Ecn 100 - Intermediate Microeconomics
University of California - Davis December 7, 2010
Instructor: John Parman

Final Exam - Solutions

You have until 12:30 to complete this exam. Be certain to put your name, id number and section on both the exam and your scantron sheet and fill in test form A on the scantron. Answer all multiple choice questions on your scantron sheet. Choose the single best answer for each question; if you fill in multiple answers for a question you will be marked wrong. Answer the short answer questions directly on the exam. You must show your work for full credit. Answers may be left as fractions. Please place a box around final answers when appropriate. Good luck!

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

SECTION I: MULTIPLE CHOICE (60 points)

1. Abel consumes only chocolate and coffee and is currently maximizing his utility by consuming four chocolate bars and five cups of coffee. We can say for certain that at this current bundle:
   (a) An additional dollar spent on coffee would increase utility the same amount as an additional dollar spent on chocolate.
   (b) An additional unit of coffee would increase utility the same amount as an additional unit of chocolate.
   (c) An additional unit of coffee would increase utility by more than an additional unit of chocolate.
   (d) An additional dollar spent on coffee would increase utility by more than an addtional dollar spent on chocolate.

   (a) If an additional dollar spent on coffee increased utility by more than an additional dollar spent on chocolate, Abel could increase utility by spending more on coffee and less on chocolate. Similarly, if an additional dollar spent on chocolate increased utility by more than an additional dollar spent on coffee, Abel could increase utility by spending more on chocolate.

2. In a competitive industry, a permanent shift of the demand curve to the right will lead to:
   (a) A higher price and more firms in the long run.
   (b) More firms in the long run but no change in the long run price.
   (c) A lower price and fewer firms in the long run.
   (d) Fewer firms in the long run but no change in the long run price.

   (b) In a competitive industry, the long run price will always be the breakeven price. This depends on the average cost curves of the firms and is not affected by a shift in demand. While the shift in demand will not change the long run price, it will lead to a larger long run quantity, requiring more firms.

3. Which of the following would change the slope of a consumer's budget line?
   (a) Doubling the price of the good on the horizontal axis.

(b) Doubling income.
(c) Doubling the prices of both goods.
(d) All of the above.

(a) Changing just one price will change the slope of the budget line (the slope is just the ratio of the prices). Changing income or multiplying both prices by the same factor will shift the budget line but will not change its slope.

4. Suppose that a firm uses only machines and workers to produce output. If the marginal product of machines and the marginal product of workers are both positive constants, the firm's isoquants will be:

(a) Upward-sloping straight lines.
(b) Downward-sloping straight lines.
(c) Upward-sloping and getting flatter when moving from left to right.
(d) Downward-sloping and getting flatter when moving from left to right.

(b) If both inputs have constant marginal products, the slope of an isoquant will be constant. The isoquants will be downward sloping since both inputs have positive marginal products (if you use less of one input you would need to use more of the other to keep output the same).

5. For a profit-maximizing monopolist facing a downward-sloping linear demand curve, at any positive quantity of output:

(a) Marginal revenue will be equal to the price the monopolist charges per unit.
(b) Marginal revenue will be greater than the price the monopolist charges per unit.
(c) Marginal revenue will be less than the price the monopolist charges per unit.
(d) Not enough information.

(c) For a monopoly facing a linear demand curve, the marginal revenue curve will have the same vertical intercept as the demand curve but will be twice as steep. This means that at any positive quantity, the marginal revenue curve lies below the demand curve. So marginal revenue will be below the price that the monopolist charges.

6. Suppose that Bill's utility goes up when the number of magazines he reads increases and goes down when the number of textbooks he reads increases. On a graph with magazines on the horizontal axis and textbooks on the vertical axis, Bill's indifference curves will be:

(a) Downward sloping.
(b) Upward sloping.
(c) Horizontal lines.
(d) Vertical lines.

(b) If we give Bill more magazines, his utility would increase. To bring his utility back down to its original level, we would also need to give him more textbooks since additional textbooks lower his utility.

7. Suppose that a firm uses capital and labor to produce widgets and has a monotonic production technology. Which of the following cannot be true?

(a) The firm's technical rate of substitution is increasing.
(b) The firm's technical rate of substitution is decreasing.
(c) The marginal product of capital is positive.
(d) The marginal product of labor is negative.

(d) If the firm's technology is monotonic, increasing any one input while holding other inputs constant will lead to at least as much output as before. This means the marginal product for each input must be greater than or equal to zero.

8. A monopolist faces a linear, downward-sloping demand curve. In which of the following cases would a profit-maximizing monopolist not generate a deadweight loss?

