ECONOMICS 110/111*

Assignment #3 – Suggested Solutions

2011/2012

Due Dates and Notes:

- ***DUE:*** By ***Friday November 18, 2:00 PM.*** Completed assignments should be placed in the slot marked for your section in the white assignment collection box on the 2nd floor of Dunning Hall. Late assignments will not be accepted.
- Use the ***Cover Page*** when submitting assignments.
- ***Group Work:*** Maximum ***four*** per group, all students must be registered in the ***same section of the same course***. Names must be in ***alphabetical order*** on the cover page.
- Graded work will be available for pick-up beginning on the afternoon of Friday December 2 in the Econ Distribution Center, Dunning Hall Room 334. You will require your ***student card***.
- This assignment covers material from the Supplement Chapter "Other Household Decisions" (available on the *Reading List* page on the website) and from Chapters 7-9 of the text.

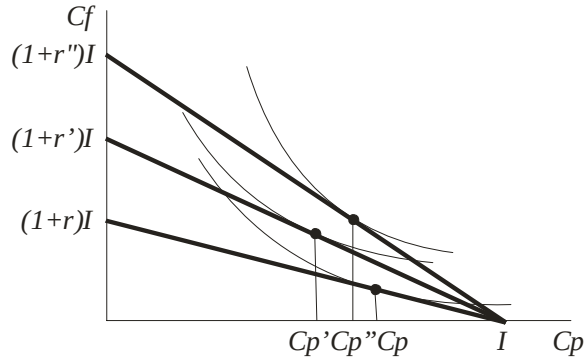
True, False, or Uncertain [48 marks - 6 marks each]

Explain why each of the following statements is True, False, or Uncertain according to economic principles. **Use diagrams where appropriate.** Unsupported answers will receive no marks. It is the explanation that is important.

A3-1. An increase in the tax rate on interest income may actually increase the amount of saving by some individuals because present consumption is a normal good.

True.

An increase in the tax rate on interest income has the effect of lowering the after-tax interest rate. Two such decreases are shown in the diagram below, from r" to r and from r' to r. Any decrease in the interest rate has both a substitution effect and an income effect. The substitution effect is to increase consumption in the present (Cp), and so save less, because Cp has become cheaper relative to consumption in the future (Cf). The income effect of the decreased "consumption possibilities" is for individuals to reduce Cp (save more) because Cp is a normal good. Which of the opposing effects is stronger determines the overall effect of the decrease in the after-tax interest rate. See the diagram below. For the decrease in the interest rate from r' to r, the substitution effect is stronger so Cp increases (from Cp' to Cp) ie. saving decreases. But for the decrease from r" to r, the income effect is stronger so Cp decreases (from Cp" to Cp) ie. saving decreases.



A3-2. Suppose 3 Econ profs quit their jobs to start the ethically dubious WillDoYourEconHomework.com. Assume they borrow all of the money needed to start the business. Revenue is $250,000/year, and the interest on the loan is $100,000/year. The new venture earns positive accounting and economic profit.

False/Uncertain.

While the accounting profit of the firm is 150,000 *(revenues minus the explicit costs), the economic profit of the firm is uncertain. This is because the value of the profs' time is not given. If they would have earned less than* 150,000 *in their old jobs, then economic profit is positive, but if they would have earned more than* 150,000 *in their old jobs, the economic profit is negative. Economic profits take this implicit cost into account (revenues minus explicit and implicit costs).*

A3-3. The short-run marginal cost curve passes through the minimum point of the short-run average variable cost curve.

True.

Marginal cost is the addition to costs when producing an extra unit. Clearly these costs must be variable with output. If this addition is less than the previous average, the average must fall. If this addition is more than the previous average, the average must rise. Therefore, if MC starts below AVC and is increasing, then MC must pass through the minimum point of AVC.

A3-4. If some technological advance increases the marginal product of labour in a firm, the firm's marginal cost curve will shift down.

True.

Marginal product measures how much output the last worker produces. Therefore if marginal product increases, then the last worker produces more output. If the worker is paid the same as before, then on a per unit basis, the output of the last worker is now less expensive. That is, the marginal cost of that output decreases.

