

**Directions:** The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

**Please realize that you are essentially creating “your brand” when you submit this homework. Do you want your homework to convey that you are competent, careful, professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional. For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you do any work for someone else!**

1. Suppose that Joe and Sue are playing tennis against one another and that both of these individuals are trying to decide on what their optimal strategies should be. Joe has a great topspin forehand and a strong approach shot (this is the shot a player makes as they come to the net) while Sue has a great backhand and a wicked drop shot (this is a shot where the ball barely cross the net and then hardly bounces off the surface of the court). Suppose that when Sue hits her backhand and Joe hits his forehand that Sue tends to win one point while Joe tends to lose one point. When Sue hits her backhand and Joe hits approach shot Sue tends to win the next two points while Joe loses the next two points. When Sue elects to play her drop shot and Joe adheres to his strong forehand Sue finds that she loses a point while Joe wins a point. And, finally, when Sue plays her drop shot and Joe plays his approach shot Sue tends to win a point for every two points that Joe wins (after all, with that approach shot Joe is closer to the net and has a better chance of getting to that drop shot).

a) Given the above information fill in the following payoff matrix where each entry indicates the number of points won (a positive numeric value) or points lost (a negative numeric value).

		Joe's Strategies	
		Forehand	Approach Shot
Sue's Strategies	Backhand		
	Drop shot		

b) Examine the payoff matrix you created in (a). Does Sue have a dominant strategy? Explain your answer.

c) Examine the payoff matrix you created in (a). Does Joe have a dominant strategy? Explain your answer.

d) Suppose Sue follows her dominant strategy, can you predict what Joe will do given the above information? Explain your answer.

e) You plan to watch Sue and Joe play each other this weekend. Describe the match you anticipate seeing. Who do you predict will win?

2. Consider two firms in an industry consisting solely of these two firms. Microfibers and Big Fibers produce identical products. Both firms are trying to decide whether they want to advertise or not advertise. They know that when they advertise the other firm benefits from this advertisement since they are selling identical products.

Microfibers knows that if Big Fibers advertises then Microfibers will earn a profit of \$100,000 for the year if it also advertises and a profit of \$80,000 for the year if it does not advertise. Microfibers knows that if Big Fibers does not advertise then Microfibers will earn a profit of \$120,000 for the year if it advertises and a profit of \$50,000 for the year if it does not advertise.

Big Fibers knows that if Microfibers advertises then Big Fibers will earn a profit of \$80,000 for the year if it also advertises and a profit of \$60,000 for the year if it does not advertise. Big Fibers knows that if Microfibers does not advertise then Big Fibers will earn a profit of \$100,000 for the year if it advertises and a profit of \$60,000 for the year if it does not advertise.

a) Given the above information, construct a payoff matrix for this situation. Put Microfibers on the left hand side of the payoff matrix and Big Fibers on the top of the matrix. Make sure your payoff matrix identifies the strategies that each firm faces as well as the payoff from each combination of strategies.

b) Identify if these two firms have the dominant strategies and, if so, what these dominant strategies are. Explain your answer.

c) Given the above information, can you predict what these two firms will do? Explain your answer.

3. Suppose there are two firms in a market and these two firms agree to form a cartel and divide up the market evenly. The two firms know the following:

Market Demand for the Product:  $P = 100 - Q$

Marginal Cost of producing the good:  $MC = 0$

Fixed Cost of production:  $FC = 0$

a) What is the profit maximizing quantity and price for the cartel? Explain your answer and provide a graph of this market to illustrate your answer.

b) What are the industry profits given your answer in (a)? Show your work.

c) What is the level of production for each firm if both firms adhere to the cartel agreement? What are the profits for each firm? Explain your answer.

d) Suppose one of the firms decides to cheat on the cartel agreement and sell the product for \$48 per unit. How many units can this firm sell at this price and what will be its profits when it follows this pricing strategy? Assume that the other firm does not drop its price and consumers know all prices, so the other firm sells zero units.

e) Suppose that one of the firms drops its price as described in (d), but now the other firm matches this price decrease. If the two firms continue to split the market evenly, what will the profit for each firm equal now that both firms are selling the good for \$48 per unit? Explain your answer.

f) Make a payoff matrix for these two firms with each firm having a choice of charging the profit maximizing price (see (a)) or the “cheating on cartel” price of \$48. Put Firm A on the left hand side of the payoff matrix and Firm B at the top of the matrix.

g) Does each firm have a dominant strategy? Explain your answer.

h) What do you predict will be the outcome of this game? Explain your answer.

i) If you apply the above logic many times to successively lower prices (e.g. \$46, \$44, ...), what will the price eventually be?

4. Joe, Mary, and Louise live in the same community (they are the only residents) and they are debating installing some street lamps. Thankfully each of these individuals is willing to reveal their preferences and demand for street lamps, but the community is still trying to decide how many street lamps they should buy. Here is the relevant information that they have gathered:

Joe’s demand for street lamps:  $Q = 20 - 2P$

Mary’s demand for street lamps:  $Q = 20 - 4P$

Louise’s demand for street lamps:  $Q = 10 - P$

Marginal social cost of a street lamp:  $MSC = \$3$

a) Given the above information draw an illustration of these three demand curves plus the market demand curve for street lamps. In your illustration provide four different graphs that are vertically stacked with the market demand curve the bottom graph in the stack. Make sure all your graphs are clearly and completely labeled. Describe verbally how you found the market demand curve.

b) Write the equation(s) for the market demand curve and provide a range or domain for any segments of the demand curve. Show how you found these equations.

c) What is the socially optimal amount of street lamps for this community? Explain how you found your answer. How much will Joe pay per street lamp? How much will Mary pay per street lamp? How much will Louise pay per street lamp?

5. Consider the market for college education in the economy of Smallville. The market demand curve for a year of college education is given by  $P = 60,000 - 2Q$  where  $P$  is the price per year of college and  $Q$  is the quantity of students attending college per year. This market demand curve expresses the marginal private benefit of going to college but does not include the social benefits derived from this education. The market supply curve for a year of college education is given by  $P = Q$ . This market supply curve expresses the marginal social cost of going to college. The

social benefit of going to college for a year is equal to \$12,000 per year per student, in addition to the private benefit that goes to the student directly.

- a) Given the above description is there a negative or positive externality in this market? Explain your answer.
- b) Given the above description, is this a consumption or a production externality? Explain your answer.
- c) What quantity of students will attend college this year and what price will they pay given the above information? Show your work.
- d) Suppose that the described externality is internalized in this market. Write the new equations we will need in order to find the socially optimal amount of college education to provide this year. Explain how you got these equations.
- e) What is the socially optimal amount of college education to provide this year given the above information? What is the “right” (the one that corresponds to the socially optimal amount of the good) price for a year of college? Explain your answer.
- f) What is the deadweight loss that occurs when the externality is not internalized in this market? Show your work.