

Problem Set #1
Problems Due Session 4

1) We proposed that a congestion externality could apply as much to a crowded highway as to grazing land held in common.

Consider a 10 mile long stretch of road with one lane in each direction (no passing). We can write the speed on this road as:

$$\text{Speed} = 87\text{mph} - .32 * (\text{number of cars per mile}).$$

In this equation, think of number of cars per mile as the answer you would get if you took an aerial snapshot of the road and you counted the cars in a one mile segment.

Suppose that at 7:15 AM one morning, there are 180 cars per mile on the road. Then you enter the road raising the traffic density to 181.

a) Think in terms of the 180 car “cohort” you entered. What does your entrance do to the time it takes for this cohort to travel the 10 miles of road.

b) If the average wage of this cohort is \$20.00 per hour, what is cost that your entrance imposes on this cohort.

c) Suppose that this highway was not held in common but actually run by a group of commuters. If the commuters are interested in “running” the road, what is a reasonable goal for them to adopt? What policy tools do they have to achieve this goal? Given the information above, sketch an approach to this problem.

2) In class, we reviewed the reasons why an emissions tax/fee might be preferable to a regulated standard that applied to all plants. In practice the issue is a little more complicated than this. The problem arises because in reality, you may know only the general shapes of the marginal abatement and the marginal cost of pollution curves rather than their detailed shapes.

a) With the above details in mind, explain in each of the following cases why you would choose an emissions tax or a regulated standard:

- You are charged with introducing a tax or a standard to a single plant. You know that the marginal cost of abatement is very elastic while the marginal cost of pollution is very inelastic but you don't know much more detail than that.
- You are charged with introducing a tax or a standard to a single plant. You know that the marginal cost of abatement is very inelastic while the marginal cost of pollution is

very elastic but you don't know much more detail than that.

b) If we move now to a multi-firm situation, what relevance, if any, do tradable permits have for this situation?

3) Suppose the city of Phoenix is considering a new airport that, like all airports, will charge a landing fee to every airplane that lands there. Even as we sit here, the airport's Director of Physical Maintenance and the airport's Director of Scheduling are arguing over the structure of that fee.

Director of Physical Maintenance: "The reality is that a 180 seat airliner like a Boeing 757 weighs about 40 times as much as a Piper Cub. People in Physical Maintenance have to deal with that extra weight every time a 757 lands. Given this reality, we have to have a landing fee schedule that charges a much higher fee for big planes than for small planes -maybe a fee schedule based on weight. If landing fees are the same for big and small airplanes we will be creating a negative externality that will undermine efficiency."

Director of Scheduling: "The reality is that a four-seater private plane, when it lands, utilizes a runway for about as much time as a 180 seat jet. If we have a weight-based landing fee schedule you want, a Piper Cub will pay much less to land than a Boeing 727. That is what will create a negative externality that undermines efficiency."

a) Assume both directors are correct, but that they are talking about different externalities. Explain the externality that each director is talking about.

b) Based on the externality she is talking about, what kind of landing fee schedule would the Director of Scheduling want?

4) You own one of three elegant houses on a quiet residential cul-de-sac. Each house has a large front lawn with space for a garden. Each garden can be cultivated at either of two levels - very pretty (which costs \$500 per year) or truly stunning (which costs \$1,000 per year). Each homeowner (including you) loves flowers and each homeowner takes regular evening walks in which they look at both their own garden and the gardens of their neighbors. While it is hard to translate beauty into money, we can estimate that a homeowner receives \$600 of pleasure per year from each very pretty garden he/she sees and \$900 of pleasure per year from each truly stunning garden he/she sees.

We can treat this problem using game theory. For simplicity, we assume that whatever strategy one neighbor chooses, the other neighbor also chooses.

a) Given the available information, construct a payoff matrix like that shown below containing net benefits (i.e. benefits - costs) for you and for one of your neighbors. Put your neighbor's net benefits below the diagonal and your net benefits above the diagonal.

Your Neighbors' Strategy
(Assume both of your neighbors do the same thing)

No Garden Very Pretty Garden Truly Stunning Garden

Your Strategy	No Garden		
	V.P Garden		
	T.S. Garden		

b) Using this matrix, calculate the socially optimum expenditure on gardens and explain your reasoning.

c) In the language of game theory, a Nash equilibrium is a situation in which each person is pursuing their best strategy given other person’s strategies – i.e. no person has an incentive to change strategies. Carefully explain why your social optimum in (a) is or is not a Nash equilibrium. If it is not, explain why not and whether another outcome is a Nash equilibrium. Does it matter to your answer whether you and your neighbors are one-year renters rather than homeowners?

5) You are the planning director of fast growing suburb outside Kansas City, Kansas. You want to create a zoning regulation in which requires developers of single-family homes in your suburb to allocate and develop land for local parks and similar public space, accessible by foot, that will enhance the quality of life of local homeowners.

In no more than 1.5 pp (using 12 point type), write a regulation that specifies, as well as you can, the regulation you want written as numbered sentences.[i.e. (1) All developers shall provide..... (2) This space shall contain) At the end of your regulation, suggest how a developer might interpret it in ways that are legal but that you didn’t intend.
