Economics 3250 Dr. Lozada
Spring 2015 Exam 1

This exam has 25 points. There are six questions on the exam. Most of the questions are worth 4 points, but one is worth 5 points.

Put your answers to the exam in a blue book or on blank sheets of paper.

You have the entire class period (that is, until **1:10pm**) to take this test.

Answer the questions using as much precision and detail as the time allows. Correct answers which are unsupported by explanations will not be awarded points.

Answer all of the following six questions.

1. **[4 points]** Give a numerical example showing that the "average" value of a function is not the same as the "marginal" value of that function.

2. **[4 points]** In class and in the textbook it was shown that, in a simple situation, a tariff is inefficient. Give a (not-so-simple) example in which *getting rid* of a tariff might be inefficient. You do not have to draw a graph, and you do not have to prove that "in a simple situation, a tariff is inefficient."

3. **[4 points]** Suppose that if a society invested $1.00 in pollution control today, it would get a benefit of $1.10 one year from now.

   Tell me everything you know about the social discount rate of a society which decides that it is not worthwhile to make that investment. Explain your answer, preferably using some mathematics.

4. **[5 points]** Give a numerical example of a plausible case in which Cost-Benefit Analysis fails to be a "complete" ranking.

   Hint: use "willingness to pay" and "willingness to accept."

5. **[4 points]** In class, in discussing "expected value," I considered the following "lottery," which depends on how many "heads" someone can toss in a row before a "tails" is thrown, ending the game:

outcome	probability	payoff
first toss is tails	$1/2$	0
heads then tails	$1/4$	$4
two heads, then tails	$1/8$	$8
three heads, then tails	$1/16$	$16
four heads, then tails	$1/32$	$32
etc.		
n heads, then tails	$1/n$	$\$n$

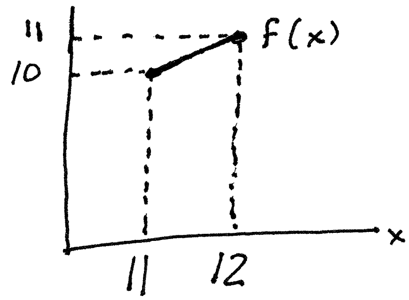
   What purpose did this example show?

   Hint: "expected utility."

6. **[4 points]** Using a graph with “output” on the horizontal axis and “$/unit” on the vertical axis, explain the Coase Theorem.

Answers to Econ. 3250 Exam 1, Spring 2015

① Answers will vary here. One example:



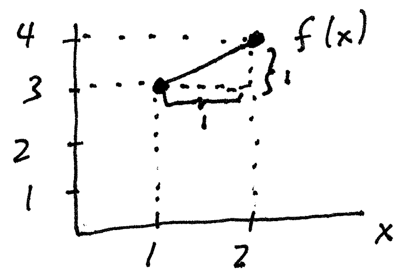
The average value of $f(x)$ at $x = 1$: $\frac{10}{11}$

— " — $x = 2$: $\frac{11}{12}$

The marginal value of $f(x)$ between $x = 1$ and $x = 2$:

$$\frac{\text{change in } f}{\text{change in } x} = \frac{\Delta f}{\Delta x} = \frac{11-10}{12-11} = \frac{1}{1} = 1$$

Another example:



Average at $x = 1$: $\frac{3}{1} = 3$

Average at $x = 2$: $\frac{4}{2} = 2$

Marginal from $x = 1$ to $x = 2$: $\frac{\Delta f(x)}{\Delta x} = \frac{4-3}{2-1} = \frac{1}{1} = 1$.

In this class we do not use the other notion of "average," which would be $\frac{10+11}{2}$ for the first example and $\frac{3+4}{2}$ for the second example.

$\frac{10+11}{2} \to 10\frac{1}{2}$ $\frac{3+4}{2} \to 3\frac{1}{2}$

(2)

Consider the situation between the USA and Mexico before NAFTA (before the mid-1990's). Mexico had a tariff on US corn imports. Getting rid of this tariff may have been inefficient, even though it shifted corn production from relatively expensive Mexican peasant farmers to relatively cheaper, mechanized US farmers. This is because US production is artificially cheap: farmers don't have to pay for pollution caused by runoff of the agricultural chemicals they use. Eliminating the tariff caused US output to rise and US pollution to increase. Mexican peasants often had to grow organically because they could not afford agrichemicals, so their fall in output did not help the environment. On net, eliminating the tariff caused the environmental inefficiency to increase. This might outweigh the efficiency-increasing shift of production to the US; if it does, then the total effect of eliminating the tariff would be an increase in inefficiency.

(3)

- \$1 today
+ \$1.10 in 1 year

$$\text{Present Value} = -1 + \frac{1.10}{1+r}$$

↑ "PV"

↑ "r" is the social rate of discount

If society does not want to make this investment, it must have a negative present value. So

$$-1 + \frac{1.1}{1+r} < 0$$

$$\frac{1.1}{1+r} < 1$$

$$1.1 < 1 + r$$

$$0.1 < r$$

So $r > 10\%$. With such high an "r," the benefit in the future has a small present value, so small that it does not offset the costs.