Or

This easy to show mathematically,

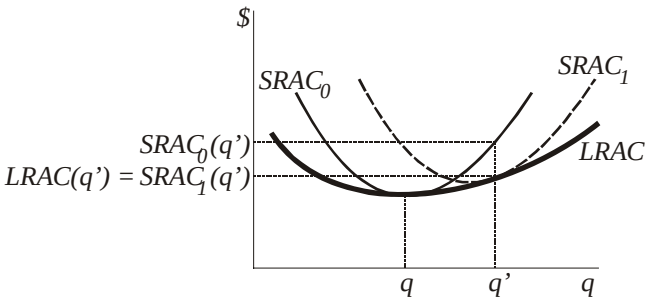
$$MC = \Delta TC/\Delta q = \Delta VC/\Delta q = \Delta(wL)/\Delta q = w(\Delta L/\Delta q) = w/MP$$

Therefore, if MP increases, MC decreases.

A3-5. If a firm decides to increase its production level, average costs are lower in the long-run than they are in the short-run.

True.

Refer to the figure below. Assume that the firm decides to expand its output from q to q'. In the short run, the only way to increase production is to hire more of its variable factors of production and cost changes are shown by a move along the short run cost curves, shown below as a move along the short run average cost curve $SRAC_0$. Thus, average costs increase to $SRAC_0(q')$. However, in the long run, the firm is able to change the level of its fixed (in the short-run) factors to take full advantage of cost minimization. This puts it on a new set of short run cost curves, represented below by $SRAC_1$. It has returned to its long run cost curves, represented below by LRAC. This level of costs $SRAC_1(q') = LRAC(q')$ is certain to be lower than $SRAC_0(q')$ since the firm is able to adjust more of its inputs and find the lowest possible cost.



A3-6. In the long-run, if economic profits are zero for a firm operating in a perfectly competitive industry, the firm has no incentive to produce and will exit the industry.

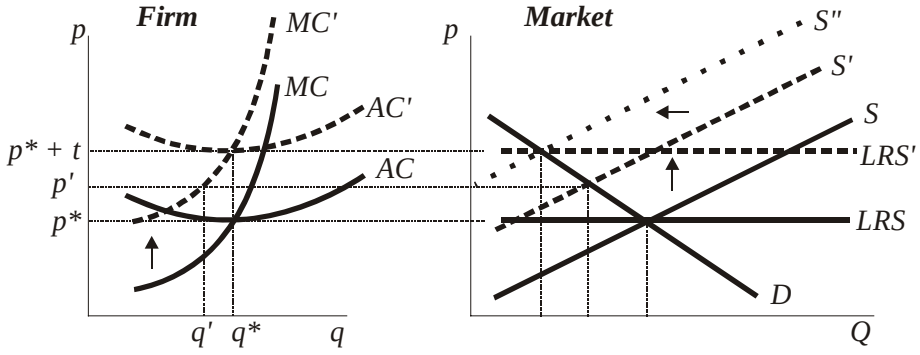
False.

Zero economic profit means the firm is doing as well in the industry as it would in its next best alternative. It is making "normal" accounting profit. Therefore it wants to stay in the industry and has no incentive to exit the industry.

A3-7. Consider a perfectly competitive industry where the firms are identical, each with U-shaped short-run and long-run average cost curves. In the short-run, consumers bear part of the burden of a per unit tax, while in the long-run, consumers bear all of the burden.

True.

Since this is a per unit tax, it is like an increase in variable costs to the firm. Thus the short-run marginal, average variable, and average total cost curves shift up by the amount of the tax. In the diagram below, this is represented by the shift in the cost curves from MC and AC to MC' and AC'. Thus the short-run analysis is the usual, since market supply shifts up from S to S' (remember, all the firms' MC curves have shifted up) consumers bear part of the burden since the price rises, but not by as much as the tax. This means that firms are making negative profits since p' < AC'(q'). Some of them leave the industry (shown by the shift to the left of supply from S' to S"), driving up the price so that it now has increased by the amount to the tax. That is, in the long-run, supply is horizontal, and it too shifts up by the amount of the tax. Therefore consumers bear the entire burden in the long-run.



A3-8. In a perfectly competitive industry, the long-run supply curve is more elastic than the short-run supply curve.

True.

Consider a shift of the market demand to the right. In the short-run, before firms can change their fixed inputs like capital and buildings etc. and before any new firms can enter the industry, any changes in output are accomplished by existing firms hiring more variable inputs, that is, moving along their short-run marginal cost curves. This gives the short-run supply response of the industry.

