Final Economics Exam **Answer Key**

I. Definitions (7 points each) Briefly define each of the following terms.

discount rate
The rate at which future values are decreased to yield present values. It is the "r" in the formula PV = FV / $(1+r)^T$. The discount rate is like an interest rate in reverse: an interest rate expresses the growth from present to future; a discount rate expresses the diminution from future to present. In practice, a market interest rate is often used for the discount rate.

option value
This is the value of retaining the option to use a good or service even if there are no present plans to use it; it arises in the context of choices that might irreversibly curtail future use possibilities.

path dependence
This describes a situation in which the mere fact that a particular course of action has been chosen in the past makes it difficult to switch from it in the future. Applied to the problem of clean technology, it refers to the barriers an existing technology throws up to potential newcomers: economies of scale, complementary technologies, advantages derived from learning-by-doing, etc.

II. Short-answer questions (15 points each) For three of the following four statements, indicate whether they are true or false and briefly explain why.

1. One of the most difficult aspects of standard cost-benefit analysis is knowing when to estimate a monetary value for a cost or benefit to be included in the study, and when not to.
False. There is no choice around whether or not to estimate monetary values; if no monetary value is assigned to a cost or benefit, it cannot be included. Of course, coming up with such values may well be very difficult.

2. Economists have conducted cost-benefit analyses of mandatory targets for reducing greenhouse gas emissions. In all probability, these studies overestimate the ultimate costs of reducing these emissions.
*True. The cost of **preventing** the release of greenhouse gases will probably be much less than the cost of **mitigating** them, although prevention may require technological innovation, which is difficult or impossible to measure in advance. (It is important to mention innovation to get full credit.)*

3. The lower the discount rate employed, the more likely it is that a cost-benefit analysis will demonstrate that the costs of logging the Tongass National Forest (a largely old-growth tract on the Alaskan panhandle) exceed the benefits.
True. The main benefit of logging will be the money earned from the timber itself; this will occur in the near-term. The main costs are to the ecological functions of the forest, which will persist for many (human) generations. Most of this will therefore occur well into the future. By making the future worth more relative to the present, a lower discount rate will accentuate the costs relative to the benefits.

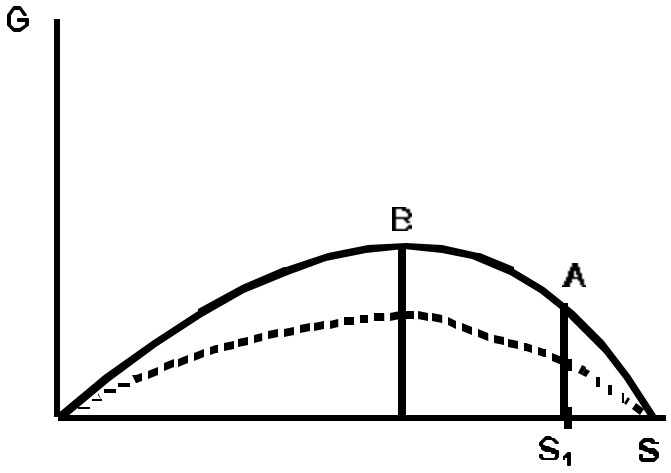
4. Since nearly all automobiles in America operate on gasoline engines and only a handful use electric engines, we can conclude that the first technology is superior to the second (in terms of manufacturing and operating costs relative to consumer willingness to pay).
*False. While gasoline technology may be superior in this sense, we can't conclude this from the information given. There is substantial **path dependence** at work: complementary technologies (decades of auto design built around gas engines), economies of scale (electric car works are small-scale and high cost), network effects (there are gas stations throughout the country but few electricity recharge stations), subsidies to the existing technology based on a constituency built up over years of use, accumulated expertise, etc.*

III. Problems Solve all of the following numerical and graphical problems.

1. (15 points) 1000 individuals are given the following survey question: “Chinook salmon have been eliminated in several tributaries of the Columbia River watershed. This is due primarily to the loss of habitat and impassability resulting from the construction of several hydroelectric dams. These dams could be breeched, but that would increase electric generating costs. If we breech the dams, there is a 20% chance that salmon could be restored upstream from them. How much more would you be willing to pay on your annual electricity bill to breech the dams for this purpose?” The average response was $60. There are four million ratepayers (individuals who pay electricity rates) in the region. If you are using this survey as the basis for a contingent valuation estimate of restoring salmon runs beyond existing dams, what monetary value would you assign? (Note: You should provide an answer that will not require you to redo the survey if new scientific evidence changes the odds that breeching the dams will restore the salmon.)
If people are willing to pay $60 for a 20% chance of salmon restoration, we can infer a WTP of $300 for a statistical certainty. Multiply this by 4,000,000 (the number of people who would presumably be willing to pay this), and the result is $1.2 billion.

In general, what is this survey measuring — use value, option value, existence value, or mitigation value? (It’s one of them.)
Existence value, since only a small proportion of the population would “use” (or even value the option of using) the salmon directly (in fishing, watching spawning runs, etc.). Also, the survey is not measuring mitigation value, which would be the cost of restoring the habitat itself.

2. (18 points) The solid line in the diagram below depicts the relationship between the quantity of timber biomass (S) in a forest plot and the annual addition (G) to that biomass (growth). In the following analysis, assume (1) there are no benefits to the forest other than cutting and selling the timber, (2) there are no costs to cutting the timber and bringing it to market, and (3) the price of timber is expected to remain constant indefinitely.



a. Identify the sustainable yield corresponding to stock size S_1.
The height of the vertical line extending to A.

b. Identify the maximum sustainable yield. (Note: not the stock size at which MSY occurs, but the yield itself.)
The height of the vertical line extending to B.

c. Suppose all factors remain the same, except that a new forestry study finds that the true S-G curve is really flatter, as represented by the broken line. Will the **profit-maximizing** stock size be greater (to the right), less (to the left) or the same as it was when the original solid line curve was used? Explain.

It will be less. The slope of the stock-growth (S-G) curve indicates the rate of return on the "investment" of letting the trees grow rather than cutting them down, producing a bigger and more productive stock in the future. This rate of return is compared to the interest rate at which money earned from the sale of timber can be invested. The profit-maximizing stock is that at which the slope of the curve corresponds to the available interest rate; it will nearly always be to the left of MSY. Looking at the diagram, the broken line curve has a flatter slope at any stock size, so its return is smaller. This means that, at the stock size corresponding to profit maximization for the solid line curve, the post-study growth rate of forest is less than the interest rate. Only at a smaller stock size would the curve be steep enough to be profit-maximizing.

Extra Credit: You go into a store and spend $1.75. How much do you have left?
This was intended to be humorous. Unfortunately, there were a lot of sincere attempts to answer it. Sorry...