

## Exam Three

Name \_\_\_\_\_

### Chapter 9

1. (5 pts) What is the socially desirable price for a natural monopoly to charge? Why will a natural monopoly that attempts to charge the socially optimal price invariably suffer an economic loss?

2. (15 pts) Suppose that an airline has a monopoly on direct flight service from Chicago to Shanghai, China. The demand curve for regular coach tickets during the summer is  $P = 2600 - 5Q$ , where  $P$  is the price of a ticket in dollars and  $Q$  is the number of tickets sold each day. The demand for tickets the rest of the year is  $P = 2000 - 5Q$ . The marginal cost of an additional passenger, regardless of the season, is \$200.

a. **Graph** the demand curve during the summer and for the rest of the year.

b. **Graph** the marginal cost curve for both markets.

c. Derive and **graph** the marginal revenue curve during the summer and for the rest of the year.

d. What price should the airline charge during the summer and for the rest of the year to maximize profits? How many tickets will be sold?

3. (20 pts) Suppose a monopolist faces a demand curve given by  $P = 30 - Q$ , with marginal cost curve  $MC = Q$ .

a. Derive equilibrium price and quantity.

b. Derive and **graph** producer surplus, consumer surplus, and total economic surplus.

c. Derive and **graph** the deadweight loss due to monopoly

4. (10 pts) Suppose the monopolist in Problem 3 can perfectly price discriminate.

a. Derive producer surplus, consumer surplus, and total economic surplus. Compare to the previous values.

b. Is there any deadweight loss due to monopoly now? Why or why not?

Chapter 11

5. (10 pts) Suppose the supply curve of boom box rentals on Golden State Park is given by  $P = 10 + 0.1 Q$ , where  $P$  is the daily rent per unit in dollars and  $Q$  is the number of units rented in hundreds per day. The demand curve for boom boxes is  $P = 25 - 0.2 Q$ .

a. If each boom box imposes \$3 per day in noise costs on others, by how much will the equilibrium number of boom boxes rented exceed the socially optimal number?

b. How would the imposition of a tax of \$3 per unit on each daily boom box rental affect efficiency in this market?

6. (5pts) Suppose the law says that Jones may not emit smoke from his factory unless he gets permission from Smith, who lives downwind. If the relevant costs and benefits of filtering the smoke from Jones's production process are as shown in the following table, and if Jones and Smith can negotiate with one another at no cost, will Jones emit smoke?

	<b>Jones emits smoke</b>	<b>Jones does not emit smoke</b>
Surplus for Jones	\$200	\$160
Surplus for Smith	400	450

Chapter 13

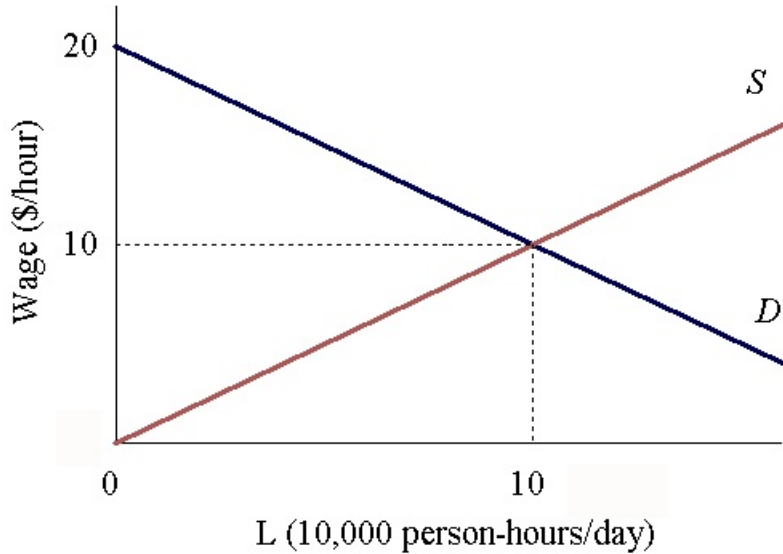
7. (10 pts) Stone, Inc., owns a clothing factory and hires workers in a competitive labor market to stitch cut denim fabric into jeans. The fabric required to make each pair of jeans costs \$10. The company's weekly output of finished jeans varies with the number of workers hired, as shown in the following table:

<b>Number of workers</b>	<b>Jeans (pairs per week)</b>	<b>MP (pairs per worker)</b>	<b>VMP (\$/wk)</b>
0	0		
1	25		
2	45		
3	60		
4	72		
5	80		
6	85		

a. If the jeans sell for \$40 a pair, and the competitive market wage is \$250 per week, how many workers should Stone hire? How many pairs of jeans will the company produce each week?

b. If the price of jeans rises to \$50, how many workers will the company now hire?

