ENGINEERING TRIPOS PART IIA 2004

Solutions to Module 3E1
Business Economics
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MODULE 3E1: BUSINESS ECONOMICS **Revised crib - 2004**

1 a

Define Cost function, C(Q), (Fixed cost plus Variable Costs).
Explain the characteristic shape of Total cost function, in terms of returns to scale.
Define Average costs : C(Q)/Q
Define Marginal cost : $\partial C(Q)/\partial Q$.
Q at which where MC = AC, is where the tangent to total cost function (at Q*) has the same slope as the line joining the origin and Q. At $Q < Q^*$, show that marginal cost is less than average cost and at $Q > Q^*$, show average cost is less.

1 b 1

Long run – K and L variable. Slope of isocost line is the same as the slope of the isoquant. Standard diagram.

1 b 2

Develop on the standard diagram above. Short run – Only L variable. Given fixed K (say K*), isocost line is a horizontal line through K*. Given Only L can be varied, and Q and K* are fixed, L is determined at the point where the Isoquant for the fixed Q* intersects the line passing through the K*.

1 c. 1. For a quadratic multiproduct cost function, economies of scope exist if $C(Q_1, Q_2) < C(Q_1, 0) + C(0, Q_2)$. It is cheaper to produce the two outputs jointly instead of separately.

$C(Q_1, 0) + C(0, Q_2) = 100 + (Q_1)^2 + 100 + (Q_2)^2$

$C(Q_1, Q_2) = 100 + Q_1Q_2 + (Q_1)^2 + (Q_2)^2$

If $100 > Q_1Q_2$: Joint production is cheaper, economies of scale.

1 c 2 Cost complementarities if the marginal cost of producing good 1 declines as more of good two is produced: $\partial MC_1/\partial Q_2 < 0$.

$MC_1 = Q_2 + 2(Q_1)$

$\partial MC_1/\partial Q_2 = 1 > 0$ so no cost complementarities.

1c. 3

From the above it is clear that the marginal cost of producing product 2 will fall if the division producing product 1 is sold.

2 a
Basic idea looked for: the assumption (law) of diminishing marginal utility implies that the MRS is declining and the indifference curves are convex to the origin.

Define Indifference Curve as the curve that defines the combinations of 2 or more goods that give a consumer the same level of satisfaction.

Define marginal utility as the rate of change of the consumer's utility with respect to consumption of X. $MU_X = \Delta U / \Delta X$

Define Marginal Rate of Substitution as the rate at which a consumer is willing to substitute one good for another and stay at the same satisfaction level.
$MU_X \Delta X + MU_Y \Delta Y = \Delta U = 0$
$MRS = \Delta Y / \Delta X = - MU_X / MU_Y$

Explain that the assumption (law) of diminishing marginal utility implies that the MRS is declining and the indifference curves are convex to the origin.

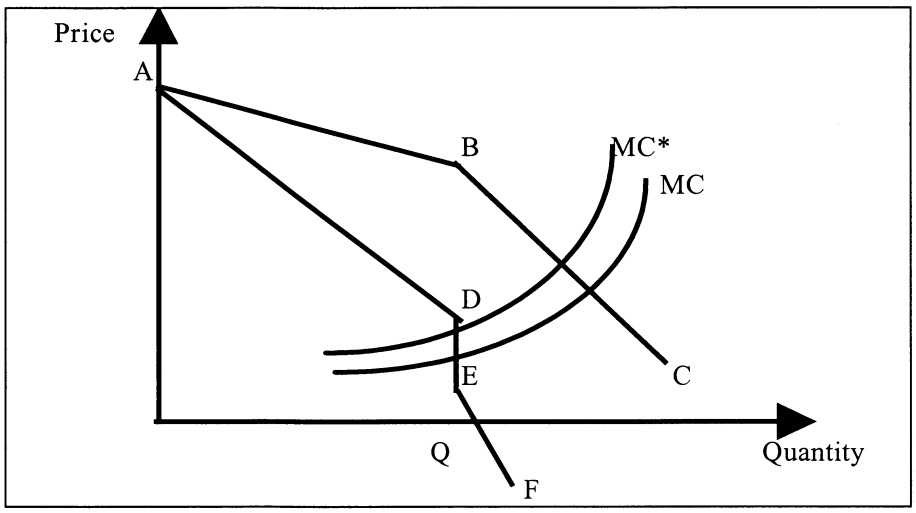
2 b 1,2,3

Standard Diagram of decomposition of effect of a price change in terms of income effect and substitution effect.

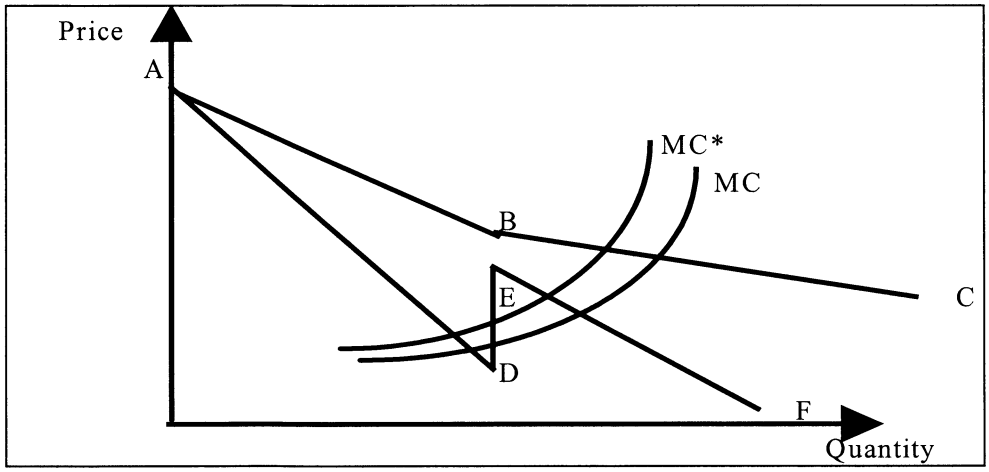
2 c.

