

# Sample exam (with answers)

## Section 1. Multiple choice questions

You have 60 minutes to do this part of the exam.

**Marking scheme:** 1 point for a correct answer, 0 if the answer has not been given.

- Dead weight loss occurs in
  - Monopolistic competition
  - Monopoly
  - Oligopoly
  - All of the above**
  - Only some (but not all) of the above

		Firm X	
Firm Y		Advertise	Status Quo
	Advertise	X: \$4 mln Y: \$4 mln	X: \$1 mln Y: \$6 mln
	Status Quo	X: \$6 mln Y: \$1 mln	X: 5 mln Y: 5 mln

- In the table above if these firms do not collude, the outcome will be:
  - Both firms maintain the status quo
  - Both firms advertise**
  - Firm X advertises and Firm Y maintains the status quo
  - Firm Y advertises and Firm X maintains the status quo
  - It's impossible to determine outcome in this situation
- The kinked demand model demonstrates that
  - Oligopoly prices tend to be sticky
  - Each firm believes its rivals will not respond when it increases its price
  - The demand curve for a firm becomes less elastic when price decreases
  - I only
  - I and II only
  - I and III only
  - II and III only
  - I, II and III**
- Consider two rival producers of camera film, Kodak and Fuji. Each firm can undertake one of two strategies, Research or No Research. The film producers have the following matrix of profits, depending on each firm's actions. Profits are given in \$millions. The first entry in each box corresponds to Fuji's profits while the second entry corresponds to Kodak's profits.

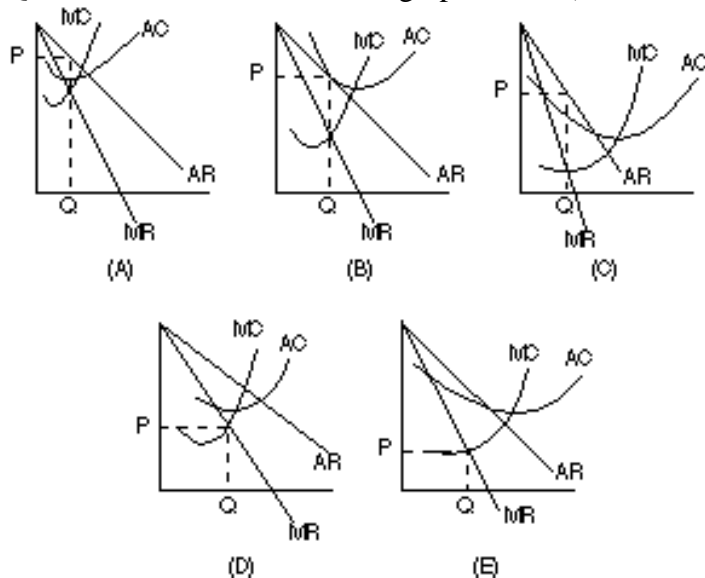
		Kodak	
		No Research	Research
Fuji	No Research	<b>\$100; \$100</b>	<b>\$0; \$150</b>
	Research	<b>\$150; \$0</b>	<b>\$80; \$80</b>

Which of the following is TRUE?

- In Nash equilibrium both Fuji and Kodak choose "No Research".
- Fuji will choose "No Research" regardless of what Kodak does.
- Kodak will choose "No Research" regardless of what Fuji does.
- None of the above is true.**
- All of the above are true.

5. The main difference between perfect competition and monopolistic competition is the following:
- A. In monopolistic competition, each firm faces a horizontal demand curve.
  - B. In perfect competition, the number of producers is very small. In monopolistic competition, it is large.
  - C. In perfect competition, the product/service is very homogeneous among producers while it is not in monopolistic competition.**
  - D. In monopolistic competition, monopolies own the firms.
  - E. The total demand that perfectly competitive industries face is very small.
6. Which of the following is a feature of long-run equilibrium in a monopolistically competitive market?
- A. The industry output level is efficient.
  - B. Firms produce differentiated products.**
  - C. Each firm makes negative accounting profits.
  - D. Each firm produces at the minimum of its average cost curve.
  - E. Each firm makes positive economic profits.

Questions 7 and 8 refer to the graph below (note that AR denotes the demand curve).