8. (15 pts) Suppose the demand and supply curves for unskilled labor in the Corvallis labor market are shown in the figure below. By how much will the imposition of a minimum wage at \$15 per hour reduce total economic surplus? Calculate and **graph** the amounts by which employer surplus and worker surplus change as a result of the minimum wage.



9. (10 pts) Describe an earned-income tax credit for workers (and a tax on employers that would raise enough money to pay for it) that would make both workers and employers better off than under the minimum wage.

On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam.

Signature \_\_\_\_\_

## Exam Three Solutions

### Chapter 9

1. (5 pts) What is the socially desirable price for a natural monopoly to charge? Why will a natural monopoly that attempts to charge the socially optimal price invariably suffer an economic loss?

*Answer:* The socially desirable price to charge is the one at which the marginal benefit to consumers equals the marginal cost of production. However, natural monopolies usually have very large fixed costs and relatively low marginal costs. The high fixed costs mean that average cost is greater than marginal cost, so that charging a price equal to marginal cost implies economic losses.

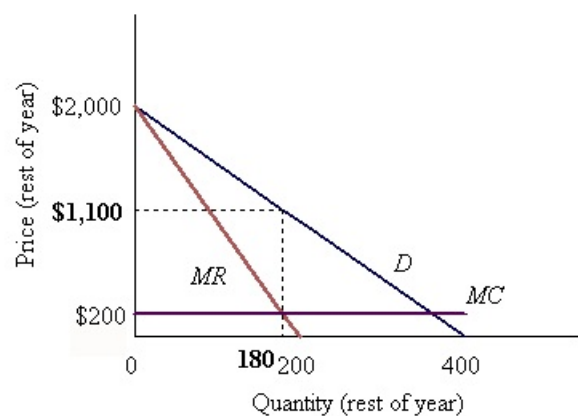
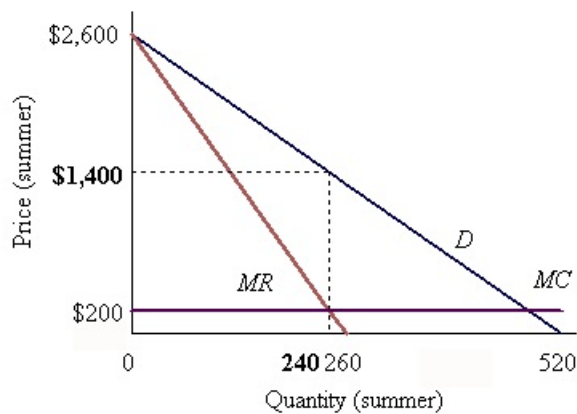
2. (15 pts) Suppose that an airline has a monopoly on direct flight service from Chicago to Shanghai, China. The demand curve for regular coach tickets during the summer is  $P = 2600 - 5Q$ , where  $P$  is the price of a ticket in dollars and  $Q$  is the number of tickets sold each day. The demand for tickets the rest of the year is  $P = 2000 - 5Q$ . The marginal cost of an additional passenger, regardless of the season, is \$200.

a. **Graph** the demand curve during the summer and for the rest of the year.

b. **Graph** the marginal cost curve for both markets.

c. Derive and **graph** the marginal revenue curve during the summer and for the rest of the year.

*Answer:* The marginal revenue curves are  $MR = 2600 - 10Q$  during the summer and  $MR = 2000 - 10Q$  during the rest of the year.



d. What price should the airline charge during the summer and for the rest of the year to maximize profits? How many tickets will be sold?

*Answer:* The airline should pick quantity to set marginal revenue equal to marginal cost in each market and then set price for that quantity based on the demand curve for each market:  
 $2600 - 10Q = 200$  yields  $Q = 240$  tickets, so  $P = 2600 - 5Q = 2600 - 1200 = \$1,400$  during the summer, and  $2000 - 10Q = 200$  yields  $Q = 180$  tickets, so  $P = 2000 - 5Q = 2000 - 900 = \$1,100$  for the rest of the year.

