Ecn 100 - Intermediate Microeconomic Theory
University of California - Davis March 19, 2009
Instructor: John Parman

Final Exam

You have until 5:30pm to complete the exam, be certain to use your time wisely. For multiple choice questions, mark your answer on your scantron sheet. Choose only one answer for each multiple choice question; if more than one letter is filled in for a question it will be marked wrong. For the short answer questions, write your answers directly on the exam. Show your work clearly, place a box around final answers and be certain to label any graphs you draw. Final answers may be left as fractions. Non-graphing calculators may be used but they should not be necessary. Good luck!

Name: **ID Number:** **Section:**

SECTION I: MULTIPLE CHOICE (60 points)

1. The short run costs of producing an amount of output y will be _____ the long run costs of producing the same amount of output.
   (a) Greater than or equal to.
   (b) Strictly greater than
   (c) Less than or equal to.
   (d) Strictly less than.

   (a) In the long run, the producer can still use the same combination of inputs it did in the short run, meaning it's long run costs should be no more than the short run costs. However, the producer has more flexibility in the long run in terms of inputs, so it may be able to achieve lower costs than in the short run.

2. When the marginal cost curve lies above the average cost curve, average costs will be:
   (a) Increasing as output increases.
   (b) Decreasing as output increases.
   (c) Constant as output increases.
   (d) They may be increasing or decreasing as output increases.

   (a) If the marginal costs are greater than the average costs, it means that the next unit of output will cost more than the previous average. Each additional unit produced will pull up the average cost.

3. On a graph with good x on the horizontal axis and good y on the vertical axis, the larger the price of good x is relative to the price of good y:
   (a) The steeper the budget line will be.
   (b) The flatter the budget line will be.
   (c) The steeper the indifference curves will be.
   (d) The flatter the indifference curves will be.

   (a) The slope of the budget line is just $-\frac{p_x}{p_y}$. If the price of x gets larger, then the magnitude of the budget line slope will get larger.

4. A firm's production function is given by $f(K, L) = KL$ where K is capital and L is labor. The marginal product of labor for this firm is:
   (a) Decreasing as L gets larger.
   (b) Increasing as L gets larger.
   (c) Decreasing as K gets larger.
   (d) Increasing as K gets larger.

   (d) The marginal product of labor in this case is $MPL = K$. A change in L will have no effect on the marginal product of labor. However, a change in K will. If K increases, MPL increases.

5. Which of the following is not a difference between monopolies and perfectly competitive firms?
   (a) Industry supply tends to be lower for a monopoly than a competitive industry.
   (b) Market price tends to be higher for a monopoly than a competitive industry.
   (c) Firm profits tend to be higher for a monopoly than a competitive firm in the long run.
   (d) Monopolies determine quantity by setting marginal revenue equal to marginal cost while competitive firms cannot choose quantity.

   (d) Both monopolies and competitive firms choose quantity by setting marginal revenue equal to marginal cost. The difference is that for competitive firms, marginal revenue is constant (and equal to the price) while for monopolies marginal revenue is a function of output.

6. If goods x and y are complements and are normal, ordinary goods, an increase in the price of good x will lead to:
   (a) An increase in demand for y and a decrease in demand for x.
   (b) An increase in demand for x and a decrease in demand for y.
   (c) An increase in demand for both x and y.
   (d) A decrease in demand for both x and y.

   (d) If the price of an ordinary good goes up, demand for that good will go down. So demand for x will decrease. If the price of one good goes up, demand for any complements will go down. So demand for y will also decrease.

7. In a competitive industry, the long run output per firm will:
   (a) Depend on the slope of the demand curve.
   (b) Depend on the number of firms in the industry.
   (c) Depend on where the minimum of the average cost curve is.
   (d) Depend on the size of fixed costs.

   (c) The demand curve will influence the number of firms but output for an individual firm will be equal to the level of output at which the minimum of the average cost curve occurs.

8. If demand for pizza is downward sloping and supply is upward sloping, increasing the size of a quantity tax on pizza will:
   (a) Decrease the amount of pizza sold and increase deadweight loss.

(b) Increase the amount of pizza sold and increase deadweight loss.
(c) Decrease the amount of pizza sold and decrease deadweight loss.
(d) Increase the amount of pizza sold and decrease deadwieght loss.

