PROBLEM SET 8 – Tutorial Week 11 (October 25–27)

Deadline: 11:59 p.m. two days before your tutorial. Please submit a PDF in groups of 2–3 within your tutorial group. On the first page, write your full names (as on the roster) in alphabetical order. Start each question on a new page. Name your PDF "PSet # – LastName LastName LastName," e.g., "PSet 8 – Banerjee Duflo Kremer." Points will be deducted for not adhering to the instructions.

QUESTION 1

Versarchery's production function is given by $Q = \sqrt{L} + K$. The price of labor is w and the price of capital is r.

First, consider Versarchery's production in the short run. Suppose the level of capital is fixed at $K = K_0$. For simplicity, suppose the fixed cost is sunk.

(a) To produce Q units of output, what is the cost-minimizing choice of labor? How does the cost-minimizing choice of labor change with Q? With w? With r?

(b) Derive the equation of the firm's short-run total cost function. How does the short-run total cost change with Q? With w? With r?

Now, consider Versarchery's production in the long run.

(c) Write down the cost-minimization problem. Derive the demand function for L and the demand function for K. Assume the firm will use both L and K in production.

(d) Is labor a normal input? Is capital a normal input?

QUESTION 2

Epiphany & Co.'s production function is given by $Q = 50\sqrt{LK}$. Let $w = 25$ and $r = 100$ be the prices of labor and capital, respectively.

(a) Find the equation of Epiphany & Co.'s long-run average total cost curve.

(b) Find the equations of Epiphany & Co.'s short-run average total cost curve when capital is fixed at $\overline{K}$. For simplicity, assume the fixed cost is sunk.

(c) Use Excel to draw a graph of the long-run average total cost curve and the short-run average total cost curves for $\overline{K} = 1$ and $\overline{K} = 2$.

QUESTION 3

Saxxon Fifth Avenue's production function is given by $Q = L + K$. Let $w = 1$ and $r = 2$ be the prices of labor and capital, respectively.

(a) Find the equation of Saxxon Fifth Avenue's long-run total cost curve.
Hint: Note that labor and capital are perfect substitutes.

(b) Suppose capital is fixed at 5 units (i.e., $K = 5$) in the short run. Derive the equation for Saxxon Fifth Avenue's short-run total cost curve. For simplicity, assume the fixed cost is sunk.

(c) In a graph, draw Saxxon Fifth Avenue's short-run total cost curve and long-run total cost curve.

QUESTION 4

The following graph shows the long-run average total cost curve and the long-run marginal cost curve of Farbucks Coffee. The graph also shows the short-run marginal cost curve for two levels of capital. For each short-run marginal cost curve, draw the corresponding short-run average total cost curve. Assume that for any short-run average total cost curve, there exists an output level at which the short-run average total cost curve is tangent to the long-run average total cost curve.