Final Exam
Introduction to Environmental and Resource Economics, December 12, 2004
150 points total

1. Answer one of the following two questions, providing one detailed example for your answer. Include a graph, with all elements labeled and defined. A good one-page answer is sufficient. (40 points)

   (a) The general theme of the class has been one of optimal conditions which balance two things (supply and demand, costs and benefits, costs to firms, net benefits across time) at the margin. Pick your favorite "marginal this equals marginal that" condition, and explain (briefly) 1) the economic issue under consideration, 2) its potential policy implications, and 3) why the "marginal this equals marginal that" solution is or is not socially optimal.

   (b) Throughout the class, we have discussed several examples where the difference between one agent's willingness to pay and another agent's willingness to accept resulted in positive gains from trade. We used this positive gains from trade to argue that a trade would take place between the two agents, and that trade would cease when the gains from trade reached zero. These examples include consumers and producers in a market with no externalities; Coasean bargaining between the party who was not assigned a property right to either pollute or have the right to a pollution-free environment and the party with that property right; two firms facing a pollution abatement requirement, and consumers of a natural resource in the future and owners of that resource in the current time period. Pick your favorite example and 1) graphically illustrate and verbally explain the WTP, WTA, and gains from trade 2) Discuss the equilibrium condition that we believe will be reached from this trading. What factors are equated at the margin by the trading?

2. (50 points) (I'm making this up, except for the part about the new city park.) The City of Fairfax is considering installing an outdoor wireless network in the planned new Fairfax Old Town Center, in order to encourage people to use the new cafes, bookstores, and city park. The city has hired a team of graduate student consultants from George Mason University to help them evaluate the costs and benefits of their decision, and ultimately decide whether or not the project should be implemented. You are part of that consultant team.

   (a) (10 points) What kind of good is the Outdoor Wireless Network (OWN)? Is it *non-rival* and *non-excludable*? Explain. Discuss one reason why we might not expect the free market to provide the optimal level of outdoor wireless service. (Please ask me if you are not familiar with wireless networks.)

   (b) (10 points) Because outdoor wireless service is not yet available in the marketplace, the city realizes that they will need to use some kind of non-market valuation technique in order to estimate the social marginal benefits of the OWN. Describe one method they might use to estimate the social marginal benefit curve. What are some of the potential difficulties with this method?

   (c) (10 points) The city decides to commission a contingent valuation study to estimate the value of implementing the OWN. Please provide them with two recommendations for developing a sound contingent valuation study.

   (d) (10 points) Using the social marginal benefit curve derived by summing the private marginal benefits curves estimated through the contingent valuation study, the city finds that the marginal social benefits (in thousands of dollars, where Q represents the number of concurrent users of the network, in hundreds) for the OWN are:

$$MSB = 10 - Q$$

   and, they estimated that the marginal costs of providing the service will be:

$$MSC = 2 + Q$$

   From these functions, they derive the following related functions:

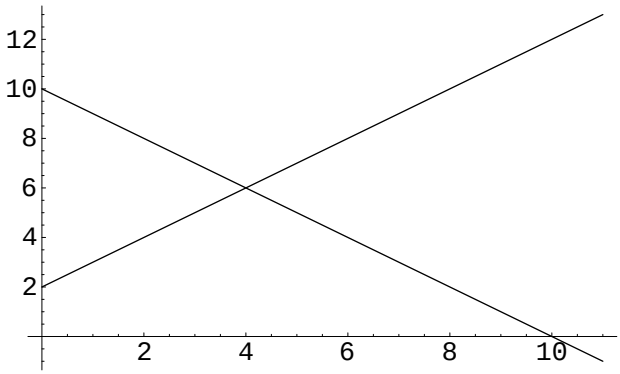
$$\text{marginal net benefit} = MNB = 8 - 2Q$$

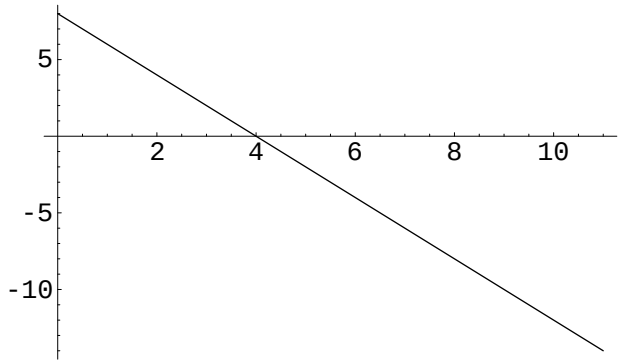
   and:

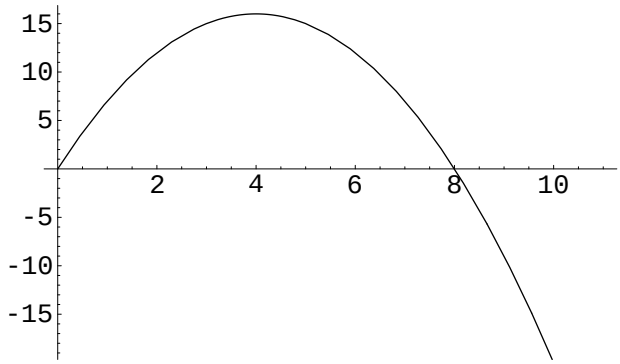
$$\text{total net benefit} = TNB = 8Q - Q^2$$

   These functions are graphed for you on the next page. What would be the socially optimal amount of OWN service that should be provided? Calculate the value, and label it on the graphs, labeling each function on each graph as well.

