MICROECONOMICS GENERAL EXAM - JANUARY 16, 2023

SECTION 1 [4 POINTS EACH]
Answer all of the following 4 questions.

Decide whether the following statements are TRUE or FALSE. Justify the answer. [The justification is more important than the classification.]

1) Consider an inferior good. If consumers' incomes increase and firms' costs of production decrease, then market demand will move to the right, market supply will move to the left, and the equilibrium price will increase.

False. An inferior good is such that an increase in income decreases the demanded quantity at any given price, that is, moves the individual demand function, and hence the market demand function, to the left. Moreover, a decrease in costs increases the supplied quantity at any given price, that is, moves the supply function to the right. The equilibrium price therefore decreases.

2) If Daniel owned 10 apples and 5 bananas, he would be willing to give 4 apples in exchange for 2 bananas. If instead he owned 5 apples and 10 bananas, he would be willing to give 4 bananas in exchange for 2 apples. Apples and bananas have the same price: 1 euro each. Daniel has an income of 15 euros, so both the first bundle (10 apples, 5 bananas) and the second (5 apples, 10 bananas) are on Daniel's budget line. Yet Daniel will not buy any of the two, preferring instead a third bundle.

True. The marginal rate of substitution of apples (X) with bananas (Y) is less than 1 at the first bundle (X=10,Y=5) and greater than 1 at the second (X=5,Y=10). For example, the bundle X=7,Y=8 is preferred to X=10,Y=5 (since the latter, based on the information given in the question, is as desirable as X=6,Y=7) and also lies on the budget line. Similarly, X=8,Y=7, also on the budget line, is preferred to X=5,Y=10 (since the latter, based on the information given in the question, is as desirable as X=7,Y=6).

3) John must decide how much to consume in the current period and how much to save for future consumption. If John is a borrower, then a decrease in the interest rate will necessarily increase his current consumption.

False. The substitution effect on current consumption is positive, but the income effect can be negative (this happens if current consumption is an inferior good).

4) The total and marginal cost functions of a competitive firm are respectively given by $C(q) = 25 + q^2$ and $MC(q) = 2q$, where 25 represents an avoidable fixed cost. If the unit price of the firm's output is P=8, the firm will shut down.

True. Average cost is $AC(q) = 25/q + q$. Equating average and marginal cost we obtain the efficient scale of production, $q = 5$, and hence the minimum average cost, $AC_{min} = 10$. Thus, the firm shuts down as long as the output price P is smaller than 10.

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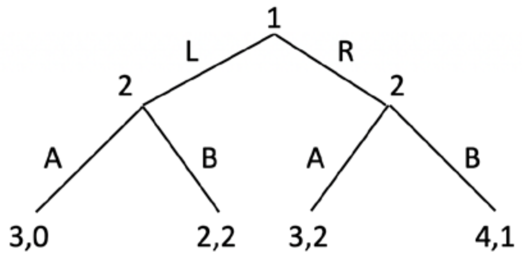
5) A monopolist sells to two groups of consumers, students and workers. The students' demand function is $Q_S = 10 - P$ while that of workers is $Q_W = 20 - P$. If the firm can choose a different price for each group, then the firm will charge workers a lower price than students.

False. At every price P students' demand is more elastic than workers', given that $E_S = -P/(10-P) < -P/(20-10P) = E_W$.

6) Reasoning by backward induction, the outcome of the game below is the following: player 1 chooses R, player 2 chooses B.



False. For player 2 the best response to L is B while the best response to R is A. By backward induction, player 1 therefore chooses R, and player 2 chooses A.

7) An entrepreneur needs to borrow M euros from a bank in order to start a project. If the project is successful, it generates a cash flow of 100. If it fails, then the cash flow is zero. The project is successful with probability 0.8 if the entrepreneur exerts high effort, 0.4 if he exerts low effort. Exerting high effort entails a disutility equal to 10 for the entrepreneur. If $M < 60$ then the bank will be willing to lend the money to the entrepreneur.

True. Letting D denote the money to be repaid to the bank, the entrepreneur will exert high effort, provided that $0.8(100-D)-10 \geq 0.4(100-D)$, i.e. $D \leq 75$. Thus the maximum profit the bank can obtain is $0.8*75-M$, which is positive for $M<60$.

8) In the market for plastic bags the demand function is $Q = 1500 - 200P$ and the supply function is $Q = 100P$. Each plastic bag generates a negative externality equal to 3. Then the equilibrium quantity is $Q = 500$ while the socially efficient quantity is $Q = 300$.

True. The equilibrium quantity is given by $Q/100 = 15/2 - Q/200$, that is, $Q = 500$, while the socially efficient quantity is given by $Q/100 + 3 = 15/2 - Q/200$, that is, $Q = 300$..

SECTION 2 [3.5 POINTS EACH]

Solve both of the following exercises

EXERCISE 1

Mary is endowed with T=12 hours a day, to be allocated between labor (L) and leisure time (N). The hourly wage rate is W=4 euro, and the price of the consumption good (C) is P=2 euro.

a) [0.5 points] Write down Mary's budget line.

Mary's budget line: 2C=4(12-N) or C=24-2N

b) [1.5 points] Mary's preferences are described by the utility function $U(N,C) = N^{1/2}C^{1/2}$. The marginal rate of substitution is therefore $MRS_{NC}=C/N$. Compute Mary's optimal choice.

Mary's optimal choice can be derived by solving the following system

$$\begin{cases} C = 24 - 2N \\ C/N = 4/2 \end{cases} \rightarrow \begin{cases} 4N = 24 \\ C = 2N \end{cases} \rightarrow N^*=6,\ C^*=12$$

c) [1.5 points] If the hourly wage rate decreases to 2€, how do Mary's budget line and optimal choice change, relative to point (b)? What can you say about the income and substitution effects on the demanded quantity of leisure time?