7. Which graph shows the long-run profit maximizing position for a monopolistic competitor?
- A. A
  - B. B**
  - C. C
  - D. D
  - E. E
8. Which graph in Figure 3 shows a profit maximizing natural monopoly?
- A. A
  - B. B
  - C. C**
  - D. D
  - E. E
9. A credible threat in strategic interactions is best defined as:
- A. A threat of legal action
  - B. A threat that has been brought to action at least once before
  - C. A threat that, if brought to action, significantly affects the well-being of the punished agent
  - D. A threat that is the best option for the punisher when punishment conditions appear**
  - E. A publicly announced threat

10. Which of the following industries may operate at zero economic profits?
- A regulated monopoly
  - A monopolistic competition
  - An oligopoly
  - D. All of the above**
  - None of the above
11. A dominant strategy is the one that:
- Implies manipulation over the other player's actions, direct or indirect
  - B. Brings the highest possible payoff for every action chosen by other players**
  - Brings a first-mover advantage
  - Constitutes a best response on the equilibrium strategy of the other player
  - Brings a payoff higher than that of the other player
12. As an oligopolistic industry moves into a cartel:
- Social efficiency decreases
  - Overall output increases
  - Profits increase
  - D. More than one of the above**
  - None of the above
13. Monopoly is inefficient because :
- The monopolist produces where the price is greater than the marginal cost
  - The consumer pays more for an extra unit of production than it costs society
  - There is a dead weight loss
  - D. All of the above**
  - Monopoly is efficient because it can price-discriminate.
14. The requirements for price discrimination are:
- Seller must be a monopolist or have considerable monopoly power
  - Sellers must be capable of dividing consumers into different classes, each class having a different demand curve
  - Marginal costs of production for the different classes must be similar
  - Consumers charged a lower price must be incapable of reselling to consumers in the higher priced class
  - E. All of the above**
15. Which of these situations is not an example of price discrimination?
- A. John works nights so he has to buy bread at 7 a.m. rather than at 7 p.m.**
  - Bob receives a "\$1 off" coupon as a frequent buyer of this shop
  - Katie buys a pack of 4 Cokes for \$3 and Josh buys one Coke at a time for \$1
  - Velma likes to go to the movies at the lower afternoon matinee price and Rosemary would rather pay more for the evening show
  - Jason and Tierney go to a popular nightclub. Because it is "Ladies Night" Tierney pays no cover charge, but Jason must pay to enter the club
16. There is no dead weight loss in
- Perfect competition
  - Natural monopoly
  - Perfectly discriminating monopoly

- A. I only
- B. I and II only
- C. I and III only**
- D. II and III only
- E. I, II and III

17. What is (or are) the right regulation of natural monopoly and it's effect on the market (use the line number for your answer)?

Line number	Regulation	It's effect on the market
I	Limit price to the level of $D=LRMC$	The monopoly has a loss, but there is allocative efficiency
II	Limit price to the level of $D=LRAC$	The monopoly breaks even and there is allocative efficiency
III	Limit price to the level of $D=LRAC$	The monopoly has normal profits, but there is no allocative efficiency
IV	No need to regulate natural monopoly	There is allocative efficiency

- A. I only
- B. I and II only
- C. I and III only**
- D. I, II and III only
- E. IV only

18. Which of the following is a necessary condition for a monopoly to exist?

- A. Economies of scale over all relevant levels of output
- B. Any potential entrant to the industry would be unprofitable
- C. Monopoly is the most efficient structure for this industry
- D. More than one of the above
- E. None of the above**

19. The short-run marginal cost curve of a multi-plant monopolist is:

- A. A vertical sum of individual plants' SMC curves
- B. A horizontal sum of individual plants' SMC curves**
- C. The same as every individual plant's SMC curve
- D. The same as every individual plant's LMC curve
- E. Unrelated to the individual plants' SMC or LMC curves

20. A multi-plant monopolist differs from a corresponding competitive industry in that:

- A. It is technologically inefficient
- B. It is productively inefficient**
- C. Its number of plants can be adjusted in short-run
- D. More than one of the above
- E. None of the above**

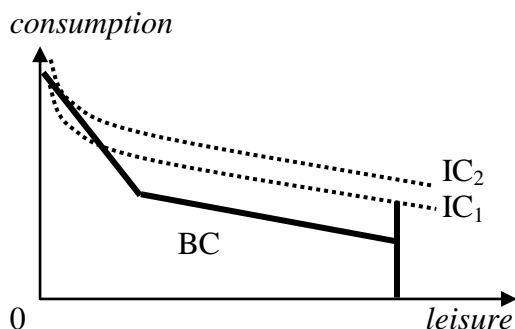
21. For a firm in monopolistic competition in the long run:

- A.  $P=MC$
- B.  $P=AC$**
- C.  $P=MR$
- D.  $MR=AC$
- E. None of the above

22. Which of these statements about the standard individual labor supply model is wrong?
- A. It usually treats labor as an economic “bad” (that is, “consuming” labor diminishes one’s utility).
  - B. It suggests consumption must always be a normal good.**
  - C. It uses the wage rate as the opportunity cost of spare time
  - D. It explains why raising wages may induce people to work more.
  - E. It explains why raising wages may induce people to work less.

