Intermediate Microeconomics

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Sample Midterm Questions

To be discussed in class 13th October

Note that this is intended to indicate the type of questions that you will get, not the number!

Question 1 Acme make magnets using labor and capital. Their production function is given by $m = \min(2l, 3k)$.

1. On a graph with k on one axis and l on the other, sketch the iso-output line for $m = 6$. For a wage rate w and a rental rate r what is the cost minimizing way of producing 6 units of m? What is cost of producing 6 units (as a function of w and r)? More generally, what is Acme's cost function?

2. Calculate Acme's marginal and average cost curves. Will Acme ever choose to produce at $m = 0$? If so, at what prices? Will they ever choose to produce at $m = \infty$ (i.e always want to produce more, however much they are currently producing)? If so at what prices?

3. Acme's technology is disrupted (possibly by roadrunner). Their new production function is given by $m = (\min(2l, 3k))^{\beta}$ for $0 < \beta < 1$. Repeat parts 1 and 2 of the question.

4. Acme's technology goes completely haywire, and their production function is now given by $m = (\max(2l, 3k))^{\beta}$. Repeat parts one and two of the question

Question 2 Bongo Inc make books (b), which they sell at p_b and Casgwent ltd. make capacitors (c).which they sell at p_c Both companies need land (l) and energy (e) to make their products. Bongo's production function is given by $b = l_b^{\frac{1}{2}} e_b^{\frac{1}{4}}$, where l_b and e_b are the land and energy used by bongo, while Casgwent's production function is given by $c = l_c^{\frac{1}{4}} e_c^{\frac{1}{2}}$, where l_c and e_c are the land and energy used by Casquent

1. Do these firms exhibit increasing, decreasing, or constant returns to scale?

2. Calculate the marginal rate of technical substitution for each firm as a function of labor and energy used. If both firms used the same amount of labor and energy which would have the higher rate of technical substitution.

3. Say that land costs p_l per unit and energy costs p_e per unit. Calculate each firm's demand for land and energy as a function of these prices and the firm's output. At any set of input prices, which firm will use a higher ratio of land to energy.

4. Say that bongo can sell books at p_b per unit and Casgwent can sell Capacitors at p_c per unit. Calculate each firms profit maximizing level of output, and its demand for energy and land.as a function of prices.

5. Which will have a bigger effect on the demand for land - an increase in the price of books or an increase in the price of capacitors? Will an increase in the price for energy have a bigger effect on the profit maximizing output of books or capacitors?

Question 3 Say that Donovan's Brewery produces lager (l), which is sold for 1 per unit. Its only input is hops (h), which cost p_h per unit. If it uses less that 10 hops, its output is given by $l = 2h$. If it uses more than then hops, its output is given by $l = 10 + h$. Sketch the production function for Donovan's Brewery. What has to be true about p_h for Donovan's to choose to produce neither 0 nor ∞? How much will they choose to produce in such a case?

Question 4 The Fishcoteque produces hallibut (h) using nets (n) and boats (b). Their production function is given by $h = n^{\frac{1}{2}}b^{\frac{1}{2}}$.The price of hallibut is 7, the price of nets is 2 and the price of boats is 3

1. Calculate the cost function for the Fishcoteque.

2. Graph the marginal revenue, marginal cost and average cost functions

3. Calculate the profit maximizing level of hallibut for the Fishcoteque. What profit will they make at this level of output?

4. Harry the Hardcase decides to extort money out of the Fishcoteque. He will charges an amout F regardless of how much hallibut they sell. Regraph the marginal revenue, marginal cost and average cost, but now add an average variable cost curve. What is the profit mazimizing level of output for the Fishcoteque now? Will they always produce a positive amount of hallibut.

5. The owners of the Fishcoteque think of another option: They could run away to Siberia. This will cost them an amout of money S, and they would not be able to sell any more halibut, but they would not have to pay Harry. What is the maximum amount that Harry can extort (as a function of S) to stop the owners running away?

Question 5 Tom Hanks has thankfully been marooned on an island again. Knowing the story of Robinson Crusoe, he decides to go schitsophrenic, and split himself into two: TH the person and THI the company. TH the person buys hammocks (h) and sells labor (l), and has preferences over hammocks and lesiure given by $u(h, 24 - l) = \min(h, 24 - l)$. THI the company buys labor from TH and sells hammocks. It has a production function $h = l^{\frac{1}{2}}$

1. Sketch the production function of THI and the indifference curves of TH on the same graph. Imagine that you are the social planner, and are going to pick a feasible combination of hammocks and labor to maximize the utility of TH. Find the optimal bundle

2. Say that the wage rate is fixed at 1, and the price of hammocks is given by p. Calculate the profit maximizing amount of labor for THI as a function of p, and the profits that THI make at this level of output (also as a function of p)

3. TH gets money from selling his labor, and is also the sole owner of THI (an so gets all the profits). Write down TC's budget constraint. Calculate his supply of labor and demand for coconuts as a function of p

4. Find the price p at which the demand for labor is equal to the supply of labor. At this p is the demand for coconuts equal to the supply of coconuts? Is the competitive equilibrium efficient?

