

The following exam consists of 60 questions on 6 pages. Please check to see that you have all parts of the exam before beginning. The exam is worth 100 points. You have 90 minutes to complete the exam. Time may be a factor, so do not get stuck on any question. You may use a calculator. Good Luck.

**A. Multiple Choice (15 points, 16 Questions. Miss one for free)**

1. The marginal product of labor is defined to be
  - a. **the additional output attributable to the last unit of labor employed.**
  - b. the amount of output obtained, on average, from each unit of labor employed.
  - c. the percentage increase in output caused by a 1% rise in labor usage.
  - d. the amount of capital that the firm can use to replace one unit of labor.
  
2. The shapes of the total product and marginal product curves are related because
  - a. An increase in total product pulls marginal product up.
  - b. **Marginal product gives the slope of total product.**
  - c. Marginal product increases as total product increases.
  - d. The marginal product curve lies above the total product curve.
  
3. An isoquant shows the various combinations of labor and capital that
  - a. the firm will choose to employ in the long run.
  - b. yield the same total cost.
  - c. **can produce some fixed level of output.**
  - d. minimize the firm's average cost of production.
  
4. If the marginal rate of technical substitution of labor for capital ( $MRTS_{LK}$ ) exceeds the relative price of labor in terms of capital ( $P_L/P_K$ ), then
  - a. the firm's long-run average cost curve is rising.
  - b. the firm is producing its output at the least possible cost, but the firm should reduce its output level to increase its profits.
  - c. the firm has increased its output level beyond the point of diminishing marginal returns.
  - d. **the firm needs to use less capital and more labor to reach its expansion path.**
  
5. A competitive firm will shut down its operations in the short run when the market price falls below its
  - a. marginal revenue.
  - b. marginal cost.
  - c. average cost.
  - d. **average variable cost.**
  
6. In the long-run, a firm will exit the industry if the market price is less than its
  - a. **break-even price.**
  - b. shutdown price.
  - c. marginal cost.
  - d. fixed cost.
  
7. Which of the following best summarizes the essence of the Invisible Hand Theorem?
  - a. Competitive markets guarantee that any shortages or surpluses existing in an economy will be quickly eliminated.
  - b. Of all the possible economic systems, competitive markets are the most philosophically compatible with democracy and freedom.
  - c. **Within competitive markets, people who selfishly pursue their own interests end up achieving a socially desirable outcome.**
  - d. The social gain created by competitive markets is second only to what a hypothetical benevolent dictator could achieve.
  
8. In an Edgeworth box, a point where two indifference curves are tangent represents
  - a. the initial endowment point.
  - b. an allocation that both consumers prefer to the initial endowment.
  - c. a competitive equilibrium.
  - d. **a Pareto-optimal allocation of goods.**

9. In an Edgeworth box, points within the region of mutual advantage represent allocations that
- can be achieved by a competitive market.
  - both consumers prefer to the initial endowment.**
  - exhaust the potential gains from trade.
  - are Pareto optimal.
10. A monopoly will always operate
- on the elastic portion of the demand curve.**
  - on the inelastic portion of the demand curve.
  - where the demand curve crosses the average cost curve.
  - where price equals marginal cost.
11. When first-degree price discrimination is perfectly implemented
- social gain is maximized, with all gains going to the monopoly.**
  - consumers' surplus and producer's surplus are both larger than in the case of simple monopoly.
  - the resulting deadweight loss is larger than if the monopoly did not price discriminate.
  - the consumer's and producer's gains from trade are identical to those in a competitive market.
12. Senior citizen and student discounts on tickets at movies theaters are examples of
- First-degree price discrimination.
  - Second-degree price discrimination.
  - Third-degree price discrimination.**
  - A two-part tariff.
13. A vertical merger, like the merger of Seagate and Dell, would be attractive
- only to Dell because it then avoids paying monopoly prices to Seagate.
  - only to Seagate because it can then obtain two monopoly rents.
  - to both Seagate and Dell but not to consumers who would find no difference in their welfare.
  - to Seagate, Dell and consumers , all of whom would stand to benefit in some way.**
14. The practice of a firm setting a price so low that all firms incur losses is called
- a tournament.
  - predatory pricing.**
  - a buy-out strategy.
  - a contestable market.
15. In the Cournot model of oligopoly, firms produce
- the competitive quantity.
  - the monopoly quantity.
  - more than the monopoly quantity, but less than the competitive quantity.**
  - less than the monopoly quantity.
16. When both players in a game play a dominant strategy, the outcome will be
- Pareto optimal.
  - a Prisoner's Dilemma.
  - a Stackelberg equilibrium.
  - the game's only Nash equilibrium.**

**B. 10 points. Use the following information for questions 17 through 21.**

(2 points each)

A firm has the production function  $\sqrt{KL}$ . Using calculus, the  $MPL = 1/2L^{-1/2}K^{1/2}$ , and the  $MPK = 1/2L^{1/2}K^{-1/2}$ . The wage rate is \$2 per hour and the rental rate is \$8 per hour. The firm decides to set output equal to 8 units.