(4)

I'll use variables instead of numbers so my answer is applicable to many students' frameworks.

Willingness to Pay = WTP

Willingness to Accept = WTA

Consider an environmentally damaging project bringing "π" benefits to a company and its customers. Suppose

$WTP < \pi < WTA$.

Decision: **Approve the project**

Winners get π.

Losers need WTA to compensate.

But $WTA > \pi$ so winners can't compensate losers.

Deny the project

Firm loses π.

Winners are WTP for their victory.

But $WTP < \pi$ so winners can't fully compensate the firm, which lost.

Hence neither course of action is Pareto Optimal. Society does not know what to do. Hence Cost-Benefit Analysis has not ranked these alternatives.

(5)

The expected value of this lottery is

$$\frac{1}{2}(\$0) + \frac{1}{4}(\$4) + \frac{1}{8}(\$8) + \frac{1}{16}(\$16) + \frac{1}{32}(\$32) + \cdots + \frac{1}{n}(\$n) + \cdots$$

$$= 0 + \$1 + \$1 + \$1 + \$1 + \cdots + \$1 + \cdots$$

$$= +\$\infty \text{ ("infinity" dollars)}.$$

Yet most people would only be willing to pay a rather modest amount of money to play this lottery, an amount much less than infinity. Thus, people don't tend to value things according to those things' expected value. Instead, they may use expected utility, which in this example is

$$\frac{1}{2}u(\$0) + \frac{1}{4}u(\$4) + \frac{1}{8}u(\$8) + \frac{1}{16}u(\$16) + \frac{1}{32}u(\$32) + \cdots + \frac{1}{n}u(\$n) + \cdots.$$

This could be finite, and it is if, for example, $u(x) = \sqrt{x}$. (Optional proof follows.) This explains why economists think people do not usually value lotteries by expected value but by some other valuation measure.

Optional: If $S = \frac{1}{2}\sqrt{0} + \frac{1}{4}\sqrt{4} + \frac{1}{8}\sqrt{8} + \frac{1}{16}\sqrt{16} + \cdots + \frac{1}{n}\sqrt{n} + \cdots$

$$= 0 + 4^{-1/2} + 8^{-1/2} + 16^{-1/2} + \cdots + n^{-1/2} + \cdots$$

$$= 2^{2\cdot\frac{-1}{2}} + 2^{3\cdot\frac{-1}{2}} + 2^{4\cdot\frac{-1}{2}} + \cdots$$

$$= 2^{-1} + 2^{-3/2} + 2^{-2} + \cdots$$

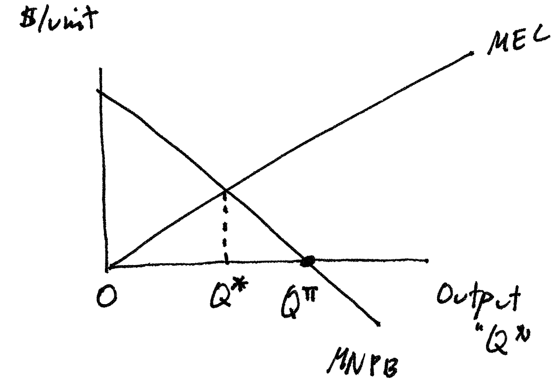
$$2^{-1/2}S = 2^{-3/2} + 2^{-2} + \cdots$$

$$S - 2^{-1/2}S = \frac{1}{2}$$

$$\left(1-\frac{1}{\sqrt{2}}\right)S = \frac{1}{2} \Rightarrow S = \frac{1}{2}\left(\frac{\sqrt{2}}{\sqrt{2}} - \frac{1}{\sqrt{2}}\right)^{-1} = \frac{1}{2}\,\frac{\sqrt{2}}{\sqrt{2}-1}\,\frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{1}{2}\,\frac{2+\sqrt{2}}{2-1} = 1 + \frac{\sqrt{2}}{2} < \infty.$$

The lottery's infinite expected value is the "St. Petersburg Paradox."

(6)



MEC: marginal external cost, measured for example by willingness [and ability] to pay for pollution reduction

MNPB: marginal net private benefit to firm to produce output. (This output causes pollution.)

If the firm has the right to pollute, $Q = Q^{\pi}$. Pollution victims offer their MEC or less in exchange for the firm reducing output and thus reducing pollution. Firms demand MNPB or more in exchange for reducing output. If MEC > MNPB then they could make a mutually-beneficial deal to reduce output. This could bring output to Q^*.

If the pollution victims have the right to clean air, $Q = 0$. Firms offer their MNPB or less in exchange for the right to increase output and hence pollution. Pollution victims demand MEC or more in exchange for allowing output to increase. If MNPB > MEC then they could make a mutually-beneficial deal to increase output. This could bring output to Q^*.

So regardless of the assignment of property rights, costless bargaining (and no strategic behavior in bargaining) would result in $Q = Q^*$, the socially-optimal level of output.