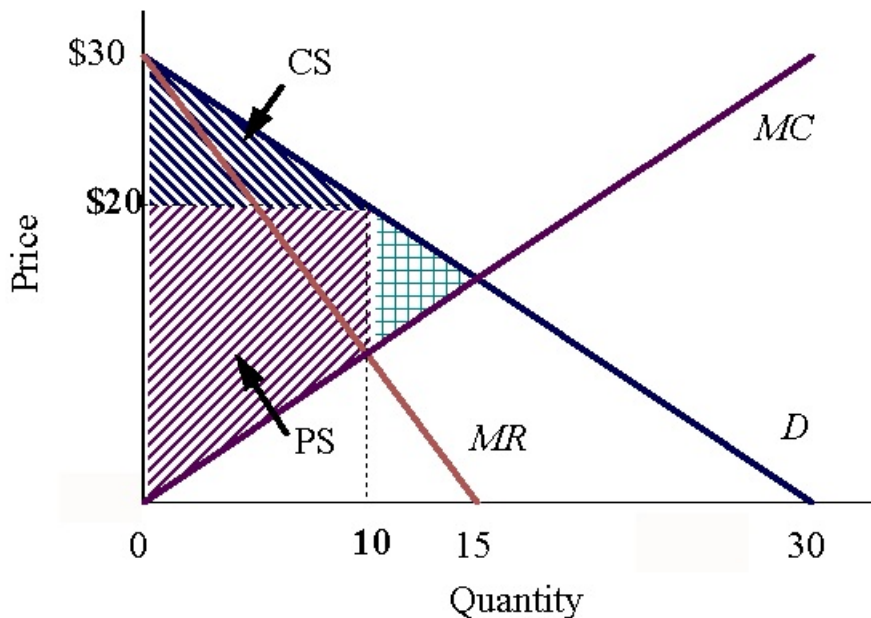
3. (20 pts) Suppose a monopolist faces a demand curve given by  $P = 30 - Q$ , with marginal cost curve  $MC = Q$ .

a. Derive equilibrium price and quantity.

*Answer:* Marginal revenue is  $MR = 30 - 2Q$ . The equilibrium quantity is found by setting  $MR = MC$  so  $30 - 2Q = Q$  gives  $Q = 10$ . The equilibrium price is  $P = 30 - Q = 30 - 10 = \$20$ .

b. Derive and **graph** producer surplus, consumer surplus, and total economic surplus.

*Answer:* Producer surplus is  $(\$20 - 10) \cdot 10 + (\$20 - 0) \cdot (10)/2 = \$150$ . Consumer surplus is  $(\$30 - 20) \cdot 10/2 = \$50$ . Total economic surplus is  $150 + 50 = \$200$ .



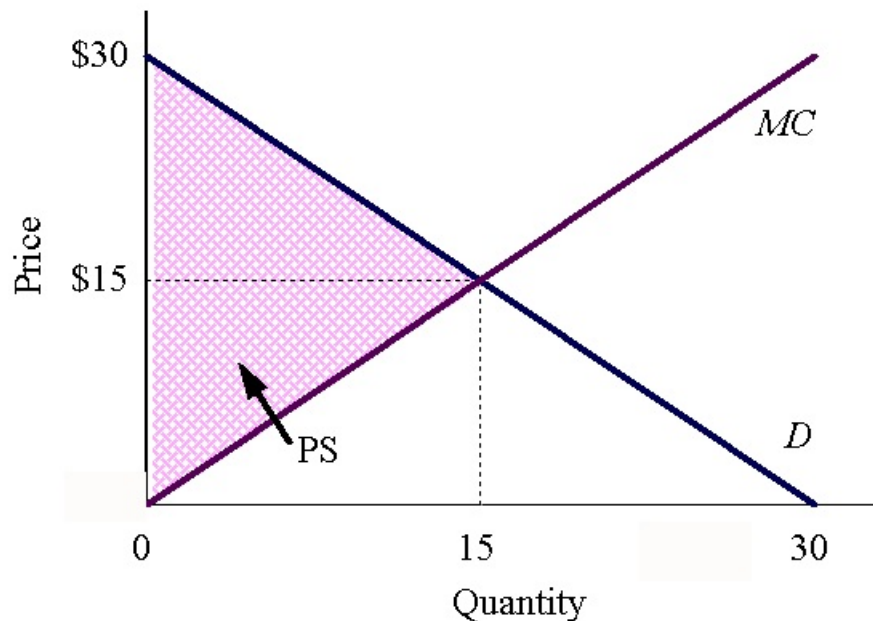
c. Derive and **graph** the deadweight loss due to monopoly

