**CHAPTER 9 EXTERNALITIES AND PROPERTY RIGHTS**

### **Answers to Review Questions**

1. No. While activities that generate external costs tend to be pursued excessively, i.e. there is more of the activity than the socially optimal level, the optimal quantity of such an activity is not zero. The optimal amount is that for which the marginal benefit of the activity equals the marginal cost, both private and external. Therefore, outlawing activities that generate external costs would thus move society from a situation in which those activities were pursued too extensively to one in which they were pursued too little.

Learning Objective: 09-02

AACSB: Reflective Thinking

Bloom’s: Understand

1. Freeways suffer from excessive congestion because individual motorists have no incentive to take external costs into account when deciding whether to drive on the freeway. Specifically, when a motorist enters an already congested freeway the road becomes marginally more congested, and this increases the travel time of thousands of other motorists.

Learning Objective: 09-03

AACSB: Reflective Thinking

Bloom’s: Understand

1. Pollution in the Great Salt Lake is regulated by a single state government, while many different states and Canadian provinces border Lake Erie and thus have jurisdiction over pollution there. Thus, enacting legislation that curbs pollution is harder for Lake Erie where no one regulatory agency or government controls pollution levels.

Learning Objective: 9-03

AACSB: Reflective Thinking

Bloom’s: Understand

1. Applying the Cost-Benefit principle to the case of freeway congestion, the socially optimal amount of freeway capacity is when the marginal cost of expanding freeway capacity exactly equals its marginal benefit (as measured by the value to motorists of reduced travel time). To reduce freeway congestion to zero would mean building a quantity of freeway for which the marginal benefit of extra capacity would be zero. But that solution cannot be socially optimal, because the marginal cost of additional freeway capacity is always positive.

Learning Objective: 09-03

AACSB: Reflective Thinking

Bloom’s: Understand

1. If there is a social advantage to being relatively tall, then individuals who wear high-heeled shoes will do better than others who don’t. But high-heeled shoes also entail costs, and when everyone wears them, the relative height distribution remains unchanged.

Learning Objective: 09-05

AACSB: Reflective Thinking

Bloom’s: Understand

### **Answers to Problems**

1. a. Vaccinations entail benefits to people other than those who are vaccinated because people

who are vaccinated against infectious diseases are less likely to contract those diseases and pass them on to others. Private markets tend to provide less than the socially optimal quantity of goods that entail external benefits.

b. Cigarettes entail costs to people other than those who smoke because second-hand smoke has been shown to be harmful to people's health. Private markets tend to provide more than the socially optimal quantity of goods than entail external costs.

c. On one hand, antibiotics entail an *external benefit* because a person who takes an antibiotic will be less likely to pass his or her bacterial infection on to others.  One the other hand, antibiotics also entail an *external cost* because bacteria often develop resistance to antibiotics and become less effective as more people use them.  Whether private markets provide more or less than the socially optimal quantity of antibiotics depends on whether you think their external costs outweigh their external benefits.

Learning Objective: 09-01

AACSB: Reflective Thinking

Bloom’s: Understand

1. The most efficient outcome is for Jones to emit smoke, because the total daily surplus in that case will be $600, compared to only $580 when Jones does not emit smoke. Since Smith has the right to insist that Jones emit no smoke, Jones will have to compensate Smith for not exercising that right. If Jones pays Smith $30, each will be $10 better off than if Smith had allowed Jones not to emit smoke.

Learning Objective: 09-02

AACSB: Reflective Thinking

Bloom’s: Understand

1. a. John and Karl stand to save $200 per month in rental payments by living together since

their total rent is $500 when they share and $700 when they each rent their own apartment. The question is whether this benefit justifies their living together despite John's objectionable habit of leaving his dirty dishes in the sink. The lowest-cost accommodation to the dirty-dish problem is for John to leave his dirty dishes in the sink. In this case, the maximum monthly rent Karl would be willing to pay to share an apartment with John is $350 - $175 = $175 per month. This amount would leave John with a remaining monthly rent bill of $325, which generates a social surplus of $25 per month. If John splits this surplus evenly with Karl, John ends up paying $337.50 per month and Karl pays $162.50 per month. Both John and Karl will therefore be better off living together.

b. Adding an additional $30 per month to the cost of the shared living arrangement makes the total cost of sharing $205 per month. Because that amount exceeds the $200 per month that John and Karl save by living together, they should live separately.

Learning Objective: 09-02

AACSB: Analytic

Bloom’s: Analyze

1. a. Barton will not install and maintain soundproofing.  Barton’s monthly payoff without

soundproofing is $50 more than with it, so his natural inclination is not to install soundproofing. Statler would have to pay Barton at least $50 to induce Barton to install soundproofing, but since soundproofing is worth only $40 per month to Statler, Statler will not be willing to pay Barton $50 to install the soundproofing.  Since the joint payoff is $230 without soundproofing and $220 with it, their choice to not install soundproofing is socially efficient.

b. Barton will not install soundproofing and this choice is socially efficient.  In this case, he will pay Statler $40 per month to compensate him for the noise he makes while practicing.

c. Either way, the efficient outcome (no soundproofing) is reached. The difference is that when Barton has the right to make as much noise as he wants, his monthly payoff is higher than when Statler has the legal right to peace and quiet.  Similarly, Statler’s monthly payoff is higher when he has the legal right to peace and quiet than when Barton has the right to make as much noise as he wants.

