Econ 393 Quiz 1

Instructions: You need paper (lined if possible), a ruler and a pen or a pencil to write this quiz. You may answer the questions in any order you like. You should start each question on a new page. You must write your answers; typed answers will not be accepted. When you are finished answering the questions, please order the pages so your answers to question 1 are first, then your answers to question 2, etc. Then, in a single email message, send an image of each page to me at jburbidg@uwaterloo.ca. Please put Econ 393, your name and your id number in the subject line of your email. The deadline for submitting your answers is 6:00 pm Tuesday May 19th, Toronto time. The marks allocated to each question are shown in brackets.

1. (4 marks for each part of this question) Look at the file labeled “Assignment 1 pictures” on my web site. As precisely as you can, produce the corresponding picture for case (i) — the long-run equilibrium for perfect competition; case (ii) — monopoly with no price discrimination; and case (iv) — monopsony with no price discrimination; for the following setting:

\[
\text{Firm/plant total cost is } c(y) = y^2 + 1
\]

\[
\text{Market demand is } Y(p) = 600 - 100p
\]

As in assignment 1, assume the number of firms/plants does not change moving from the long-run competitive equilibrium to monopoly or monopsony. Your pictures should have all the labeling, and the appropriate numbers for this new setting. I made you turn your heads sideways to read Figures (i), (ii) and (iv) in the Assignment 1 pictures. I am happy to do the same for you.

**ANSWER**

See the Figures at the end of this pdf.
2. (2 marks for each part of this question) (i) In question 1 above, what would prices be if the monopolist were able to practice perfect price discrimination?
(ii) In question 1 above, what would prices be if the monopsonist were able to practice perfect price discrimination?

**ANSWER**

(i) The monopolist would capture all of the area below the demand curve and above the supply curve, up to the competitive equilibrium output; prices would range from 2 to 6 dollars.

(ii) The monopsonist would capture all of the area above the supply curve and below the demand curve, up to the competitive equilibrium output; prices would range from 0 to 2 dollars.

3. (2 marks for each part of this question) Suppose a monopolist faces a linear market demand

\[ Q(p) = a - bp, \]

where \( Q \) is its output, \( p \) is the price it sets, and \( a \) and \( b \) are positive numbers. Further, assume its total cost is

\[ C(Q) = cQ, \quad c > 0, \quad a > bc \]

Assume this monopolist is unable to practice any form of price discrimination. (i) Write average revenue and marginal revenue as functions of \((Q, a, b)\).

(ii) Assuming the monopolist chooses \(Q\) to maximize its profits write the formula for \(Q\) as a function of \(a, b\) and \(c\).

**ANSWER**

(i) Inverting the demand curve we have

\[ p = \frac{a - Q}{b}. \]

If the monopolist must sell every unit at the same price then we have

\[
\begin{align*}
\text{Total revenue} & = TR(Q) = pQ = \frac{aQ - Q^2}{b} \\
\text{Average revenue} & = \frac{pQ}{Q} = p = \frac{a - Q}{b} \\
\text{Marginal revenue} & = TR'(Q) = \frac{a - 2Q}{b}
\end{align*}
\]

(ii) Treating \(a, b\) and \(c\) as parameters, we have
Profits\((Q)\) = Total revenue\((Q)\) – Total cost\((Q)\)
\[= \frac{aQ - Q^2}{b} - cQ\]

Profits\(^{(1)}(Q)\) = \(\frac{a - 2Q}{b} - c\)

Profits\(^{(2)}(Q)\) = \(-\frac{2}{b} < 0\)

Profits are strictly concave in \(Q\). Setting Profits\(^{(1)}(Q)\) = 0 we see that the optimal output for the monopolist is

\[Q(a, b, c) = \frac{a - bc}{2}.\]
Figure (1) Price-Quantity Relationship

Demand: \( P = 6 - \frac{Y}{100} \)

Supply: \( P = \frac{Y}{200} \)

Market

Consumer Surplus

Producer Surplus

MC

AC

Firm / Plant

Revenue

Y

Price

Quantity
Figure (1) Linear Flow - no P.D.

\[
\frac{Z_{oo}}{Y} = \frac{y}{y_y}
\]

\[
Z_{oo} = \frac{100}{18}
\]

Average Raum & Manipulation

F.I.m./Plant
Figure (1) Maquetry - no P.O.

\[ \text{Average Cost} = \frac{\text{Total Cost}}{\text{Output}} \]

\[ \text{Marginal Cost} = \frac{\text{Change in Total Cost}}{\text{Change in Output}} \]

\[ \text{Marginal Benefit} = \frac{\text{Change in Total Benefit}}{\text{Change in Output}} \]

\[ \text{Marginal Benefit} - \text{Marginal Cost} = \text{Profit} \]

\[ \text{Profit} = Q \times (\text{Marginal Benefit} - \text{Marginal Cost}) \]