# MIDTERM EXAMINATION III

## Intermediate Microeconomics
(ECON 520)

November 17, 2005 Professor D. Weisman

**Instructions**: There are two parts to this examination weighted 50 points each. Please write legibly and think carefully about your answers. You may find that graphical and/or mathematical analysis will assist you in answering some of these questions.

**Part I. Multiple Choice (50 points).** Indicate the best answer to the question on the standardized answer sheet provided.

1. The function that indicates the maximum output per unit of time that a firm can produce for every combination of inputs is called
   a. an isoquant.
   b. a production possibility curve.
   c.* a production function.
   d. an iso-cost function.

2. Suppose a firm's production function is given by Q = 4KL, where K is capital and L is labor. What is the marginal product of capital when 4 units of labor are employed?
   a. 2.
   b. 4.
   c. 6.
   d.* 16.
   e. None of the above.

3. The Law of Diminishing Returns assumes that
   a. there is at least one fixed input.
   b. all inputs are changed by the same percentage.
   c. the firm is operating in the short run.
   d. all inputs are held constant.
   e.* a. and c.

4. A production function in which the inputs are used efficiently in fixed proportions would have isoquants that are
   a.* right angles.
   b. convex to the origin.
   c. linear.
   d. characterized by a diminishing MRTS.
   e. (b) and (d).

5. A firm's marginal product of labor is 5 and its marginal product of capital is 10. If the firm adds one unit of capital, but does not want its output quantity to change, the firm should
   a. reduce its use of labor by 5 units.
   b.* reduce its use of labor by 2 units.
   c. maintain the same level of labor utilization.
   d. also increase capital by 1.5 units.

6. Increasing returns to scale in production means
   a. more than twice as much of all inputs is required to double output.
   b.* less than twice as much of all inputs is required to double output.
   c. more than twice as much of only one input is required to double output.
   d. isoquants must be linear.
   e. none of the above.

7. A firm is operating in a range of production where the Law of Diminishing Returns has set in. The firm's total product when 6 units of labor is employed is 20. The marginal product of the 6th unit of labor is 4. The firm's total product when 7 units of labor is employed is
   a. less than 20.
   b.* greater than 20 but less than 24
   c. greater than 24.
   d. 24.
   e. none of the above.

8. The marginal product of labor is 2 and the marginal product of capital is 4. This implies that the $MRTS_{K-L}$ is equal to
   a. 1.
   b.* 2.
   c. 1/2.
   d. 4.
   e. 1/4.

9. Which of the following statements is true regarding sunk costs?
   a. Sunk costs are avoidable costs.
   b. Sunk costs cannot be recouped once they are incurred.
   c. Sunk costs are irrelevant for making forward-looking decisions.
   d. All of the above.
   e.* b. and c.

10. When AT&T was broken up in 1984, thereby separating the production of long distance telephone service from the production of local telephone service, the government recognized that it was sacrificing
   a. economies of scale.
   b. diseconomies of scale.

c.* economies of scope.
d. diminishing returns to labor.
e. diminishing returns to capital.

11. Assume that a firm's production process is subject to increasing returns to scale over a broad range of outputs. Long run average costs over this range of output will tend to
a. increase.
b.* decrease.
c. remain constant.
d. fall to a minimum and then rise.

12. A firm that produces using a typical production function finds that at current levels of input utilization it is producing the desired level of output and $MP_K > MP_L$ when r = w. To minimize the cost of producing this level of output, the firm should
a.* increase capital utilization and decrease labor utilization.
b. maintain current levels of capital and labor utilization.
c. increase labor utilization and decrease capital utilization.
d. increase both capital and labor utilization.
e. none of the above.

13. The firm's total cost of producing 10 units of output is 120. At this output level, average fixed costs are equal to 2. It follows that the firms average variable costs are equal to
a.* 10.
b. 20.
c. 2.
d. 4.
e. none of the above.

