Homework 7

Due on Dec 8

Choose the best answer

1. The Nash equilibrium in a Bertrand game in which firms produce perfect substitutes and have equal marginal costs is
   a. efficient because all mutually beneficial transactions will occur.
   b. efficient because of the free entry assumption.
   c. inefficient because some mutually beneficial transactions will be foregone.
   d. inefficient because of the uncertainties inherent in the game.

2. All of the following are problems associated with maintaining a cartel except
   a. cartels are illegal.
   b. a large amount of information is needed to coordinate a cartel.
   c. profits are not maximized by a cartel so it will evolve into a monopoly.
   d. each member of the cartel has an incentive to "chisel" by expanding output.

3. Which of the following factors might explain why the long-run equilibrium number of firms can in some instances exceed the socially optimal number?
   a. The appropriability effect (the increase in consumers surplus following entry is not "appropriated" by entrants).
   b. The feedback effect (an increase in the number of firms increases the competitiveness of the market).
   c. The business-stealing effect (entry reduces rival firms' profits, a social loss that entrants do not account for).
   d. The ratchet effect (the more profits the entrants earn, the more the stockholders expect them to earn in the future).

4. Suppose the more a firm invests in a new production technology, the lower its marginal costs. Which of the following scenarios involving this incumbent firm and a potential entrant makes the **least** economic sense?
   a. The incumbent overinvests to deter entry when this investment is observable to the entrant.
   b. The incumbent overinvests to deter entry when this investment is unobservable to the entrant.
   c. The incumbent underinvests to accommodate entry when this investment is observable and they compete in prices.
   d. The incumbent overinvests to accommodate entry when this investment is observable and they compete in quantities.

Analytical questions

1. Two firms $i = 1, 2$ engage in Cournot quantity competition. Each firm chooses its output level q_i. The inverse demand of the market is $p(q_i, q_j) = a - q_i - q_j$. The total cost of firm i depends both firm i and firm j's production: If the output is q_i, firm i's total cost is $(q_i - q_j)q_i$; firm j's total cost is $(q_j - q_i)q_j$.

a. What will the outcome be if the two firms choose their outputs simultaneously?

b. If instead firm 2 chooses its output after observing firm 1's output, what will be the subgame perfect equilibrium?

2. A firm can offer the product at high quality (H) or low quality (L). The consumer needs to decide whether to buy or not without observing the quality of the good. The firm incurs a cost $c_H = 2$ and $c_L = 0$ in producing high-quality and low-quality good, respectively. Consumer obtain value $v_H = 5$ for high-quality good and value $v_L = 2$ for low-quality good. The price of the good is exogenously given at $p = 3$. If the consumer decides to buy, she pays the price p and the firm obtains p. If she chooses not to buy, she gets a payoff of zero.

		Consumer	
		Buy	Not
Firm	H	$p - c_H,\ v_H - p$	$-c_H,\ 0$
	L	$p - c_L,\ v_L - p$	$-c_L,\ 0$

a. Compute the payoff in each cell of the game. What is the Nash equilibrium of this game? What is the social optimal outcome (where the summation of payoffs is maximized)?

		Consumer	
		Buy	Not
Firm	H	,	, 0
	L	,	, 0

The unique NE is (L, Not). The social optimal outcome is (H, Buy).

b. Continue with part (a). Suppose the regulator will punish the firm by a fine $f > 0$ if the firm sells a low-quality product to the consumer. Write down the normal form of the game with the fine. What is the least amount of fine that can induce the social optimal outcome in part (c)?

c. Continue with part (a) (Ignore the fine in part (b)). Suppose that the firm and the consumer play this game infinitely number of times with a common discount factor $\delta \in (0, 1)$. The consumer decides to use a strategy that "If I experiences one time of the low-quality product, I will not buy from this firm any more." Translate this into a trigger strategy as contingent actions in period $t = 1, 2, 3, \ldots$.

d. Continue with part (c). Suppose that the consumer adopts the strategy in with part (d). What is the minimum discount factor δ that can induce the firm to choose H at all period of the game?

In the "cooperative" outcome, the firm receives $\pi^C = 1$. In the deviation outcome, the firm receives $\pi^D = 3$. In the NE outcome, $\pi^{NE} = 0$. So the firm to choose H when

3. Consider the following problem of Cournot quantity competition model with asymmetric costs. The market inverse demand is

$$p(q) = 16 - q,$$

where $q = q_1 + q_2$. q_1 denotes quantity produced firm 1. Firm 1 has a constant marginal cost at $c_1 = 1$ (per unit cost is 1). Firm 2 has a constant marginal cost at $c_2 = 2$.

a. Find the Nash (Cournot) equilibrium

b. Firm 1 and firm 2 are considering whether to merge. They can merge and operate as one firm. However, the marginal cost of production will be 2 for every unit. Is it profitable for them to merge?

4. Consider two firms $i = 1, 2$ in a certain industry. They want to maximize their profit, they have no marginal cost of producing goods.
Consumers are uniformly distributed along the interval $x \in [0, 1]$
$t = 1$, two firms choose location a, b simultaneously, with restriction $a \in [0, \frac{1}{2}], b \in (\frac{1}{2}, 1]$.
$t = 2$, two firms choose thei price p_1, p_2 simultaneously, $p_i > 0$.
Consumer has quadratic transportation cost m^2 for traveling distance m. Each consumer will buy one product no matter how much it cost, and he will buy from the firm with cheaper cost.

a. Find demand q_1, q_2 as functions of choice variables p_1, p_2, a, b.

b. Taking a, b as given, find the optimal pricing scheme (best responses functions) of each firm and $t = 2$ Nash Equilibrium. Are prices strategic complement or substitute?

c. Solve for $t = 1$ Nash equilibrium of location choice. Find the outcome of the entire game.

d. Consider a new game: firm 1 is leader and can commit on his location a first. Firm 2 is follower, it observes a and choose b. Then both firms choose their prices simultaneously. What's the outcome of location choice of firm 1 and 2?

5. Textbook exercise 15.1

6. Textbook exercise 15.2

7. Textbook exercise 15.4