Question 6 Robinson Crusoe, having spent too much time on the island, has now split hiself into three: RC the person, RCI the company and RC.gov, the government. RC the person buys starfruit (s) and sells labor (l), and has preferences over starfruit and lesiure given by $u(s, 24 - l) = s^{\frac{1}{2}}(24 - l)^{\frac{1}{2}}$. RCI the company buys labor from RC and sells starfruit. It has a production function $s = l^{\frac{1}{2}}$. RCI the government adds a tax of t to each starfruit sold.

1. Sketch the production function of RCI and the indifference curves of RC on the same graph. Imagine that you are the social planner, and are going to pick a feasible combination of starfruit and labor to maximize the utility of RC. Show that you would pick the

point where the marginal product of labor is equal to the marginal rate of substitution. Find the optimal bundle of starfruit and labor

2. Say that the wage rate is fixed at 1, and thepost-tax price of starfruit is given by p (i.e. RCI receives p for each starfruit sold). Calculate the profit maximizing amount of labor for RCI as a function of p, and the profits that RCI make at this level of output (also as a function of p)

3. RC gets money from selling his labor, and is also the sole owner of RCI (an so gets all the profits). The price he has to pay for starfruit is $(1 + t)p$. However, he also gets a rebate from the governement equal to R Write down TC's budget constraint. Calculate his supply of labor and demand for coconuts as a function of p

4. Show that, for any given price p, the marginal product of labor is equal to the marginal rate of substituition if and only if $t = 0$

5. Say that the revenue that the government gives to RC is equal to the total tax revenue the government gets (i.e. ts). Plug this into your answer for 3. Find the price p at which the demand for labor is equal to the supply of labor. What happens to labor supply as t increases.

Question 7 This is a partial equilibrium question for the market for apples. Say that demand is given by $D(p) = 20 - bp$, and supply is given by $S(p) = 3p$

1. Graph the supply and demand curves. Calculate the equilibrium price, output and the consumer and producer surplus at equilibrium (note that this will all be a function of b)

2. Imagine that the governement imposes a tax t, so that if a supplier sells an apple for price p, a consumer has to pay $p + t$. Calulate the new equilibrium price, consumer surplus, producer surplus and deadweight loss. Draw a graph of this.

3. Imagine that the market for tangerines has demand $D(p) = 20 - cp$, and supply is given by $S(p) = 3p$. where c is greater that b. If a the same tax were introduced in the market for apples and the market for tangerines, in which market would it have a bigger effect on equilibrium price? How about equilibrium output? Consumer Surplus? Producer Surplus? Deadweight loss?

Question 8 US demand for grits is given by $D(p) = 15 - 2p$.US firms supply grits according to $S_{us}(p) = 2p$. UK firms (being more efficient) supply grits at $S_{uk}(p) = 3p$. Assume that each

4

firm is setting price equal to marginal cost, and have no fixed costs. Sensibly, people in the UK do not eat grits, so demand in the UK for grits is zero.

1. Say there is no international trade in Grits, so US consumers can only buy from US producers (we call this autarky). Calculate the equilibrium price, consumer and producer surplus in the US market.

2. Imagine that there is now international trade. Calculate the industry supply curve for Grits from US and UK firms.

3. Graph total supply and total demand for grits. Find the equilibrium price of grits. Calculate the consumer surplus and producer surplus (i.e profits) for each firm in equilibrium

4. Jealous of the magnificence of UK firms, congress passes a law charging a tarrif of $\tau < 1$ on imported grits. Thus, if the price in the US market is p, then UK firms receive $p\tau < p$. What is equilibrium price and output now?

5. What is the consumer surplus and the profit of US firms in this case? Compare these to the case of autarky and full international trade. Compared to a case of full international trade, how much would US firms be prepared to bribe congress in order to ensure a tarrif of level τ?

Question 9 Sandy's Fish Market produces fish (f) which she sells at \$6 and has costs equal to $c(f) = f^3$. For every fish she produces, there is a smell $s = f$ .John's Herbalism next door produces herbs h, which he sells for \$4. His costs are equal to $c(h, s) = h^2 + 4s$.

1. What is the level of fish production that would maximize the total profit of Sandy and John? What is their maximum joint profit?

2. If John produces at his profit maximizing level and Sandy at hers, how much fish will be produced? What will their total profits be?

3. Imagine that the government sets up a market where John can pay sandy to stop the smell. So for a price p_s Sandy can pay John to stop producing one unit of smell. Write down John's new profit function. How much smell would he buy if p_s was less that 4? What if it was more than 4?

4. Say Sandy has the right to sell 10 units of smell, which he can either use in producing fish, or sell at a price p_s. Show that Sandy's profit funtion is now

$$(6 - p_s) f - f^3 + 10 p_s$$

5. What is Sandy's profit maximizing ouput now? Imagine that the price of smell is \$4. How much would Sandy choose to produce? How does this relate to the amount that would maximize total profit? How many units of smell would he sell? Would Sandy be happy buying this number of units of smell?

6. Why is \$4 special? What does it represent