14. A firm's production function is given by Q = 2 min {K, 2L}. What input bundle represents a cost-minimizing choice for producing 12 units of output?
a. K = 6, L = 6.
b. K = 7, L = 3.
c.* K = 6, L = 3.
d. K = 8, L = 3.
e. K = 6, L = 4.

15. In the long run, which of the following is considered a variable cost?
a. Expenditures for wages.
b. Expenditures for research and development.
c. Expenditures for raw materials.
d. Expenditures for capital machinery and equipment.
e.* All of the above.

16. A production function is given by $Q = 2K + L$, where K is capital and L is labor. Suppose initially that $r = 2$ and $w = 1$. If the price of labor, w, should increase, *ceteris paribus*, then it follows that
   a. the total cost of production will rise.
   b.* the total cost of production will not change.
   c. the total cost of production will fall.
   d. more units of labor will be used in production.
   e. fewer units of capital will be used in production.

17. A production function is given by $Q = 2K + L$. The firm is minimizing costs and produces output using 8 units of K and 4 units of L. If $r = 2$ $w =$
   a. 2
   b.* 1
   c. 4
   d. 5
   e. unable to be determined with this information.

Use the following information to answer the next two questions. Suppose that your grade on this examination is described by $G = 3A^{0.5}E^{0.5}$, where G is your numerical score, A is ability, and E is effort measured in terms of hours studied. Suppose that $A = 100$.

18. How many hours would you have to study to earn a grade of precisely 90?
   a. 12.
   b. 10.
   c.* 9.
   d. 6.
   e. none of the above

19. The marginal product of effort for the ninth hour studied is (approximately)
   a 4 points.
   b.* 5 points.
   c. 6 points.
   d. 8 points.
   e. 10 points.

20. The cost functions for producing products A and B separately are given by $C(Q^A) = 200 + 2Q^A$ and $C(Q^B) = 300 + 3Q^B$, respectively. The cost function for jointly producing products A and B is $C(Q^A, Q^B) = F + 3Q^A + 3Q^B$, where F is fixed costs. Let $Q^A = Q^B = 100$. There are economies of scope in the joint production of products A and B when
   a. $F > 600$.
   b. $F > 500$.
   c. $F < 600$.

d. $F < 500$.
e.* $F < 400$.

**Part II. Problems (50 points).** Answer both questions. Each question is worth 25 points. Show all of your work to receive partial credit. Write legibly, be precise with your answers, and remember that economy of presentation is a desirable quality.

1. Let the firm's production function be given by $Q = 2 \min \{½K, L\}$ Suppose that $r = 2$ and $w = 8$.

a) (8) How much K and L is employed in the efficient production of 20 units of output?

b) (5) What is the minimum cost of producing 20 units of output?

c) (6) Illustrate your results graphically with a representative isoquant and iso-cost line consistent with the answers you derived in parts a) and b) above.

d) (6) Determine whether this production function reflects increasing, decreasing, or constant returns to scale? What is the long run average cost of producing 20 units of output?

2. Production and Cost Functions.

A.(12) A firm operates with a production function that is characterized by a constant $MRTS_{L\text{-}K} = 2$. When the firm has an input bundle consisting of 4 units of labor and 8 units of capital, it produces total output of 16. Write down a production function that reflects these properties. Does this production function reflect increasing, decreasing, or constant returns to scale?

B.(12) Firm A operates with technology $Q^A = \min \{K, ½L\}$ and Firm B operates with technology $Q^B = ½K + ¼L$.

(a) Suppose that current input prices are $r = 2$ and $w = 1$. Determine the cost function for each of the two technologies. [That is, find x, were $C(Q) = xQ$ for each technology.]

(b) Would Firm B have an incentive to "collude" with the local labor union to raise the wage rate from $w = 1$ to $w = 2$? Why or why not? Provide the economic rationale for your answer.

**Extra Credit (4):** A firm's production function is given by $Q = K \cdot L \cdot R$, where K is capital, L is labor and R is raw materials. All three inputs have the same unit price of 2. What is the minimum cost of producing 64 units of output?