

- 1 (a) Explain what is meant by the terms perfect substitutes and perfect complements in consumption. [25%]
- (b) Describe the effects of the introduction of a price ceiling and a price floor in a competitive market. [25%]
- (c) Show that firm profits are optimised at the level of production where marginal cost equals marginal revenue. [25%]
- (d) Using the concept of the multiplier, explain how a reduction in the rate of income tax could increase national income. [25%]

- (a) *The student is expected to base their definition on the concept of marginal rate of substitution (MRS), which measures the rate at which a consumer is willing to substitute a small amount of one good for another and is equal to the (absolute value of) the slope of an indifference curve. In the theory of consumption two goods are perfect substitutes if the consumer is always willing to substitute one good for the other at a constant rate (the relevant utility function takes the form:  $u = \alpha x_1 + \beta x_2$ ). Perfect complements are instead goods that are always consumed together in fixed proportions (the relevant utility function takes the form:  $u = \min \{\alpha x_1, \beta x_2\}$ ).*
- (b) *A good answer should start by profiling a suitable demand and supply framework to define a price ceiling as a maximum legal price that sellers can charge (e.g. rent controls) and a price floor as a minimum legal price that sellers can charge (e.g. minimum wages, Common Agricultural Policy). Students should state that in order to be effective a price ceiling must lie below the original equilibrium price, thereby creating excess demand. Similarly, in order to be effective a price floor must lie above the original equilibrium price, thereby creating excess supply.*
- (c) *The students can provide a diagrammatic and/or qualitative answer by defining the nature of the firm's decision 'at the margin'. However, the best answers will provide the following synthetic answer. The firm maximises profit by producing at the level of output where  $MC = MR$  because the first-order condition that characterises the solution to the profit-maximisation problem*

*(max  $TR(Q) - TC(Q)$ ) is  $MR(Q) - MC(Q) = 0$  (the derivative of the profit function is set to 0). This is equivalent to stating that for the first order condition to be satisfied  $MC(Q)$  has to be equal to  $MR(Q)$ . The best students will not forget to note that the second derivative of the profit function has to be negative.*

- (d) *The students are expected to demonstrate a good understanding of basic Keynesian macroeconomic principles in relation to government expenditure. They could address the question by presenting the 'Keynesian cross' with planned expenditure and national income curves. Then they should define the tax multiplier as a measure of the change in aggregate income generated by changes in government taxes. This is obtained by finding the equilibrium condition of the Keynesian cross holding  $G$  (government expenditure) and  $I$  (investment) constant. It is equal to  $-MPC/(1-MPC)$ , where  $MPC$  is the Keynesian marginal propensity to consume. A reduction in income tax will increase  $C$ , and increase income. If the multiplier is greater than one, a change in taxes has a multiplier effect on income. If it is smaller than the government spending multiplier, consumers will save the fraction  $(1 - MPC)$  of a tax cut, so the initial boost in spending from a tax cut is smaller than from an equal increase in  $G$ .*

2 (a) Define the marginal rate of technical substitution of labour for capital. Explain why it is equal to the factors' price ratio when a firm chooses the cost-minimising combination of inputs. [25%]

(b) What are 'normal' and 'inferior' goods? [25%]

(c) Provide an example of a normal-form game that has more than one Nash Equilibrium. [25%]

(d) Define the concept of investment and explain the role of each component of the following investment function:  $I = I_n [MPK - (P_K/P)(r + \delta)] + \delta K$ . [25%]

(a) *The marginal rate of technical substitution (MRTS) measures the rate at which a firm is able to substitute one input for another while holding output constant. It corresponds to the slope of an isoquant and usually varies along an isoquant. Modelling isoquants as strictly convex implies diminishing MRTS. The problem of cost minimisation can provide a very clear illustration of the required answer. An isocost line shows combinations of inputs which have the same total cost (C).  $C = wL + rK$  and  $K = C/r - (w/r)L$ , where C is cost, K is capital, L is labour, w is labour's wage and r is capital's rental rate (the factor prices). The cost minimisation problem can be phrased as the problem of finding the point on an isoquant that has the lowest possible isocost line associated with it. This identifies a tangency solution where the marginal rate of technical substitution is precisely equal to the factor price ratio.*