(a) An increase in a quantity tax in this case will lead to a lower quantity of pizza being sold, a higher price paid by consumers and a lower price received by producers. This will lead to an increase in deadweight loss.

9. Compared to the case of no price discrimination, first degree price discrimination will:

(a) Lead to a more socially efficient outcome but lower firm profits.
(b) Lead to a more socially efficient outcome but lower consumer surplus.
(c) Lead to a less socially efficient outcome but greater firm profits.
(d) Lead to a less socially efficient outcome but greater consumer surplus.

(b) First degree price discrimination will lead to the socially efficient outcome but the monopoly will capture all of the surplus as monopoly profits. So total surplus will be maximized but consumer surplus will be zero.

10. A quantity tax placed on consumers in a perfectly competitive industry will:

(a) Lead to a higher price paid by consumers in the short run and an even higher price paid by consumers in the long run.
(b) Lead to a lower price received by producers in the short run and an even lower price received by producers in the long run.
(c) Lead to a greater burden on firms in the long run than in the short run.
(d) Lead to a greater burden on consumers in the short run than in the long run.

(a) The long run supply curve in a perfectly competitive industry is a horizontal line. This means that the burden of a tax will fall entirely on consumers in the long run. In the short run, the supply curve is upward sloping so the tax burden will be shared by consumers and producers. This means that a quantity tax will increase consumer prices in the short run and those prices will rise even more as firms leave the industry in the long run.

11. A firm has two factories, A and B with the following cost functions: $C_A(y) = 4y^2$ and $C_B(y) = 2y^2$. Which of the following is true if the firm is maximizing profits and producing a positive amount of output?

(a) The firm will use both factories but will be producing more output at factory A than at factory B.
(b) The firm will use both factories but will be producing more output at factory B than at factory A.
(c) The firm will only use factory A.
(d) The firm will only use factory B.

(b) Factory B has lower marginal costs at any given level of output. For the marginal costs at the two factories to be equal (which would maximize profits), the output at factory B must be larger than the output at factory A.

12. If apples are a normal good, the income elasticity of demand for apples will be:

(a) Positive.
(b) Negative.
(c) Positive at high income levels and negative at low income levels.
(d) Positive at low income levels and negative at high income levels.

(a) If apples are normal, an increase in income would increase demand for apples. This implies a positive income elasticity.

13. At a competitive firm's current level of output, the firm's total revenue is less than the firm's total variable cost. Which of the following is true?

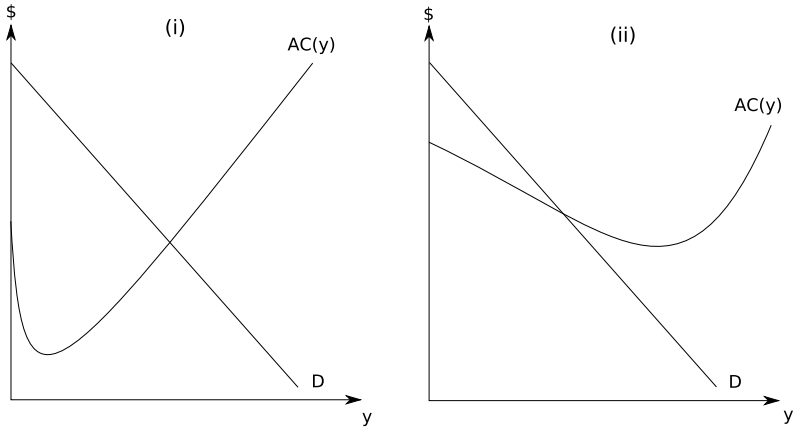
(a) The firm is maximizing profits.
(b) The firm should be producing fewer units.
(c) The firm's average costs are lower than the price.
(d) Producer surplus is positive.

(b) If the firms total revenues are less than the total variable cost, the firm is losing an amount of money equal to the uncovered portion of the variable costs plus the variable costs. In this situation, the firm could lose less money by shutting down and only paying the fixed costs.

14. If apples and oranges are both normal, ordinary goods and the price of apples increases:

(a) Both the income and substitution effects for apples will be positive.
(b) Both the income and substitution effects for apples will be negative.
(c) The sign of the income effect for apples will depend on whether apples and oranges are complements or substitutes.
(d) The sign of the substitution effect for apples will depend on whether apples and oranges are complements or substitutes.

