DUSP 11.203 Frank Levy
Microeconomics Session 7

Problem Set #4
(Problem Sets will not be Collected).

1) The natural log [the LN (   ) that we use for utility functions] is not defined for negative numbers and so we will rephrase the health insurance problem so that outcomes are measured from a positive income rather than from 0. In doing this problem, use the LN function on your calculator or call it up on a computer – Excel or the calculator program in Windows listed in the "Accessories" menu

In this problem, we assume you over the next year, you will have household income of $80,000. If you have no insurance, there is a .98 chance that you will be generally healthy and incur no healthcare expenses and there is a .02 chance that you will sick and incur $70,000 of healthcare expenses.

a) Consider a health insurance policy written specifically for you. What would be the annual premium if the policy was to represent a "fair bet"?

b) Suppose you value income according to the utility function:

$$U(\text{Income}) = 6\text{LN}(\text{income})$$

Demonstrate that if you were offered the "fair bet" premium, you would prefer to buy the insurance rather than through the year without health insurance.

c) Either directly or by trial and error, calculate a rough estimate of the maximum premium the insurance company could charge before you would decide to go into the year without health insurance.

2) In 1950, median family income $20,668 while median family income in 1990 was $46,429 (both figures are in 2003 dollars – i.e. inflation has been taken out). What would have to size of the income elasticity of demand for health care if this increase in median family income was to explain the rise in health care expenditure per person?

3) Ten ounce bags of Wah-Hoo Potato Chips have the following demand curve:

$$Q = 100{,}000P^{-2.0}$$

Where Q is the number of bags sold per week and P is the retail price per bag in dollars.

As we have seen and contrary to intuition, a straight line demand curve does not have the same elasticity at every point. But the demand curve shown above does have the same elasticity at all price/quantity points – in this particular case, an elasticity of -2.0 (See http://plaza.mit.edu/econ/ Example 1.5).Given this constant elasticity at all prices/quantities, carefully explain which parts of the following statement you agree and disagree with.

"We know from economic theory that when you reduce the price of a good along an elastic portion of the demand curve, total revenue will rise. This demand curve always has an elasticity of -2.0 and so it follows that the profit maximizing strategy is to sell Wah-Hoo Potato Chips at as low a price as possible."

4) Consider a simple production function of the form:

$$Q = .4LN(K) + .6LN(L)$$

This is, roughly speaking, a variant of a Cobb Douglas production function that makes it easier to take derivatives.

Suppose that W, the wage rate of Labor is $12.00 per hour and V, lease rate of Capital is $4.00 per hour.

a) Choose values for Labor and Capital – any positive values will do – and demonstrate that in this production function, the Marginal Product of Capital and the Marginal Product of Labor are both positive and diminishing.

b) If you had a total of $300 to spend on paying labor and leasing capital, what is the maximum amount of output you could produce? What combination of Labor and Capital would you use to produce this output? (Recognize that the mathematics here are fairly similar to the mathematics you used in utility maximization.)

c) On way of describing a production technology is the capital/labor ratio which is computed just as it sounds:

$$\text{Capital/Labor Ratio} = \frac{\text{\# of Hours of Capital you are leasing}}{\text{\# of Hours of Labor you are hiring}}$$

Compute the capital/labor ratio for your solution in (b) above. Suppose that we now change the problem to determine the maximum amount of output you could produce if you had a total of $600 to spend. Would your capital/labor **ratio** change? (In solving this problem, it should be enough to set up the equations and inspect them without completely grinding out the answer).

d) In class, we touched on the idea that a small firm might produce units largely by hand, but as the firm's output expanded, it would move to an assembly line with conveyer belts, etc. Does this production function look like a good way to represent this process? Briefly explain your answer.

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