**Answer: B. Note that (D) and (E) do not contradict each other.**

23. The following graph depicts the budget constraint and some indifference curves of an individual deciding how to allocate her time between labor and leisure:



Which of the following hypotheses is inconsistent with this graph?

- A. She has an opportunity to receive some unemployment benefit.
- B. She currently chooses to work.
- C. She is paid extra for overtime work.
- D. She has an initial endowment of goods that she can consume or sell.
- E. All statements are consistent with this graph.**

24. Involuntary unemployment will most likely occur when:

- A. One firm is the only employer in the region (a monopsony)
- B. Workers possess more human capital than their potential employers are ready to pay for
- C. Workers form a strong trade union in order to raise their wages**
- D. The government reduces unemployment benefits
- E. The government increases personal income taxes

25. If a firm possesses market power in both output and labor markets, the equilibrium amount of labor employed is determined by \_\_\_\_\_ and equilibrium wage is \_\_\_\_\_.

- A.  $L^D = L^S$ ; equal to  $P \cdot MP_L$ ;
- B.  $MRP_L = w$ ; equal to  $MRP_L$ ;
- C.  $MVP_L = MC_L$ ; equal to  $MC_L$ ;
- D.  $P/w = MP_L$ ; determined by labor demand;
- E.  $MRP_L = MC_L$ ; determined by labor supply;**

26. Consider two theories explaining wage differentials: human capital and signaling. Identify the statement about which those two theories would disagree:

- A. In the short run, the economy-wide supply of educated workers is almost perfectly inelastic.
- B. If every worker increases his educational attainment, the overall wage level must rise.**
- C. More able workers tend to be relatively more educated.
- D. An increase in demand for qualified workers will rise their wages in the short run, but in the long run the wage level will decline somewhat.
- E. All statements are consistent with both theories.

**Answer: B. According to human capital theories, that would raise productivity and hence, wages. According to signalling theories, that would just raise the average level of education, but not affect differences in education – which are the only thing that matters.**

27. Suppose a firm’s MVPL curve is horizontal, whereas its MRPL curve is downward-sloping.

Which of the following would be a complete explanation for that:

- A. This firm is a monopoly that acts as a price-taker on its labor market.
- B. This firm is a monopsony that acts as a price-taker on its output market.
- C. This firm is perfectly competitive on both output and input markets, but its product is a Giffen good.
- D. This firm is a monopoly that faces an effective minimum wage law on its labor market.
- E. This firm is a monopoly with no market power in the labor market, whose technology violates the law of diminishing marginal returns.**

28. Which of the following events would MOST LIKELY increase the market demand for construction workers?

- A. Immigration from third-world countries increases.
- B. Government starts to subsidize long-term bank loans for young families.**
- C. Construction machinery producers offer substantial discounts on their new equipment.
- D. Construction workers organize themselves into a powerful union
- E. A minimum wage law is enacted.

**Answer: B, since that would lead to increased demand for housing. Note that (E) could be true under a monopsony, and (C) could work if those factors were complementary.**

29. To produce its output, a competitive firm employs labor and capital, that it hires on competitive markets. If it acquires a new technology, which makes labor 20% more productive for any level of output, in the short run...

- A. It will employ more labor.
- B. It will employ less labor.
- C. It will employ less of both factors.
- D. It will increase its output.
- E. (A) and (D) are correct.**

30. Consider an industry that is perfectly competitive in its output market and in all input markets. Then the industry demand curve for labour is:

- A. Steeper than the horizontal sum of individual MRPL**
- B. Flatter than the horizontal sum of individual MVPL
- C. The vertical sum of individual MRPL
- D. More than one applies
- E. None applies

31. Consider a firm whose only input is labor. The following table summarizes all the information available to this firm:

1. L	3. $w(L)$	4. $Q(L)$	6. $P^D(Q(L))$
2. (# of workers)		5.	
7. 5	8. 1	9. 1	10. 10
11. 10	12. 1	13. 2	14. 8
15. 15	16. 2	17. 3	18. 6
19. 20	20. 3	21. 4	22. 4

Given the above data, we can tell that this firm will hire:

- A. 5 workers
- B. 10 workers**
- C. 15 workers
- D. 20 workers
- E. This firm will cease production.