(b) A price increase for apples means a decrease in effective income. This will lead to a negative income effect for apples. Because apples have become relatively more expensive than oranges, the substitution effect for apples will also be negative.



Use the graphs above of two different markets to answer questions (15) and (16). Each graph shows the average cost curve for a monopolist and the market demand curve.

15. Which of the two monopolists would be earning a positive profit?

    (a) (i) only.
    (b) (ii) only.
    (c) (i) and (ii).
    (d) Not enough information.

    (c) Notice that in both cases, there are quantities at which average costs are below the demand curve. If the monopoly produced at any of those quantities they would be earning positive profits.

16. Which of the two monopolists would earn positive profits at the socially efficient quantity?

    (a) (i) only.
    (b) (ii) only.
    (c) (i) and (ii).
    (d) Neither.

    (a) For graph (i), the marginal cost curve will intersect the demand curve at a point that is above the average cost curve. So the monopoly would earn positive profits at the socially efficient quantity. For graph (ii), it is the opposite case. The marginal cost curve will intersect the demand curve at a point that lies below the average cost curve. The firm would earn negative profits at this quantity.

17. For a competitive industry with many firms, each of which has an upward sloping marginal cost curve, the short run industry supply curve will be _____ an individual firm's marginal cost curve and _____ the long run industry supply curve.

    (a) Flatter than, flatter than.
    (b) Flatter than, steeper than.
    (c) Steeper than, flatter than.
    (d) Steeper than, steeper than.

    (b) The marginal cost curve for a firm will be the same as the firm's supply curve (above the shutdown price). Adding up these firm supply curves to get the short run industry supply curve will lead to a flatter curve. In the long run, the industry supply curve will be a horizontal line (and therefore flatter than the short run supply curve).

18. Which of the following might change an individual's optimal consumption bundle?

    (a) A doubling of all prices and income.
    (b) All prices and income being cut in half.
    (c) A doubling of all prices and income being cut in half.
    (d) Doubling the individual's utility function.

    (c) Multiplying all prices and income by the same factor will not change the set of affordable bundles and therefore won't change the optimal bundle. Multiplying income by a different factor than prices will change the set of affordable bundles and could lead to a different optimal bundle.

19. Suppose that all firms in a competitive industry have the same cost function and the minimum of the average cost for a firm is \$10, occurring at an output level of 15. If market demand is given by $D(p) = 150 - 3p$, how many firms will there be in the long run?
    (a) 8.
    (b) 10.
    (c) 12.
    (d) 15.

    (a) If the minimum of the average cost curve is at \$10, that will be the market price in the long run. At a price of \$10, market demand is 120. If each firm is producing 15 units, it will take 8 firms to meet the market demand.

20. If demand for bread is currently inelastic, a store can increase total revenues by:
    (a) Increasing the price of bread.
    (b) Decreasing the price of bread.
    (c) The store cannot change revenues.
    (d) It will depend on the cost curves of the store.

    (a) If demand is inelastic, the store can raise prices without a large decrease in demand. The extra revenue on each loaf of bread still sold will more than enough to offset the lost revenue from the small decrease in the number of loaves sold.

21. A monopoly will be most likely to occur:
    (a) In an industry with no barriers to entry or exit.
    (b) In an industry with a very small minimum efficient scale and a very large market demand.
    (c) In an industry with no fixed costs and low, constant marginal costs.
    (d) In an industry with a very large minimum efficient scale and a relatively small level of demand.

    (d) If the minimum efficient scale is large and demand is relatively small, multiple firms splitting output would tend to lead to negative profits. It is likely that the only way for firms to earn non-negative profits is if there is a single firm (allowing the firm to operate closer to the minimum efficient scale than if there were multiple firms).

22. The average costs for a firm with increasing returns to scale will:
    (a) Decrease as output increases.
    (b) Increase as output increases.
    (c) Stay constant as output increases.
    (d) Increase as output increases but by less and less.

    (a) If a firm has increasing returns to scale, it will take smaller and smaller increases in inputs to keep producing additional units of output. This means that marginal costs and average costs will be falling as output levels increase.

23. For a profit-maximizing firm in a competitive industry:
    (a) Profits may be negative in the short run but producer surplus will always be greater than or equal to zero.

(b) Profits and producer surplus may be negative in the short run.
(c) Profits and producer surplus always be positive in the long run.
(d) Producer surplus may be negative in the short run but profits will always be greater than or equal to zero.

