AGEC 350, April 2016
Review Questions for the Final Exam

The following pages contain a list of questions that you should be able to answer given the material covered in AGEC 350 since the midterm exam.

In addition to these questions, you should review the key concept sheets, RATs and old exams. In terms of graphs, in addition to those covered directly below, you should make sure that you can quickly make graphs dealing with MWTP/demand, MC/supply, consumer and producer surplus, positive or negative externalities and public goods.

Copies of previous exams are available at on the class web site. Since material changes somewhat from one year to the next, it is possible that material included in previous years is excluded this year or vice versa.

YOU WILL BE ALLOWED TO BRING TO THE EXAM TWO 3X5 INCH NOTECARD WITH NOTES ON BOTH SIDES OF THE CARD. No calculators will be allowed. If calculations are necessary, you can simply write out the formula that you would type into your calculator.

- The final exam is comprehensive. About 2/3 of the material will focus on topics covered since the midterm exam, but will often rely on basic theoretical concepts presented in the first half of the class. Be sure to review all material from before the midterm too.
- To perform well on the exam you must be able to answer these questions. You must understand the concepts, not simply be able to reiterate the answers to questions you’ve already seen.
- There will also be at least one “clippings question” in which you are asked to apply economic concepts to a newspaper clipping.
- There will two RAT-repeat questions base on RATs administered since the midterm exam.

Environmental Policies

1. The figure above presents the profits that two firms can make as a function of the amount of pollution they emit when they make other choices optimally.
   a. If they are not regulated, how much pollution would each firm emit?
   b. For Firm 2, draw the marginal abatement cost curve. That is, on a graph show the cost to the firm in terms of reduced profits for each pound of pollution that it reduces? The start of the
graph is provided below

![Graph showing marginal abatement cost vs pounds of pollution.](image)

c. Suppose the government imposed a regulation in which each firm were required to reduce their emissions to 5 thousand pounds. Would this be cost effective? Why or why not? What does it mean for these two firms if it is not cost effective?

d. Approximately, what would be a cost effective allocation of pollution for the firms to get to 10 thousand pounds of total pollution? How do you know this is cost effective?

e. If the government wanted to use a tax to reduce pollution to a total of 10 thousand pounds, what tax rate per pound of pollution would it need to charge? What would be the final allocation of pollution control responsibilities?

f. If the government wanted to use a subsidy to reduce pollution to a total of 10 thousand pounds, what subsidy rate per pound of pollution that each firm reduces would it need to pay? What would be the final allocation of pollution control responsibilities?

g. If the government used a cap and trade approach in which each firm started with rights to emit 5 thousand pounds of pollution. Would any trading take place? If so, which firm would buy rights to emit more and which firm would sell rights and emit less? What would be the final allocation and approximately what price would the rights trade at?

2. A business uses labor and materials to produce a product. The production process yields profits, but also creates pollution. The manager’s options are presented in the table below.

<table>
<thead>
<tr>
<th>Labor (workers/day)</th>
<th>Materials (total tons/day)</th>
<th>Profit</th>
<th>Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Profit: 10</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Profit: 15</td>
<td></td>
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<tr>
<td>1</td>
<td>3</td>
<td>Profit: 15</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>Profit: 13</td>
<td></td>
</tr>
<tr>
<td>2</td>
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<td>2</td>
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<td>3</td>
<td>1</td>
<td>Profit: 12</td>
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<tr>
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<td>2</td>
<td>Profit: 18</td>
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<td>2</td>
<td>Profit: 18</td>
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<td>3</td>
<td>Profit: 20</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Profit: 22</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Pollution Limit</th>
<th>Labor</th>
<th>Materials</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 pounds</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3 pounds</td>
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<td></td>
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<td>2 pounds</td>
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<td></td>
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<tr>
<td>1 pounds</td>
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</tr>
</tbody>
</table>

a. If there is no restriction on pollution, what inputs would the firm choose?

b. Consider the option 4 workers and 2 tons of materials. Explain why this option is “dominated.”

c. Complete the following table:

d. If the firm is required to pay a tax of $1 per pounds of pollution, what would be its optimal choice?
e. If the firm is paid a subsidy of $2 for each pound that it reduces its pollution, what would be its optimal choice?
f. Suppose the firm had initial rights to emit 2 pounds of pollution but could buy or sell credits. What would be the highest price the firm would pay for one additional credit? What would be the lowest price at which the firm would sell one credit?

