ECO206Y Problem Set 4 (Second Half)

Due Thursday, August 1 (optional)

Question 1: Music externality

An after-hours club in New York City ("Sound Factory") plays deafeningly loud music all night to keep its patrons entertained. You are new to "the city" (Manhattan)[1] and unwittingly rent an apartment right beside this club. Even with thick walls between you and this club, you can still hear the music emanating from the club all night. Suppose that the amount of sleep you can get depends only on how much music is being played at the club. That is, suppose that you can sleep comfortably only when the club is not blasting music (indirectly) into your apartment.[2] Let $f(z)$ be a function that describes how many hours of sleep you get (per night), and suppose that this depends on the number of hours that the club blasts its sound system. Let z be the number of hours that the club plays music. Then

$$s \equiv f(z) = 9 - z. \tag{1}$$

Furthermore, suppose that you can place a monetary value on sleep according to the rule

$$v = 50000s(16 - s) \tag{2}$$

(Hey, you have to be rich if you can afford to live in Manhattan. In any case, suppose that you're working as some Wall Street investment banker and need your rest to broker lucrative deals. Moreover, sleeping too much means that you're not in your office working!) The club's profits, on the other hand, depend on how many hours it stays open.

$$\pi = 100000z - 5000z^2 \tag{3}$$
$$= 5000z(20 - z) \tag{4}$$

How many hours of sleep will you get in equilibrium (assuming you can pay off the owner of the club to close a little earlier)?

Question 2: Boardwalk on Gilligan's Island

The seven castaways on Gilligan's Island are contemplating building a boardwalk along the beach. Once built the boardwalk is non-rival and non-excludable. The inhabitants of the island must decide on the length of the boardwalk (given by y). There are no fixed costs associated with the construction of the boardwalk[3]; however, the marginal cost of production is

$$MC = 70 + 2y \tag{5}$$

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[1] In London, England the term "the city" refers to the financial district. However, in New York, one says that one is going to "the city" if they are going to Manhattan.

[2] On the bright side, Sound Factory does play some pretty wicked, rowdy music.

[3] On the island coconuts serve as a medium of exchange, and all money values are quoted in terms of coconuts.

Suppose that each inhabitant has the exact same demand for the amount of boardwalk to be laid:

$y_i = 25 - p$ for $i = 1,\dots,7$ (6)

(a) What is the so-called "free rider" problem. How does it hamper the optimal provision of a non-rivalrous (public) good? In particular, will the boardwalk be built if it requires that each person splits the tab equally for the boardwalk equally?

(b) What is the condition for efficiency in the provision of a public good? How does this compare to the condition for efficiency in a private good?

(c) Find the socially optimal length of the boardwalk.

Question 3: Define and explain

Define the following words or phrases and in one or two sentences state its significance.

(a) Coase theorem (1960).

(b) Public good.

(c) Externality.

(d) Pigouvian tax.

(e) Pareto improvement.

Question 4: Pollution and clean up

Suppose that the city of New York has enacted a "clean air" act. The objective of the act is to reduce the amount of airborne pollutants. Furthermore, suppose that scientists have collected the following information: Automobiles in the city annually emit 20 tonnes of pollutants; factories in the region emit 15 tonnes annually. Scientists along with economists have estimated cost functions (in millions of dollars) for reducing pollution from the two sources as

$C_a = \frac{1}{2}y_a^2 + 7$ (7)

for automobiles, and

$C_f = \frac{1}{2}y_f^2 + 35$ (8)

for factories. The notations y_a and y_f represent automobile and factory pollution reductions, respectively. The benefits of reduced pollution is given by

$B(y) = \frac{1}{4}\,y^2 + 2y + 49$ (9)

where $y = y_a + y_f$.

(a) Suppose that Mayor Bloomberg has called for a complete ban on pollution. Under what conditions would this be an efficient plan?

(b) Mayor Bloomberg's advisor instead suggests that emissions from cars be reduced by 16 tonnes and that for factories by 10 tonnes. Under this scheme the cleanup cost in each sector would be $135 million. Is this an efficient plan?

(c) What is the economically optimal (i.e. efficient) level of cleanup from each source?

(d) How might one achieve the goal in part c? That is, what incentive mechanism could be used to lower emissions to their efficient level?

Question 5: Unions and pollution

Comment on the following:

"The presence of unions in a competitive industry is detrimental. This is especially true in an industry where there are negative externalities. The inefficiency of a unionised wage that is higher than equilibrium exacerbates the negative externality produced by the firm."