*Answer:* The deadweight loss is the triangular area  $(20 - 10) \cdot (15 - 10)/2 = \$25$ , which is the difference between fully efficiency and total economic surplus with the monopoly  $(\$30 - 0) \cdot 15/2 - 200 = \$25$ .

4. (10 pts) Suppose the monopolist in Problem 3 can perfectly price discriminate.

a. Derive producer surplus, consumer surplus, and total economic surplus. Compare to the previous values.

*Answer:* The perfectly-discriminating monopolist charges the reservation price for each consumer whose reservation price exceeds marginal cost, in this case  $Q = 15$ , and thus captures the full economic surplus. Producer surplus is total economic surplus of  $(\$30 - 0) 15/2 = \$225$ , and consumer surplus is zero. Producer surplus rises by \$75, consumer surplus falls by \$50, and total economic surplus rises by \$25.



b. Is there any deadweight loss due to monopoly now? Why or why not?

*Answer:* No, there is not any deadweight loss due to the monopoly. By being able to charge each customer their reservation price, a perfectly-discriminating monopolist escapes the troubles of a single price monopolist. Selling an additional unit does not require lowering the price of other units, so marginal revenue is the price, not less than the price. Therefore, a perfectly-discriminating monopolist is willing to sell all units for which the buyer's valuation exceeds the monopolists' marginal cost and achieves full efficiency.

Chapter 11

5. (10 pts) Suppose the supply curve of boom box rentals on Golden State Park is given by  $P = 10 + 0.1 Q$ , where  $P$  is the daily rent per unit in dollars and  $Q$  is the number of units rented in hundreds per day. The demand curve for boom boxes is  $P = 25 - 0.2 Q$ .

a. If each boom box imposes \$3 per day in noise costs on others, by how much will the equilibrium number of boom boxes rented exceed the socially optimal number?

*Answer:* The equilibrium quantity of boom box rentals is found by solving  $10 + 0.1 Q = 25 - 0.2 Q$  for  $Q_{\text{pvt}} = 50$  units per day. To find the socially optimal number of rentals we first find the Social MC curve by adding the \$3 per unit noise cost to the Private MC curve to get Social MC =  $13 + 0.1 Q$ . Equating Social MC to demand, we have  $13 + 0.1 Q = 25 - 0.2 Q$ , which solves for  $Q_{\text{soc}} = 40$  units per day, or 10 less than the equilibrium number.

b. How would the imposition of a tax of \$3 per unit on each daily boom box rental affect efficiency in this market?

*Answer:* Imposition of this tax would shift the Private MC curve upward by \$3 per unit, making it identical to the Social MC curve. The socially optimal number of boom boxes would be rented, resulting in an overall increase in efficiency in this market.

6. (5pts) Suppose the law says that Jones may not emit smoke from his factory unless he gets permission from Smith, who lives downwind. If the relevant costs and benefits of filtering the smoke from Jones's production process are as shown in the following table, and if Jones and Smith can negotiate with one another at no cost, will Jones emit smoke?

	<b>Jones emits smoke</b>	<b>Jones does not emit smoke</b>
Surplus for Jones	\$200	\$160
Surplus for Smith	400	450

*Answer:* The most efficient outcome is for Jones to not emit smoke, because the total daily surplus in that case will be \$610, compared to only \$600 when Jones emits smoke. The most Jones would be willing to pay Smith is \$40 to be able to emit smoke, but Smith would need to be paid at least \$50 to agree.

## Chapter 13

7. (10 pts) Stone, Inc., owns a clothing factory and hires workers in a competitive labor market to stitch cut denim fabric into jeans. The fabric required to make each pair of jeans costs \$10. The company's weekly output of finished jeans varies with the number of workers hired, as shown in the following table:

Number of workers	Jeans (pairs per week)	MP (pairs per worker)	VMP (\$/wk)
0	0		
1	25	25	750
2	45	20	600
3	60	15	450
4	72	12	360
5	80	8	240
6	85	5	150

a. If the jeans sell for \$40 a pair, and the competitive market wage is \$250 per week, how many workers should Stone hire? How many pairs of jeans will the company produce each week?

