# FINAL EXAM STUDY QUESTIONS PART II

12) Suppose the government wishes to regulate mercury emissions of factories in a specific industry by either setting an emissions standard or imposing an emissions fee (per ton of mercury). The government is uncertain as to the marginal abatement costs, which may be high ($MC_1$) or low ($MC_2$).

$MC_1 = 15M + 500$

$MC_2 = 15M - 500$

where $M$ is the units of mercury abated. The government believes there is a 50% chance of each of the marginal abatement costs. The marginal benefit of abatement is known to be:

$MB = 1500 - 10M$

a. What is the optimal level of emissions for each of the cost curves above?
b. What is the expected marginal abatement cost (equation)?
c. What is the optimal emissions standard according to the expected abatement costs?
d. What is the optimal abatement fee according to the expected abatement costs?
e. Which regulation will result in a lower DWL in the presence of the uncertainty? Explicitly compute the expected DWL arising from each proposal.

13) Consider the following pollution offset problem:

There are two firms, each with the same total abatement cost functions:

$TC_1 = (100 - e_1)^2$ and $TC_2 = (100 - e_2)^2$

The marginal cost functions are, respectively, are

$MC_1 = -200 + 2e_1$ and $MC_2 = -200 + 2e_2$

At receptor Station One, the diffusion coefficients are $a_{11} = 0.5$ and $a_{12} = 1$. The target ambient level is 100. Therefore, at Station One, the emission constraint is:

$0.5e_1 + e_2 = 100$

a) Determine the cost minimizing levels of emissions at Station One (hint: either use the Lagrange method or the method outlined in the text).

Now suppose that there is a second receptor, Station Two, that has the following emissions constraint:

$2e_1 + e_2 = 120$

Where the diffusion coefficients are $a_{21}=2$ and $a_{22} = 1$; with a target ambience of 120.

b) Use the same approach as in part (a) to determine the cost minimizing level of emissions that satisfy Station Two.
c) Carefully graph both constraints on a graph with e1 on the horizontal axis and e2 on the vertical axis. Indicate the region that satisfies both constraints.
d) Label the solutions to (a) and (b) on your graph. Can you determine if each violates the other constraint? Is there a solution where both constraints are satisfied? If so, which receptor has the binding constraint?

e) Suppose the government had initially granted emission permits to each firm: firm one was given 13.33 permits and firm two was given 93.33 permits. (These are the initial allocations that satisfy both constraints). Given the information in your answers for (a) to (d), determine who will sell permits and who will buy permits. What will be the price ratio of the permits that are traded?

14) A firm operating in a competitive market has the following profit function

$\pi = PQ - Q^2 - 2A^2 + 24A$

Where P is price, Q is output and Ais abatement. Further, the level of pollution, denoted Z, is determined by $Z = 2Q - 2A$.

If the price is \$240 and the socially optimal **Z** is 48 then

**a)** What is the level of Q and A that the firm would choose if there were no environmental regulations? What would be the level of pollution?
**b)** Use the Lagrange method to find the socially optimal Q, A and profits.
**c)** Assume the government fixes the level of A equal to your answer in (b) but allows the firm to choose Q. Find the optimal Q and determine the actual pollution Z.
d) Assume the government fixes the level of Q equal to your answer in (b) but allows the firm to choose A. Find the optimal A and determine the actual pollution Z
e) Carefully illustrate your answers to (a) to (d) in a graph