Discussion 11 - Solutions

Important Topics

- Marginal Revenue

- Input Markets

Problem 1

Consider the market for archery lesson in Nottingham. Market demand for archery lessons is given by $P = 250 - 2Q_D$. Merry Men Incorporated is granted a legislated monopoly over archery lessons in Nottingham by King Richard. The company has a cost function $TC = 100 + 10q + q^2$, with marginal cost $MC = 10 + 2q$.

a. Suppose the CEO of Merry Men Inc, Robin of Locksley, has not taken any economics classes and so chooses a quantity as if he was in a perfectly competitive market (i.e. he charges a price equal to his marginal cost). What price and quantity will be supplied?

Let's find firm supply first: $P = MC = 10 + 2q$. Note that since there is one firm on the market, we can change q to Q, which gives us market supply as $P = 10 + 2Q$. Equilibrium then is $Q^* = 60$ and $P^* = 130$. Respective profits are 3500$.

b. The shareholders fire Robin and replace him with Guy of Gisbourne. Instead of setting price equal to marginal cost, Guy ruthlessly attempts to maximize his revenue. Plot total revenue as a function of quantity. What quantity maximizes revenue and what is the elasticity of demand at this point?

Revenue is maximized at point where elasticity of deman equals to 1, which is also the mean price $P = \frac{250}{2} = 125$. Then $Q = 62.5$, which gives us profits of 3181.5 $.

c. The shareholders are still not entirely happy so they fire Guy of Gisbourne and hire the Sheriff of Nottingham instead. The Sheriff is even more devious than Guy and he manages to maximize profits. Plot his marginal revenue curve and calculate what quantity and price he uses.

The Sheriff knows that to maximize profits he must set marginal revenue equal to marginal cost. He also knows that when he sells one more unit the price goes down a bit, so he realizes his marginal benefit is not exactly the price. For a linear demand curve marginal revenue has the same y intercept but is twice as steep (this is true by applying calculus to total revenue, since total revenue is a parabola). Thus the Sheriff sets: $MR = 250 - 4Q = MC \Rightarrow 250 - 40Q = 10 + 2Q$ which gives us $Q = 40$ and then $P = 250 - 2 * Q = 170$. Also see graph below

d. What can you say about the elasticity of demand at the quantity the Sheriff decides to produce?

We want to produce at points where MR is positive, hence demand is elastic.

e. What is the profit at the quantity the Sheriff decides to produce? $\pi = TR - TC = P \cdot Q - (100 + 10Q + Q^2) = 4700$ $.

f. What is the deadweight loss (DWL) caused by Merry Men Inc acting like a monopolist instead of a competitive firm?
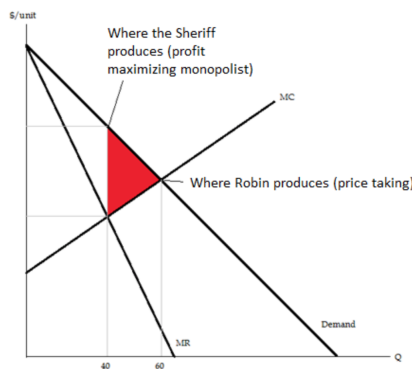
The deadweight loss is the area of the red triangle. It turns out to be $\frac{1}{2}(60-40)\cdot(170-90)=800\$$.

g. If the government wants to put a price ceiling in order to minimize DWL, what price ceiling should it put? What is the DWL now?

The price ceiling should be equal to the competitive market price $P=130$. $DWL=0$ in this price. Remark: Government can implement efficiency if it has full information of market demand and monopolist's cost curve.

Problem 2

Some undergraduate students form a research group to study the market of a popular video game called "Grand Theft Auto V". Suppose Rockstar North Company is the only provider of this game and the current monopoly price for this game is \$80. Their large-scale survey result shows that 9 in every 10 students who plan to buy this game would still be willing to buy this game if the price of this game increases by \$4. Assume each student only buys one set of this game.

a. In order to estimate the demand elasticity of this game, this group assumes that their survey represents the actual demand change. According to this assumption, how large is the demand elasticity of this game at current price \$80?

