

Assignment #5Due Friday 10/13/06 by 6 p.m. in the Econ 301-1 slot in the Economics Alcove

Please show the calculations used to arrive at your answers. Draw graphs neatly and label axes and points clearly. In general, leave numbers in fractional form while solving problems. Round final answers to the first decimal place if necessary.

A. Jarupanich Industries produces output Q according to the production function $Q = 6K^{1/3}L^{1/2}$, where K = units of capital and L = units of labor. Capital costs \$2 a unit and labor costs \$6 a unit. Q sells for \$30 a unit.

- (1)
 - a. What is the marginal product of capital?
 - b. What is the marginal product of labor?
 - c. What is the technical rate of substitution for Jarupanich?
 - d. What is the optimal ratio of capital to labor for Jarupanich?
- (2)
 - a. Write down the profit function for Jarupanich. How do we know that there is a unique profit-maximizing output?
 - b. Write down the two conditions for Jarupanich to maximize profits.
- (3)
 - a. How much capital and labor will Jarupanich use?
 - b. How much output will Jarupanich produce? What will its profit be?
- (4) If Jarupanich were not allowed to purchase more than 79,507,000 units of capital, now what would your answers to (3) be? [Hint: Think carefully about whether or not your answer to (1) d. is still valid in this case]

B. Koralturk Enterprises uses the production technology $Q = F(K,L) = \sqrt{2K^2 + 4L^2}$

A unit of capital K costs r and a unit of labor L costs w . The firm wants to produce Q^* units of output in order to maximize profits.

- (1) Set up the cost minimization problem for Koralturk Enterprises.
- (2) Solve for the input demand functions for capital and labor, $K = K(w,r,Q^*)$ and $L = L(w,r,Q^*)$ [Simplify as much as possible].
- (3) What is the cost function $C(w,r,Q^*)$ for Koralturk Enterprises [Simplify]?
- (4)
 - a. Explain carefully what a cost function is.
 - b. Why do we often write the cost function as just $C(Q)$?

C. Zeigarnik Inc. has the cost function $C(Q) = 1000 + 100Q + 10Q^2$, where Q = the quantity of output produced.

- (1) Write expressions for Average Fixed Cost (AFC), Average Variable Cost (AVC), Average Total Cost (ATC), and Marginal Cost (MC).
- (2)
 - a. Graph the four cost functions found in (1).
 - b. Indicate the firm's short-run supply curve on the graph.
 - c. Write down the formula for the inverse supply curve.
 - d. At what price is the firm indifferent between shutting down and staying open in the short run?
- (3) Solve for the quantity that minimizes ATC using one of the two possible methods; then check answer using the other method.
- (4)
 - a. Write down an expression for Zeigarnik's profit function. Then derive the formula for the quantity that will maximize the profit function (i.e. $q^* = q(p)$, where p = unit price).
 - b. Graph the profit function for Zeigarnik if the unit price of Q is \$500. Then graph the profit function if the unit price of Q is \$100. Be sure the important points of the functions are illustrated, i.e. the maximum point and points of zero profit.