(b) *Normal goods are goods for which the quantity demanded increases (decreases) with a rise (fall) in income. Inferior goods are instead goods for which the quantity demanded decreases (increases) with a rise (fall) in income.*

(c) *We discussed asymmetric two-player games. A very good answer will discuss the rankability of the Nash equilibria and whether there is any obvious way to play the game they write down.*

(d) *An essential component of aggregate demand, investment is defined as new spending on capital goods which will allow increased output of goods and services in the future. The fundamental point about this (gross) investment function is that investment ( $I$ ) is a function of the real interest rate  $r$  (the nominal interest rate corrected for inflation), which captures the cost of borrowing as well as the opportunity cost of using one's own funds to finance investment spending. Firms will invest in new capital when the benefit of doing so outweighs the cost. The benefit (per unit of capital) is defined as  $R/P$  where  $R$  is the nominal rental rate and  $P$  is the price of output. When firms maximize profits, the benefit equal the marginal product of capital ( $MPK$ ). The real cost of capital depends on the relative price of capital ( $P_K/P$ ), the real interest rate ( $r$ ) and the depreciation rate ( $\delta$ ).  $I_n$  is thus a function capturing how investment responds to incentive to invest. In order to obtain gross investment, we add the replacement of depreciated capital ( $\delta K$ ).*

3 (a) State and then comment on the Keynesian expenditure equation for GDP. [25%]

(b) Define a 'Giffen good' and illustrate your definition by means of an appropriate diagram. [25%]

(c) Compare the Cournot and the Stackelberg models of oligopoly. Discuss the implications of their market outcomes for producers and consumers. [25%]

(d) Define first, second and third degree price discrimination. For each type: give an example of an industry where a firm might employ such discrimination and discuss how it is possible to enforce the differential prices. [25%]

(a)  $Y=C+I+G+X-M$

*Explain each term (could adjust for indirect taxes, as was stated in the lectures).*

*(b) A Giffen good is a good for which quantity demanded falls as its own price falls (in violation of the standard 'law of demand'). It is an extremely inferior good whose income effect more than outweighs the substitution effect. The student should include a graph representing changes in income and changes in the relative prices of two goods, and identify precisely the magnitude and direction of income and substitution effects.*

*(c) Both the Cournot and the Stackelberg model assume a small number of firms, producing similar (identical or differentiated) goods, some barriers to entry (which imply no possible threat from firms outside the industry, and therefore an opportunity for positive profits in the long run), choices about output levels as opposed to price, with the market determining the price at which this output sells. While in a Cournot oligopoly decisions about output are simultaneous, in a Stackelberg oligopoly (with perfect information) one firm has a first mover advantage and decisions about output are sequential. Under Cournot the price is greater than the marginal cost of either firm (i.e. Cournot price exceeds competitive price). Under Stackelberg the first mover (or market leader) will produce more than the Cournot equilibrium output and will have larger market share and higher profits; the follower will produce less than the Cournot equilibrium output, will have a smaller market share and lower profits. The best students will be able to comment on the models' outputs and prices.*

*(d) Clear definitions required.*

*First: country doctor, accountant, lawyer. Why? Key is that clients do not shop around.*

*Second: bulk discounts of any kind. Mobile phone tariffs very obvious ones.*

*Third: the key here is no resale and the ability to segment the market: any time or space differentiation would work. Student discounts work because of identity card. Of course it is important to emphasise that in the pure form the costs of production should be identical for both groups, or else it is not really price discrimination. Thus business class seats, off peak discounts, hard back books are impure forms of P.D. because there is some product differentiation as well, even though analytically they look very similar and exploit differences in the steepness of the demand curve of the sub-group.*