3. Perverse incentives
   a. Define the term perverse incentive.
   b. How did the Corporate Average Fuel Economy (CAFE) standards create a perverse incentive?
   c. Explain how a tax on gasoline could have achieved the same outcome as the CAFE standards (i.e., higher mileage cars) without creating a perverse incentive.
   d. With the goal of reducing water use, governments sometimes subsidize drip irrigation, which uses less water per acre. These subsidies, however, frequently lead farmers to change crops and irrigate more land, leading to an increase in total water usage. Explain how this is another example of a perverse incentive.

Climate Change

4. According to the best available scientific measurements, what has been the pattern of global temperatures in the past 50 years? (One sentence)

5. What is a greenhouse gas and what is the basic theory behind the hypothesis that climate change has been anthropogenic. One to two sentences.

6. For each of the consequences of global climate change listed below, identify
   1) one of the most important impacts on humans,
   2) whether the impact is a market or non-market impact,
   3) the valuation method that would be best suited to placing a dollar value on the impact,
   4) a brief explanation how adaptation might diminish to some extent the magnitude of the consequences.
   a. Global average sea level has rise
   b. Loss of habitat for species.
   c. Climatic disruption, with some areas experiencing drought

7. The figure above presents the MC curves for corn and wheat in a particular region before climate change (solid lines) and after climate change (dashed lines). Using the graphs, explain how adaptation is likely to occur in this region and how adaptation is related to the cost of climate change.
8. Define adaptation and mitigation. Which of these is more likely to occur without cooperation or government coercion and why? (Refer to characteristics of efficient property rights).

9. Complete these sentences. “The level of mitigation that is efficient would be that level that maximizes _______. This will be achieved where the ____________ is equal to the ____________. This is an application of the _______ equimarginal principle.”

10. Assuming that global climate change is in fact anthropogenic, is the US economy currently producing the efficient level of CO$_2$? Explain. (Hint: there is currently no national policy regulating CO$_2$ emissions).

Toxic risks

11. A safety product has been shown to reduce the mortality rate from 0.00060 (about 1 in 1,660) to 0.00059 (about 1 in 1,690). Consumers willingly pay on average $90 for this product. From these choices, what is the inferred value per statistical life? (ans: $9 million).

12. Imagine that every year a toxic chemical causes an average of 2 deaths per 100,000 people in the population. In a nation of 10 million people, the cost to eliminate the chemical is $5 million.
   a. Calculate the cost per statistical life.
   b. If people in the nation hold a value per statistical life of $2 million, would the policy eliminating the chemical pass a benefit-cost test?

13. The figure above presents two demand curves for water, with and without perchlorate, which may lead to thyroid damage.
   a. Which of the following areas tells us the total willingness to pay of the consumer for making water perchlorate-free: enhd, enb, emkd, ema?
   b. Which of the following areas tells us the net benefits to consumer of making water perchlorate-free at $b/unit: enhd, enb, emkd, ema?
   c. Assume the government is committed to supplying perchlorate-free water, but will pass the cost on at the price $c/unit. What areas (one positive one negative) will indicate the net benefit to the consumer?
d. Assume that the size of the area emkd is $1.50, the probability of thyroid damage drinking water with perchlorate is 0.00001, and the probability is zero if the water does not have perchlorate. What is the statistical value to the consumer of avoiding thyroid damage?

14. Recall the video about the Royale Comfort Seating:  
https://youtu.be/4LedrWsMx50

a. Develop an argument that the labor market led to an efficient outcome in which workers voluntarily accepted the risks they faced.

b. Develop an argument that the labor market led to an inefficient outcome in which workers are not compensated for the risks they faced.

Efficient allocation of a resource. The problem of water

15. In terms of each system’s ability to achieve an efficient allocation of water, what is the key difference between a system of riparian rights and a prior appropriation system?

16. In the following graph, Al lives downhill from the reservoir, so for him the cost to use water is zero. Betty, on the other hand, has to pump water uphill, every unit she uses costs her $1.

![Graph of marginal net benefit (MB) for Al and Betty](image)

a. What is the marginal net benefit to Al of the 20th unit that he uses?

b. What is the marginal net benefit to Betty of the 20th unit that she uses?

c. Suppose Betty already has a right to 20 units of water. How much would she be willing to pay per unit for a marginal increase water delivered to her field? What price per unit would she be willing to pay to increase her water rights by a little bit?

d. Suppose there are 100 units of water available in the supply. What would be the efficient allocation of water between Al and Betty?

e. Suppose there are only 15 units of water available in the reservoir. What would be the efficient allocation of water between Al and Betty?

f. Now suppose there are 30 units of water available. What would be the efficient allocation of water between Al and Betty?

g. Suppose it turns out that Al has complete control over the water supply with 30 units of water. Al doesn’t feel like dealing with water sales, so Betty ends up with nothing. What is the welfare cost that results?
h. When Al’s son takes over the property, he is willing to make a deal. What is the welfare gain to both parties?

i. Describe in words how the third equimarginal principle is satisfied or not satisfied under riparian and prior appropriation systems of rights. If the equimarginal principle is not satisfied, which characteristic of efficient property rights fails?

