

Fall 2005

FINAL EXAM**December 12, 2005**

Answer EVERY question. You have 180 minutes to do this. Good luck!

1. There are 2 companies: a power station and a fishery. The power station produces electricity x using one input z (labor) according to the technology

$$x = f(z_1) = 4\sqrt{z_1}$$

The fishery produces fish, y , using the same input z according to the technology

$$y = g(z_2, x) = 4\sqrt{z_2} - \frac{1}{2}x$$

where x is the level of output of the power station and z_i is the input used by company i . Assume that x, y, z are traded in competitive markets at constant prices (you may assume that all prices are equal to 1).

- a) Specify the game both companies play (assuming no cooperation between companies is possible).
- b) Compute equilibrium level of output of each producer
- c) What are the efficient output levels?
- d) What Pigouvian tax could be imposed by an omniscient government to achieve efficiency?

2.. Consider a society of individuals who receive an income of \$10,000 pesos if they are healthy and \$0 pesos if they are sick. Their probability of being sick is affected by a risky but enjoyable behavior: e.g., they could choose to smoke or not. if they don't smoke, their probability of sickness is 10%, otherwise it is 50%. All individuals are expected utility maximizers with the same utility function

$$u(x) = \sqrt{x}$$

In addition, they get a lump sum utility gain of 1 "util" if they smoke.

- a) supposing insurance companies can't observe whether agents smoke (or for some other reason can't write contingent contracts - say, discrimination of smokers is prohibited), what would be the minimal cost of the full insurance such that the insurance company earns zero expected profit (actuarially fair rate of full insurance)?
- b) what would the agents do, if they all bought full insurance (at any rate)?
- c) would the agents want to buy full insurance at the rate in (a)?
- d) if there is Pareto inefficiency associated with the outcome in (c), could it be resolved by requiring everyone to purchase insurance?

3. a) Consider the following measure of wealth inequality: the proportion of wealth in this society held by the richest 10% of the population. Show that it

contradicts the transfer principle. Does it satisfy the Lorenz criterion? (if yes, explain, if no, provide a counterexample - a graph is enough).

b) Provide a simple example of an income tax schedule that is progressive in average rate, but not progressive in marginal rate.

4. An electricity company operates in two markets, A and B. The electricity demand in A (in kWt) is

$$x(p_a) = \frac{100}{p_a^2}$$

and in B it is

$$x(p_b) = \frac{100}{p_b^3}$$

The markets are completely independent from one another (in particular, the demand in each market is independent of the price in the other). You may assume that all buyers have quasi-linear preferences, so that the compensated and uncompensated demands are the same.

If the firm produces x kWt of electricity (which it can sell in either market) its total production costs are given by

$$c(x) = 2 + 3x$$

- a) what are the elasticities of demand in both markets?
- b) interpreting the marginal cost function as the supply, what is its elasticity?
- c) suppose the company is the monopolist in both markets but the government regulates the company so that the total profits of the company are equal to zero, what should be the prices p_a and p_b the company should be allowed to charge in each market (it's enough to write the equations, you don't have to solve them)? *Hints* think Ramsey rule.