

# Microeconomics for Business

## Practice Session 5

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**Exercise 1.** Consider the following game with two players, 1 (he) and 2 (she). Player 1 chooses either **L** or **R**. After observing 1's move, player 2 chooses either **l** or **r**. Afterwards, if at the beginning **R** was played by 1, then the game continues and player 1 chooses either **a** or **b**. If instead **L** was chosen at the beginning, then the game ends with player 2's move.

The payoffs of the game are the following. If 1 chooses **L** and 2 chooses **l**, then the payoff vector is  $(2, 3)$ ; if 2 plays **r** then the payoff vector is  $(1, 1)$ . If player 1 chooses **R** and player 2 plays **l**, then the payoff vector is  $(3, 1)$  if 1 plays **a** and  $(4, 3)$  if he chooses **b** in the second round. If instead player 1 chooses **R** and 2 plays **r**, then the payoff vector is  $(2, 0)$  if 1 chooses **a** and  $(0, 2)$  if he plays **b** in the second round.

1. Find the strategy set for each player and construct the normal-form representation of this game.
2. Find all pure-strategy Nash equilibria.
3. Draw the extensive-form representation of this game. How many subgames does this game have?
4. Find the pure-strategy subgame perfect Nash equilibria of the game.

**Exercise 2.** Find all the Nash equilibria of the following normal-form game, both in pure strategies and in mixed strategies. Then assume that Player 2, before playing simultaneously with Player 1, must chose between action *A*, leading her to a payoff of 3, and action *B*, leading her to the simultaneous game. Which action will she take?

	<i>L</i>	<i>R</i>
<i>T</i>	6, 2	0, 6
<i>B</i>	0, 6	10, 0

**Exercise 3.** Consider the following demand curve:

$$q(p) = 100 - 50p$$

- Define the price-elasticity of the demand.
- Draw the demand curve corresponding to the above parameters, and explain what is the elastic and what the inelastic portion of that curve.

**Exercise 4.** Let the demand curve of a market in which there exists a single firm, be given by  $P(Q) = 360 - 10Q$ . Let the total cost function of such firm be  $TC(Q) = 10Q^2$ .

1. Compute the optimal quantity and price offered by the monopolist in the market and compute the value of its profits.
2. Provide a graphical representation of the marginal cost curve ( $MC$ ), marginal revenue curve ( $MR$ ), and demand curve, then show the optimal price and quantity calculated in 1.
3. Using the same graph, represent the consumer surplus, the producer surplus, and the deadweight loss that emerges with a monopolistic market.
4. Compute the value of the consumer surplus and compare it with its value in a competitive version of the same economy. Compute the value of the deadweight loss.

**Exercise 5.** Assume that a businessman wants to contract a worker, but there are aspects of the worker that are unknown to the businessman. He does know that the worker receives a positive utility from the wage  $w$ , but with respect to disutility of effort, the worker could be either of two types. His disutility is either  $e^2$  or  $2e^2$ . That is, the second type ( $\theta_b$ ) suffers greater disutility to effort than the first type ( $\theta_g$ ). Therefore, the worker's utility function is either  $U^g(w, e) = w - e^2$  or  $U^b(w, e) = w - 2e^2$  depending on his type. The probability that a worker is type  $G$  is  $q$ . Both worker's types have reservation utility equal to  $\bar{U} = 0$ . The businessman values the workers' effort  $ke$  with  $k$  large enough for the businessman to be interested in contracting the worker, independently of her type. Hence, for each unit of effort that the worker exerts, the businessman gets  $k$  units of revenues. In addition he pays the wage  $w$  to the worker.

1. Describe the indifference curves of every type of worker. Write down the marginal rate of substitution (MRS), is it increasing? Provide a graphical representation of these curves in the space  $(w, e)$ .
2. Write down the iso-profit curves for the businessman. Represent them on the same graph  $(w, e)$ .
3. Formulate and solve the problem of the businessman, who wants to maximize his profit and has perfect information on the worker's type. What effort levels are demanded, and what wages are paid?
4. Are these contracts (effort-wage pairs) still optimal if the businessman cannot observe the worker's type? Motivate your answer.