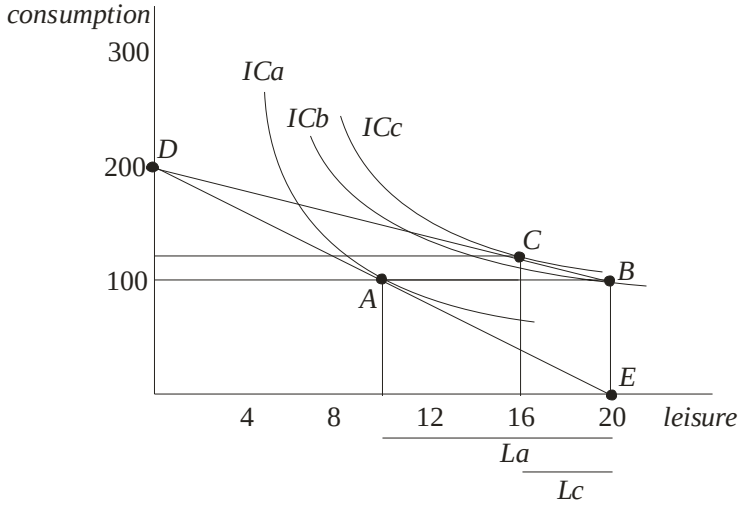
In the long-run, not only can existing firms make the adjustment described above, but they can also adjust their capital stocks, etc. to reflect cost minimization. In addition, if there are economic profits available at the margin, new firms can enter the industry. Thus in the long-run there will be a greater change in production for a given price change than there is in the short-run. That is, the long-run supply curve is more elastic than the short-run supply curve.

Problems [52 marks - marks for each part as shown]

A3-9. Suppose Lorne has 20 hours per day that can be spent either working or at "leisure". Assume (at least initially) that Lorne earns all income from working at the after-tax wage rate of $10/hour.

(a) Using an indifference curve, illustrate Lorne's decision if he decides to work 10 hours per day. Calculate, and in your diagram, identify, Lorne's quantity of leisure, supply of labour, and consumption. What is the price of leisure? [5]

Lorne's decision is depicted below. He chooses to consume 10 (=10 – 10) *hours of leisure per day and works* 10 *hours per day earning $*100 (=10*10) *to spend on consumption goods. It is at point A in the diagram below that his indifference curve (ICa) is tangent to his budget line, DAE. The price of leisure is the amount of consumption he gives up to take an extra hour of leisure, that is, $*10.



(b) Suppose the government institutes a program that will pay Lorne $100/day. However, if he works, he will have to pay back the government benefit with any labour income he earns until the full $100 is paid back. Only after that will he be able keep any further labour income. Illustrate the new budget line in your diagram. How much labour will he supply? How much consumption will he have? Is he better off or worse off than he was in part (a)? [5]

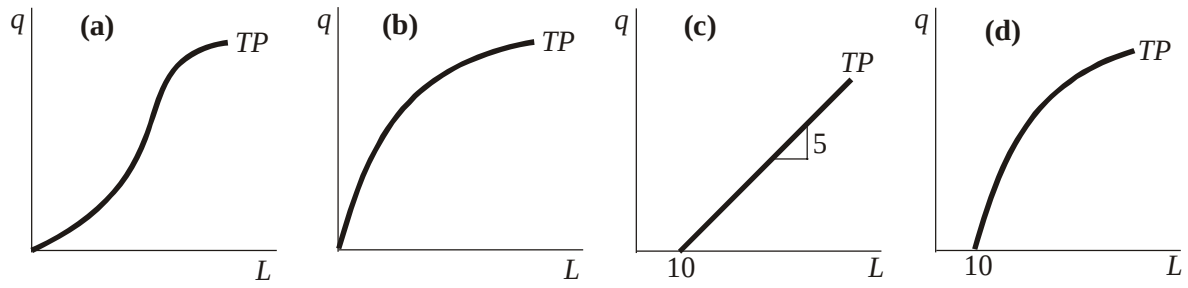
Lorne's budget line is shown by DAB. Given his choice from part (a) we can be sure that he will choose point B because it is here that he reaches his highest available indifference curve, ICb. He will therefore choose 20 *hours of leisure and supply no labour. His consumption level will be the* $100 *benefit he receives from the government. He is better off than he was in part (a) because he is on a higher indifference curve.*

(c) Now suppose the government changes the program. It will still pay $100/day, but now if he works, Lorne will have to pay only half of his labour income to the government until the full $100 is paid back. Illustrate the new budget line in your diagram. If he chooses to work 4 hours under the new scheme, how much consumption will he have? Is he better off or worse off than he was in part (b)? Which version of the program costs the government more? [6]

The new budget line is shown by DCB. Given his choice to work 4 *hours, his new level of consumption is* $120 (= 100 + 5*4). *Given that he could have chosen point B under the new system, but actually chose point C, shows that he is on a higher indifference curve (ICc). He is therefore better off under the new version of the program.*

In the original version of the program the cost to the government is $100*/day. The second version of the program cost the government only* $80*/day. It pays the* $100 *but receives a* $20 *"pay back" from Lorne's work effort.*

A3-10. For each of the short-run production functions (Total Product curves) depicted below, briefly explain and graph corresponding marginal and average product curves. [3 marks each].