**Answer: B. The fastest way would probably be to calculate profit for each possible L directly.**

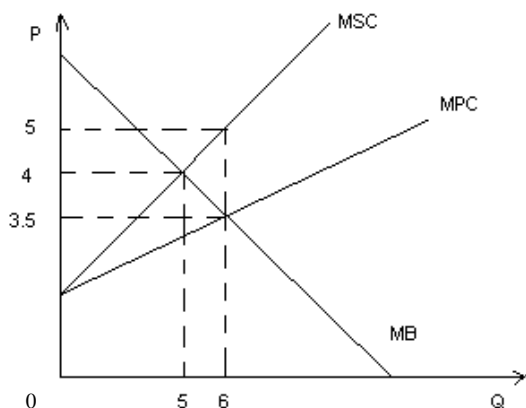
32. Which circumstances would decrease an industry's demand for labor?

- A. The price of a complementary resource rises.
- B. The government subsidizes the consumers of the output produced.
- C. The price of a substitute resource rises, and the output effect outweighs the substitution effect.**
- D. The government bans all imports of substitutes to the output produced.
- E. Labor productivity decreases.**

33. A firm finds that at its current level of output,  $q$ ,  $MP_L/P_L < MP_K/P_K$ . To minimize its costs of producing  $q$ , it will want to hire more \_\_\_\_\_ and less \_\_\_\_\_, which will increase \_\_\_\_\_ and decrease \_\_\_\_\_.

- A. labor; capital; output; total costs;
- B. capital; labor; profit; total costs;**
- C. labor; capital; MPL; MPK;
- D. capital; labor; MPK; MPL;
- E. capital; labor; PL; PK;

34. The graph below depicts a market for a particular good such that the production of the good imposes an externality.



Which of the following statements is TRUE?

- A. There is an external benefit in this industry.
- B. There is an external cost in this industry.**
- C. The market allocation is socially efficient.
- D. If we let the market determine how much of the good to produce, too little will be produced, relative to the output that is socially efficient.
- E. B and C.

35. The free rider problem refers to:

- A. situation when city government offers free bus riding during holidays.

B. situation in the Asia Minor when land was largely unfenced and riders have free access to private range land.

**C. situation in which consumers have no incentive to pay for a nonexcludable good.**

D. variation on the phrase, "There is no such thing as free lunch," which is replaced by, "There's no such thing as a free ride."

E. all of the above.

36. Suppose that good X is a (pure) public good. Then:

A. If we let the market decide how much X is produced, then in general we will have an efficient amount of X produced.

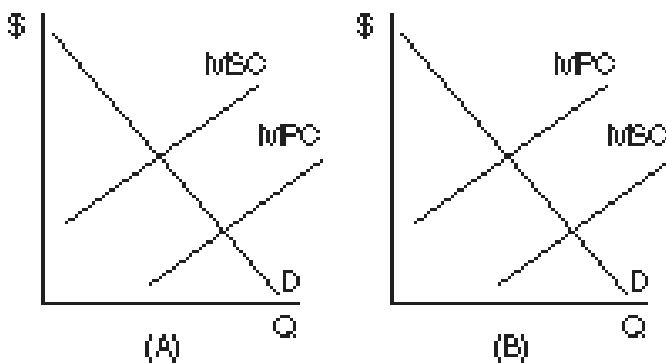
B. If one individual consumes X, then this will decrease how much of X another individual can consume.

**C. It is impossible, or very costly, to prevent an individual from consuming X.**

D. Only A and C.

E. A, B and C.

37. From the graph below we can conclude that



A. **Both graphs demonstrate the existence of externalities**

B. Both graphs demonstrate the existence of negative externalities

C. Both graphs demonstrate the existence of positive externalities

D. Graph A demonstrates inefficiency through underproduction

E. Graph B demonstrates inefficiency through overproduction

38. Which of the following is not an example of an activity that generates an externality?

**A. Bob's Car Repair Shop donates a car to charity.**

B. Bob's Car Repair Shop dumps used oil in the river.

C. Bob occasionally drives while drunk.

D. Bob renovates a run-down house in the neighborhood.

E. None of the above

Use the following information for questions 39 and 40:

You are given the following demand and supply curves for a market:

D:  $P = 10 - QD$

S:  $P = 2 + QS$

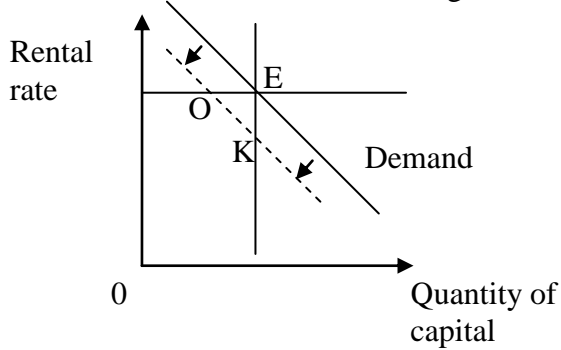
This market has a negative externality that results in an additional cost of \$2/unit for the producers. This externality is currently **NOT** being corrected in this market.

