Problem Set 4 Solutions

1) A) If the firm can perfectly price discriminate it will charge each customer that customer's willingness to pay. So, it will charge person A $400, Person B $300, Person C $200, and Person D $100. The firm will not sell to person E since Person E will only pay $0, and this would be below the firm's marginal cost.

1B) Since each customer is charged exactly their willingness to pay, there is no consumer surplus. Yes, this market would be considered efficient. The monopolist continues to produce until Price equals Marginal Cost. Net Benefits to society are maximized, but all the benefits go to the producer.

2A) If the movie theater charges $5 per ticket, both students and professors will buy tickets. The movie theater will sell to 1,000 customers at a price of $5 each. Since the movie theater's cost per ticket is $3, its profit is $2 per ticket for a total profit of 1,000 x $2 = $2,000. Students will receive no consumer surplus. Each of the professors will receive consumer surplus of $10 - $5 = $5, for a total consumer surplus of 100 x $5 = $500.

2B) If the movie theater charges $10 per ticket, only professors will buy tickets. The movie theater will sell to 100 customers at a price of $10 each. Since the movie theater's cost per ticket is $3, its profit is $7 per ticket for a total profit of 100 x $7 = $700.

Students receive no consumer surplus since they buy no tickets. Each of the professors receive zero consumer surplus since the price is equal to their willingness to pay. So, consumer surplus is $0.

2C) If the movie theater charges students a price of $5, it sells 900 tickets at a profit of $5-$3 = $2 each so the total profit from students is $1,800.
The theater charges professers $10 and sells 100 tickets, for a profit of $10 - $3 = $7 per ticket. The total profit from ~~students~~ professors is $700.
The theater's total profit is $1,800 + $700 = $2,500
Since each customer is charged exactly their willingness to pay, there is no consumer surplus.

3A) If the store puts pizza on sale for half price the price per pizza would be $10. At this price the consumer will buy the first pizza, because MV exceeds the price (15.01 > 10), but will not buy a second pizza. The consumer will receive $5.01 in Consumer Surplus, and the firm will receive $10 - $2 = $8 of profit.

Note: Consumer always wants to maximize Consumer Surplus

3B) If the store uses a buy-one-get-one-free deal, then the consumer buys pizza as a bundle of 2 Pizzas for $20. The consumer is willing to pay $20.02, so will buy the bundle. Consumer surplus would be $0.02 and Store profit would be $20-$4=$16
Twice the profit as would have earned with the 50% off price. This is an example of price discrimination with the firm attempting to capture more consumer surplus, and increase their profits.

4A) Pepsi sells 4 million cans at $0.20 for total revenue of $0.20 x 4 million = $800,000. Its only cost is the fixed cost of $100,000, so its profit is $800,000 − $100,000 = $700,000.

If Pepsi were to raise its price, it would lose all its customers. This is because customers regard Coke and Pepsi as identical products and so will buy none of the product that is more expensive. So Pepsi loses money, its fixed cost: its loss will be $100,000. in the short-run.

4B) If Pepsi raises its price to $0.30, it will lose some customers but not all customers. It will sell 3 million cans at a price of $0.30 per can and so have total revenue of $0.30 x 3 million = $900,000. Since its only cost is the fixed cost, Pepsi's profit is $900,000 − $100,000 = $800,000.

4C) Since Pepsi can raise its revenue by $100,000 (from $700,000 without advertising to $800,000 with advertising), it should be willing to spend at most $100,000 on the advertising campaign.

5)

		Firm B: Cartel	Firm B: Cheat
Firm A	Cartel	450, 450	337.50, 506.25
	Cheat	506.25, 337.50	400, 400

Payoffs: A, B (Firm A, Firm B)

NE = (cheat, cheat)
Both firms have a dominant strategy to cheat, Regardless of which strategy the other firm selects. Example of Prisoner's Dilemma

(4)

6A)

Philip Morris \ R.J. Reynolds	Advertise	Do Not Advertise
Advertise	1.5, 1.5	2.8, 1
Do Not Advertise	1, 2.8	2, 2

All values are in millions. Payoffs: X, Y
X → Philip Morris; Y → R.J. Reynolds

B) Collectively, they would be best off not Advertising. Their combined profits would be $4 million, the most they can achieve as a group. So, the cooperative solution here would be to: (Do not Advertise, Do not Advertise)

C) Each firm will consider what its best action is depending on the action of the other firm. If R.J. Reynolds advertises, Philip Morris should as well, since it will earn $1.5 million instead of $1 million. If R.J. Reynolds does not advertise, Philip Morris should advertise, since $2.8 million is better than $2 million. So, no matter what R.J. Reynolds does, the best action for Philip Morris is to advertise. The same Logic applies to R.J. Reynolds. As a result, each firm will advertise, yielding profit of $1.5 million for each firm. This is another example of the prisoners' Dilemma.

