ECOE 70312: Environmental Economics Problem Set 2

Professor Jensen Spring 2011

DUE: Wednesday, March 9

1. Consider a simple economy with one consumer whose "net" utility is U(q) – D(a), where $U(q)=\mu q^{1/2}$ is utility from q units of a good, and $D(a)=\alpha a^3$ is damage from the amount a of effluent resulting from production of the good ($\mu>0$ and $\alpha>0$ are constants). The cost of production is $C(q,a)=\beta q^2+\gamma(a^2-4a+4)$, where ($\beta>0$ and $\gamma>0$ are constants).

a. Determine the market equilibrium values of q and a.

b. Determine the socially optimal values of q and a.

c. Compare these and interpret the differences.

d. Design a policy to achieve the social optimum.

2. Consider another simple economy with one consumer who maximizes net utility from driving. The benefit from driving is μs, where s is the size of the car, and $\mu>0$ is a constant. The cost to the driver is βs^2, and the damages to the road are γs^3 ($\beta>0$ and $\gamma>0$ are constants).

a. What size of car is chosen by this driver?

b. What is the socially optimal car size?

c. Compare these and interpret the differences.

d. Design a toll system that induces the driver to choose the socially optimal car size.

3. Now consider a market with two firms, 1 and 2, who produce electricity. The pollution abatement cost functions for these firms are αe_1^2 and αe_2^3, where e_i is the abatement of carbon dioxide emissions by firm i and $\alpha>0$ is a constant. The benefits from the abatement of carbon dioxide emissions are given by $B(e_1+e_2) = \beta(e_1+e_2)$, where $\beta>0$ is a constant.

a. What level of emissions does each firm choose?

b. Determine the socially optimal levels of emissions.

c. Design a policy to achieve the social optimum level of emissions.