Name: _____ Section: _____

Date assigned: Thursday, 9/4
Date due: Thursday, 9/11

Instructions:

- This problem set has 6 questions, for a total of 35 points. The number of points for each question is indicated at the start of the question.
- Please solve the questions on separate pieces of paper that are to be turned in with your name written on top, **stapled**.

1: 3 points for each subquestion, 5 subquestions (15 points total)

For each of the examples below, please answer the following:

1. Does an externality exist? If so, classify the externality as positive/negative (or both).
2. If an externality exists, determine whether the Coase Theorem applies (i.e. is it possible to assign property rights and solve the problem?)
3. If an externality exists and the Coase Theorem does not apply, argue which of the government's tools are best suited to address the issue: quantity regulation, taxes/subsidies, tradable permits, or something else.

Consider the following examples.

1. British Petroleum drills for oil in the gulf coast.
   1) Yes. You can either think of there being a negative externality (accidents on oil rigs cause spills, which negatively affect other inhabitants of the gulf states) or a positive externality (identifying where oil is allows other companies to drill for oil more effectively because they know where it is).
   2) If oil spills only damage property, and these property owners can costlessly recoup costs in the legal system, then the drillers will internalize the impact of their drilling on the social cost of the oil spill. But, if it is hard to determine the true costs from an oil spill (e.g. may be hard to figure out whether someone lost their job b/c of an oil spill or b/c of some other reason), then the Coase Theorem may not apply. In the positive externality case: may be difficult to assign property rights to an oil field after it is identified, so Coast Theorem may not apply.
   3) Quantity regulation on the amount of safety/advanced drilling technology investment seems feasible. One could also argue for subsidies for safer drilling technologies (or taxes on less safe technologies). Tradable permits seems difficult to do here...
2. Carbon emissions for vehicles.
   1) Yes. I drive my car which emits gases that harm others, whose harm I do not pay for.
   2) Coase Theorem is difficult to apply since it would require assigning property rights to those who are harmed. Since many of the harmed are very dispersed (e.g. driving in Charlotte theoretically harms everyone in the world a small amount) and in some cases involves the "unborn" (future generations facing global warming), the feasibility of negotiated private contracts is highly questionable.

3) As discussed in class, if we believe that the social marginal benefit curve is flat (horizontal), we would want to price the carbon using a tax. Quantity regulation would require different quantities for each producer of carbon but each individual has different marginal costs, so this would be hard to do. Perhaps can also do quantity regulation with tradable permits to solve the issue of not knowing the costs.

3. Your upstairs neighbors throwing an awesome, but loud party.
   1) Yes, an externality exists but it may be positive/negative depending on your tastes and preferences.
   2) Coase Theorem would require the neighbors to own the rights to holding the party. Then the neighbor would pay the other neighbor to have (or not have) the party. This could work (so an answer of "yes" is fine). But, in reality, there are likely many different people who are affected by the throwing of the party (e.g. multiple neighbors hate the noise). Bargaining with all parties may allow one party to "hold-up" the others, rendering the Coase Theorem inapplicable.

4. Buying a car with added safety features that prevent the drivers/passengers' deaths in the event of an accident.
   1) Depends; If people drive more recklessly as a result of having a safer car, then buying the safety feature imposes a negative externality on other drivers. If having a safety feature does not change the likelihood of an accident or the impact on the other cars, then there is no externality.
   2) The Coase Theorem does not apply: It would be incredibly difficult to write a contract with those with whom you may eventually be engaged in a car accident.
   3) Quantity regulation (e.g. regulating the safety feature, or preventing it), or taxation would correct the externality. It seems strange but yes, theoretically we would want to tax the safety feature if it causes people to drive more recklessly.

5. Bringing crying babies on a plane.
   1) Yes, obviously negative.
   2) Coase Theorem does not apply.
   3) One solution: tax parents that brings babies on the plane and redistribute the tax to those who are exposed to the crying around the baby in the plane. Airlines potentially could also intervene and lower the ticket price for everyone who has to listen to baby crying (or serve free drinks/snacks when a baby starts crying).

