ECON 301, Prof. Hogendorn

Problem Set 9

1. *Coke.* Suppose that all around the world, there are small towns in which the price elasticity of demand for Coca-cola is constant at -1.2. Each of these towns is served by a monopoly Coke distributor. However, the technology for distributing Coke varies widely: huge bottling plants and 18-wheeler truck delivery in the USA, local bottlers and van delivery in Japan, delivery by pack mule to isolated parts of Bolivia, etc.

   (a) What is the markup (Lerner Index) on Coke in these markets?

   (b) Let the production function be $f(K) = \beta K^2$, where β varies from place to place, and let the price of capital be 20. How does the price of Coke vary with β? (This is pretty tricky. Note that there is a constant elasticity demand.)

2. *Technologies.* Suppose there are three technologies for providing a new Internet service, and one of them will eventually emerge as clearly superior to the other two. All three technologies use the factors S for servers and B for bandwidth, and the factor prices are $w_S = w_B = 1$.

   Technology A has production function $F(S, B) = S^{0.7}B^{0.7}$ but S must be set to 10 units and can never be changed.

   Technology B has production function $F(S, B) = S^{0.6}B^{0.6}$ and both factors can be freely varied.

   Technology C has production function $F(S, B) = S^{0.3}B^{0.6}$ and both factors can be freely varied.

   Recall that in a natural monopoly, $y^{MES} > y^{AC}$. If demand is $P(X) = 50-2X$, which of the above technologies would result in a natural monopoly? Do as little work as possible to answer, but explain your reasoning. *Hint:* For many cost functions, you can only find y_{AC} by using a computer (or a lot of trial and error). But you can easily solve this problem without resorting to these techniques.

3. *Tractors.* Two American companies, Case and John Deere, have decided to introduce their tractors in either the Polish market or the Hungarian market. Neither company has sufficient resources to enter both markets.

   If they both enter the Polish market, they both expect profits of $1 million. If they both enter the Hugarian market, they both expect profits of $1.5 million.

   If Case enters the Polish market and John Deere enters the Hugarian market, then Case expects profits of $3 million and John Deere expects profits of $4 million.

If Case enter the Hungarian market and John Deere enters the Polish market, then Case expects profits of $5 million and John Deere expects profits of $3 million.

There is a single consulting firm with special expertise that will enable either Case or John Deere to move first. The firm will offer its services to the highest bidder.

Using a normal form game, describe what is the most likely outcome.

(a) Case outbids John Deere for the consultant's services. Case enters the Polish market first and then John Deere enters the Hungarian market.

(b) Case outbids John Deere for the consultant's services. Case enters the Hungarian market first and then John Deere enters the Polish market.

(c) John Deere outbids Case for the consultant's services. John Deere enters the Polish market first and then Case enters the Hungarian market.

(d) John Deere outbids Case for the consultant's services. John Deere enters the Hungarian market first and then Case enters the Polish market.

Review problems only, not to turn in:

4. *Minus2.* Suppose the demand curve for a good is:

$$X(p) = 1000p^{-2}$$

There is a monopoly which produces this good, and it has constant marginal cost of $2 per unit.

(a) What is the monopoly optimal price, quantity, and profit?

(b) What is the deadweight loss of this monopoly?

5. *Normal.* Find the Nash equilibrium(a) in the following normal form game:

	L	C	R
T	(2,2)	(5,0)	(1,1)
M	(0,5)	(4,4)	(1,1)
B	(1,1)	(1,1)	(2,2)

6. *CreditCards.* Go back to the Visa and Discover problem, ps5. Suppose that Visa can move first and choose $K = 17$ or $K = 32$, and Discover

can see what it chose. Then Discover chooses either $K = 17$ or $K = 32$. Finally, both firms reveal their short-run total cost of producing 100 units. The lower cost firm gets to sell 100 units at a price of 13 each. The higher cost firm exits the market – it gets no revenue but also has no costs, including no fixed cost of capital. In the event of a tie, both firms get to sell 50 units at a price of 13.

(a) Draw the extensive form of this game and fill in the payoffs.