The demand decreases $\frac{1}{10}=10\%$ when price increase by $\frac{4}{80}=5\%$. Therefore, demand elasticity is $\varepsilon_D=\frac{\%\Delta Q}{\%\Delta P}=\frac{-10\%}{5\%}=-2$.

b. Suppose this company's marginal cost is $MC=0.05q$, market demand curve is linear and our estimation of demand elasticity is precise. How many sets of this PC games is produced at this monopoly price? (Hint: Assume the demand curve is $P=b-kQ$)

In order to determine the production of a monopoly company, we need to use the profit maximization condition here: $MC=MR$. Since we already have equation for MC, we only need to find MR. Let's assume the demand curve is $P=b-kQ$. Then at $P^*=80$, $\varepsilon_D=-\frac{1}{k}\frac{P^*}{Q^*}=-\frac{P^*}{kQ^*}=-2$. Then $kQ^*=\frac{1}{2}P^*=40\$$. Then $80=b-40$, so $b=120$. Hence, we get $MR=b-2kQ^*=120-2(40)=40\$$. Now we can equate MC and MR: $0.05Q^*=40$. Therefore, the production level is $Q*=\frac{40}{0.05}=8000$ sets.

Problem 3

A monopoly firm operates under cost structure and faces with market demand as summarized by the information in the below table.

Quantity	Price	Total Revenue	Marginal Revenue	Total Cost	Marginal Cost
0	200	0	-	100	-
1	180	180	180	130	30
2	170	340	160	170	40
3	160	480	140	220	50
4	150	600	120	280	60
5	140	700	100	350	70
6	130	780	80	430	80
7	120	840	60	520	90
8	100	800	40	620	100

a. Complete the missing values in this table. What is the profit- maximizing level of output? What is the profit-maximizing profit?

A profit-maximizing firm will choose $MC = MR$. From the table, $MC = MR$ when $Q = 6$. At this production level, $\pi = TR - TC = 780 - 430 = 350$.

b. What is the social desirable output and price? How much profit does firm get under this socially desirable outcome?

The social desirable outcome can be implemented by competitive market. At a competitive market, $P = MC$. Therefore, $P = 100$, $Q = 8$. At $Q = 8$, $\pi = TR - TC = 800 - 620 = 180$.

Difficult Midterm 2 Problems

3. Original Prices: $Q_{wine} = 3$
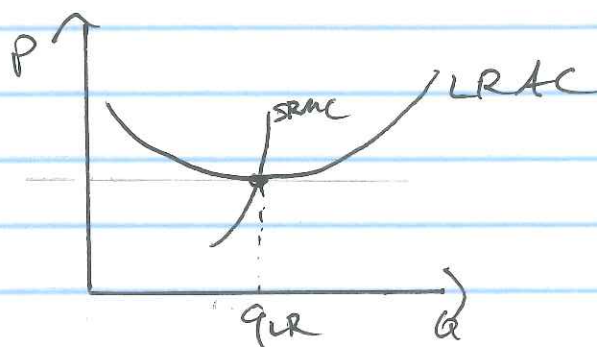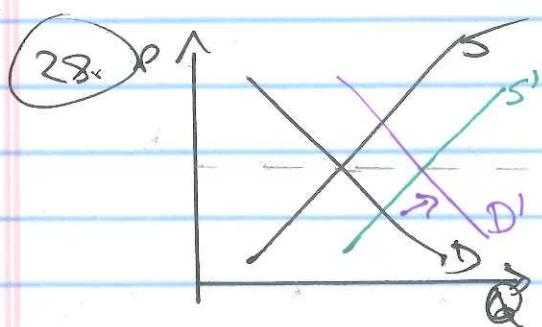
New Prices: $Q_{wine} = 1$

P_{Bread} increased.

$\Rightarrow$ Sub Effect: Bread $\downarrow$ Wine $\uparrow$

price increase is like a decrease in income

Inc Effect: If normal, wine $\downarrow$

inferior, wine $\uparrow$

We know the Price effect is negative, so we must have a negative effect from the income effect so that they are negative when combined.

25. $L = 1 \rightarrow TFC = 100, TUC = 120$

One laborer produces $Q = 10$.

$AFC = TFC / Q = 100/10 = \underline{10}$

$AVC = TVC / Q = 120/10 = \underline{12}$.

Remember we average over quantity, not labor or another input.

28.

28 continued.

All firms minimize LRAC in perfect competion.

① Demand increased.
$$\Rightarrow P\uparrow \text{ and } \pi > 0 \text{ in SR}$$

in the long run...

② Supply increases.

P must fall to the break-even price.
Positive profit induces entry, each firm
produces the same quantity they did before
the change in demand.

③1.
$$\pi = TR - TC$$
$$= P \cdot Q - TFC - TVC$$
perfect competition, in equilibrium P=MC
$$\pi = MC \cdot Q - TFC - TVC$$
We know $TVC = AVC \cdot Q$ because $AVC = \frac{TVC}{Q}$.
$$\Rightarrow \pi = \underline{MC \cdot Q - TFC - AVC \times Q}$$

The first two choices don't restore coverages
to totals.
The third choice gives negative profit.