DIPLOMA INDUCTION: MICROECONOMICS

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Exercises in Consumer Theory

Q1: Suppose Charlotte spends her monthly income (M) on bananas (B) and jam (J), with Jam measured on the horizontal axis. With her income, two bundles (B, J), are just affordable: X: (100, 200) and Y: (120, 190). Suppose also that the price of jam is 5£/100g.

(a) What is Charlotte's monthly income (M)?
(b) Graph Charlotte's budget constraint.
(c) What is the price ratio (or marginal rate of transformation)?
(d) Assume the price of bananas increases to £0.040/g and the price of jam falls to £0.045/g. How has that affected her budget constraint?

Q2: Consider two goods X and Y, where X is pasta and Y is coffee and the price of each good is denoted P_x and P_y, respectively and income is denoted M.

(a) Find an equation for the budget constraint and then determine the slope of the budget constraint and its intercepts.

What will happen to the budget constraint if:

(b) The government imposes a quantity tax (t) on coffee?
(c) The government imposes a lump sum tax?
(d) The government rations pasta to $\bar{x}$?
(e) The government imposes a tax, t, on past consumed beyond $\bar{x}$?
(f) The consumer receives an in-kind transfer of 40g of pasta?

Q3: Consider the following 5 utility functions and assume that α and β are positive real numbers.

1. $U^A(x_1, x_2) = x_1^{\alpha} x_2^{\beta}$
2. $U^B(x_1, x_2) = \alpha x_1 + \beta x_2$
3. $U^C(x_1, x_2) = \alpha x_1 + \beta ln x_2$
4. $U^D(x_1, x_2) = \left(\frac{\alpha}{\beta}\right) ln x_1 + ln x_2$
5. $U^E(x_1, x_2) = -\alpha ln x_1 - \beta ln x_2$

(a) Calculate the formula for the MRS for each utility function.
(b) Which utility functions represent tastes that have linear indifference curves?
(c) Which of these utility functions represent the same underlying tastes?
(d) Which of these utility functions represent tastes that do not satisfy the monotonicity assumption?
(e) Which of these utility functions represent tastes that do not satisfy the convexity assumption?

Exercises in Producer Theory

Q1: Assume that labour is the only input to production. We often work with production technologies that give rise to initially increasing marginal product of labour, which then becomes decreasing.

(a) For such production technologies (as described above), the marginal product of labour is increasing so long as the slope of the production frontier becomes steeper as we move towards more labour input.
(b) The marginal product of labour becomes negative when the slope of the production frontier begins to get shallowed as we move towards more labour input.
(c) The marginal product of labour is positive so long as the slope of the production frontier is positive.
(d) If the marginal product of labour ever becomes zero, we know that the production frontier becomes perfectly flat at that point.
(e) A negative marginal product of labour necessarily implies a downward-sloping production frontier at that level of labour input.

Q2:

(a) Find the marginal products of capital and labour, MP_K and MP_L, for each of the following production functions:

(i) $Q = K + L$
(ii) $Q = 4K^{0.5}L$
(iii) $Q = 5L^{0.5}K - L$

Q3: Suppose the production function for high quality wine is given as below and that in the short run, capital is fixed at 100 units:

$$Q = \sqrt{KL}$$ where K = units of capital and L = units of Labour.

(a) If capital rents for £10 and wages are £5 per hour, find the equation for the short run total cost curve.
(b) Given the short run total cost curve you found in part (a), find an expression for the short run marginal cost curve. How much labour will the firm hire, and how much will the firm produce if wine costs £20 per bottle?
(c) Suppose that in times of recession, the price of wine falls to £15 per bottle. How much labour will the firm hire, and how much will the firm produce if wine costs £15 per bottle?
(d) Suppose the firm believes that the fall in the price of wine will only last for a week, after which it will therefore want to return to the initial level of production (corresponding to a price of £20). Assume also that for each hour that the firm reduces its workforce below that described in part (b), it incurs a cost of £1. Assuming the firm is profit maximising and decides to proceed to act as it does in recessions (charging a price of £15), should it hire the level of labour found in part (b), or in part (c)?

Exercises in Partial Equilibrium

Q1: The market for wheat is competitive.

(a) The demand for wheat is initially given by $y_d(p) = 52 - p$, and the cost curve of individual firms is given by $c(y)=y^2 + 1$. Write down the firm's supply curve and determine the price and output, as well as the number of firms in equilibrium.

(b) Now suppose that the demand curve shifts to $y_d(p) = 52.5 - p$. Using your knowledge about the minimum price at which a bag of wheat can be sold, determine how this will affect how many additional firms enter.

(c) Suppose the government imposes a tax on the firms in the wheat industry, when it is in long run equilibrium. Comment on the incidence of the tax on buyers and sellers of wheat.

Q2: A small island nation contains 100 identical citizens who need to buy socks. Each citizen i has the same demand function, given by: $Q_{D,i} = 20 - p$

The industry supply function for domestic producers is given by: $Q_S = -500 + 150p$

(a) Find the market demand function Q_D and then solve for the equilibrium price and quantity of socks.

(b) Say that consumers can now buy imported socks at a price of £5 per pack. Find the quantity imported, assuming trade is unencumbered and the supply curve of foreign producers is perfectly elastic.

(c) The government is considering implementing a £3 tariff on imported socks.

   i. What would be the new quantity imported?
   ii. How much tariff revenue would be generated?
   iii. What is the maximum amount that domestic producers would spend to lobby for this tariff proposal to be implemented?

Exercises in Market Structures and Game Theory

Q1: In a duopoly, two firms compete simultaneously choosing the quantity to produce. They face the following market inverse demand function: P = 50 – Q, where Q = $q_1 + q_2$ and q_1 and q_2 are the quantities produced by each of the two firms. The marginal cost to produce this good for both firms is equal to 5. Fixed costs are zero.

(a) Find the Nash equilibrium quantities, price and profits in this market and draw a graph of the best response functions for both firms to confirm your answer for the equilibrium quantities.

(b) What would be the profits if the two firms agreed to form a cartel and act like a profit maximizing monopolist, in which each firm produced half of the cartel quantity?

(c) Does Firm 1 have an incentive to deviate from the cartel? If Firm 1 deviated from the cartel agreement, state how much would be the deviation quantities and profits for each firm and the market price.

Q2: Two rowers are rowing a boat up a river and must exert effort to maintain their speed. The speed of the boat is given by $f(x_i, x_j)$ where x_i is the effort of rower i and x_j is the effort of rower j. Effort can either take value 0 or 1 and is privately costly to each rower. Utility functions for rowers i and j are:

$$u_i = f(x_i, x_j) - \frac{1}{2}x_i^2$$
$$u_j = f(x_i, x_j) - \frac{1}{2}x_j^2$$

(a) Suppose that $f(x_i, x_j) = 2x_i x_j$. Find any pure strategy Nash equilibria of this game.

(b) Find a mixed strategy equilibrium for this game.

(c) Suppose instead that $f(x_i, x_j) = \sqrt{x_i + x_j}$. Find any pure strategy Nash equilibria of this game.

(d) How many outcomes of the new game in part (c) are Pareto optimal?

(e) Suppose finally that $f(x_i, x_j) = \sqrt{x_i + x_j}$ but each rower also incurs a psychological cost of c if the other rower exerts strictly more effort than them. Which values of c will guarantee that the surplus maximising outcome is the unique pure strategy Nash equilibrium of the game?