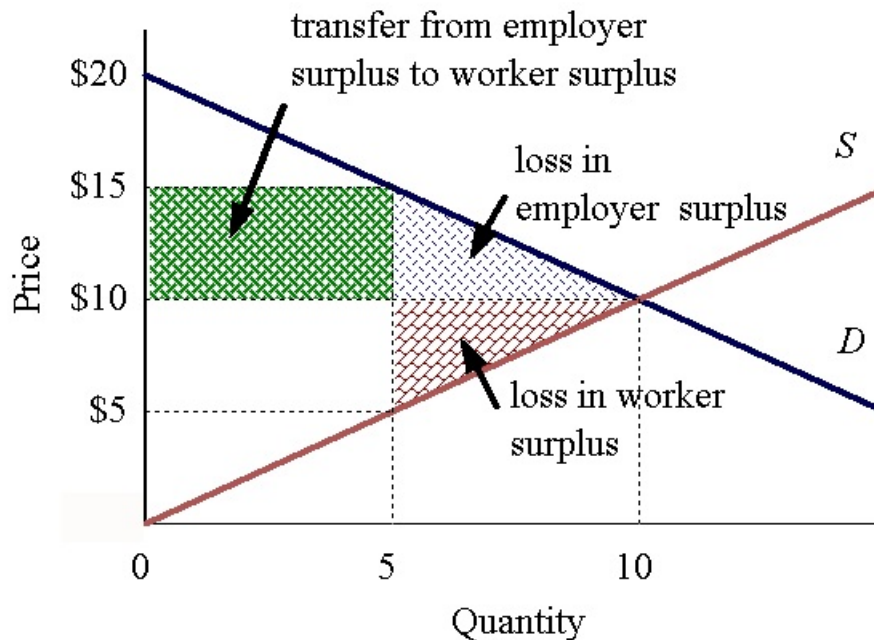
*Answer:* After deducting the \$10 cost of the fabric, the company receives \$30 from the sale of each pair of jeans. The marginal product of labor and the value of the marginal product of labor are shown on the table. Since the market wage is \$250/wk, it is not worthwhile to hire the fifth worker, whose VMP is only \$240/wk. The firm hires 4 workers and produces 72 pairs of jeans per week.

b. If the price of jeans rises to \$50, how many workers will the company now hire?

*Answer:* The final column of the table now has VMPs of 1000, 800, 600, 480, 320, and 200. Stone will now hire a fifth worker.

8. (15 pts) Suppose the demand and supply curves for unskilled labor in the Corvallis labor market are shown in the figure below. By how much will the imposition of a minimum wage at \$15 per hour reduce total economic surplus? Calculate and **graph** the amounts by which employer surplus and worker surplus change as a result of the minimum wage.

*Answer:* Without a minimum wage, both employers and workers would enjoy economic surplus of \$10  $(100,000/\text{day})/2 = \$500,000/\text{day}$ . With a minimum wage set at \$15/hr, employer surplus falls to  $(\$20 - 15) (50,000/\text{day})/2 = \$125,000/\text{day}$ , and worker surplus rises to  $\$5 (50,000/\text{day})/2 + \$10 (50,000/\text{day}) = \$625,000/\text{day}$ . The minimum wage thus reduces employer surplus by \$375,000/day, and increases worker surplus by \$125,000/day. The net reduction in surplus is a deadweight loss of  $\$125,000 - \$375,000 = (\$15 - \$5) (100,000 - 50,000/\text{day})/2 = \$250,000/\text{day}$ .



9. (10 pts) Describe an earned-income tax credit for workers (and a tax on employers that would raise enough money to pay for it) that would make both workers and employers better off than under the minimum wage.

*Answer:* The government would have to offer a tax credit worth at least \$1.40/hr for each of the 100,000 person-hours of employment to match the additional \$140,000/day of worker surplus. Because employer surplus is \$180,000/day lower under the minimum wage than under the earned-income tax credit, employers would be willing to pay a tax up \$180,000 to avoid the reduction in their surplus due to the minimum wage, an amount sufficient to finance the earned-income tax credit required and make workers and employers better off.