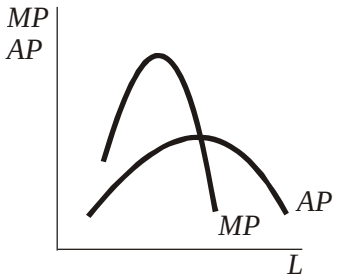


To correctly answer this question we must remember something about the geometry of Total Product, Marginal Product and Average Product:

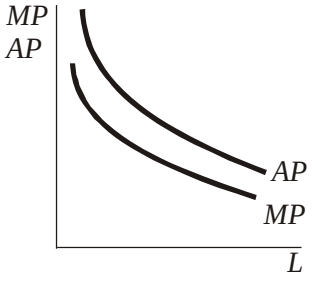
At a given level of labour input the marginal product (MP) is shown by the slope of the total product (TP) at that level of labour.

At a given level of labour input the average product (AP) is shown by the slope of a ray from the origin to the total product curve at that level of labour.

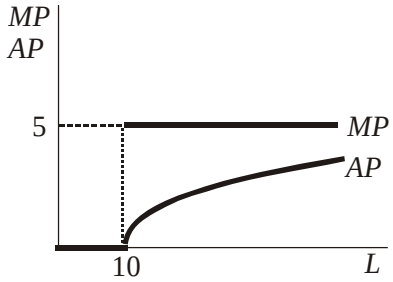
(a) *The marginal product increases then decreases. The average product increases then decreases and is equal to MP when the slope of a ray from the origin to TP is tangent to TP. This occurs after the initial point of diminishing marginal product.*



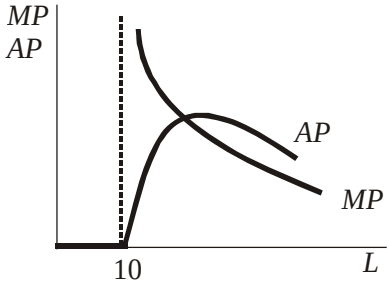
(b) *Marginal product is everywhere decreasing, as is average product. The geometry tells us that the slope of TP at any point is less that the slope of a ray from the origin to that point, so that MP is always less than total product. We also know this because the only way for the average product to be decreasing is if the marginal product is below average, pulling the average down.*



(c) *Marginal Product is undefined (or zero) up to* 10 *units of labour then is constant at* 5 *units of output for all levels of labour. Average Product is zero up to* 10 *units of labour then rises thereafter. However it never quite reaches* 5 *units of output.*



(d) *Marginal Product is undefined (or zero) up to* 10 *units of labour then is declining thereafter. Average Product is zero up to* 10 *units of labour then rises, reaches a maximum where it is equal to MP (where the slope of a ray from the origin is tangent to TP), then declines.*



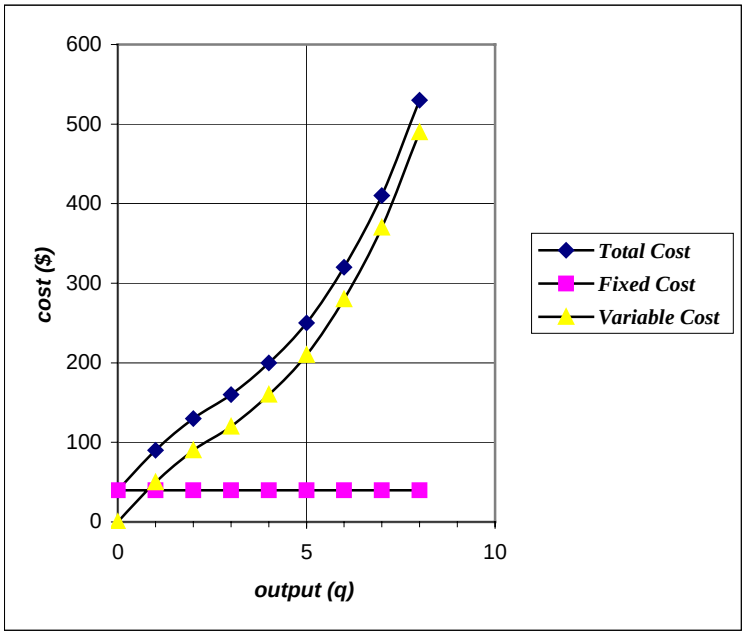
A3-11. Suppose that the total cost information for a firm is given below:

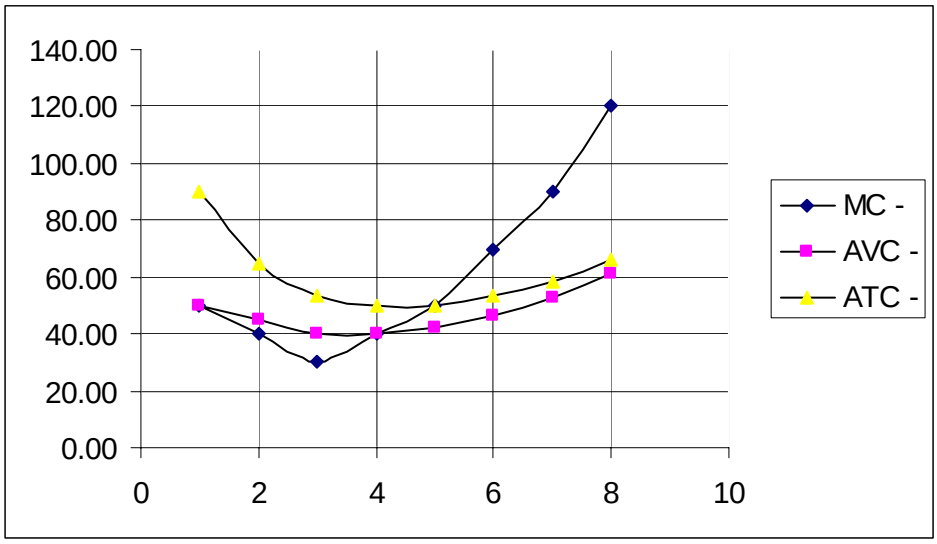
Output	0	1	2	3	4	5	6	7	8
Total Cost	40	90	130	160	200	250	320	410	530

(a) Create a table with the following columns: output (*q*), total cost (*TC*), fixed cost (*FC*), variable cost (*VC*), marginal cost (*MC*), average variable cost (*AVC*), and average total cost (*ATC*). [8]

q	TC	FC	VC	q	MC	AVC	ATC
0	40	40	0	0	-	-	-
1	90	40	50	1	50.00	50.00	90.00
2	130	40	90	2	40.00	45.00	65.00
3	160	40	120	3	30.00	40.00	53.33
4	200	40	160	4	40.00	40.00	50.00
5	250	40	210	5	50.00	42.00	50.00
6	320	40	280	6	70.00	46.67	53.33
7	410	40	370	7	90.00	52.86	58.57
8	530	40	490	8	120.00	61.25	66.25

(b) In one diagram graph *FC*, *VC*, and *TC*. In another diagram graph *MC*, *AVC*, and *ATC*. [6]





(c) Suppose that this firm is one of 100 identical firms operating in a perfectly competitive market with demand conditions given by:

Price	30	40	50	70	90	120
Quantity Demanded	1000	950	900	800	700	550

Create and fill in a table with the following columns: price (p), firm supply (q^S), industry supply (Q^S), and quantity demanded (Q^D). What is the short-run equilibrium price in this market? equilibrium market quantity? output per firm? profits per firm? [5]

P	q^S	Q^S	Q^D
30	0	0	1000
40	4	400	950
50	5	500	900
70	6	600	800
90	7	700	700
120	8	800	550

Short-run equilibrium price = 90 *since* $Q^S = Q^D$ = 700, *and there is no excess supply or demand.*

Each firm supplies 7, *so profits/firm* = $pq - TC(q)$ = (90×7) – 410 = 630 – 410 = $220

(d) Assuming that these firms are at the long-run efficient plant size, what are the long-run equilibrium values for the price, market quantity, output per firm, profits per firm, and number of firms in the industry? [5]

If these firms are at the long-run efficient plant size, then the minimum point on the short-run average total cost curve is also the minimum point on the long-run average cost curve.

In the long-run, firms enter until profits are driven to zero. This means that p = ATC. Firms must also be maximizing profits so p = MC. From the cost data MC = ATC = 50 *at q* = 5.

Therefore in long-run equilibrium, p = 50 *and q* = 5.

At p = 50, Q^D = 900.

Therefore the long-run equilibrium number of firms, n = 900/5 = 180.