ECON 331: Environmental Economics

Homework 2

- Define any variables you need to answer the problems.
- Use any materials to help you with these questions. That includes others in this course!
- Please write your answers in the space provided.
- Keep your answers short but clear. Your goal is to convince a skeptical grader that you understand the relevant concepts well enough to answer the question you are given.
- The questions on this homework sum to 41 points. But you get a 100 for completing/attempting the majority of the questions.
- Remember to write down the names of anyone you worked with on this homework!
- Bring any and all questions to office hours!

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1. (2 points) What is your name?
2. (2 points) Who did you work with on this homework?

1 True/False Questions

Indicate "T"rue or "F"alse for each of the following statements or claims. For each false statement, if you explain why it is false I will give you a bonus point.

3. (2 points) Patagonia is a clothing company that believes part of its mission is to preserve the forests in South America, and so part of their objective function is preserving the environment rather in addition to maximizing profit. Suppose producing clothing generates air and water pollution. **Claim**: Based on what we have learned in class, Patagonia's marginal private benefit of abatement is 0.

4. (2 points) Suppose there is a chemical plant controlled by the town. That is to say the town as a whole votes and decides the amount of chemicals the plant produces. This town has no visitors or tourists. Also suppose the pollution from this plant is localized. That is to say the pollution does not spread beyond the town. **Claim**: Based on what we have learned in class, the pollution from the chemical plant is an externality on the town.

5. (2 points) **Claim**: In the prescence of a negative externality where the marginal external cost is not the same at all levels of quantity, the Pigouvian tax is calculated as the marginal external cost at the competitive equilibrium level of quantity.

6. (2 points) Suppose there is a positive externality on the consumer side for a particular commodity. Also suppose the marginal external benefit is constant for all levels of quantity. **Claim**: The Pigouvian tax is negative (a subsidy) and you can calculate the Pigouvian subsidy as the marginal external benefit at any quantity.

7. (2 points) Suppose the residents of a particular town suffer from air and water pollution generated by a group of nearby factories within the town's industrial area. Suppose that the social costs of this pollution are greater than the social benefits. **Based on what we have learned in class, in the real world the Coase Theorem would likely apply and result in the closure of the industrial area.**

2 Multiple Choice Questions

Circle the best answer to each question. There is only one answer for each question. No explanation necessary.

8. (2 points) Suppose there exists a pollutant such that if there is 0 pollution, the total damages inflicted upon society is 0. As soon as there is any pollution at all, total damages is $100. The amount of pollution does not matter, only whether or not any pollution is present. In our MAC-MDF diagram using emissions on the horizontal axis, the MDF curve would be:

    A. Upward-sloping.

    B. Downward-sloping.

    C. Vertical at 0.

    D. Horizontal at 0.

9. (2 points) Suppose an environmental economist is presenting findings on the optimal number of emission permits/allowable tons of nitrous oxide each year based on a MAC-MDF curve with emissions on the x-axis. You notice that the MAC curve on this graph is horizontal at $50. Which option best describes how to interpret this flat MAC curve?

    A. The marginal cost of abating an extra ton of nitrous oxide is 0 for all units.

    B. The marginal cost of abating an extra ton of nitrous oxide is 50 for all units.

    C. The marginal cost of abating an extra ton of nitrous oxide decreases as abatement increases.

    D. The marginal cost of abating an extra ton of nitrous oxide increases as abatement increases.

10. (2 points) **Use the information from question 9**. In the same talk the economist says that her estimation of the MDF curve has some uncertainty to it, and that she is presenting the upper bound of her estimates. That is to say the true MDF might be lower than her estimated and shown MDF curve. If the true MDF curve is indeed below the MDF curve she shows in her graph, how does her estimated socially optimal amount of pollution compare to the true socially optimal level of pollution?

    A. The true socially optimum amount is higher than her estimated socially optimum amount.

    B. The true socially optimum amount is lower than her estimated socially optimum amount.

    C. The true socially optimum amount is equal to her estimated socially optimum amount.

    D. We do not have enough information.

11. (2 points) **Use the information from questions 9 and 10.** Suppose the policy that will be implemented based on the economist's analysis is a cap and trade system in which the number of permits allocated are equal to the estimated socially optimum amount of pollution, traded within companies at a price equal to what the optimal pollution tax would be to achieve the estimated socially optimum amount of pollution. If the estimated socially optimum is actually below/lower than the true socially optimum amount of pollution, which of the following is true compared to if the true socially optimum amount of pollution was used to set the number of permits?

    A. Too few permits will be issued, and the permit price will correct.

    B. Too few permits will be issued, and the permit price will be too high.

    C. Too many permits will be issued, and the permit price will be correct.

    D. Too many permits will be issued, and the permit price will be too high.

12. (2 points) Suppose there are 3 steel factories within a town that discharge waste into the local river. Factory A is small, Factory B is medium, and Factory C is large. All 3 factories have a constant marginal abatement cost where $MAC_A = \$20$, $MAC_B = \$10$, and $MAC_C = \$5$ for each unit of abatement. Suppose without government intervention the total pollution into the river is 12 tons a year, where Factory A emits 3, Factory B emits 3, and Factory C emits 6. In order to reduce pollution to the socially optimum level of 3 tons per year, the government adds a tax of \$15 per ton of pollution emitted into the river. Assume this is perfectly enforceable. Which option pollution describes the amount of abatement by each factory in response to this tax?

    A. Factory A:3, Factory B: 3, Factory C: 3.

    B. Factory A: 0, Factory B: 3, Factory C: 6.

    C. Factory A: 1, Factory B: 2, Factory C: 6.

    D. Factory A: 2, Factory B: 2, Factory C: 5.

3 Short Answer Questions

These questions all require an explanation. Remember you are trying to convince me you understand the why and the how of what you are doing, not simply getting the answer correct. Cite specific concepts from class in your answers for full credit.

13. **What is up with Those Barriers along the Highway?** Suppose Binghamton has asked you to study whether or not to install noise-reduction barriers along the major highway interchange in Binghamton. People who drive their cars along the highway generate noise which Binghamton residents who live near the highway have to listen to 24/7. After doing some research you know the following information. The barriers cost $90,000 to install, and this figure includes all costs. Noise is measured in decibels. Currently, there are no barriers, and the average highway noise level experienced by residents is 100 decibels. If the highway noise were 0 decibels there would be 0 health impacts. You estimate for each 1 decibel increase in highway noise the dollar value of health impacts increases by $40. In terms of abatement costs, using the next best non-barrier method of noise abatement would cost an average of $40 to reduce the highway noise by 1 decibel for the first 50 decibels. After the 50th decibel, it costs an average of $100 to reduce the highway noise by 1 decibel.

    (a) (4 points) Draw a MAC-MDF graph with highway noise emitted (in decibels) on the horizontal axis, and dollar amounts ($) on the vertical axis. Draw the MAC and MDF curves according to the verbal description above. Be sure to label your axes and each curve on your graph.

(b) (4 points) On the graph you drew in part A, label your MAC and MDF curve correctly as either the MSB or MSC curve. Then, indicate the MPB and MPC curves on your graph.

(c) (4 points) On your graph, indicate the competitive equilibrium level of highway noise and the socially optimum level of highway noise. Explain how your equilibrium and socially optimum level differ and the intuition behind this difference.

(d) (5 points) At the competitive, what is the total welfare of Binghamton residents? What is their total welfare under the social optimum? Does their increase in welfare justify the cost of installing the noise-reducing panels? Explain