Econ 301, Fall 2009

Intermediate Microeconomics
Final Exam - Sample

Your Name___________________________________________________________
Your ID Number____________________________________________________________________

Directions

1. This is a 2-hour exam.

2. Answer all questions in the space provided.

3. Next to each section is the number of points allocated to that section. Total number of points on this exam is 30.

GOOD LUCK!
PART A. Define the following concepts. [10 POINTS]

1. Using the best response function of the rival, describe how a Stackelberg type leader can exploit the follower. Is the Stackelberg leader better off than when being a follower in the Cournot equilibrium?

2. Explain why prices are stable when oligopolists are pessimistic. What are the problems with the kinked demand theory?

See the note on the kinked demand theory.

3. What is the tragedy of commons? What remedies does a society have?
(see the note on Thursday)
PART B. (10 points) Answer the following questions. Show all your workings.

In a duopoly, each firm has marginal cost $MC = 20$, and market demand is

$$Q = 100 - \frac{1}{2}p.$$ 

1. Find the Cournot equilibrium. You need to find:
   - best-response function of each firm.
   - best output level for each firm.
   - Equilibrium price.
   - Profit of each firm.

First, derive the inverse demand, $p = 200 - 2Q = 200 - 2(X + Y)$.

$$\pi(X) = (200 - 2(X + Y))X - 20X. \text{ (ignore fixed cost)}$$

$$\pi_X = -2X + (200 - 2X - 2Y) - 20 = 0,$$

Best response function of X: $4X = 180 - 2Y$, or $X = 45 - \frac{1}{2}Y$. \hfill (1)

$$\pi(Y) = (200 - 2X - 2Y)Y - 20Y.$$

$$\pi_Y = -2Y + (200 - 2X - 2Y) - 20 = 0,$$

Best response function of Y: $4Y = 180 - 2X$, or $Y = 45 - \frac{1}{2}X$. \hfill (2)

Cournot solution: From (1) and (2), we get

$$X = 45 - \frac{1}{2} \left( 45 - \frac{1}{2}X \right) = 22.5 + \frac{1}{4}X,$$

Or

$$\frac{3}{4}X = \frac{45}{2}, \text{ or}$$

Cournot solution: $X = \frac{45}{2} \times \frac{4}{3} = 30$. $Y = 45 - 15 = 30$.

Price?

$$p = 200 - 2(X + Y) = 200 - 120 = 80.$$ 

2. Assume $Q = 100 - \frac{1}{2}p$, $MC_x = 4X$, $MC_y = 4Y$. Find a perfect cartel’s output
levels and price?

Cartel cost

\[ C = 2X^2 + 2Y^2. \]

Cartel marginal cost: \( MC_X = 2X, MC_Y = 4Y. \)

Cartel profit

\[ \pi(X, Y) = P(X + Y) - 2X^2 - 2Y^2 = (200 - 2X - 2Y)(X + Y) - 2X^2 - 2Y^2. \]

\[ \pi_X = -2(X + Y) + (200 - 2X - 2Y) - 4X = 0. \]

Or \( 8X + 4Y = 200, \ Y = 50 - 2X \)

\[ \pi_Y = -2(X + Y) + 200 - 2X - 2Y - 4Y = 0. \]

Or

\[ 4X + 8Y = 200. \]

\[ -12X + 400 = 200, \]

\[ 4X + 8(50 - 2X) = 200. \Rightarrow 12X = 200, X = 50 / 3, \]

\[ Y = 50 - 2X = 50 - 100 / 3 = 50 / 3. \]

III. (10 POINTS)
Suppose that the inverse demand curve for paper is \( p = 200 - Q, \) the marginal private cost (unregulated competitive market supply) is \( MPC = 80 + Q, \) and the marginal harm on the society from gunk is \( MGC = Q. \) (\( MSC = MPC + MGC \))

a. What is the unregulated competitive equilibrium?

\[ p = MPC, \]

\[ 200 - Q = 80 + Q, \]

\[ 2Q = 120, \ Q = 60. \]

b. What is the social optimum? What specific tax (per unit of output or gunk) results in the social optimum?

Social optimum requires

\[ MSC = MB, \]

\[ 200 - Q = 80 + Q + Q = 80 + 2Q, \]

\[ 120 = 3Q, Q = 40. \]
To achieve this socially optimal level of output $Q=40$, compute the private marginal cost,

$$PMC = 80 + Q = 80 + 40 = 120.$$  
Compute the marginal social cost, $SMC = 80 + 2Q = 160$.

Specific tax required is 
$$t = SMC - PMC = 160 - 120 = 40.$$  
c. What is the unregulated monopoly equilibrium?

$$MR = MPC,$$
$$TR = (200 - Q)Q = 200Q - Q^2.$$  
$$MR = 200 - 2Q; MPC = 80 + Q$$
$$200 - 2Q = 80 + Q,$$
$$120 = 3Q, Q = 40.$$  
d. How would you optimally regulate the monopoly? What is the resulting equilibrium?

Unregulated monopoly yields the socially optimal level of output. (theory of second best). In this case, there is no need to push the monopolist to increase output because it is a dirty industry.