(a) When the marginal cost curve for the monopolist is upward sloping.
(b) When the marginal cost curve for the monopolist is a horizontal line.
(c) There would be deadweight loss in both (a) and (b).
(d) Neither (a) nor (b) would lead to a deadweight loss.

(c) In either case, the marginal cost curve will intersect the marginal revenue curve to the left of where it intersects the demand curve. This means that the monopolist will choose to produce a quantity that is to the left of the efficient quantity, generating a deadweight loss.

9. Coffee is a normal, ordinary good. If the price of coffee goes up, demand for coffee will _____ and the income and substitution effects for coffee will have _____.

(a) Increase, opposite signs.
(b) Increase, the same signs.
(c) Decrease, opposite signs.
(d) Decrease, the same signs.

(d) Coffee is an ordinary good so an increase in price will lead to a decrease in demand. Since coffee has become relatively more expensive, the subsitution effect will be negative. Since effective income has decreased and coffee is a normal good, the income effect will be negative.

10. Suppose there are one hundred identical firms in the market for bagels. Each firm has a supply curve with a slope of 100. The industry supply curve will have a slope:

(a) Greater than 100.
(b) Equal to 100.
(c) Less than 100.
(d) Not enough information.

(c) The industry supply curve will be flatter than the individual supply curves.

11. In the short run, the number of machines a firm uses is fixed at 100 but the firm can vary the number of workers it employs. The short run costs of producing 500 units of output will be:

(a) Greater than the long run costs of producing 500 units of output.
(b) Less than the long run costs of producing 500 units of output.
(c) Equal to the long run costs of producing 500 units of output.
(d) (a) or (c) could be true.

(d) If the firm happens to be at the same combination of workers and machines it would use in the long run to produce 500 units, the short run and long run costs will be the same. If they would choose a number of machines different than 100 in the long run, the short run costs will be greater than the long run costs.

12. Suppose that in a competitive industry, the market price is currently above each firm's average variable cost and below each firm's average total cost. Which of the following will happen?

    (a) Firms will enter the industry and market price will increase.
    (b) Firms will enter the industry and market price will decrease.
    (c) Firms will leave the industry and market price will increase.
    (d) Firms will leave the industry and market price will decrease.

    (c) At this market price, firms are between their shutdown price and their breakeven price. So they will produce in the short run but they will be earning negative profits. In the long run, firms will leave because of the negative profits. This will decrease industry supply, raising the market price.

13. Peanut butter and jelly are complements. If the price of jelly increases:

    (a) The short run supply curve for peanut butter will shift to the right.
    (b) The demand curve for peanut butter will shift to the right.
    (c) The short run supply curve for peanut butter will shift to the left.
    (d) The demand curve for peanut butter will shift to the left.

    (d) If the price of one good increases, demand for a complement will decrease. This is a shift in the demand curve for the complement, not a movement along the demand curve.

14. In a competitive market, the long run equilibrium will occur at:

    (a) A market quantity equal to the efficient quantity.
    (b) A market price equal to the individual firms' breakeven prices.
    (c) Both (a) and (b).
    (d) Neither (a) nor (b).

    (c) In the long run, firms will earn zero profits meaning that they will be at their breakeven price. Because competitive firms determine quantity by setting marginal cost equal to price, the equilibrium quantity will be efficient (every unit for which marginal cost is below the price people are willing to pay is produced).

15. Suppose that supply is perfectly elastic and the demand curve is downward sloping. A quantity tax placed on consumers will:

    (a) Increase consumer surplus.
    (b) Decrease the price received by producers.
    (c) Decrease consumer surplus.
    (d) Decrease producer surplus.

    (c) Because the supply is perfectly elastic, consumers end up paying the full burden of the tax. So quantity will decrease, price for consumers will increase by the full

amount of the tax, and price for producers will stay the same. This leads to a decrease in consumer surplus but no change in producer surplus.

16. Which of the following statements must be true?
    (a) If a firm's marginal costs are increasing, its average costs must be increasing.
    (b) If a firm's marginal costs are increasing, its average variable costs must be increasing.
    (c) If a firm's marginal costs are above its average costs, its average costs must be increasing.
    (d) If a firm's marginal costs are above its average variable costs, its average costs must be increasing.

    (c) If a firm's marginal costs are above its average costs, the additional costs of the next unit produced will be greater than the previous average. This means the next unit will increase average costs.

17. Potato chips and soda are both normal goods and are the only goods that Christine consumes. The Engel curve for potato chips and the income offer curve will:
    (a) Both be downward sloping.
    (b) Both be upward sloping.
    (c) Neither (a) nor (b).
    (d) Not enough information.