Learning Objective: 09-02

AACSB: Analytic

Bloom’s: Analyze

1. a. Barton will now install and maintain soundproofing, because doing so is cheaper than

compensating Statler at a rate of $60 per month for the noise nuisance. This outcome is socially efficient.

* 1. Barton will not install soundproofing in this case. The noise costs Statler $60 per month, so in the absence of transaction costs Statler would be willing to pay up to that amount to induce Barton to install soundproofing. However, if Statler must also pay a $15 fee for this transaction, it is not worthwhile. Thus, no soundproofing will be installed, and the outcome will be socially inefficient.
  2. If Statler has the legal right to peace, then installing and maintaining the soundproofing will be cheaper for Barton than to pay Statler $60 per month compensation for noise damage. In this case, the outcome is socially efficient.
  3. When negotiation is costly, the Coase theorem does not guarantee that private parties will arrive at the socially efficient outcome.  Thus, the attainment of the socially efficient outcome will depend on who has the legal right to perform the activity that generates the externality.

Learning Objective: 09-02

AACSB: Analytic

Bloom’s: Analyze

1. True/ false questions:
2. [*Note: This question should really be moved to Chapter 10. Your students may have difficulty answering the question within the context of this chapter.]*

True. Suppose that the marginal cost of emission reduction for plant A is higher than that in plant B. That means that we can reduce the total cost by allowing plant A to pollute more (since the marginal cost will fall) and ordering plant B to reduce its emissions further (since the marginal cost will rise.) We can do this until the marginal cost of emission reduction is the same at the two plants.

1. True. An example is the excessive use of pesticides on crops. This activity reduces the amount of insect damage to crops, and thus lowers the farmer’s production cost. However, the pesticide runoff pollutes waterways, imposing a negative externality on recreational users of those waters.

Learning Objective: 09-03

AACSB: Reflective Thinking

Bloom’s: Understand

1. The table below shows the total village income from grazing llamas as well as the marginal village income from the activity:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of llamas on the commons | Price per 2-year-old llama  ($) | Income per llama  ($/yr.) | Total village income  ($/yr.) | Marginal village income  ($/yr.) |
|  |  |  |  | 22 |
| 1 | 122 | 22 | 22 |  |
|  |  |  |  | 14 |
| 2 | 118 | 18 | 36 |  |
|  |  |  |  | 12 |
| 3 | 116 | 16 | 48 |  |
|  |  |  |  | 8 |
| 4 | 114 | 14 | 56 |  |
|  |  |  |  | 4 |
| 5 | 112 | 12 | 60 |  |
|  |  |  |  | -6 |
| 6 | 109 | 9 | 54 |  |

* 1. If each villager decides individually how to invest, then the villagers will continue to send llamas onto the commons as long as the income each earns from doing so is greater than $15, the amount a villager could earn from buying a government bond.  Thus, from the information in the "Income per llama" column in the table above, we can see that 3 llamas will be sent onto the commons. The resulting net village income will be $48 from the llamas plus $45 from government bonds, or $93.
  2. A llama should be sent onto the commons if and only if its marginal contribution to total village income is greater than $15, the amount a villager could earn from buying a government bond. Thus, the socially optimal number of llamas on the commons is 1. When the villagers decide individually how to invest, they send 3 llamas, rather than just 1, because in deciding whether or not to send a llama each villager ignores the negative impact of his or her llama’s presence on the other llamas’ fleece quality. Total village income with 1 llama on the commons is $22 from the llama plus $75 from government bonds, or $97 in total.
  3. If a single villager could control access to the commons, she would send only a single llama onto the commons, which she could sell after one year for $22 more than she paid for it. If the land were free, the owner would thus earn $22 per year by raising one llama per year on it, or $7 more than she would have earned had she used her $100 to buy a bond. The price of the land will be bid up until owning the land is no better than putting the same amount in the bank at 15 percent interest. That price is the amount of money, *X*, that would yield $7 per year if deposited at 15 percent interest: 0.15*X* = $7, or *X* = $46.67. The new owner will graze one llama. Total village income will be the same as in part b.

Learning Objective: 09-04

AACSB: Analytic

Bloom’s: Apply

1. a. Since each cyclist's payoff depends on his relative performance, any step either takes to

improve his performance will necessarily lower the expected payoff of the other.

b. See below. To see how the numbers in the table were calculated, note that, for example, when both Lance and Jan dope, each has a 50 percent chance of winning, so both Lance and Jan have an expected payoff of (0.50 × $100,000) - $25,000, or $25,000.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dope**     **Jan**                **Not dope** | **Lance**                **Dope                                      Not dope**   |  |  | | --- | --- | | $25,000 for Jan      $25,000 for Lance | $75,000 for Jan      $0 for Lance | | $0 for Jan      $75,000 for Lance | $50,000 for Jan      $50,000 for Lance | |

c. Note that this game is a prisoner's dilemma. For both Jan and Lance, doping is a dominant strategy. Yet when both dope, each gets an expected payoff of only $25,000. Each would have had an expected payoff of $50,000 if they both did not dope.

Learning Objective: 09-04

AACSB: Analytic

Bloom’s: Analyze