39. This market, if it does NOT correct for the externality, will have an equilibrium price equal to \_\_\_\_\_, an equilibrium quantity equal to \_\_\_\_\_, and (too much, too little, just the right amount) of the good.



- A. **\$6, 4 units, too much.**  
 B. \$4, 4 units, too much.  
 C. \$8, 4 units, just the right amount.  
 D. \$4, 6 units, too much.  
 E. \$6, 4 units, just the right amount.
40. If we internalize this externality and have producers pay for it, the new supply curve for the producers will be:  
 A.  **$P = 4 + QS$ .**  
 B.  $P = 2 + (1/2)QS$ .  
 C.  $P = 6 + QS$ .  
 D.  $P = 2 + 2QS$ .  
 E.  $P = 10 - 2QS$ .
41. Suppose government officials have set an emissions tax to reduce pollution. Further suppose that with the emissions tax, the marginal social cost of pollution exceeds the marginal social benefit of pollution. The emissions tax is:  
 A. optimal.  
 B. too high.  
 C. **too low.**  
 D. need exact numbers to determine  
 E. none of the above.
42. Which of the following embodies most of the characteristics of a pure public good?  
 A. Taking the Advanced Placement economics examination  
 B. **Street lights**  
 C. A new family car  
 D. A new book  
 E. All of the above
43. Which of the following events would most likely lead to an increase in the price of capital services to an economy in the long run?  
 A. The government cuts the unemployment benefits program.  
 B. Increased trust in the banking sector leads more people to keep their money on bank deposits.  
 C. **Severe climatic conditions result in a higher depreciation rate.**  
 D. Financial crisis causes a decline in domestic business activity.  
 E. New Central Bank policy leads to a drop in the nominal interest rate.
44. Which of the following events would increase an industry's demand for capital goods (or services)?  
 A. An earthquake has destroyed much of the country's capital assets  
 B. **That industry's output becomes more appreciated by consumers**  
 C. A new government has abolished all taxes on imported capital goods  
 D. More than one answer is correct  
 E. None of the above
45. Which of the following statements about capital supply is true:  
 A. An increase in demand for capital services would increase the supply of capital assets  
 B. The smaller the industry is, the steeper its short run capital supply curve would be  
 C. In long-run, capital services supply curve would be perfectly elastic  
 D. More than one answer is correct  
 E. **None of the above**

Questions 46 and 47 are based on the figure below:



46. If the demand for capital assets in a small industry decreases (guessing what the other lines represent) the short run equilibrium moves from point E to which of the following:
- K**
  - O
  - Stayed at E
  - Any point between O and K
  - None of the above
47. If the demand for capital assets in a small industry decreases (guessing what the other lines represent) the long run equilibrium moves from point E to which of the following:
- K
  - O**
  - Stayed at E
  - Any point between O and K
  - None of the above
48. On the market for capital assets in the long run, if the real interest rate decreases
- Demand curve shifts down
  - Demand curve shifts up**
  - Supply curve shifts down
  - Supply curve shifts up
  - Nothing happens, as interest rate doesn't influence the capital assets market
49. Which of the following best explains why the demand curve for a factor of production slopes downward?
- The law of diminishing returns**
  - The law of comparative advantage
  - Economies of scale
  - Decreasing returns to scale
  - None of the above
50. When the demand for long skirts increases, dressmakers are willing and able to buy more fabric at different rental rates. This is an example of
- Decreasing costs
  - Derived demand**
  - The law of demand
  - Increasing marginal utility
  - Increasing returns
51. The overall economy supply for land is

- A. Perfectly inelastic**
- B. Perfectly elastic
- C. Unit elastic
- D. Upward-sloping
- E. Downward-sloping

52. A purchase of government bond generates \$1 in perpetuity, beginning next year. An investment project generates \$22 in the next year and \$0 afterwards. If the interest rate is 10%, the price of government bond should be

- A. 2 times less than the investment for the project**
- B. 2.2 times less than the investment for the project
- C. 20 times less than the investment for the project
- D. 22 times less than the investment for the project
- E. More than the investment for the project

53. Microeconomic theory predicts that the person who will end up renting a particular piece of land will be...

- A. The one who would be ready to pay the required rental rate.
- B. The one who will earn the greatest amount of money from using the land.**
- C. The one who wants to farm it.
- D. The one who wants to resell it in the future.
- E. The one who has the lowest costs of production.

