

University of Southern California

Economics of Industrial Organization

ECON 480

Problem Sets

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The following problems are class material. They will be solved in-class to illustrate the concepts of the course. You are strongly encouraged to prepare them in advance whenever you are instructed to.

Problem 1: Individual and market demands

Reference to course:

The demand side : some consumer theory (Topic 1 - Handout01.pdf)

The preferences of a given consumer can be summarized by the utility function $\theta V(q) - T$ where θ is a taste parameter, q the quantity of the good and T the payment made to purchase q . Assume that $V(q) = \frac{1-(1-q)^2}{2}$ and $T = pq$ where p is the price per unit of good.

(a) Compute the individual demand as well as the surplus of a consumer with taste θ .

(b) Suppose there are two possible values for θ : 5 or 15. What is the total demand if there are 100 consumers in total, 1/4 is of type 5 and 3/4 of type 15.

(c) Suppose $p = 4$, compute the total surplus in the economy of question (b).

Problem 2: A perfectly competitive market

Reference to course:

Pricing with and without market power : the two extreme cases of perfect competition and monopoly (Topic 2 - Handout02.pdf)

Suppose the market is competitive and demand is summarized by $D(p) = 2400 - 50p$. There are 100 identical firms and the cost function of each firm is $C(q) = 0.25q^2 + 0.5q + 36$.

- (a) Determine the supply of each firm as well as the industry supply.
- (b) What is the equilibrium?

Problem 3: Monopoly pricing and social inefficiency

Reference to course:

Pricing with and without market power : the two extreme cases of perfect competition and monopoly (Topic 2 - Handout02.pdf)

Inverse demand is $p(q) = 100 - 2q$ and the cost function of the single supplier is $C(q) = 20q$.

- (a) Determine the equilibrium price and quantity.
- (b) What is the surplus of consumers and the welfare.
- (c) Compare your results with the solution you would obtain by creating conditions of perfect competition in that market.

Problem 4: Price discrimination and information

Reference to course:

Monopoly power and price discrimination (Topic 3 - Handout03.pdf)

Consider N consumers. A fraction λ has a taste represented by the parameter θ_1 and the rest of the population has a taste represented by $\theta_2 > \theta_1$. The utility of a consumer with taste parameter θ when he buys the quantity q at price T is $\theta V(q) - T$ where $V(q) = \frac{1-(1-q)^2}{2}$. The firm's cost structure is represented by $C(q) = c * q$. Consumers do not have other option but to buy the good: their reservation utility is 0. The firm knows there are λN consumers of type θ_1 and $(1 - \lambda)N$ consumers of type θ_2 .

- (a) What is the optimal pricing policy if the firm can also identify consumers?
- (b) What is the optimal pricing policy if the firm cannot identify consumers?

Problem 5: Price discrimination, profits and social efficiency

Reference to course:

Monopoly power and price discrimination (Topic 3 - Handout03.pdf)

There are two types of consumers. The demand of type 1 is $D_1(p) = 10 - p$ and the demand of type 2 is $D_2(p) = 20 - p$. The cost function is $C(q) = 2q$.

- (a) What is the optimal strategy of the firm if it cannot discriminate?
- (b) What is the optimal strategy of the firm when it knows both demands and can identify consumers in each group?
- (c) Suppose that agents are identical in each group. Can the monopolist increase its profit? How?
- (d) Comparing these cases, what about consumer surplus and welfare?

Problem 6: Product durability and consumers' patience

Reference to course:

The limits of monopoly power : the durable-good problem (Topic 4 - Hand-out04.pdf)

Consider the market for a durable good. The market is competitive and the supply function can be summarized by $S(p) = -10000 + 3000p$.

(a) In 2002, demand is $D(p) = 40000 - 2000p$. Neglecting the fact that the good can be sold in the future, what is the equilibrium price? Which quantity is sold at this price?

(b) The good is sold also in 2003. No new customers enter the market. Given that some agents have already bought the good last year, what is the demand this period? At which price the good is sold in 2003? Which quantity is sold at this price?