17. What is the optimal level of K? 4

18. What is the optimal level of L? 16

19. What are the firm's total costs? 64

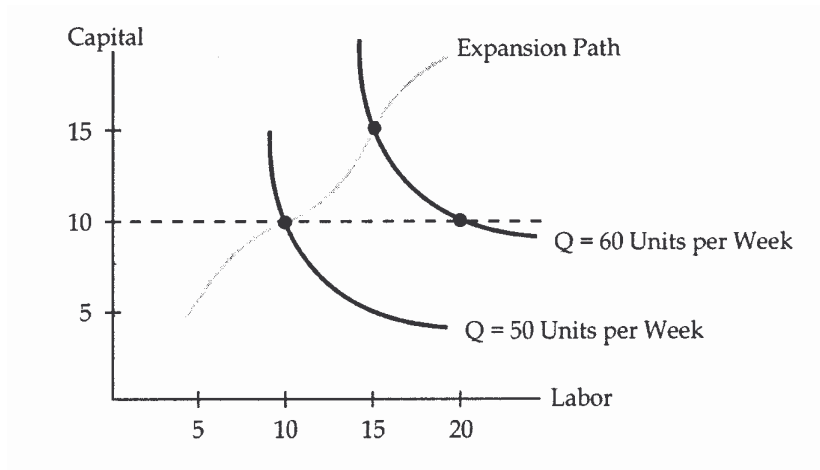
20. Graph the entire situation below. Label both curves, including endpoints, and indicate the optimal bundle.

Isocost eq:  $64 = 2L + 8K$ , y-intercept is  $(0,8)$ ; x-intercept is  $(32,0)$   
 Optimal point  $(16,4)$

21. Does this production function  $Q = \sqrt{KL}$  exhibit increasing, decreasing, or constant returns to scale? (Circle One)

**C. 8 points. Use the following information for questions 22 through 25.**  
 (2 points each)

Refer to the diagram below. The wage rate ( $P_L$ ) is assumed to be \$15 per hour, the capital rental rate ( $P_K$ ) is assumed to be \$10 per hour, and capital is assumed to be fixed in the short run at 10 units.



22. What is the short-run *total* cost of producing 60 units of output per week? \$400

23. What is the long-run *average* cost of producing 60 units of output per week? \$6.25

24. What is long-run *average* cost of producing 50 units of output per week? \$5

25. Currently, this firm is experience decreasing returns to scale. Suppose instead that this firm was experiencing *constant* returns to scale. In this case, rather than rising from 50 to 60 units per week, output would rise from 50 units per week to 75 if both capital and labor inputs were increased from 10 to 15 units.

**D. 12 Points. Use the following information for questions 26 through 31.**  
 (2 points each)

Consider a competitive constant-cost industry in which each firm's marginal and average costs are given by the formulas  $MC=4q$  and  $AC= 2q + 50/q$ .

26. Determine the quantity supplied by each firm in long-run equilibrium. 5

27. Determine the firms' break-even price. \$20

Suppose the market demand for the good produced by this industry is given by the formula  $P=320 - 2Q$ , where P is the market price and Q is the market quantity.

28. If the industry is in long-run competitive equilibrium, what is the market quantity? 150

29. How many firms will be in the industry? 30

Suppose that industry demand increases to  $P= 330 - 2Q$ . In the short run it is impossible to manufacture any more units.

30. What will the price of the units be? \$30

31. How much profit will each firm earn? \$50

**E. 20 Points. Use the following information for questions 32 through 41.**

(2 points each)

In the widget industry, each firm has **fixed costs of \$10**, and has the following marginal cost and demand structure:

Firm Marginal Cost		Space for scrap work			Industry Demand		
q	MC	TC	ATC	Supply 6 firms*q	Price	Q (old demand)	Q' (new demand)
1	2	12	12	6	2	60	96
2	4	16	8	12	4	48	84
3	5	21	7	18	5	36	72
4	7	28	7	24	7	24	60
5	11	39	7.8	30	11	12	48
6	13	52	8.66	36	13	0	36

Suppose the industry is initially in long-run equilibrium and faces demand Q (old demand).

32. What is the initial equilibrium price of a widget (P) ? \$7

33. What is each firm's output (q) ? 4

34. How many firms are in the industry? 6

\*\*\* Now demand shifts such that we match industry supply with the new Quantity Q' (new demand).

35. In the short run, what is the new price of widgets (P)? \$13

36. In the short run, what is the quantity of widgets produced by each firm (q)? 6

37. In the short run, how many firms are producing widgets? 6

38. In the short run, how much profit are the firms earning? \$26

39. In the long run, what is the new price of widgets (P)? \$7

40. In the long run, what is the quantity of widgets produced by each firm (q)? 4

41. In the long run, how many firms are producing widgets? 15

**F. 20 Points. Use the following information for questions 42 through 50.**

(Questions 1-8 are worth 2 points each, question 9 is worth 4 points.)