54. Consider the following statements about the land market:

- I. Since the supply of land is largely fixed, it could be supplied even at a zero rental rate – which means that current rental rates should decrease with time.
- II. Since the supply of land is largely fixed, and the demand for it is likely to grow together with our economic activity, in the long run equilibrium price of land will never decrease. That must make land the best non-financial asset for long-run investment.
- III. Inflation could bid down the price for which the landowner would be willing to sell land.

- A. Only I is correct.
- B. Only II is correct.
- C. Only III is correct.**
- D. Only II and III is correct.
- E. All statements are wrong.

**Answer: C. I would be true if there were no competition among buyers. II is wrong – yes, the price of land will grow, but there is no reason for it to grow faster than other assets' prices. III is correct, since the majority of possible uses for land take time before land owners can receive any income.**

## Section 2. Free response questions.

You will have a total of 60 minutes for this section of the exam. It is strongly recommended that you spend the first 10 minutes reading the exam carefully, and the next 50 minutes working on the questions.

**Please, start your answer for each question on a separate page.**

1. (35 points total) Nissan and General Motors compete to be the first to bring a fully electric family vehicle to the market. The profit for each company depends on whether the competitor succeeds in introducing a similar vehicle at the same time. The payoff matrix is given below, where the payoffs are annual profits in billions of dollars.

	GM: offer electric car	GM: do not offer electric car
Nissan: offer electric car	4.1                  6.2	4.6                  6.3
Nissan: don't offer electric car	4.2                  6.5	3.9                  5.8

A. (5 points) Does Nissan have a dominant strategy? If so, what is it? Explain your answer.

**Answer: No, it does not. If GM offers an electric car, Nissan should not offer one, since  $4.2 > 4.1$ . If, however, GM does not offer electric car, Nissan should, since  $4.6 > 3.9$ .**

**Marking scheme: 3 points answer, 2 points – explanation.**

B. (5 points) Does GM have a dominant strategy? If so, what is it? Explain your answer.

**Answer: No, it does not. If Nissan offers an electric car, GM should not offer one, since  $6.3 > 6.2$ . If, however, Nissan does not offer electric car, GM should, since  $6.5 > 5.8$ .**

**Marking scheme: 3 points answer, 2 points – explanation.**

C. (15 points) Find Nash equilibrium (equilibria) of this game.

**Answer: There are two pure strategy equilibria (where the first strategy is for Nissan and the second is for GM):  
(offer electric car, do not offer electric car) and (don't offer electric car, offer electric car).**

**Marking scheme: 15 points if answer is (offer electric car, do not offer electric car) and (don't offer electric car, offer electric car), with no other candidates named.**

**Only one equilibrium found correctly: 8 points;**

**Found other equilibria: minus 3 points each;**

**Equilibrium is written in payoffs, not strategies: minus 7 points;**

D. (10 points) Suppose the companies no longer make their decisions simultaneously. GM makes its decision first, and if it decides to offer an electric vehicle, announces its decision by investing in research and development and new production facilities. Nissan observes GM's decision, whatever it is, and makes its own choice of whether to offer electric car or not. Find the solution (solutions) of this game. Explain your answer.

**Answer: If Nissan knows that GM will offer an electric car, it would prefer not to offer one, since that decision would yield a higher payoff (4.2 vs. 4.1). GM knows this, so it knows that the decision to offer an electric car would give it 6.5. If GM does not offer an electric**

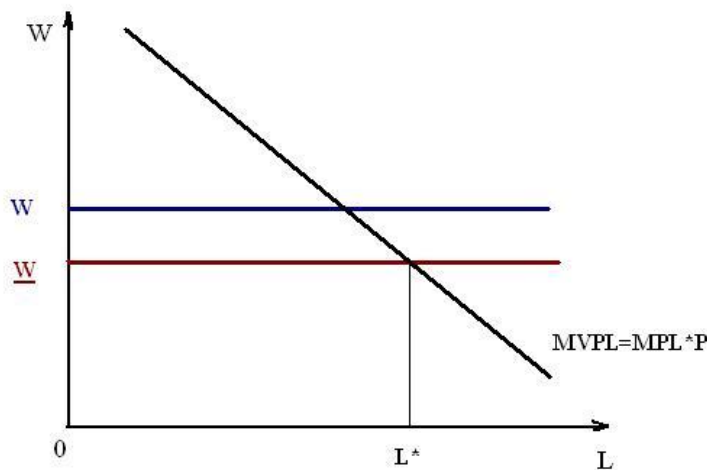
car, than it knows that Nissan would rationally choose to offer one (since for Nissan payoff of 4.6 exceeds payoff of 3.9), thus GM's payoff in this case would be only 6.3. Thus, the equilibrium is (GM offer electric car, Nissan does not offer electric car).