(c) Suppose that agents are infinitely patient. Does this affect their decision to buy? If yes, how? What happens in this market?

(d) Suppose the market is not competitive but rather a single supplier is producing. How does this affect your answers to the previous questions?

Problem 7: Competing in quantity

Reference to course:

Oligopolistic competition (Topic 5 - Handout05.pdf)

The market demand curve is summarized by $p(q) = 30 - q$ and two duopolists produce the good. The cost of production of each firm is simply $C(q) = 0$.

- (a) What is the equilibrium if firms choose their quantities simultaneously?
- (b) What is the equilibrium if one firm chooses its quantity first?
- (c) What would be the equilibrium if only one firm was present on the market (or a collusive coalition)?
- (d) Conclude

Problem 8: Competing in price

Reference to course:

Oligopolistic competition (Topic 5 - Handout05.pdf)

As in the previous problem, the market demand curve is summarized by $p(q) = 30 - q$ and two duopolists produce the good. Assume the cost of production of each firm is $C(q) = 3q$.

- (a) What is the equilibrium if firms choose their quantities simultaneously?
- (b) What is the equilibrium if firms choose their prices simultaneously?
- (c) Compare the two types of competition
- (d) What happens if firms compete in price but one firm moves first?

Problem 9: Preventing entry

Reference to course:

Oligopolistic competition (Topic 6 - Handout06.pdf)

There are two firms, an incumbent and a potential entrant. At date 1, the entrant decides whether to enter or not. At date 2, the incumbent decides whether to double output or not.

(a) Determine the subgame perfect equilibrium when the payoffs for the entrant and the incumbent respectively are:

- enter & double: $(-10, 0)$
- enter & not double: $(5, 5)$
- not enter & double: $(0, 10)$
- not enter & not double: $(0, 20)$

(b) Answer the same question when the payoffs are:

- enter & double: $(-10, 10)$
- enter & not double: $(5, 5)$
- not enter & double: $(0, 19)$
- not enter & not double: $(0, 20)$

Problem 10: Price competition and product differentiation

Reference to course:

Product Differentiation (Topic 7 - Handout07.pdf)

Suppose two firms have already differentiated their products and compete in price. Firm 1 sets price p_1 and firm 2 sets price p_2 . For those prices, the residual demand of firm 1 is summarized by $q_1(p_1, p_2) = 12 - 2p_1 + p_2$ and the residual demand of firm 2 is summarized by $q_2(p_1, p_2) = 12 - 2p_2 + p_1$. The cost function of each firm is $C(q) = 20$.

- (a) What is the equilibrium if they choose their prices simultaneously
- (b) Compare Price competition in the case of differentiated products with respect to the case of homogeneous products.

Problem 11: How to differentiate?

Reference to course:

Product Differentiation (Topic 7 - Handout07.pdf)

Consider the model of vertical differentiation introduced in class. Assume that the taste parameter is distributed on $[0, 1]$ and firms can choose any quality on this interval. Moreover, the marginal cost of production is 0 and there is no fixed cost.

- (a) What is the equilibrium?
- (b) Explain

Problem 12: The effects of vertical integration

Reference to course:

Product Differentiation (Topic 8 - Handout08.pdf)

There are two firms: one upstream monopolist and one downstream monopolist. The upstream monopolist produces an input and its production cost function is $C(i) = 4i$ where i is the quantity of input produced. The downstream monopolist faces demand $D(p) = 40 - p$ to sell a final good. The final good is produced out of the input sold by the upstream firm. To produce one unit of final good, the firm needs one unit of input. There are no further costs to produce the final good. At date 1, the upstream firm sets the price w of each unit of input. At date 2, the downstream firm purchases inputs to produce final goods, and it sets a price p for each unit of final good.

(a) What is the equilibrium (prices, quantities of input and output, profits, surplus and welfare) in that market?

(b) Suppose the two firms merge, so that the downstream firm does not need to purchase the input anymore. What is the new equilibrium?

(c) Compare your answers.