I. Uncertainty

UC Berkeley has finally decided to have its own Environment Protection Office to escape the growing environment fees charged by the City of Berkeley. You have been appointed to the Board of the EPO and are in charge of economic analysis of pollution policy. You don't know the marginal cost or benefits of pollution, and so you have decided to start by setting a target level of 400 units per day of pollution. Suppose that the main source of pollution is food waste from the disposal of leftovers from box lunches. All cafés sell box lunches for $5 per box, and at this price they sell as many as they produce. You somehow simplify this problem so that all cafés use a single input \( x \) (which can be viewed as an “aggregate” of various inputs used to make a lunch box) for the box lunches. The price for \( x \) is 5 cents, and the production function is \( f(x) = 2x^2 \). On average 20% of the box lunch is wasted because the portion sizes are too large for the students. You also know that \( q \) units of leftovers cause \( q^2 \) units of pollution.

1) Derive the profit function of the cafés.
2) Derive the pollution generation function (pollution as a function of the input).
3) If there is no regulation, how many box lunches will the cafés sell? How much pollution is produced?
4) Taking into account your target level of pollution, write down the objective function you would like to maximize, and find the second best level of pollution and the input level that yields that much pollution.
5) Say that you decide to try to achieve this goal by taxing \( x \), the input. How much will you set the unit input tax to achieve this goal? What if you decide to tax pollution- how much should you tax pollution so that the cap is just reached?
6) How many box lunches will be sold under the input tax? How much pollution is produced in this case? How much is the cafés’ profit?
7) Now several of your genius friends send you an email, telling you they have figured out that the marginal cost of the pollution is 5+x. In addition, they have added the benefits of consumers to the profits and found that the social marginal benefit of each box lunch is either 555-0.1x or 355-0.1x. They need one more week to figure out the exact marginal benefit of the lunch box- unfortunately, tomorrow there will be a board meeting! You need to write a proposal regarding the relevant regulation to implement. You should either propose a pollution tax or a quota to optimize the level of emissions. Thus, you should choose only one policy (tax or quota), specify the relevant optimal tax or quota for each possible level of marginal benefit (give the relevant figures), and give solid numerical and graphical evidence (e.g. the potential loss due to uncertainty in each case), and intuitions to support your arguments. If you cannot decide, then you should ask for an extra week in the proposal and explain why you cannot make a choice between these two policies. Please write it in the form of a proposal, and the length shouldn’t exceed one page (12pt, double space).
8) What would you do if your friends had told you that the marginal benefit is actually either 10-10x or 30-10x? Would you change your proposal? Please explain the intuition briefly without mathematical computation or graph.
II. Externality Essay

Read the articles under “Related Readings” on the course website talking about San Francisco’s proposed tax on grocery bags, and be sure you’ve looked through the reader. The following questions are based on these readings, but many of them ask for you to give your personal opinion. Some questions may not have a single “right” answer, but you can still lose points for failing to support your contentions adequately. That said, conciseness is always appreciated!

A. This whole set of writings is dealing with trying to internalize the cost of an externality. Give at least three examples of the types of social costs associated with the distribution of plastic bags at supermarkets. (No numbers are needed.)

B. What is a Pigouvian tax? List some other instruments that could be used to try to internalize this externality.

C. What are the two main groups fighting the regulation, and why are they opposed to it? Explain how the proposed regulation would likely affect them.

D. One writer notes that raising the price of bags will result in reduced use. Is there any evidence for this? Describe what would happen if the price were too high.

E. How will the consultant hired to examine the regulation go about finding the “social optimum”?

F. Do you support the proposed tax? Why or why not?