**Marking scheme: Correct answer: 5 points, Explanation: 5 points.**

2. (25 points total) The restaurant industry in Town is perfectly competitive, and so is Town's labour market for unskilled workers. The workers can receive wage  $W$  if they work outside of the restaurant industry, and wage  $\underline{W}$  plus tips if they work in the restaurant industry. The tips are equal to a fixed percentage of the meal price.

A. (10 points) Draw a graph to illustrate a restaurant's decision of how much labour to employ. Show also labour supply for a typical firm outside of the restaurant industry.

**Answer:**



**Marking Scheme:**

The graph is generally correct with all the markings in place (labour supply and demand functions slope the way they should in the perfectly competitive case): 5 points;

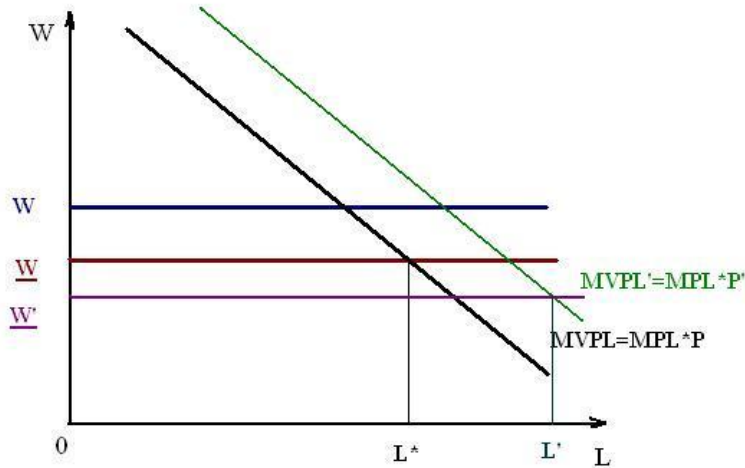
There are 2 correctly positioned labour supply functions: + 3 points;

The equilibrium labour quantity marked: +2 points.

**If labour supply is at the industry level – cut points by a third.**

B. (15 points) Suppose the price of the meal increases. What would you expect to happen to the amount of labour a restaurant would wish to hire? Would you expect any changes to occur to the restaurants' supply of labour? Illustrate your answer with a graph. (Also show labour supply for a typical firm outside of the restaurant industry.)

**Answer:**



Both labour demand and labour supply shift if the price of a meal changes. Labour supply shifts because it depends on the tips the waiters can get, which are a fixed proportion of the meal's price. Thus, the quantity of labour hired increases to  $L'$ .

**Marking Scheme:**

**Graph is properly marked: 3 points;**

**Only shift labour demand: plus 5 points;**

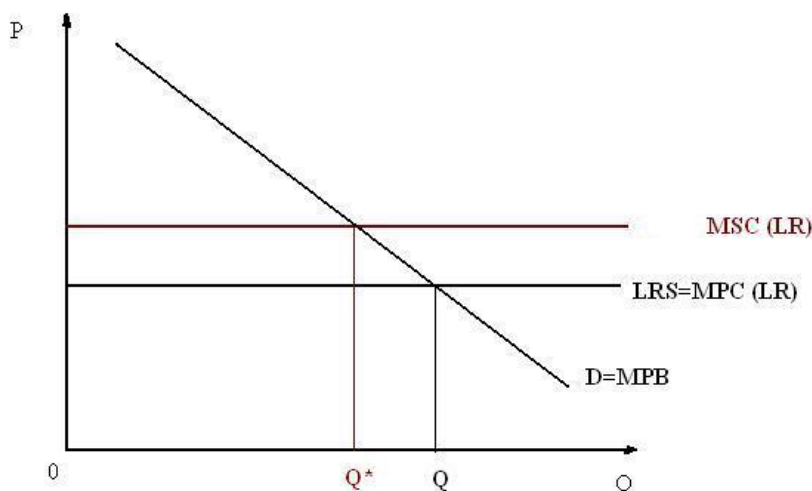
**Shift labour demand and supply: plus 5 points;**

**Mark new quantity of labour: plus 2 points (for a total of 15 points).**

3. (40 points total) Widget production is a constant average cost perfectly competitive industry. Their production creates harmful smoke that causes health problems for nearby residents.