2: (3 points total)

Suppose that a firm's marginal production costs are given by

$$MC = 10 + 3Q$$

The firm's production process generates a toxic waste, which imposes an increasingly large cost on the residents of the town where it operates: the marginal external cost (i.e. marginal cost inflicted on the residents) associated with the Qth unit of production is given by $6Q$. What is the marginal private cost associated with the 10th unit produced? What is the total marginal cost to society associated with producing the 10th unit (the marginal social cost of the 10th unit)?
The marginal private cost is $10 + 3(10) = 40$. The external cost (cost incurred by those not directly participating in the market) is $6(10) = 60$. So the marginal social cost of producing the 10th unit is 100.

3: (3 points total)

In two-car automobile accidents, passengers in the larger vehicle are significantly more likely to survive than are passengers in the smaller vehicle. In fact, death probabilities are decreasing in the size of the vehicle you are driving, and death probabilities are increasing in the size of the vehicle you collide with. Some politicians and lobbyists have argued that this provides a rationale for encouraging the sale of larger vehicles and discouraging legislation that would induce automobile manufacturers to make smaller cars. Critically examine this argument using the concept of externalities.

The evidence suggests that driving a larger vehicle imposes negative externalities on other drivers. (Or, viewed from the other direction, driving a smaller vehicle imposes positive externalities on other drivers.) Individuals probably take their own safety into account when selecting an automobile but probably do not fully take into account these externalities, which suggests that people choose vehicles that are larger than is socially optimal. The correct conclusion is that intervening to encourage the sale of smaller vehicles (or to discourage the sale of larger vehicles) can improve welfare—just the opposite of the proposed argument.

4: (4 points total)

Davidsonia has two regions, Chambersland and Preyerland. In Chamberland, the marginal benefit associated with pollution cleanup is

$$MB = 300 - 10Q$$

while in Preyerland, the marginal benefit associated with pollution cleanup is

$$MB = 200 - 4Q$$

Suppose that the marginal cost of cleanup is constant at \$12 per unit. What is the optimal level of pollution cleanup in each of the two regions?

The optimal level of cleanup will occur when the marginal benefit just equals the marginal cost. In Chamberland, the marginal benefit is $300 - 10Q$; marginal cost is 12. Therefore, the equation to solve for Chamberland is $300 - 10Q = 12$, or $288 = 10Q$. The optimal level in Chamberland is equal to 28.8. For Preyerland, the marginal benefit is $200 - 4Q$. Setting the benefit equal to 12 yields $200 - 4Q = 12$, or $188 = 4Q$. The optimal level in Preyerland is equal to 47.

5: (5 points total)

The private marginal benefit associated with a product's consumption is

$$PMB = 360 - 4Q$$

and the private marginal cost associated with its production is

$$PMC = 6Q$$

Furthermore, the marginal (external) damage associated with this good's production is

$$MD = 2Q$$

To correct the externality, the government decides to impose a tax of T per unit sold. What tax T should it set to achieve the social optimum?

Find the social optimum by setting $PMB = PMC + MD$ where $SMB = PMB$ and $SMC = PMC + MD$: $360 - 4Q = 8Q \implies Q^* = 30$ Setting a tax of T effectively increases the PMC by T per unit sold. The new equilibrium quantity solves $360 - 4Q = 6Q + T$. Setting $Q = 30$ and solving for T gives $T = 60$. A tax of $T = 60$ will achieve the social optimum.

6: (5 points total)

Suppose that demand for a product is

$$Q = 1,200 - 4P$$

and supply is

$$Q = -200 + 2P$$

Furthermore, suppose that the marginal external damage of this product is \$8 per unit. How many more units of this product will the free market produce than is socially optimal? Calculate the deadweight loss associated with the externality.

To answer this question, first calculate what the free market would do by setting demand equal to supply: $1200 - 4P = -200 + 2P$ or $1400 = 6P$, which gives that P is 233.33. So the quantity produced in a free market is $1200 - 4(233.33) = 266.67$. The socially optimal level occurs when the marginal external cost is included in the calculation. Suppose the \$8 externality were added to the price each consumer had to pay. Then demand would be $Q = 1200 - 4(P + 8)$. Solving for P: $1200 - 4(P + 8) = -200 + 2P$, or $P = 228$. Solving for Q, $1200 - 4(228 + 8) = 1200 - 944 = 356$. The quantity that is socially optimally is then 256, $10\frac{2}{3}$ units less than provided by the free market. Deadweight loss is the area of a triangle of height 8 and width $10\frac{2}{3}$: $\frac{1}{2}(8 \times 10\frac{2}{3}) = 42.67$.