Problem Set #9-Key

Sonoma State University
Economics 201B-Principles of Microeconomics

Given the following supply, demand and marginal revenue functions:

\[
\begin{align*}
Q^s &= 5P - 25 \\
Q^d &= 100 - 5P \\
MR &= 20 - 2/5Q
\end{align*}
\]

(1) (a) Find the competitive equilibrium price and quantity.
Set \( Q^s = Q^d \) to get
\[
\begin{align*}
P &= $12.5 \\
Q &= 37.5
\end{align*}
\]
(b) Calculate the amount of consumer surplus.
Consumer surplus = \( \frac{1}{2} \times 37.5 \times (20 - 12.5) = 140.625 \)
(c) Calculate the amount of producer surplus.
Producer surplus = \( \frac{1}{2} \times 37.5 \times (12.5 - 5) = 140.625 \)
(d) Show the above answers graphically.

(2) Suppose now that the above market is taken over by a monopolist.
(a) Find the monopolistic equilibrium price and quantity for a single price monopolist.
Hint: Recall that supply curve of the competitive industry is the marginal cost curve, so to get the marginal cost function you need to solve the supply curve for price. This is the marginal cost function.
Setting \( MR = MC \) produces
\[
\begin{align*}
Q &= 25 \\
P &= $15
\end{align*}
\]
(b) Calculate the amount of consumer surplus. Compare the consumer surplus with that of the competitive equilibrium. Explain.
Consumer surplus = \( \frac{1}{2} \times 25 \times (20 - 15) = 62.5 \)
(c) Calculate the amount of producer surplus. Compare the producer surplus with that of the competitive equilibrium. Explain.
(Producer surplus = 25)(5) + \( \frac{1}{2} \times 25 \times 5 = 187.5 \)
(d) Calculate the amount of the deadweight loss. Define deadweight loss. What causes the deadweight loss.
\[
DWL = \frac{1}{2} \times (37.5 - 25)(5) = 31.25
\]
(e) Show the above answers graphically.
Suppose now that the monopolist engages in perfect (first degree) price discrimination.

(a) What is the equilibrium price and quantity of the perfectly price discriminating monopolist.

The competitive quantity of 37.5 is produced.
There is no single equilibrium price since every consumer is charged the maximum price they are willing to pay.

(b) What is the amount of consumer surplus. Compare the consumer surplus with that of a single price monopolistic equilibrium and the competitive equilibrium. Explain.

Consumer surplus = 0.

(c) What is the amount of producer surplus. Compare the producer surplus with that of a single price monopolistic equilibrium and the competitive equilibrium. Explain.

Producer surplus is equal to $281.25.

(d) Show the above answers graphically.
(4) Suppose instead that the monopolist wants to engage in second degree price discrimination by employing a two part tariff.

(a) Find the price per unit and the amount of the tariff that will maximize the monopolists total profits. Assume there are 100 consumers with homogeneous preferences.

The price per unit is $12.50.
The tariff price is $1.40.

(b) Calculate the amount of consumer surplus. Compare the consumer surplus with that of a single price monopolistic equilibrium and the competitive equilibrium. Explain.

Consumer surplus = 0.

(c) Calculate the amount of producer surplus. Compare the producer surplus with that of a single price monopolistic equilibrium and the competitive equilibrium. Explain.

Producer surplus is equal to $281.25.

(d) Calculate the amount of the deadweight loss.

There is no dead weight loss.

(e) Show the above answers graphically.

(5) Suppose that the market consist of two main groups who differ based on their price elasticities of demand. The demand and marginal revenue functions of each group are as follows:

<table>
<thead>
<tr>
<th>Demand</th>
<th>Marginal Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market One: $Q_1 = 50 - P_1$</td>
<td>$MR_1 = 50 - 2Q_1$</td>
</tr>
<tr>
<td>Market Two: $Q_2 = 50 - 4P_2$</td>
<td>$MR_2 = 50/4 - ½Q_2$</td>
</tr>
</tbody>
</table>

Assume also that output can be produced at a constant marginal cost of $10.

(a) What market conditions must exist in order to engage in third degree price discrimination?

(b) Calculate the profit maximizing price, output and profits in market one.

Setting $MR = MC$ in market one produces

$50 - 2Q_1 = 10$

$Q_1 = 25$

$P_1 = $15

(c) Calculate the profit maximizing price, output and profits in market two.

Setting $MR = MC$ in market two produces

$50/4 - ½Q_2 = 10$

$Q_2 = 5$

$P_2 = $11.25