17. Using again the Al and Betty figure above, assume now that Al and Betty are consumers who purchase their water from a municipal water authority. The cost to the water authority to deliver water is $2 per unit.

In wet years the water authority can get as much water as it wants.

a. What would be the efficient price?

b. How much would Al use? How much would Betty use?

c. Would the water authority make a profit?

In dry years, the water authority can only obtain 40 units of water.

d. What would be the efficient price that the water authority should charge in dry years?

e. How much would Al use? How much would Betty use?

f. Would the water authority make a profit?

g. Suppose that a law like the one in California were passed making it illegal for a public water authority to make a profit. What would be the outcome in dry years?

18. Consider the following pricing system for municipal water. For each, explain why it could or could not satisfy the 1st and 3rd equimarginal conditions.

a. Uniform rate structure

b. Declining block rate structure

c. Inverted block rate structure

d. Seasonal rate structure with uniform rates within each season

Discounting, present-value benefit-cost analysis and the efficient allocation over time

19. A policy maker is considering whether to spend $6,000 on a project that will generate a $1,200 per year in benefits for five years? How do we know that for any positive discount rate, the will not project pass a benefit-cost test?

20. Suppose a project costs $10,000 immediately and then $1,000 each year for 3 years. The benefits of the project are worth $3,500 per year and occur for 4 years starting one year from now. Given a 10% discount rate, does the project pass the benefit cost test? (On a test you would be required to show the calculations you would need to carry out to evaluate the project).

21. At one time, it was not permitted to use discounting to evaluate water projects such as the construction of reservoirs. How does this restriction lead to socially inefficient allocations of resources? Hint: Think about what we give up (i.e. what are the opportunity costs) when we spend money on a reservoir.
22. The figure above presents the demand for a nonrenewable resource. There are 950 units of the resource available that must be used in two periods.
   a. If the discount rate is 10% per year, what is the dynamically efficient allocation of the resource over two periods?
      \[Q(\text{today}) = \underline{\phantom{0000}}, \quad Q(\text{next yr}) = \underline{\phantom{0000}}.\]
   b. What price in each period would lead to the dynamically efficient allocation across the two periods?
      \[P(\text{today}) = \underline{\phantom{0000}}, \quad P(\text{next yr}) = \underline{\phantom{0000}}.\]

23. Using the figure above question 22, and assuming a 0% discount rate and that there are 600 units of the resource to be used over the two periods, which of the curves below is the marginal user cost curve in the first period? On the exam, you should be able to actually derive the user cost curve.

24. If the decision maker had a discount rate of 10%, how would that change the marginal user cost curve relative to question 23.

25. True or false and explain. If a resource is used in a dynamically efficient manner then the marginal net benefits obtained from the resource should be equal in all periods. \text{ ans: false } ...

26. Explain why theory tells us that there is a tendency for the price of a non-renewable resource to rise over time.
27. Building on your answer to the previous question, explain why prices would not tend to increase as far if there is an alternative resource (i.e. a backstop technology) that can provide the same benefits as the non-renewable resource.

28. What “the bet” between Julian Simon and Paul Ehrlich tell us about the reliability of the basic theoretical model of prices for non-renewable resources?

29. The Ogallala Aquifer is a vast underground reserve that recharges very slowly, meaning that for the most part we can treat it like a non-renewable resource. How does the principle of user cost apply to the Ogallala?

30. Consider the decision about whether to build a windmill on your property. You know that it will generate electricity, but if you build it you won’t be able to develop your land for tourism. Next year a decision will be made about whether to build a theme park about five miles from your property, which would make your land much more valuable for tourism.
   a. Applying the principle of quasi option value, what question would you ask yourself when evaluating this decision?
      ans: By waiting until next year, you know more about the value of the alternative use of your land. There is a value to waiting – this is the quasi option value.
   b. Now explain how the principle of quasi option value might be helpful in making a decision regarding the building of a dam.
      ans: The value of a dam depends on the surrounding community and many other factors. The more you wait, the better the information about these factors – that’s the quasi-option value. Of course, you can’t wait forever because you don’t get benefit if you don’t build.

Energy

31. When will we run out of oil? Why?

32. The table below presents some data from the U.S. Energy Information Agency’s estimates of the levelized costs in dollars per megawatt-hour of new electricity production entering in 2018.