    (b) Since potato chips are normal, an increase in income will lead to an increase in demand, producing an upward sloping Engel curve. When income increases, consumption of both potato chips and soda will increase since both are normal, producing an upward sloping income offer curve.

18. A firm is currently using a combination of inputs where the slope of the isoquant is steeper than the slope of the isocost curve. The firm can increase output without changing costs by:
    (a) Using more of the input on the horizontal axis and less of the input on the vertical axis.
    (b) Using more of the input on the vertical axis and less of the input on the horizontal axis.
    (c) Using more of both inputs.
    (d) Using less of both inputs.

    (a) If the firm moves down and right along the isocost line, costs will stay the same but it will move above the original isoquant, meaning it will produce more output.

19. A good with many close substitutes will tend to have _____ than a good with no close substitutes.
    (a) More elastic demand.
    (b) Less elastic demand.
    (c) More inelastic demand.
    (d) Both (b) and (c).

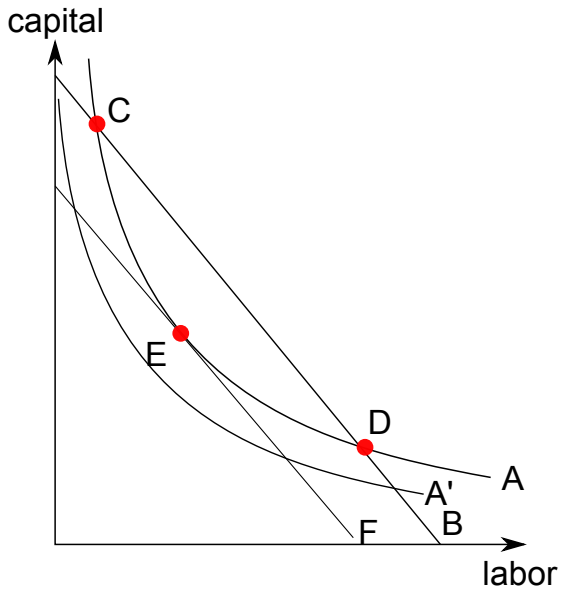
    (a) If a good has many close substitutes, consumers will switch to these substitutes when the price goes up. So demand for the good will be very responsive to changes in price. If a good does not have close substitutes, demand will be less responsive to price and therefore more inelastic.

20. Suppose a firm uses only capital and labor to produce output and the marginal products of capital and labor are both positive constants. Which of the following is not true?
    (a) The firm's production technology exhibits increasing returns to scale.
    (b) The firm's production technology is monotonic.
    (c) The firm's technical rate of substitution is constant.
    (d) The firm's isocost lines are downward sloping.

    (a) The production technology is monotonic since both marginal products are positive. The technical rate of substitution is constant because both marginal products are constant. The isocost lines are downward sloping because using more of one input will always require using less of the other to keep costs constant. The production technology exhibits constant returns to scale due to the constant marginal products of the two inputs.

SECTION II: SHORT ANSWER (40 points)

1. (10 points) On the graph below, one isoquant (curve A) and one isocost line (curve B) are shown for a firm. The isoquant and isocost line intersect at two different combinations of capital and labor. These points of intersection are labeled as C and D on the graph. The firm is currently on both isoquant A and the isocost line B. In other words, the firm is currently at either point C or point D.



   (a) Suppose that the current rental rate of capital is \$2 and the current wage is \$10. The current marginal product of capital is 10 and the current marginal product of labor is 15. Based on this information, is the firm currently at point C or at point D? Explain your answer.

   The slope of the isoquant at the current combination of capital and labor is:

$$-\frac{MP_L}{MP_K} = -\frac{15}{10} = -\frac{3}{2}$$

   The slope of the isocost line is:

$$-\frac{w}{r} = -\frac{10}{2} = -5$$

   Notice that the magnitude of the isoquant slope is smaller than the magnitude of the isocost line's slope. This tells us that the isoquant is flatter than the isocost line, implying that the firm is currently at point D.

   (b) Suppose that the firm decides to hold output at its current level but adjust its inputs to minimize total costs. Show on the graph which combination of inputs the firm will move to. Label this point E. Add and clearly label any additional isocost lines or isoquants that are needed to determine the location of this cost-minimizing bundle.

The firm is going to move along its isoquant until it reaches a point of tangency with an isocost line. This point of tangency occurs at point E on the graph where the isoquant is tangent to the isocost line F. Notice that F is parallel to the original isocost line.

(c) Now suppose that the firm develops a new technology that leads to greater output at any given combination of inputs compared to the original technology. This new technology still exhibits a diminishing technical rate of substitution. Show on the graph how this change in technology affects isoquant A. In other words, draw a new isoquant that corresponds to the same level of output as isoquant A but is based on the new technology. Label this new isoquant A'.