On our first midterm, the demand and supply equations were given by the following equations:

Demand equation:  $Q = -60P + 270$  ( $P = 4.5 - 1/60 Q$ )

Supply equation:  $Q = 30P$  ( $P = 1/30Q$ )

Using these equations, we found the equilibrium price and quantity to be  $P = \$3$ ,  $Q = 90$ .

42. What is the consumer surplus at this original price and quantity? \_\_\_\$67.5\_\_\_

43. What is the producer surplus at this original price and quantity? \_\_\_\$135\_\_\_

44. What is the total social welfare? \_\_\_\$202.5\_\_\_

We then looked at the effect of a \$3 excise tax. We found the new market price to be \$4 and new quantity to be 30.

45. What is the post-tax consumer surplus? \_\_\_\$7.5\_\_\_

46. What is the post-tax producer surplus? \_\_\_\$15\_\_\_

47. What is the tax revenue collected by the government? \_\_\_\$90\_\_\_

48. Assume the tax revenue is re-distributed as welfare payments. What is the post-tax social welfare? \_\_\_\$112.5\_\_\_

49. How much deadweight loss is created by this tax? \_\_\_\$90\_\_\_

50. Illustrate these effects graphically. Label post-tax consumer surplus (A), post-tax producer surplus (B), tax revenue (C), and deadweight loss (D).

*A: triangle above 4 to 4.5 on y and out to 30 units on X*

*B: triangle below  $p=1$  to 0 on y and out to 30 units on X*

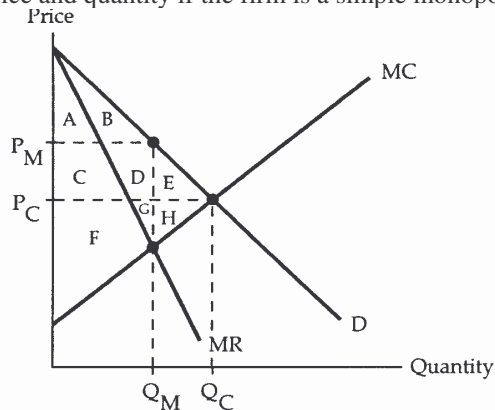
*C: rectangle between 1 and 4 and y and out to 30 units on X*

*D: triangle between 30 and 90 units on X below demand and above old supply*

**G. 5 Points. Use the following information for questions 51 through 55.**

(1 point each)

$P_C$  and  $Q_C$  are the equilibrium price and quantity if the firm behaves competitively, and  $P_M$  and  $Q_M$  are the equilibrium price and quantity if the firm is a simple monopoly.



51. What area represents the producer's surplus earned in the monopoly equilibrium? \_\_\_CDFG\_\_\_

52. Suppose this firm initially acted competitively. If the firm switched to the monopoly equilibrium, how much deadweight loss would be created?  $EH$

53. The difference between producer's surplus as a monopolist and producer's surplus if the price was set at the competitive equilibrium is :  $CD-H$

54. Relative to the surplus they would receive in a competitive market, consumers lose how much surplus because there is a monopoly?  $CDE$

55. Suppose the firm could sell some of its product in a different city for the competitive market price. Should the firm sell more or less than  $Q_m$  in its local market?  $LESS$

**H. 10 Points. Use the following information for questions 56 through 60.**

(2 points each)

The following questions refer to the game matrix below.

Player A can play the strategies UP, MIDDLE, and DOWN.

Player B can play the strategies LEFT, MIDDLE and RIGHT.

Payoffs are in the form (A, B) where the first payoff in square is the payoff for player A and the second is for player B.

		B		
		L	M	R
A	U	<b>5,3</b>	<b>4,4</b>	<b>3,3</b>
	M	<b>3,2</b>	<b>0,0</b>	<b>5,4</b>
	D	<b>1,1</b>	<b>2,2</b>	<b>7,1</b>

56. List any Nash Equilibrium for the game:  $(U,M)$

57. How many Pareto Optimum are there? 2  $(M,R)$  &  $(D,R)$  Draw the diagram of Pareto Optimum below.

58. Does any player have a dominant strategy? If so, list the (Player, strategy) :  $NO$

59. What is the outcome if the game is played sequentially with player A going first?  $(M,R)$

60. What is the outcome if the game is played sequentially with player B going first?  $(U,M)$

$(0,0) \rightarrow (1,1) \rightarrow (2,2) \rightarrow (3,2) \rightarrow (3,3) \rightarrow (4,4) \rightarrow (5,4)$   
 $\rightarrow (7,1) \qquad \qquad \qquad \rightarrow (5,3) \rightarrow (5,4)$