RESOURCE ECONOMICS PRELIMINARY EXAMINATION
August 19, 1994

You have until 12:00 (four hours) to complete this examination. Exams will be collected promptly. Pace yourself in responding to questions so that you do not spend an undue amount of time on any one question at the expense of other questions.

Part I: Answer all of the following three questions

1. Suppose that there exists a pollutant that is known to be emitted by a certain industry, but it is impractical to observe emissions from individual firms. Suppose further that it is possible to observe firms' use of pollution-causing inputs. Then it becomes possible to attach policy to input use instead of emissions. Use this opportunity in the following setting.

   Firms 1 and 2 in the same "pollutionshed" produce good y using inputs n and w. Market-determined prices for y, n, and w are 20, 2, and 2 respectively. Production functions are given by

   $$y_1 = 2n_1^{.5}w_1^{.25} \quad \text{and} \quad y_2 = n_2^{.5}w_2^{.25}.$$

   These two firms are known to be emitting a pollutant called z. Their individual pollution contributions are not exactly known but they are estimated to be related to input use according to these linear relationships:

   $$z_1 = n_1 + w_1 \quad \text{and} \quad z_2 = 2n_2 + 2w_2.$$

   Pollution damages are given by $0.25 \cdot (z_1 + z_2)$.

   Your tasks are to completely specify two efficient policies for this setting – one is to be an efficient Pigouvian tax policy (for the inputs!) and the other is to be efficient command-and-control regulations (for the inputs!). The policy objective is to achieve maximum net social benefits. To avoid confusing the managers of these two firms, you must state each policy very clearly. Which policy would you recommend and why?

2. Residential solid waste disposal is problematic for a city for at least two reasons. First, landfill space is increasingly expensive to procure because of population-induced land scarcity. Second, public concern for ground water quality has created a variety of regulations concerning landfill management. As a result, landfills must be lined with nonporous soils and a system of observation wells must be drilled around the site to monitor possible ground water contamination.

Traditional city policy (Policy I) has been to charge each resident $10 per month for twice-a-week pickup of any and all bagged garbage placed at the roadside on Mondays and Thursdays. A policy proposal (Policy II) is to (a) collect only garbage placed in authorized containers, (b) charge $15 per month to rent each authorized containers (no other means of obtaining containers is possible), (c) change to once-a-week pick-up, and (d) encourage recycling by offering free pick-up of separated paper, aluminum, and plastic.

Analyze Policy II relative to Policy I with respect to economic merit. Provide a policy recommendation of your own construction (Policy III) and indicate its merits relative to Policy II.

3. Pollution along an important Texas river has been a highly debated issue over the last few years. Among the more prevalent environmental problems are the dumping of toxic chemicals into the river and air pollution due to the generation of electricity by three power plants located along the river. What type of a marketable permit system would you advise using, and why, for each of the aforementioned environmental problems? At times pollution along the river comes about as a result of "accidents" such as toxic spills from storage tanks. Could a marketable permit system be used in this case? Explain why or why not?

Part II: Answer one of the following two questions

4. In the Gulf of Mexico, shrimp are harvested with a fishing trawl which is non-discriminatory in what it catches. As a result, shrimp fishermen catch juvenile red snappers who are sought by commercial and recreational fishermen. Because of pressure from these three sources, red snapper stocks are down. To alleviate this problem the government has mandated that the red snapper stock be rebuilt. Its strategy has three elements: (a) require shrimp trawlers to use a bycatch reduction devise which would eliminate at least 50% of the red snapper juveniles being caught and 10% of the shrimp catch, (b) set an overall total allowable catch for the commercial harvest of red snapper, and (c) set bag limits for recreational harvest of red snapper. Please discuss the impacts of these policies and suggest an alternative policy that could be considered.

5. When an economy is faced with an essential resource that is exhaustible, say oil, it certainty behooves its citizenry to be concerned about the question of how the limited supply of the resource is best to be allocated for use over time. How would you go about allocating this resource over time? What policies would you suggest? Why? Suppose that you now find out that the citizens of this economy are also intensely concerned about quality of the environment in which they live. If use of the exhaustible fuel (oil) generates pollution as a by-product, how would your prior analysis change? Why?