This new isoquant should lie entirely below the original isoquant since it requires fewer inputs to produce the same amount of output. The isoquant will still be convex since the new technology exhibits a diminishing technical rate of substitution.

2. (14 points) A monopolist has the following cost function:

$$C(y) = 30y \tag{1}$$

The demand curve for the industry is given by:

$$D(p) = 1000 - 25p \tag{2}$$

(a) Derive expressions for marginal cost, $MC(y)$, and marginal revenue, $MR(y)$, for the monopolist.

$$MC(y) = \frac{dC(y)}{dy}$$
$$MC(y) = 30$$

To get the marginal revenue curve, we first need to rewrite the demand function as an inverse demand function:

$$y = 1000 - 25p$$
$$25p = 1000 - y$$
$$p = 40 - \frac{1}{25}y$$

Now we can write revenue in terms of y and derive the marginal revenue function:

$$R(y) = p(y) \cdot y$$
$$R(y) = (40 - \frac{1}{25}y)y$$
$$R(y) = 40y - \frac{1}{25}y^2$$
$$MR(y) = \frac{dR(y)}{dy} = 40 - \frac{2}{25}y$$

(b) What price will the monopolist charge and how many units of output will it produce?

The monopolist will determine quantity by setting marginal cost equal to marginal revenue:

$$MC(y) = MR(y)$$
$$30 = 40 - \frac{2}{25}y$$
$$\frac{2}{25}y = 10$$
$$y = 125$$

So the monopolist will produce 125 units. They will determine the price by figuring out how much consumers are willing to pay for a quantity of 125:

$$p(125) = 40 - \frac{1}{25} \cdot 125$$
$$p(125) = 40 - 5$$
$$p(125) = 35$$

So the monopolist will charge \$35 per unit.

(c) What is the socially efficient quantity (the quantity that maximizes total surplus)?

The socially efficient quantity will be where the marginal cost curve intersects the demand curve:

$$MC(y) = p(y)$$

$$30 = 40 - \frac{1}{25}y$$

$$\frac{1}{25}y = 10$$

$$y = 250$$

So the socially efficient quantity is 250 units.

3. (16 points) The industry for laptops is perfectly competitive; all firms are price takers. Currently there are ten different firms, each with the following cost function:

$$C(L) = L^3 - 20L^2 + 110L \tag{3}$$

where L is the number of laptops produced. In the short run, no firms can enter or leave the industry. Firms currently in the industry can decide to produce zero laptops. In the long run, firms can freely enter and leave the industry.

(a) Derive expressions for the marginal costs of each firm and the average costs of each firm in terms of L.

$$MC(L) = \frac{dC(L)}{dL}$$
$$MC(L) = 3L^2 - 40L + 110$$
$$AC(L) = \frac{C(L)}{L}$$
$$AC(L) = L^2 - 20L + 110$$

(b) Suppose that the market price is currently \$110. How many laptops is each firm producing, assuming they are all maximizing profits? (You can assume that firms can produce fractions of laptops.)

Each firm will determine its quantity by setting price equal to marginal cost:

$$p = MC(L)$$
$$110 = 3L^2 - 40L + 110$$
$$3L^2 = 40L$$
$$L = \frac{40}{3}$$

(c) Determine whether the number of firms will increase or decrease once firms are able to enter or leave the industry. Be certain to fully justify your answer.

Whether firms enter or leave depends on whether the firms already in the industry are earning positive or negative profits. We can determine whether profits are positive or negative by comparing price to average cost:

$$AC(\frac{40}{3}) = \left(\frac{40}{3}\right)^2 - 20\frac{40}{3} + 110$$
$$AC(\frac{40}{3}) = \frac{190}{9}$$
$$p - AC(\frac{40}{3}) = 110 - \frac{190}{9} = \frac{800}{9}$$

So price is greater than average cost telling us that the firms are earning positive profits on each unit sold. If firms are earning positive profits, new firms will enter the industry. (Note that there are several correct ways to identify that firms are earning positive profits.)

(d) What will the equilibrium price be in the long run?

In the long run, the market price will be equal to the breakeven price. To find the breakeven price, we can set marginal cost equal to average cost:

$$MC(y) = AC(y)$$

$$3L^2 - 40L + 110 = L^2 - 20L + 110$$

$$2L^2 = 20L$$

$$L = 10$$

So the quantity at the breakeven price is 10. To get the breakeven price itself, we can simply plug this quantity back into the marginal cost function:

$$p_{BE} = MC(10)$$

$$p_{BE} = 3 \cdot 10^2 - 40 \cdot 10 + 110$$

$$p_{BE} = 10$$