



**(1) [10 points]** The diaper industry in Albania consists of 5 firms producing identical diapers. Similarly, the diaper industry in Bolivia consists of 6 firms. It has been recently observed that firms' market shares in each country are given by

Country	Firms						Concentration Index	
	1	2	3	4	5	6	$I_4$	$I_{HH}$
Albania	40%	15%	15%	15%	15%	0%		
Bolivia	45%	11%	11%	11%	11%	11%		

Fill-in the missing items in the above table (show all your calculations). Then, conclude which industry is more concentrated (and according to which measure).

**(2) [5 points]** Discuss whether it is illegal to price discriminate according to U.S. Law. Explain which section of the law deals with price discrimination, and how this section should be interpreted.

(3) The table below displays the profits from a price game between GM and FORD.

		FORD					
		LOW PRICE		MID PRICE		HIGH PRICE	
GM	LOW	100	100	150	50	200	0
	MID	50	150	200	200	350	250
	HIGH	0	200	250	350	300	300

Each firm can set either a high price,  $p^H$ , a mid price,  $p^M$ , or a low price,  $p^L$ , where  $p^H > p^M > p^L > 0$ . Solve the following problems.

**(3a) [10 points]** Write down Ford's and GM's price best-response function, and conclude which pairs of prices constitute Nash equilibria.

**(3b) [5 points]** Is the outcome  $\langle p_G, p_F \rangle = \langle p^H, p^M \rangle$  Pareto superior to  $\langle p^H, p^H \rangle$ ? Prove your answer.

**(3c) [10 points]** Solve for a subgame-perfect equilibrium price strategies of this two-stage game in which Ford announces its price before GM does.

**(4) [10 points]** Each *u*Phone costs  $c = \$100$  to produce. The producer owns exclusive patent rights which prevents competition in this market. On the demand side, there are:  
 $n^H = 1000$  consumers who are willing to pay a maximum amount of  $V^H = \$500$  for a *u*Phone,  
 $n^M = 3000$  consumers who are willing to pay up to  $V^M = \$300$  for a *u*Phone, and  
 $n^L = 5000$  consumers who are willing to pay a maximum amount of  $V^L = \$200$  for a *u*Phone.  
Each consumer chooses whether to buy one unit or not to buy at all. Compute the profit-maximizing price of this monopoly *u*Phone producer.

**(5)** In Ben Barber there are two suppliers of distilled water, called firm  $A$  and firm  $B$ . Distilled water is considered to be a homogenous good. Let  $p_A$  and  $p_B$  denote the price per gallon, and  $q_A$  and  $q_B$  the quantity sold by firms  $A$  and  $B$ , respectively. Suppose that the Ben Barber municipality provides all the water for free, so firms don't bear any production cost. Formally, assume that  $c_A = c_B = 0$ .

Ben Barber's inverse demand function for distilled water is given by

$$p = 12 - \frac{1}{3}Q = 12 - \frac{q_A + q_B}{3},$$

where  $Q = q_A + q_B$  denotes the aggregate industry supply of distilled water in Ben Barber.

**(5a) [15 points]** Suppose the firms compete in quantities (production levels). Assume that firm  $A$  sets its output level  $q_A$  first. Then, firm  $B$  observes  $q_A$  and sets its output level  $q_B$ . Compute the quantity produced by each firm in this two-stage game. Also, compute the resulting market price,  $p$ , and the firms' equilibrium profit levels,  $\pi_A$  and  $\pi_B$ .

**(5b) [5 points]** Suppose the firms compete in prices. Assume that firm  $A$  sets its price  $p_A$  first. Then, firm  $B$  observes  $p_A$  and sets its price  $p_B$  to maximize profit. Solve for the Subgame-perfect equilibrium price strategies of this game.

**(5c) [5 points]** Answer part (5b) (two-stage price game) assuming that the firms' unit costs are  $c_A = 0$  and  $c_B = \$4$ .

**(6) [10 points]** The demand function for concert tickets to be played by the Ann Arbor symphony orchestra varies between nonstudents ( $N$ ) and students ( $S$ ). Formally, the two demand functions of the two consumer groups are given by

$$q_N = 7290(p_N)^{-3} \quad \text{and} \quad q_S = 40960(p_S)^{-4}.$$

Assume that the orchestra's total cost function is  $TC(Q) = 6Q$ , where  $Q = q_N + q_S$  is the total number of tickets sold. Compute the concert ticket prices set by this monopoly orchestra, and the resulting ticket sales, assuming that the orchestra can price discriminate between the two consumer groups, say by requiring students to submit their student ID cards.

**(7)** Two firms, labeled firm  $A$  and firm  $B$ , compete in prices in a market for a homogeneous product. In this market there are  $N > 0$  consumers; each buys one unit if the price of the product does not exceed \$10, and nothing otherwise. Consumers buy from the firm selling at a lowest price. In case both firms charge the same price, assume that  $N/2$  consumers buy from each firm.

Assume the unit production of firm  $A$  and firm  $B$  are given by  $c_A = c_B = \$2$ . Solve two problems on the next page.

**(7a) [5 points]** Find the Bertrand equilibrium prices for a single-shot game, assuming that the firms choose their prices simultaneously.

**(7b) [10 points]** Now suppose that the game is repeated infinitely many times,  $t = 0, 1, 2, \dots$ . Let  $\rho$  ( $0 < \rho < 1$ ) denote the time-discount parameter. Propose trigger price strategies for each firm yielding the collusive prices of  $(10, 10)$  each period, assuming that each firm reverts to the Bertrand equilibrium price if any firm deviates from its collusive price. Calculate the minimal value of  $\rho$  that would enforce the collusive prices under the trigger price strategies you proposed.

THE END