Intermediate Microeconomics
ECNS 301
Fall 2015

Homework #: 6

Due by the beginning of class on: Thursday November 19, 2015

Name: ____________________________________________

Instructions:
There are 3 questions worth a total of 100 points. Answer each question clearly and concisely. You must show your work to receive credit. You are allowed to work with others, but all work must be your own.

Clearly print your name above and in the space provided on the next page. You must turn in both sides of this cover sheet along with your responses. You do not need to turn in the questions, only your responses with the cover sheet. All pages must be stapled to be graded.
Firms and Production
1. Give careful reasons for your answer to the following. (30)
   (a) Why do economists assume that marginal product is often initially increasing?
   
   **Solution:** MP is often initially increasing due to specialization.

   (b) Why do they assume that marginal product eventually falls?
   
   **Solution:** Marginal product eventually falls because of diminishing returns. These diminishing returns exist in the short run because one factor is fixed.

   (c) When marginal product is falling what is happening to average product?
   
   **Solution:** When marginal product is below average product, average product is also falling. Likewise, when marginal cost is below average cost, average cost is falling.

Production & Costs
2. A firm can use either high skilled or low skilled workers in production. One high skilled worker can produce as much as 2 low skilled workers: they are substitutes. (30)

   Unions represent high skilled workers. They are only concerned about the level of employment and wages for high skilled workers. The wage for high skilled workers is $10. Low skilled workers are not represented by the union, and their wage is $4. The government is considering introducing a minimum wage of $5.01.

   What will be the union’s position on the minimum wage increase and why?

   **Solution:** They will be in favor of minimum wages. Without minimum wages, firms will hire all low skilled workers. With minimum wages, the firm will hire all high skilled workers.

3. Jane Eyre runs a medical clinic. Her production function is \( Q = KL \) where \( Q \) is the number of patients treated, and \( K \) and \( L \) are inputs. \( K \) is the number of nurses and \( L \) is the number of doctors. The price of \( K \) is 1 and the price of \( L \) is 5. (40)

   (a) Suppose Jane currently employs 1 doctor \((L = 1)\). If she is operating at a point on her long run average cost curve, how many nurses does she hire? (Hint: on her long run average cost the choice of \( L \) is optimal) How many patients does she treat (what is \( Q \))? What are her total and average costs?
Solution: Since she is on her LRAC curve, she must be using the inputs in an optimal combination. ($L$ is not being restricted to 1, but is an optimal amount.) We can setup Jane’s cost minimization problem where Jane chooses $L$ and $K$ to minimize costs subject to the production function. The Lagrangian of the problem is

$$\min_{K,L,\lambda} \mathcal{L}(K, L, \lambda) = w_L L + w_K K + \lambda(Q - KL)$$

where $w_L$ and $w_K$ are the factor prices. From the Lagrangian, we get that the MRTS = wage ratio.

$$MRTS = \frac{MP_L}{MP_K} = \frac{K}{L} = \frac{w_L}{w_K} = \frac{5}{1}$$

$$\frac{K}{L} = \frac{K}{1} = 5 \rightarrow K = 5$$

$$Q = 1 \times 5 = 5$$

$$TC = 1 \times 5 + 5 \times 1 = 10$$

$$AC = \frac{10}{5} = 2$$

(b) Suppose Jane expands output to 80 patients. In the short run, if $L$ is fixed at one unit and $K$ is variable, how much $K$ will Jane use? What will be her total and average costs in the short run?

Solution: $Q = 80$. If $L = 1$, then $80 = 1 \times K \rightarrow K = 80$.

Total costs = $1 \times 80 + 5 \times 1 = 85$

Average costs = $85/80 = 1.06$

(c) Jane expands output to 80 patients. In the long run, how much $K$ and $L$ will Jane use? ($L$ is now variable.) What will be her total and average costs for 80 patients?

Solution: $Q = 80$ but $L$ is now variable.

$$\frac{K}{L} = \frac{5}{1} \rightarrow K = 5L$$

$$Q = L(5L) = 5L^2 = 80$$

$$L^2 = 16$$

$$L = 4$$

$$K = 5L = 20$$

$$TC = 20 \times 1 + 4 \times 5 = 40$$

$$AC = \frac{40}{80} = .5$$
(d) Plot 2 points on Jane’s long run average cost curve. Plot 2 points on her short run average cost curve based on $L = 1$. (Hint: You only need to plot three points here because one point is on both curves. Use your answers to Parts a-c.)

Solution: