Economics 431
Homework 3
Due Wed, July 18

Part I. Bundling

GigaTech is *the only* manufacturer of the cutting-edge new generation phone handsets that sell for $ 200. SneakyCom is one among *many* providers of prepaid calling cards that sell for $ 20. The customers who buy GigaTech phones and/or prepaid calling cards have the following reservation prices:

Customer's name	Reservation price for a phone, R_1	Reservation price for a card, R_2
A	205	10
B	210	15
C	180	25
D	190	40

Consumer utility from a product equals their reservation price minus the price of the product. Consumers do not buy unless they get positive utility.

a) Suppose that the calling card and the phone are offered separately at prices $p_1 = 200$ for the phone and $p_2 = 20$ for the card. Which consumer buys which product(s).

b) SneakyCom CEO approaches GigaTech CEO with the following plan. Instead of selling phones and cards separately, they can offer the phone and the card *only* as a package for the price of $220 per package. Then consumers who like calling cards a lot may also buy phones, and GigaTech will be able to sell more phones. Which consumers buy which product(s) if the phone and the card are bundled? (Hint: calling cards are still available separately from other providers) What happens to the sales of phones?

c) Reconcile your result in b) with the fact that most new cars are offered only together with tires as one package. Will the dealers sell more cars if they offer them without tires and let the customers buy their most preferred tires elsewhere? Explain.

Part II. Tie-in sales of complementary products

This example presents one possible defense for Microsoft in its antitrust proceedings. It shows that if a firm has monopoly power in one product, then allowing it to tie in a *complementary* product never decreases welfare and increases it if the complementary product market is anything but perfectly competitive. Microsoft is a monopoly on the market of operating systems for PCs, but it faces competition on the market for browsers. Operating system and browser are complementary products - consumers necessarily want *one of each.* Let

$$Q = V - (p_1 + p_2)$$

be the demand for computer systems when the price of operating system is p_1 and price of browser is p_2 (suppose that price of hardware is already included in V, so V here is a residual maximum willingness to pay for the software). The Microsoft's marginal costs are c_1 for the operating system and c_2 for the browser. Suppose first that Microsoft sells *only* operating systems and each consumer buys a browser elsewhere at a price $p_2 \geq c_2$. The residual demand for operating systems is

$$Q(p_1) = (V - p_2) - p_1$$

which gives the inverse demand

$$p_1(Q) = (V - p_2) - Q$$

a) Solve for the monopoly price for operating systems and quantity sold. (Microsoft has no market power in browsers, so it maximizes its profits from sales of operating systems taking the price of browser as given).

b) Now suppose that Microsoft can tie in the operating system and the browser, i.e. sell them as a bundle for a common price $p = p_1 + p_2$. What is the demand for this bundle? What is the quantity produced? Has Microsoft's profit gone up?

c) Show that consumer surplus in b) is always no less than in a). What is the value of p_2 for which the consumer surpluses are equal in a) and in b)?

d) Does welfare (sum of producers' profits and consumer surplus) increase when we allow tying in the operating system and the browser?

e) "Microsoft uses its monopoly power to force Internet Explorer on the customers, because it cannot compete on the browser market". Do you agree with this statement? Why or why not?

Part III A three-player game

Consider a game between three major car producers, C (Player 1), F (Player 2) and G (player 3). Each producer can produce either large cars, or small cars, but not both. That is, the action set of each producer i ($i = C, F, G$), is $A_i = \{S, L\}$. Let

$$\pi_i(a_C, a_F, a_G)$$

be the payoff producer i when the action combination is (a_C, a_F, a_G)

The payoff function is defined as follows:

If all three producers make only large cars, each gets the payoff of γ

If all three producers make only small cars, each gets the payoff of γ

Whenever any two producers make the same type of car and the other one makes a different type of car, these two producers get a payoff of β, and the other producer gets a payoff of α

For example:

$$\begin{aligned} \pi_C(S, L, L) &= \alpha \\ \pi_F(S, L, L) &= \beta \\ \pi_G(S, L, L) &= \beta \end{aligned}$$

Here F and G make the same type of car (L), so they get β each. C makes a different type of car, so he gets α.

a) Let C be the row player, F be the column player and G be the page player. Write the payoff matrix for this game. (it will consist of two matrices - one will correspond to all strategy combinations where G plays S (i.e. chooses the left matrix) and the other will correspond to all strategy combinations where G plays L (i.e. he chooses the right matrix)

b) Find all the Nash equilibria when $\gamma > \alpha > \beta$. Are any of these equilibria Pareto optimal? Is the sum of profits (social welfare) maximized in these Nash equilibria?

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Part IV Bertrand duopoly

Two firms, A and B, engage in Bertrand price competition in a market with inverse demand given by $p = 12 - Q$. Firm A has a higher marginal cost: $c_A > c_B$. Whenever a firm undercuts the rival's price, it has all the market. If a firm charges the same price as the rival, it has half of the market. If a firm charges more than the rival, it has zero market share.

a) Suppose that $c_A = 8$ and $c_B = 3$. Find a Nash equilibrium of this game (p_A, p_B) where one of the firms charges its marginal cost.

b) Suppose that there are not 2, but n firms with different marginal costs. Any number of firms may also have equal marginal costs. Can we have a marginal cost structure where one firm earns a positive profit? Can we have a marginal cost structure where more than one firm earns a positive profit? Explain.

Part V End of chapter problems from the textbook

End of chapter 9.1, 9.5, 9.6