frac{45}{q} - 2\right)q\right)q - 35 - q^2 = 0$ → solve for q

$45q - \left(\frac{45}{q} - 2\right)q^2 - 35 - q^2 = 0$

$\cancel{45q} - \cancel{45q} + 2q^2 - 35 - q^2 = 0$

$\sqrt{q^2} = \sqrt{35}$

$\boxed{q = 5.92}$

2 b. # of firms

$$n = \frac{45}{q} - 2 = \frac{45}{5.92} - 2 \boxed{= 5.6 \text{ firms}}$$

2 c. Eq price ; $P = MC$

$$P = 2(5.92) \boxed{= \$11.9}$$

$$\boxed{\begin{aligned} q &= 5.92 \\ n &= 5.6 \\ P &= \$11.9 \end{aligned}}$$

3. a. In LR equilibrium, we know firms $\pi = 0$ or they are producing where $P = MC = AC_{min}$

$$LRAC = 0.03q - 1 + \frac{50}{q}$$

$$MC = 0.06q - 1$$

LRAC = MC & solve for q

$$0.03q - \cancel{1} + \frac{50}{q} = 0.06q - \cancel{1}$$

$$\cancel{q} \cdot \frac{50}{\cancel{q}} = 0.03q \cdot q$$

$$\frac{50}{0.03} = \frac{0.03q^2}{0.03}$$

$$\sqrt{1666.66} = \sqrt{q^2}$$

$$\boxed{q = 40.8}$$

b. In LR $P = MC = AC_{min}$

$$P = 0.06(40.8) - 1 = 1.448$$

$$P = 0.03(40.8) - 1 + \frac{50}{40.8} = 1.448$$

$$\therefore \boxed{P = 1.448}$$

$$Q = 2{,}500{,}000 - 250{,}000(1.448)$$

$$\boxed{Q = 2{,}138{,}000}$$

c. # of candy stores

$$\frac{Q}{q} = \frac{2{,}138{,}000}{40.8}$$

$$\boxed{\text{eq \# stores} = 52{,}401 \text{ stores}}$$

5. a. $P = 100 - Q$

$C = 10 + 5Q$

Revenue $= (100-Q)Q = 100Q - Q^2$

$MR = 100 - 2Q$; $MC = 5$

A monopolist produces where $MR = MC$

$MR = 100 - 2Q = MC = 5$

$100 - 2Q = 5$

$\frac{95}{2} = \frac{2Q}{2}$

$\boxed{Q = 47.5}$

$P = 100 - 47.5$

$\boxed{P = \$52.5}$

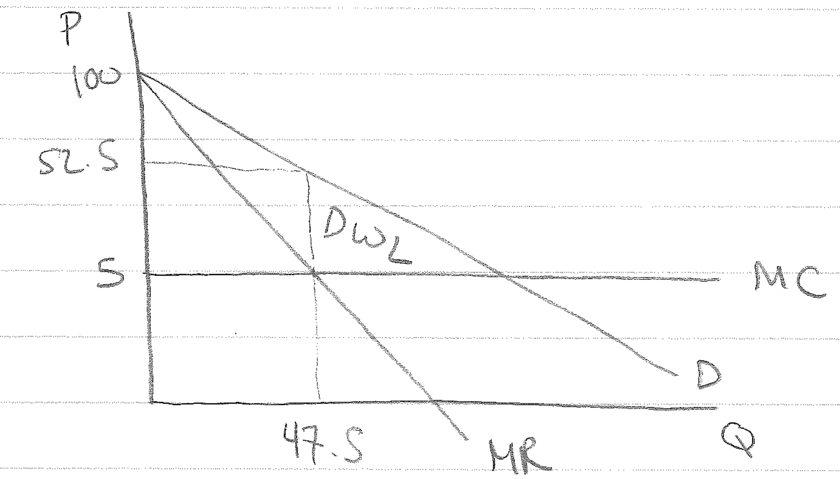
b. $\pi = p(Q)Q - c(Q)$

$= (100 - 47.5)(47.5) - 10 - 5(47.5)$

$= \$2493.75 - 247.5$

$\boxed{\pi = \$2246.25}$

c.



5 d. Now $C(Q) = 100 + 5Q$

$MR = 100 - 2Q$

$MC = 5$

$\therefore MR = MC$

$100 - 2Q = 5$

$\boxed{Q = 47.5}$

$Pr = 100 - Q$

$= 100 - 47.5$

$\boxed{P = 52.5}$

$\pi = 52.5(47.5) - 100 - 5(47.5)$

$= \$2493.75 - 337.5$

$\boxed{\pi = \$2156.25}$

So an increase in fixed cost does not impact P or Q but does decrease profits.

6 a. budget constraint: $10 = X_1 + X_2 \Rightarrow X_2 = 10 - X_1$

$MRS = -\frac{MU_{x_1}}{MU_{x_2}} = -\frac{X_2}{X_1}$

price ratio $= -\frac{X_2}{X_1} = -1$

$\frac{X_2}{X_1} = 1 \quad \therefore \quad X_1 = X_2$

Plug $X_1 = X_2$ into budget constraint

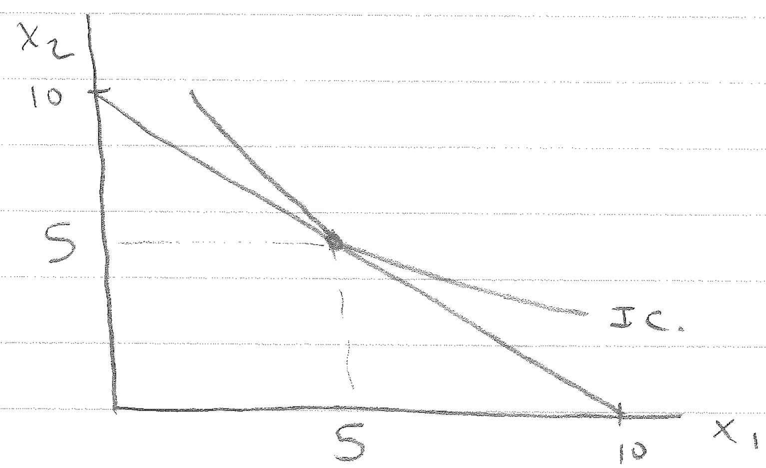
$10 = X_2 + X_2 = 2X_2$ solve for X_2

$\frac{10}{2} = X_2$

$\boxed{\begin{matrix} X_2 = 5 \\ X_1 = 5 \end{matrix}}$ plug into $X_1 = X_2$ &

$\boxed{\text{Utility} = X_1 X_2 = 5 \cdot 5 = 25}$

b.



c. Total demand $X_1 = 5 \frac{X_1}{\text{worker}} \cdot 10$ workers $=$ 50 total demand for X_1

Total demand $X_2 = 5 \frac{X_2}{\text{workers}} \cdot 10$ workers $=$ 50 total demand for X_2.