(a) Profits may be negative if market price is below average total costs. However, producer surplus will never be negative because the firm can always shut down, leading to a producer surplus of zero.

24. The utility function $U(x, y) = x + y$ exhibits:

(a) A diminishing marginal rate of substitution.
(b) A increasing marginal rate of substitution.
(c) A constant marginal rate of substitution.
(d) Not enough information.

(c) The marginal rate of substitution is given by the ratio of the marginal utilities. The marginal utility of x is constant and the marginal utility of y is constant, so the marginal rate of substitution will also be constant.

25. The technical rate of substitution is given by:

(a) The slope of the isocost curve.
(b) The slope of the isoquant.
(c) The slope of the budget line.
(d) The slope of the production function.

(b) The technical rate of substitution tells us how one input can be substituted for another to keep total output the same. This is precisely what the slope of the isoquant is telling us.

SECTION II: SHORT ANSWER (40 points)

For this section, be certain to show your work and clearly label any graphs you draw. Give complete answers but keep them concise. Please place a box around final answers where appropriate.

1. A firm in a perfectly competitive industry uses two different factories, A and B, to produce output y. The cost functions for the two factories are the following:

$$C_A(y_A) = \frac{1}{3}y_A^3 \tag{1}$$

$$C_B(y_B) = \frac{4}{3}y_B^3 \tag{2}$$

   (a) Using the above cost functions and what you know about how a firm divides output between factories, find an expression for the amount of output produced at factory A (y_A) in terms of the amount of output produced at factory B (y_B). You must show your work to get full credit. (4 points)

   To maximize profits, the firm will divide output between factories so that the marginal costs at the two factories are equal:

$$MC_A(y_A) = MC_B(y_B)$$

$$\frac{dC_A(y_A)}{dy_A} = \frac{dC_B(y_A)}{dy_B}$$

$$y_A^2 = 4y_B^2$$

$$y_A = 2y_B$$

   (b) Given your answer in part (a), find an expression for the firm's total costs of producing y, $C(y)$. Your expression should contain only constants and y. The final expression should not contain y_A or y_B. (4 points)

   Total costs for the firm will be:

$$C(y) = C_A(y_A) + C_B(y_B)$$

$$C(y) = \frac{1}{3}y_A^3 + \frac{4}{3}y_B^3$$

$$C(y) = \frac{1}{3}(2y_B)^3 + \frac{4}{3}y_B^3$$

   We need to replace y_B with an expression in terms of y. To do this, we can use the fact that y_A and y_B must add up to the total amount of output:

$$y = y_A + y_B$$

$$y = 2y_B + y_B$$

$$\frac{1}{3}y = y_B$$

Plugging this into the cost function above gives:

$$C(y) = \frac{1}{3}(\frac{2}{3}y)^3 + \frac{4}{3}(\frac{1}{3}y)^3$$

$$C(y) = \frac{8}{81}y^3 + \frac{4}{81}y^3$$

$$C(y) = \frac{12}{81}y^3$$

$$C(y) = \frac{4}{27}y^3$$

(c) If the market price is \$100, how many units of ouptut will the firm produce? (4 points)

The firm will choose to produce the quantity at which price is equal to marginal cost:

$$100 = MC(y)$$

$$100 = 3 \cdot \frac{4}{27}y^2$$

$$100 = \frac{4}{9}y^2$$

$$y^2 = \frac{100 \cdot 9}{4}$$

$$y = \frac{10 \cdot 3}{2}$$

$$y = 15$$

2. A monopolist has a cost function given by $C(y) = 10y^2$. The inverse demand curve for the market is given by:

$$p(y) = 600 - 5y \tag{3}$$

(a) Find expressions for the monopoly's total revenue as a function of y and for the monopoly's marginal revenue as a function of y. (3 points)

The revenue for the monopolist is just price times quantity:

$$R(y) = p(y) \cdot y = (600 - 5y)y = 600y - 5y^2$$

To get the marginal revenue function, you need to take the derivative of the revenue function with respect to y:

$$MR(y) = \frac{dR(y)}{dy} = 600 - 10y$$

(b) Find the price charged by the monopoly and the quantity produced when the monopoly cannot price discriminate. (4 points)