Application of the above concepts with standard diagram. Notion of Giffen goods.
Substitution effect is always negative, relative price rise leads consumers to reduce consumption.
Relative price rise reduces "real" income.
Income effect and hence income elasticity is negative only for inferior goods.
Thus in the case of inferior goods, when income goes down, the consumption of the good goes up.
If the income effect is relatively weak, then effect of a price change will be dominated by the substitution effect, and be as expected – price rise, lower demand and vice-versa.
If the "negative" income effect is strong enough, this can mean that price rise leads to increase in consumption of the good, and vice versa. This is the pathological case of Giffen goods.

Answer 3 a 1
The diagram will show a kinked demand curve with the kink at the current price. The marginal revenue curve will be discontinuous.
So long as marginal cost changes by a small amount, your output will remain at Q.
For large increases in MC, the profit-maximizing level of output will fall.
A few students did not get the discontinuity.



3 a 2
The diagram will again show a kinked demand curve with the kink at the current price angled in the opposite direction – re to the above answer. The corresponding marginal revenue curve will not be continuous -
An increase in marginal cost leads to a reduction in the profit-maximizing level of output.
This appeared to be a difficult variation to many students - even for some who answered 3a1 correctly.



3b1 Your (Stackelberg leader's) profit-maximizing quantity is 125 units; Stackelberg follower's profit maximizing quantity is 61.5 units.

3 b2 P = 127.00.

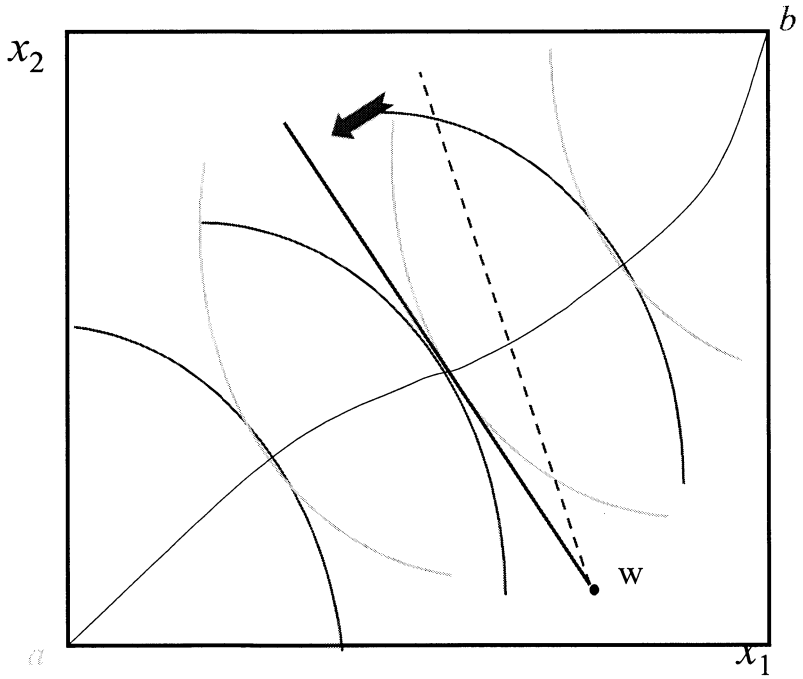
3 b 3 $\pi_y = 15{,}625.00; \pi_R = 7{,}564.50.$

3 b 4 Assuming that the merged firms adopted the patented technology that allows it to produce at a lower cost of $C_y(Q_y) = 2Q_y$, a merger would be profitable. Profits of the merged firm would be 30,000.50 compared to joint (industry) profits of 23,189.50 when firms compete in the Stackelberg setting.

A significant number of students got the answers wrong.

4 a.
Using a two good, two person world example, represent the economy in the form of an Edgeworth box, and show the way from any initial endowment, the economy can converge to a pareto superior (efficient) equilibrium. Diagram from lecture reproduced below. The first Fundamental Theorem of Welfare Economics : all competitive equilibria are Pareto efficient. Diagram from lecture below.

Walrasian / General Equilibrium



4b
Using the same apparatus as above, take one of the "goods" to be the right to clean environment, and the other to be "money income". Two individuals or firms with different preferences relating to pollution (smokers or firms that have pollution as by-products.) An equilibrium point that is pareto efficient is reached if the property rights (to the clean environment) are clearly assigned and trading is possible. Then in equilibrium price ratio between clean environment and income is equal to marginal rate of substitution between clean environment and income for individuals A and B. As long as rights are clearly defined, competitive trading can take the economy to an efficient outcome This will in general involve nonnegative amounts of pollution only if the individuals are willing to trade off pollution against money.

4B. Using the prisoner's dilemma as an archetypical non-co-operative game or any other comparably simple game, show the non-co-operative or nash equilibrium which

is the result of players proceeding in an individually rational way. Also show the pareto-efficient equilibrium, the result of individuals proceeding in a collective rational way. Show the difference between the two. Illustrate how the trigger strategy supports the pareto-efficient outcome when the game is infinitely repeated.
Many students were unable to show in detail how exactly repetition helped sustain co-operation.