Proceeding as before, we now solve the new system.

$$\begin{cases} C = 12 - N \\ C/N = 2/2 \end{cases} \rightarrow \begin{cases} 2N = 12 \\ C = N \end{cases} \rightarrow N^*=6,\ C^*=6$$

Mary does not change the quantity of leisure time enjoyed. This implies that income and substitution effects, that have opposite directions, exactly offset each other,

EXERCISE 2

Each of the 40 firms operating in a perfectly competitive market has the same short-run total cost function, $C(q) = 2q^2$, where q denotes the individual firm's output level. The market demand curve is $P = 120 - Q/5$, where Q denotes total output.

a) [1 point] Knowing that the individual firm's marginal cost function is $MC(q) = 4q$, compute each firm's supply function and the market supply function.

Since $AC(q) = C(q)/q = 2q$, we have $AC_{min} = 0$, so the profit maximization rule is simply $MC(q) = P$. It follows that the individual firm's supply function is $q = P/4$. The market supply function is therefore $Q = 40 * P/4 = 10P$.

b) [1.5 points] Compute the equilibrium price and quantity. Compute each firm's profit.

The market demand function is $Q = 600 - 5P$. Imposing equality of demand and supply, $600 - 5P = 10P$, we get the equilibrium price, $P = 40$, and hence the equilibrium quantity, $Q = 400$. Each firm produces $q = 10$ units, obtaining profit $40 * 10 - 2 * 10^2 = 200$.

c) [1 point] Moved by the possibility of making profits, 60 new firms enter the market. How does the equilibrium price, quantity and profits change after the new firms have entered?

The market supply function is now $Q = 100 * P/4 = 25P$. Imposing equality of demand and supply, $600 - 5P = 25P$, we get the equilibrium price, $P = 20$, and hence the equilibrium quantity, $Q = 500$. Each firm produces $q = 5$ units, obtaining profit $20 * 5 - 2 * 5^2 = 50$.

EXERCISE 3

Firms A and B compete à la Cournot. The market demand function is $P = 50 – Q/5$, where $Q = Q_A + Q_B$. The two firms have constant and equal marginal costs: $MC_A= MC_B = 2$.

a) [0.5 points] Compute the two firms' best response functions.

Firm A's profit is Q_A (50-(Q_B+ Q_A)/5-2). Maximizing with respect to Q_A we obtain 50-Q_B/5- 2Q_A/5-2=0 and hence Q_A=(5/2)(48-Q_B/5), A's best response function. Symmetrically, B's best response function is Q_B=(5/2) (48-Q_B/5).

b) [1.5 points] Compute the equilibrium quantities, price, and profits.

Solving the system of equations describing the two firms' best response functions we obtain the Cournot-Nash equilibrium: Q_A=80, Q_B=80. The equilibrium price is P=50-(80+80)/5=18. Each firm's equilibrium profit is therefore 80(18-2)=1280.

c) [1.5 points] Assume now that firm A moves before firm B, so that the two firms compete à la Stackelberg. Compute the equilibrium quantities, price, and profits.

Plugging B's best response function into A's profit function, setting A's marginal profit equal to zero and solving for A's quantity we obtain Q_A=120. Plugging the latter into B's best response function we obtain Q_B=60. The equilibrium price is therefore P=14. Firm A's profit is therefore 120(14-2)=1440, while B's profit is 60(14-2)=720.

EXERCISE 4

In a labor market there are two types of workers, the high ability ones (type H) and the low ability ones (type L). All potential employers value a high-ability worker at 6,000 euros per month and a low-ability worker at 3,000 euros per month. The supply of high-ability workers is $Q_H^S(W) = 0.2 \times (W - 1{,}000)$ and the supply of low-ability workers is $Q_L^S(W) = 0.4 \times (W - 1{,}000)$, where W is the monthly wage.

a) [1 point] Assume that workers' abilities are observable to employers. How many workers of each type will employers hire? Represent the equilibrium in the diagram above.

When ability is observable, equilibrium wage for a high ability worker is 6,000*. From this we compute that* $Q_H = 0.2 \times (6{,}000 - 1{,}000) = 1{,}000$ *high ability workers will be hired. The equilibrium wage for a low ability worker is instead* 3,000*, from which we compute that* $Q_L = 0{,}4 \times (3{,}000 - 1{,}000) = 800$ *low ability workers will be hired.*

b) [1 point] Assume from now on that workers' abilities are not observable to employers. What is the fraction of high ability workers, among those who are willing to work at a given wage? How much is an employer willing to pay for a worker?

As long as the wage is at least 1,000, the fraction of type H workers is always 1/3, given that $Q_H^S/(Q_L^S + Q_H^S) = 1/3$ *for every value of W. Thus, an employer is willing to pay 1/3*6,000+2/3*3,000=4,000 for a worker.*

c) [1.5 points] How many workers of each type will employers hire? Why does asymmetric information determine a deadweight loss?

At wage W=4,000 there are $Q_H^S = 0.2 \times (4{,}000 - 1{,}000) = 600$ *workers of type H and* $Q_L^S = 0.4 \times (4{,}000 - 1{,}000) = 1{,}200$ *workers of type L who are willing to work. Compared to the case where ability is observable, too many low ability workers and too few high ability workers are hired. In particular, each of the 1,200-800=400 additional low ability workers have a reservation wage higher than their value for the employer (total surplus would increase if they were not hired). Moreover, each of the 1,000-600=400 high ability workers who are now unemployed have a reservation wage lower than their value for an employer (total surplus would increase if they were hired).*