Problem set 3
(due in class @9.40 Thursday, March 3rd)

1) \textit{(Coase Theorem)} Rugi's neighbor Kara is a misunderstood musician who feels she can only express her angst through her music. Unfortunately, Rugi has a hard time studying when there is so much noise, and both signed year long leases before they realized that they would be affecting each other this way. Rugi is statistically inclined, and once for a class project he estimated the effect of his grades upon his expected future income. Further, he has managed to figure out the effect of time studying on his grades, and the effect of the music on his grades. He has come to the conclusion that his marginal benefit from studying at home is $200 - 5Q$, where $Q$ is the number of hours per week he has studied. Rugi interviewed Kara and determined that her willingness to pay for time playing is $160 - 2Q$. Assume that there are only 80 hours per week during which they will both be home and awake, i.e., during which the issue is likely to arise, and that Kara's playing completely precludes Rugi's studying.

A) How much would Rugi like to study per week? How much would Kara like to play each week?

B) Say that Rugi goes to the landlord and finds out that she is a musician herself. The landlord tells Rugi that she supports Kara completely and that Rugi will have to compensate Kara any time he wants her to stop playing. How much time will Rugi buy from her (assume that he can afford it if it’s worth it to him), and how much will he have to pay for that time, in total? What if the landlord had sided with Rugi- how much would Kara pay Rugi in total, and for how many hours?

C) Now say that Kara is happy only if she is playing her guitar in the library, where it disturbs 20 people who are trying to study, all of whom have the characteristics of Rugi. She has the same willingness to pay for time playing. What is the likely outcome?

D) Which assumption of the Coase Theorem is not likely to hold under C) above?
2) (Technology adoption)

Worldwide, almost two billion people rely on wood charcoal, dung, and crop residues as their primary cooking fuels. Respiratory infections, causally linked to exposure to particular matter and other pollutants in smoke, are the leading cause of illness in many developing nations. This environmental pollution accounts for approximately 4% of the total global burden of disease.\(^1\)

All citizens in Millockston use homemade indoor charcoal stoves to cook their food. Their Supreme Leader worries about high levels of pollution and the effects on health. A new type of stove, the Lakech stove\(^2\) is more efficient, and the Supreme Leader has requested your help in investigating and finding solutions for the pollution hurting her people. Your field research team has found the following information:

1. \(Y = e^{\frac{1}{2}}\) where \(Y\) is “output” of heat in kilo-joules, the total amount of heat that is transferred to cooking vessels and \(e\) is the amount of effective input (i.e. the share of fuel which, when burned, actually goes to warm the pot and not just to warm the surrounding air).
2. \(e = h_i a_i\) where \(h_i\) is the percentage of the input producing useful heat, and \(a_i\) is the amount of charcoal used in one year
3. \(Z = (1 - h_i) a_i \cdot T\) where \(Z\) is the amount of pollution emitted annually, measured in total suspended particulate concentration * days (TSPdays), \(T\) is cooking time in hours over one year.

<table>
<thead>
<tr>
<th></th>
<th>Traditional Stove</th>
<th>Lakech Stove</th>
</tr>
</thead>
<tbody>
<tr>
<td>(h_i)</td>
<td>0.5</td>
<td>0.75</td>
</tr>
<tr>
<td>Price/unit of charcoal</td>
<td>$0.50</td>
<td></td>
</tr>
<tr>
<td>(T)</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>Value of time (opportunity cost)</td>
<td>$1</td>
<td></td>
</tr>
<tr>
<td>Cost of stoves</td>
<td>0</td>
<td>$80</td>
</tr>
</tbody>
</table>

Let’s assume there are no credit constraints and everyone is “rational” [so they switch to Lakech stoves if the net gains from switching are positive]. There isn’t a price for output: instead, each household has an absolute need for 4 mega-joules. Show your calculations and clearly mark your answers to each of the following questions:

A) Calculate the net cost or benefit of switching to Lakech stoves for the year of adoption, ignoring health and pollution effects. (Be sure to count both time and fuel input and note that \(T\) and \(a\) are already in annual units).

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1. [socrates.berkeley.edu/~rael/Kammen-Ezzati-ARI-PressRel.doc](http://socrates.berkeley.edu/~rael/Kammen-Ezzati-ARI-PressRel.doc) (2001 press release from a Cal research team)
2. [igadrhep.energyprojects.net/Links/Profiles/ImprovedStoves/ImpStoves.htm](http://igadrhep.energyprojects.net/Links/Profiles/ImprovedStoves/ImpStoves.htm)
If Lakech stoves are more expensive, how large a capital subsidy (i.e. decrease in stove price) would be necessary for the two to cost the same? How much of an increase in the input price would achieve the same result?

B) Now let’s consider health effects. Taking everything as laid out in the initial problem (i.e. ignoring the taxes or subsidies you thought about in part (a)) say that exposure to pollution makes people sick, so they lose hours of work according to the following formula: \((Z - 500)/50\) where \(Z\) is the level of annual pollution, and the wage is \$1 / hour. Which technology is preferred in this case?

II. ESSAY QUESTION
Please read the following articles and answer the questions below. (Maximum 2 pages)

http://scienceinpolicy.org/cgi-bin/issues.py?title=clear_skies_initiative
http://www.brookings.edu/views/op-ed/easterbrook/20050216.htm

A) What is the “Clear Skies initiative”? Name at least two of the discussed goals of the initiative, and describe the basics behind how it will work. (Hint: What previous legislation is the initiative modeled after?) Use a few lines only, please, to concentrate on answering B and C.

B) Based on your readings and/or your notes from class lectures, give two reasons why cap and trade programs may be better than command and control programs. Give two reasons why command and control programs may be better.

C) What’s your assessment of this initiative with respect to the criteria of regulatory burden (consider industry only, not the EPA) and potential hot spots? How should regulators be sure that the special problems caused by non-uniformly mixed pollutants are dealt with?