(b) What is the subgame perfect Nash equilibrium outcome?

(c) Suppose Visa had an additional cost of 100 if it chose $K = 32$, but otherwise everything is the same. Does this change the subgame perfect Nash equilibrium? Does it suggest some type of contract that Visa might like to write with Discover?

Answers to Review Problems:

4. *Minus2.*

(a) This is easy because we have a constant elasticity demand curve with $\epsilon = -2$ and a constant marginal cost of \$2. Thus, the Lerner Index form of the monopoly's first order condition tells us that

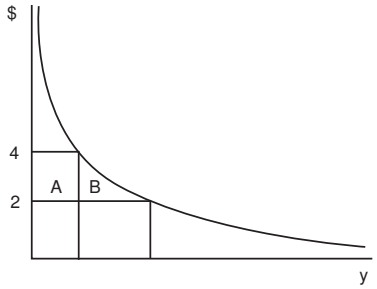
$$\frac{p-2}{p} = -\frac{1}{-2} \Rightarrow p = 4$$

The demand curve tells us that $X(4) = 1000 \cdot 4^{-2} = 62.5$. The constant MC is the same as the AC, so there is a profit of \$2 per unit, or a total profit of 125.

(b) At $P = MC = 2$, the monopoly quantity is $X(2) = 1000 \cdot 2^{-2} = 250$. The deadweight loss is the area between the price of 2 and 4, but not including the monopoly profit:

$$\int_2^4 1000p^{-2}dp - 125 = -1000 \cdot 4^{-1} + 1000 \cdot 2^{-1} - 125 = \$125$$

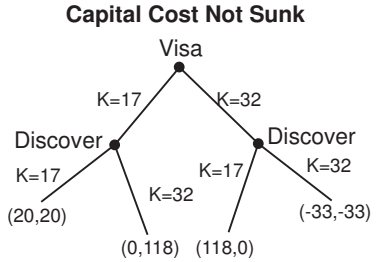
This is represented by areas A and B in the following figure:



5. *Normal.* If the first number in each pair is the payoff of the player who chooses the rows and the second payoff is for the person who chooses the columns, then (T,L) and (B,R) are Nash equilibria. Note that (M,C) is not a Nash equilibrium because if the row player deviated from M to T, her payoff would increase from 4 to 5.

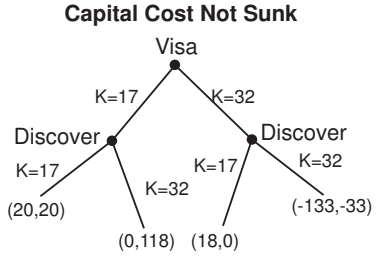
6. *CreditCards.*

   (a) The extensive form game tree is:



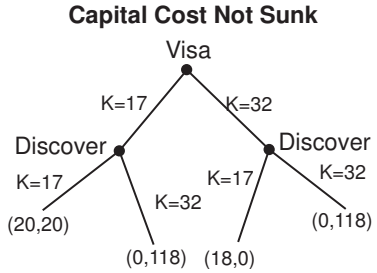
   (b) The equilibrium of the left hand subgame is $K = 32$ and the equilibrium of the right hand subgame is $K = 17$. By backward induction, Visa chooses $K = 32$, preempting Discover. Discover does not have a credible threat to choose $K = 32$ in this case.

   (c) The simpler way to treat the change is to subtract 100 from Visa's payoffs when it chooses $K = 32$ and leave everything else unchanged:



   This does not change the equilibrium, but it does make it suboptimal: Visa gets 18 whereas it could get 20 from a cooperative contract where both choose $K = 17$. Discover would also gain from the contract, going from 0 to 20.

   A more subtle point is that the 100 cost to Visa may be counted in the short run total fixed cost that determines which firm get to sell 100 units. In that case, Discover now wins even in the case where both firms pick $K = 32$:



Now the equilibrium of both subgames is for Discover to choose $K = 32$, and the equilibrium of the whole game has Visa indifferent and choosing $K = 17$. Visa would like to write the same contract discussed above, but its gain of 20 is not sufficient to compensate Discover for its loss of 98.