7)

		Player 2: Left	Player 2: middle	Player 2: Right
Player 1	Up	1, 0	1, 2	0, 1
	Down	0, 3	0, 1	2, 0

Payoffs: X, Y (X → Player 1, Y → Player 2)

For Player 2, Playing "Middle" will always strictly Dominate playing "Right" no matter what player 1 Does.

- If Player 1 plays "Up", player 2 could get 2 from playing "Middle" or 1 from playing "Right"
- If Player 1 plays "Down", player 2 could get 1 from playing "Middle" or 0 from playing "Right"

So, Player 2 would Never play "Right" since they could always do better playing "middle". This eliminates "Right" as an option.

Game Becomes:

		Player 2: Left	Player 2: middle
Player 1	Up	1, 0	1, 2
	Down	0, 3	0, 1

For Player 1, no matter what player 2 does, will always be better off playing "Up". So, Player 1 has a dominant strategy to play "up". knowing this, Player 2 will be best off playing "middle". NE = (Up, middle)

8A) If BASF expands production by 10 tons, it will be producing 50 total tons and the price would fall to $3 per ton.

Price Effect: BASF will lower the price by $1 on each of the units it was selling at the higher price of $4.

$\Rightarrow -\$1 \times 40 \text{ units} = -\$40$

Quantity Effect: As a result of lowering its price by $1. BASF will now gain 10 units of new sales at $3 per unit.

$\Rightarrow +\$3 \times 10 \text{ units} = +\$30$

On net, total Revenue will fall by $10. Marginal Cost is assumed zero, so profits would fall by $10. BASF would have no incentive to expand output as a single price monopolist.

8B) If BASF expands production by 10 tons, a total of 50 tons will be produced (20 by Roche, 30 by BASF) and the price will be $3 per ton.

Price Effect: BASF will lower the price by $1 on each unit it was selling at the higher price of $4.

$\Rightarrow -\$1 \times 20 \text{ units} = -\$20$

Quantity Effect: As a result of lowering its price by $1 BASF will now gain 10 units of new sales at $3 per unit.

$\Rightarrow +\$3 \times 10 \text{ units} = +\$30$

On net, total revenue will rise by $10. Marginal Cost is assumed zero, so profits for BASF will rise by $10. BASF would, therefore, have an incentive to expand output in this case.

(7)

9)

Price	Quantity	Total Revenue		MR	MC
10	0	0	>	9	2
9	1	9	>	7	2
8	2	16	>	5	2
7	3	21	>	3	2
6	4	24	>	1	2
5	5	25	>	-1	2
4	6	24	>	-3	2
3	7	21	>	-5	2
2	8	16	>	-7	2
1	9	9			

A) The Cartel (monopoly) maximizes profit by producing where marginal Revenue ≥ marginal Cost, Since MC is constant at $2, the cartel (monopoly) would produce 4 million units and charge a price of 6 euros per unit. They wont produce the 5th unit because the MR of the 5th unit ($1) is less than the MC ($2), so they would lose money on that unit.

If the firms evenly divide production then each would produce 2 million liters.

Profits for each firm:

Profit = €12 million − €1 million − €4 million = €7 million

- €12 million ↑ Total Revenue: P*Q, 6*2 million
- €1 million ↑ Fixed Cost
- €4 million ↑ Variable Cost: €2*2 million
- €7 million ↑ Profit: TR − TC

B) If Perrier increases production by 1 million liters the total amount produced would become 5 million liters and the price would fall to €5 per liter.

Perrier now produces 3 million liters and has profit of:
€5*3 million − €1 million − €2*3 million = €8 million

Evian's profits become:
€5*2 million − €1 million − €2*2 million = €5 million.

C) Since the cheating firm (in this case Perrier) can increase its profits by cheating and moderately increasing its production, the likelihood of cheating is high.

D) ~~If the industry~~
If Perrier increased production by 3 million liters, the total amount produced would become 7 million liters and the price would become €3 per liter.

Perrier now produces 5 million liters and has profit of:

€3*5 million − €1 million − €2*5 million = €4 million

This profit is lower than found in part (B). This implies that although Perrier has an incentive to increase production somewhat, it does not have an incentive to increase production dramatically.