A. (10 points) Use a graph to illustrate that a perfectly competitive market will result in overproduction of widgets for the long run case.

**Answer:**



**In the long run, social marginal cost exceeds private marginal cost. Thus, the long run MSC curve lies above the LRS curve. The efficient quantity of widgets  $Q^* < Q$ .**

**Marking Scheme:**

The graph is generally correct (LRS is horizontal): + 3 points;

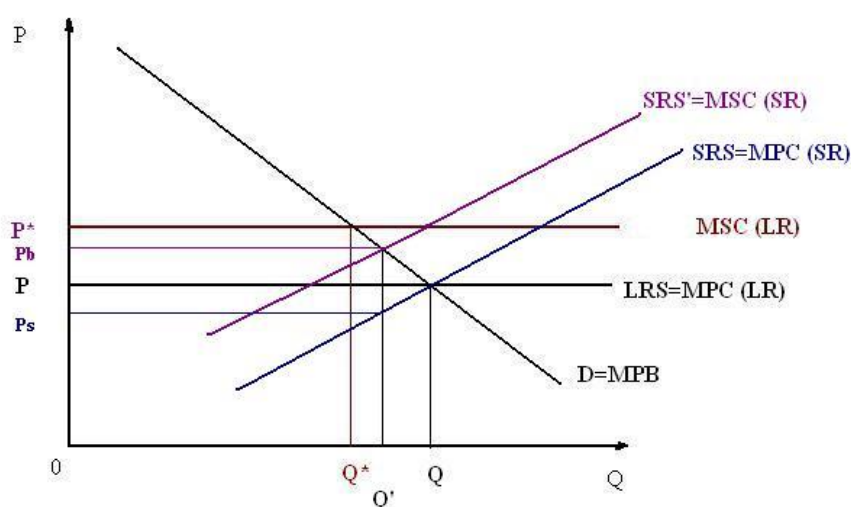
All the markings are there: +3 points;

The MSC is above LRS: + 2 points;

The equilibrium and efficient quantities are marked: +2 points.

- B. (10 points) The government proposes a per unit tax on the production of widgets. Is this an appropriate government policy in this case? Use a graph to illustrate the effect of the tax on the equilibrium price and quantity of widgets in the short run. Who pays the burden of the tax in the short run?

**Answer:** The policy would help restore the efficient quantity of widgets if the per unit tax is equal to the marginal cost of pollution. The graph below illustrates the effect of tax in this case:



In the short run, the quantity of widgets falls to  $Q'$ , which is still above the efficient  $Q^*$ . The buyers pay  $P_b$  per widget, while the sellers receive  $P_s$ . The difference between these prices is equal to the amount of the tax. Both consumers and producers pay the burden of the tax in the SR. The proportions depend on the relative elasticities of demand and SR supply.

**Marking Scheme:**

Answer: appropriate if the size of the tax offsets the externality : 2 points;

Graph is properly marked: + 1 point;

SRS is properly drawn: + 2 points;

SRS is shifted by the amount of the cost of externality: + 2 points;

New quantity if marked: + 1 point;

Tax burden: + 2 points.

- C. (10 points) What will be the effect of the tax on the equilibrium price and industry output in the long run? Use a graph to illustrate your answer. Who pays the burden of the tax in the long run?

**Answer:** See graph above. In the long run, some firms exit, since at the short run price  $P_s$  they make negative profits. The quantity falls to  $Q^*$ , producers receive per unit price  $P$  and consumers pay  $P^*=P+\text{tax}$ . Thus, in the LR, consumers pay the entire burden of the tax.

**Marking Scheme:**

Same as above (only with LRS).

- D. (10 points) Identify one alternative approach to solving this externality problem and discuss the advantages and disadvantages of this approach as compared with a tax.

**Answer:** The government could assign property rights, either to the residents or to the producers. If, for example, the residents are entitled to clean air, they can trade pollution quantity with the producers of widgets. If the harmful activity can be costlessly monitored and enforced, this would restore the efficient quantity of widget production. This, however, is difficult and can rarely be accomplished. The disadvantage of the tax policy is that it requires the government to know the precise cost of the externality. Administering the tax is also costly.

**Marking Scheme:**

**Mentioning of property rights or quota: 5 points**

**Partial discussion of property rights or quota: 8 points**

**Full discussion of property rights or quota: 10 points**

**Discussing obligatory air cleaning devices: 2 points**

**Subsidies for suffering consumers: 0 points**