(e) (10 points) It turns out that the city has a choice of buying two sizes of wireless network transmission stations. The first serves 500 users at a time ($Q = 5$), and the second serves 1000 at a time ($Q = 10$). Should they purchase either of these transmission stations? If so, which one should they purchase, and why?







3. (30 points) Pat and Chris are students in next fall's "Introduction to environmental and resource economics" class. At the beginning of one class, I give Pat and Chris each one 3 ounce bag of M& M's. I indicate that these M& M's need to last each of them two weeks. They are each allowed to eat part today, and save part for next class. However, they are not allowed to bring any other food to class. Pat and Chris each have identical marginal benefits and costs of consumption of M& M's. They face an interest rate of 10%. Each has diminishing marginal enjoyment from their consumption equal to:

$$MB = 3 - Q$$

and constant marginal cost, in terms of weight gain, of:

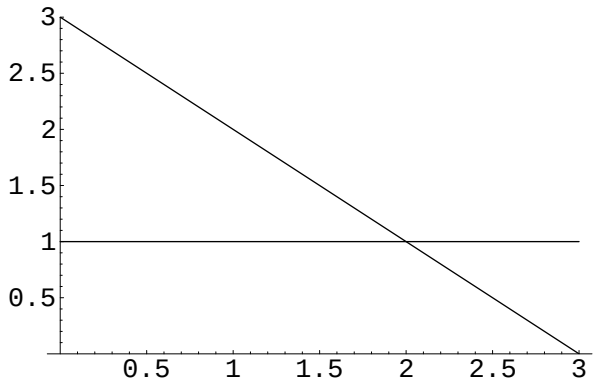
$$MC = 1$$

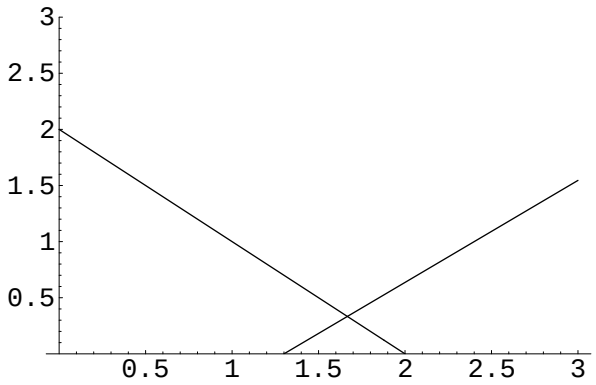
Their marginal benefits and costs for each of the following two weeks are graphed for you below. As well, the present value of net marginal benefits, assuming the limited supply of 3 units, are graphed for you in a box graph.

(a) (10 points) Calculate each individual's optimal consumption of M& M's for week 1 and week 2. Do they consume equal amounts of M& M's each week? Why or why not?

(b) (10 points) What is the Hotelling rent for each week? How does the Hotelling rent change over time? Why?

(c) (10 points) How would your answers to the above two questions change if the interest rate went up to 20%? Explain. (You can answer in qualitative terms; you do not need to recalculate your answers.)





4. (30 points) After the two weeks are up, I change the property rights structure of M& M's. Instead of giving each person their own bag of M& M's, I put all 6 ounces of M& M's in one container, and allow each person to take as many as they want, before they pass the container to the next person.

   (a) (10 points) What kind of property rights regime now best describes the M& M's, in terms of whether the goods are rivalrous and excludable? Explain. Give another example of a natural resource that shares these characteristics.

   (b) (10 points) Pat presented the Hardin article about the "tragedy of the commons" and was very impressed with the arguments that it presented. She decides to develop a simple game-theoretic set up to help her figure out how many M& M's she should take when it is her turn. She outlines two possible courses of action. Each person can be "restrained" by consuming only 1.5 ounces of M& M's in each time period, or "not restrained" by consuming as many as they want in the first time period, then half of what is left in the second. She comes up with the following payoff structure, in terms of total M& M's consumed. (Note she is in a hurry and doesn't discount, or calculate net marginal benefits of each outcome.)

	Pat is restrained	Pat is not restrained
Chris is restrained	(3,3)	(2.75,3.25)
Chris is not restrained	(3.25.2.75)	(3,3)

   Having calculated the Nash equilibrium, what does Pat decide to do? Given your answer to 3.(a), do you think this outcome is socially optimal?

   (c) (10 points) Chris presented the Ostrom article and was very impressed with the arguments it outlined. He briefly describes these arguments, applied to the M& M problem, to Dr. Parker, describes the reasons why he believes that a set of rules to manage M& M allocation over the next two weeks could be successfully developed, and suggests characteristics of the set of rules that might be developed. Briefly summarize Chris' possible comments to Dr. Parker. (Two conditions for successful rules and their implementation are sufficient.)