AEM 4510 / ECON 3865 Cornell University

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*Problem Set #1: Externalities, Public Goods, and Coase*

**Name (e.g., John Doe):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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(Sign Here)

**Instructions:**

This problem set consists of four questions. Each is worth 25 points. Please show your work in order to receive partial credit. In general, space has been provided to answer all questions (which is why this document is so long). Feel free to attach more sheets if you need more room.

You may work in groups of up to 3, use your notes, textbook, or other resources in answering these questions, but you must hand in your own, individual answers.

1. (Key Concepts): Social cost is a measure of the opportunity cost of all resources used in producing a good or a service. Private cost is a measure of the opportunity cost incurred by the individual or firm when make a decision. One resource use where there is a large gap between the public and private cost is the use of public motorways. (For example, one additional driver on the road imposes a cost, in terms of increased congestion, on all the other drivers on the road. It is likely that the sum of the costs imposed by one additional driver on all of the commuters using the road exceeds the benefits that the additional driver receives from using the road as opposed to a alternative method of commuting).

a. Give all the private costs of commuting by car to work/school/etc. Remember that private costs are all the opportunity costs that a driver incurs when operating a car.

b. One private cost of commuting via car is the costs of fuel. How much of the retail cost of a gallon of fuel is comprised of state and local taxes (check the EIA website)? When the price of a good includes a large tax component, only the non-tax part of the price represents real opportunity costs. In New York, what part of the price of fuel includes real opportunity costs?

c. Read the article “Is Gasoline Undertaxed in the United States?” by Ian Parry, which can be found at http://www.rff.org/rff/Documents/RFF-Resources-148-gasoline.pdf (or just google). Report four sources of external costs associated with gasoline consumption described by Parry, and describe the size of those external costs (in $/gallon)?

c. What kinds of policies are in place at the Federal and state level that reduce the number of individuals who choose to commute by car?

2. (Externalities) Buchanan Industries receives total profit from polluting according to the formula:

 

where  = pollution emitted (in tons), and profits are measured in dollars (hint: think about how since emissions increase profit, what from our standard setting in class is the same thing as profit here?). The total costs/damages associated with pollution from this facility are estimated to be:



1. Draw a graph of both the marginal profit and marginal damages from pollution curves, labeling all axes, intercepts, and slopes.
2. If Buchanan Industries could ignore the damages it caused…

- How much Q would it produce?

- How much profit would it earn at this level of production?

- How much would its total damages be?

- What would be the net benefits (i.e., difference between profits and damages)?

1. What is the efficient level of Q for this firm? How much profit would Buchanan Industries earn at this level of production? How much would total damages be? What would be the net benefits?
2. What is the deadweight loss associated with Buchanan Industries ignoring the damages that its production causes? Show the deadweight loss on your diagram.
3. Those who live near Buchanan Industries propose that it produce no more than  = 1. What is the deadweight loss associated with this level of production? Show this DWL on your graph.
4. Who benefits from reducing Q from the initial level in (b) to the efficient level in (c)? Who bears the costs? Is this change Pareto improving or could it be a potential Pareto improvement (say after transfer/compensation)?

3. (Coase’s Theorem) In a remote valley, two businesses share a waterway. Tom’s Tomato Farm pumps water from a river and uses it to irrigate its fields. The used water eventually flows back into the river, carrying some of the fertilizer that Tom applies to his crops. Up to a point, more fertilizer helps increase Tom’s harvest. Downstream, Jay’s Riverview Campground offers campsites to interested vacationers. Fertilizer contamination of the river creates algae blooms that adversely affect Jay’s business.

The functions describing the profits of each establishment are:



where the subscripts “T” and “J” refer to Tom’s and Jay’s places of business, respectively. “F” represents the amount of fertilizer in the river generated by Tom.

(a) Derive the functions representing (i) the marginal benefit of fertilizer to Tom and (ii) the marginal cost of fertilizer to Jay. Plot them on the graph on the following page.



(b) Suppose that the existing law defines property rights that favor recreational users of waterways (e.g., campsites) at the expense of farmers. A campsite can sue a polluting farmer for prohibitive damages if any pollution takes place, unless the affected parties consent to an alternative agreement. Indicate (i) the amount of pollution that takes place in this scenario, and (ii) the profits of Tom and Jay. Assume that Jay has all the bargaining power (i.e., he captures the entire Coasean bargaining surplus).

(c) There exists a containment process for recapturing irrigation water in underground troughs and cleansing it of any leached fertilizer contaminants. This technology, which can be purchased for a cost of $X, would prevent Tom’s operations from polluting the river at all (regardless of his choice of F). Suppose property rights and bargaining power are defined as in (b). What is the most Tom would be willing to pay to obtain this new process?

4. (Coase’s Theorem): Consider a beekeeper that is deciding how much honey to produce. The beekeeper gains a benefit from producing honey, represented by the marginal benefit function and which is given by:

MB = 300 - 6*Q*

where *Q* is barrels of honey. In addition, she has a marginal cost function, which reflects her cost of producing honey; this is given by:

MC = 40 + 4*Q*

The more honey the beekeeper produces, the more bees there are to pollenate a neighboring apple orchard. And, thus, in addition to the private benefit accruing to the beekeeper herself, there is also an external marginal benefit to the apple orchard, which is given by:

EMB = 100 - 2*Q*

a. Find an expression for social marginal benefits (SMB) in this case, defined as you think appropriate. Calculate the level of honey production that will arise if the beekeeper acts in her self-interest only. Calculate the socially efficient level of honey production as well.

b. Suppose that the beekeeper and the owner of the apple orchard enter into negotiations. The orchard owner wants to offer a payment to the beekeeper to change honey production from her self-interested production level to the socially efficient level (all at once). What is the maximum total payment that the orchard owner would be willing to pay for this overall change? What is the minimum total payment that the beekeeper would require before making this overall change?

c. Assume that, if a deal is reached, *each* party must pay $35 in legal fees to finalize it. If there are no additional transaction costs, will the socially efficient quantity be reached? Explain.

d. Irrespective of your answer to the previous part, assume that the beekeeper and the orchard owner come to a private agreement to set honey production at the socially efficient quantity. However, now suppose that a policymaker reads somewhere that honey production provides a positive externality to apple orchards, and therefore decides that the beekeeper should be provided with a production subsidy for each unit of honey that the beekeeper is willing to produce. With this subsidy in place, the beekeeper decides to increase production by an additional 5 barrels. Calculate the associated efficiency loss. If honey is good to eat and bees are good for trees, why is there such a thing as too much honey?