Econ 101
Fall 2014
Problem Set 9

1) Suppose there are five potential customers for a particular good. Customer A is willing to pay $400 for the good, customer B is willing to pay $300, customer C is willing to pay $200, Customer D is willing to pay $100 and Customer E is willing to consume the good if offered for free. This information is illustrated by the following demand schedule facing a monopolist. Assume that the marginal cost of producing the good is constant at $100 per unit and there are no fixed costs.

Price	Quantity Demanded
$500	0
400	1
300	2
200	3
100	4
0	5

a. Suppose that the monopolist can perfectly price discriminate. To which customers will the monopolist sell the good and at what prices?
b. Given the solution to part (a), how large is each individual's consumer surplus? How large is total consumer surplus? Would this market be considered efficient?

2) The movie theater in Collegetown serves two kinds of customers: students and professors. There are 900 students and 100 professors in Collegetown. Each student's willingness to pay for a movie ticket is $5. Each professor's willingness to pay for a movie ticket is $10. Each will buy at most one ticket. The movie theater's marginal cost per ticket is constant at $3, and there are no fixed costs.

a. Suppose the movie theater cannot price-discriminate and needs to charge both students and professors the same price per ticket. If the movie theater charges $5, who will buy tickets and what will the movie theater's profit be? How large is consumer surplus?
b. If the movie theater charges $10, who will buy movie tickets and what will the movie theater's profit be? How large is consumer surplus?
c. Now suppose that, if it chooses to, the movie theater can price-discriminate between students and professors by requiring students to show their student ID. If the movie theater charges students $5 and professors $10, how much profit will the movie theater make? How large is consumer surplus?

3) Stores often use buy-one-get-one-free promotions. Consider the market for pizza. Suppose that a consumer values the first pizza at $15.01 and the second pizza at $5.01. The marginal cost to the store is $2 per pizza. The retail price is $20 per pizza.

a. Suppose the store places pizzas on sale for half price. How many pizzas will this consumer purchase and how much will the store earn in profits?
b. Now suppose that instead of a half price sale, the store offers a buy-one-get-one-free deal. How many pizzas will the consumer buy in this case and how much will the store earn in profits?

4) Suppose that Coke and Pepsi are the only two producers of cola drinks, making them duopolists (oligopoly with only two firms). Assume both companies have zero marginal cost and a fixed cost of $100,000

a. Assume first that consumers regard Coke and Pepsi as perfect substitutes. Currently both are sold for $0.20 per can, and at that price each company sells 4 million cans per day. How large is Pepsi's profit? If Pepsi were to raise its price to $0.30 per can, and Coke does not respond, what would happen to Pepsi's profit?
b. Now suppose that each company advertises to differentiate its product from the other company's product so consumers no longer view them as perfect substitutes. As a result of advertising, Pepsi realizes that if it raises or lowers its price, it will sell less or more of its product, as shown by the demand schedule in the accompanying table.

Price of Pepsi (per can)	Quantity of Pepsi Demanded (millions of cans)
$0.10	5
0.20	4
0.30	3
0.40	2
0.50	1

If Pepsi now were to raise its price to $0.30 per can, what would happen to its profit?

c. Comparing your answer to part (a) and to part (b), what is the maximum amount Pepsi would be willing to spend on advertising?

5) Suppose there are only two firms in an industry. They attempt to form a cartel and restrict output so that they can raise the price and collectively earn the monopoly profits. Each firm has two choices: stick to the cartel agreement or cheat and take advantage of the high price by producing more than the cartel agreement amount. Each firm's profits are given in the following payoff matrix.

	Firm B Produces Cartel Amount	Firm B Cheats
Firm A Produces Cartel Amount	450, 450	337.50, 506.25
Firm A Cheats	506.25, 337.50	400, 400

What is the Nash Equilibrium for this game? Briefly explain.

6) Philip Morris and R.J. Reynolds spend huge sums of money each year to advertise their tobacco products in an attempt to steal customers from each other. Suppose each year Philip Morris and R.J. Reynolds have to decide whether or not they want to spend money on advertising. If neither firm advertises, each will earn a profit of $2 million. If they both advertise, each will earn a profit of $1.5 million. If one firm advertises and the other does not, the firm that advertises will earn a profit of $2.8 million and the other firm will earn $1 million.

a. Use a payoff matrix to depict this problem.
b. Suppose Philip Morris and R.J. Reynolds can write an enforceable contract about what they will do and this contract effectively prevents either firm from cheating on any agreed course of action. What is the cooperative solution to this game?
c. What is the Nash equilibrium without an enforceable contract? Explain why this is the likely outcome.

7) Consider the following game: Player 1 has two strategies, play up or down. Player 2 has three strategies, play left, middle, or right. The two players face the following payoff matrix: What is the Nash Equilibrium?

		Player 2		
		Left	Middle	Right
Player 1	Up	1,0	1,2	0,1
	Down	0,3	0,1	2,0

8) The accompanying table shows the demand schedule for vitamin D. For simplicity, assume that the marginal cost of producing vitamin D is zero.

Price of vitamin D (per ton)	Quantity of vitamin D Demanded (tons)
$8	0
7	10
6	20
5	30
4	40
3	50
2	60
1	70

a. Suppose that BASF is the only producer of vitamin D and acts as a monopolist. It currently produces 40 tons of vitamin D at $4 per ton. If BASF were to produce 10 more tons, what would be the price effect for BASF? What would be the quantity effect? Would BASF have an incentive to produce those 10 additional tons?
b. Now assume that Roche enters the market by also producing vitamin D and the market is now a duopoly. BASF and Roche agree to produce 40 tons of vitamin D in total, 20 tons each. BASF cannot be punished for deviating from the agreement with Roche. If BASF, on its own, were to deviate from that agreement and produce 10 more tons, what would be the price effect for BASF? What would be

the quantity effect for BASF? Would BASF have an incentive to produce those 10 additional tons?

9) In France, the market for bottled water is controlled by two large firms, Perrier and Evian. Assume each firm has a fixed cost of €1 million and a constant marginal cost of €2 per liter of bottled water (€1 = 1 euro). The following table gives the market demand schedule for bottled water in France.

Price of Bottled Water (per liter)	Quantity of Bottled Water Demanded (millions of liters)
€10	0
9	1
8	2
7	3
6	4
5	5
4	6
3	7
2	8
1	9

a. Suppose the two firms form a cartel and act as a monopolist. Calculate marginal revenue for the cartel. What would the monopoly price and output be? Assuming the firms divide the output evenly, how much will each produce and what will each firm's profits be?
b. Now suppose Perrier decides to increase production by 1 million liters (cheat on the cartel agreement) and Evian doesn't change its production. What will the new market price and output be? What is Perrier's profit? What is Evian's profit?
c. What does your results from part (b) suggest about the likelihood of firms cheating on such agreements?
d. What if Perrier increases production by 3 million liters (relative to the cartel level of output) and Evian doesn't change its production. What would Perrier's output and profits be relative to those in part b?