<table>
<thead>
<tr>
<th>Plant type</th>
<th>Variable Costs (including fuel)</th>
<th>Total system levelized cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Coal</td>
<td>29.2</td>
<td>100.1</td>
</tr>
<tr>
<td>Advanced Coal with CCS</td>
<td>37.2</td>
<td>135.5</td>
</tr>
<tr>
<td>Natural Gas: Advanced Combined Cycle</td>
<td>45.0</td>
<td>65.6</td>
</tr>
<tr>
<td>Natural Gas: Advanced CC with CCS</td>
<td>54.1</td>
<td>93.4</td>
</tr>
<tr>
<td>Wind</td>
<td>0.0</td>
<td>86.6</td>
</tr>
<tr>
<td>Solar Photovoltaic</td>
<td>0.0</td>
<td>144.3</td>
</tr>
</tbody>
</table>

   a. Based only on these data, what is the most profitable type of energy to develop if all electricity is sold at the same price?
   b. Suppose that the government wanted to encourage producers to build solar photovoltaic electricity. How much of a subsidy in dollars per megawatt-hour would the government have to pay producers to get them to build of solar energy instead of their best alternative option?
   c. Suppose that you own an existing conventional coal power plant. If the government wanted to incentivize you to shut down the plant and replace it with a wind plant, based only on these data, how much of a tax on your coal production would the government have to impose?
   d. What is the difference between dispatchable and non-dispatchable technologies? Which of the technologies in the table are dispatchable? Why is it important for an electric grid operator to have dispatchable energy?
Fishes and open-access resources

33. Using the figure above,
   a. What is the open-access equilibrium level of effort, revenue, cost and profit?
   b. Approximately, what is the maximum sustainable revenue?
   c. Approximately, what is the economically efficient level of effort, revenue, cost and profit?
   d. Assuming fishing effort started at 100 fishing days, explain how it eventually ends up at the open-access equilibrium.
   e. In a single sentence, explain what is meant by the Tragedy of the Commons? How is it represented in the figure above?
   f. If the fishery were owned by a single owner who seeks to maximize sustainable profits, approximately how many boat days would the fisherman use?
   g. Suppose that in order to reduce overfishing, the government placed a tax on fishing effort so that for each boat-day the fishermen have to pay a tax of $10. What would be the new equilibrium levels of effort, revenue and profit?
   h. If you could place a limit on the number of fishing days in order to maximize the profits to the fishermen, what would be the limit that you would place?
   i. What tax on effort would lead to an equilibrium at the economically efficient level of fishing effort? $20/boat day

34. Consider each of the following types of policies and explain whether (i) the policy can be effective in reducing overfishing, (ii) the policy can achieve an economically efficient outcome in terms of the rents generated by the fishery, and (iii) the policy leads to an improvement in the welfare of fishermen in the fishery relative to the open-access equilibrium. For each of these you should be able to show the impact graphically on a standard curve like the one in question 33 and explain the intuition in a way that could be understood by someone with no economic knowledge.
   a. Limits on the season.
   b. Restrictions in the type of gear that fishermen can use.
   c. A tax on fishing effort
   d. A tax on fish sold (reducing the price paid to fishermen).
   e. A transferable rights program.
Recycling
35. **Using an economic perspective**, if recycling is the answer, what is the question? (For full credit, the question that you ask, will need to make clear what benefits and/or costs are of concern at each level and the question must be such that recycling really is a correct answer.)
   a. from the perspective of a city trying to deal with its waste management?
   b. from the perspective of an individual?
   c. from the perspective of society?
   d. For each of these, why is recycling the answer to the question you pose?

36. How does marginal-cost pricing lead to more socially efficient waste management?

37. Suppose that 80% of aluminum is recycled. How many pounds of final product are generated for each pound of ore that becomes a product? If the recycling rate increases to 90%, now how many pounds of final product are generated for each pound of ore that becomes a product?

A few good basic questions
38. The word externalities refers to benefits or costs that are external to the person that controls the asset. Using a graph, explain how a tax can **internalize** a negative externality.

39. Why are public goods (non-rival and non-exclusive) not provided efficiently by the private market?

40. True or false and explain. (note: if a T/F question is on the exam, the majority of the points will be based on the explanation, not on the true or false answer).
   a. If the marginal benefit of an additional unit is greater than the marginal cost, then it would be efficient for the economy to provide that unit. **ans: generally yes, as long as by benefit & cost we're capturing all the benefits & costs, i.e. there are no externalities.**
   b. A resource is being used efficiently if the marginal net benefits are maximized. **ans: false**

41. Give an example of the failure of each of the characteristics of efficient property rights.

42. Don’t forget Uncle Bob and Aunt Sue. One of them is very likely to visit us on the final exam.