The monopolist will choose the quantity at which marginal revenue is equal to marginal cost:

$$MR(y) = MC(y)$$
$$600 - 10y = 20y$$
$$600 = 30y$$
$$y = 20$$

To get the price charged by the monopoly, we just need to plug this quantity into the demand function:

$$p = 600 - 5 \cdot 20 = 500$$

(c) Calculate the deadweight loss generated under the monopoly outcome you found in part (b). (4 points)

To calculate the deadweight loss, we first need to find the efficient quantity. This is the point at which the marginal cost curve intersects the demand curve:

$$p(y) = MC(y)$$
$$600 - 5y = 20y$$
$$600 = 25y$$
$$y = 24$$

The deadweight loss can now be calculated as the area under the demand curve, above the marginal cost curve between the monopoly quantity and the efficient quantity.

$$DWL = \frac{1}{2}(24 - 20)(500 - 400) = 200$$

(d) Suppose that the monopoly can use first degree price discrimination. What quantity will the monopoly produce and what will the deadweight loss be? (4 points)

Under first degree price discrimination, the monopoly will produce at the efficient quantity of 24 units. The deadweight loss will be zero since the efficient quantity is being achieved.

3. There are two types of firms in a competitive industry, type A and type B. There are 10 of each type of firm. The cost functions of the individual firms are given by:

$$C_A(y) = y^2 + 5y \tag{4}$$

$$C_B(y) = y^2 + 10y \tag{5}$$

(a) Find an expression for the industry supply function, $S(p)$, and graph the supply function, labeling all slopes, intercepts and kinks. (5 points)

First we need to find the individual firm supply curves which are the same as the marginal cost curves (above the shutdown price).

$$MC_A = 2y + 5$$

$$p(y_A) = 2y_A + 5$$

$$y_A = -\frac{5}{2} + \frac{1}{2}p$$

$$MC_B = 2y + 10$$

$$p(y_B) = 2y_B + 10$$

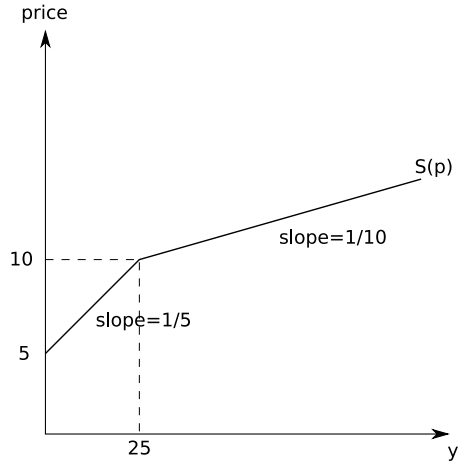
$$y_B = -5 + \frac{1}{2}p$$

Notice that the shutdown price for firm type A is 5 and the shutdown price for firm type B is 10. So the industry supply curve is the following:

$$S(p) = 0 \text{ for all } p < 5$$

$$S(p) = 10y_A = -25 + 5p \text{ for } 5 \leq p < 10$$

$$S(p) = 10y_A + 10y_B = -25 + 5p - 50 + 5p = -75 + 10p \text{ for } p \geq 10$$



(b) Suppose that the market demand function is $D(p) = 150 - 5p$. What will be the equilibrium price? What quantity will be produced by an individual firm of type A and an individual firm of type B? (5 points)

Notice that demand is equal to 25 when the price is equal to 25. So at the kink in the supply curve, the demand curve still lies above the supply curve. This tells us that the equalibrium price and quantity will occur to the right of the kink and we should use the supply equation that corresponds to that segment of the supply curve. To find the equilibrium price and quantity, we simply set demand equal to supply:

$$D(p) = S(p)$$

$$150 - 5p = -75 + 10p$$

$$225 = 15p$$

$$p = 15$$

$$D(15) = 150 - 5 \cdot 15 = 75$$

So the equilibrium price will be 15 and the equilibrium quantity will be 75. To find the amount produced by a firm of type A and a firm of type B, we simply need to plug the price into the individual supply functions:

$$y_A = -\frac{5}{2} + \frac{1}{2}15 = 5$$

$$y_B = -5 + \frac{1}{2}15 = 2.5$$

(c) What will the market price and total quantity sold be in the long run? (3 points)

In the long run, only the most efficient firm type will remain and will earn zero profits. This means that only type A firms will remain and the price will be equal to 5. At a price of 5, the total quantity sold will be 125 (this number comes from plugging 5 into the demand equation).