PROBLEM SET 3

Due Tuesday, March 16, 1999, in class
(Late assignments will not be graded)

1. Assume that Y is produced using *flood irrigation*. Let the irrigation efficiency, (effective input / applied input) be h. P_x is the price of input water (X) and P_y is the price of the crop. The production function for Y is given by,

$$Y = (h\,X)^{\beta}$$

where β is a positive parameter.

(a) Before using any numbers,

i. Write down the profit maximization problem.

ii. Solve for the optimal amount of X, as a function of P_x, P_y, h, and β.

(b) Assume that P_x = \$80, P_y = 500, and β = 0.75. Also, assume there are two possible irrigation technologies: *Furrow irrigation* (h = 0.6) and *drip irrigation* (h = 0.9).

i. For *furrow irrigation*,

1. Calculate the input demand for X .
2. Calculate the output supply of Y.
3. Calculate the profits.

ii. For *drip irrigation*,

1. Calculate the input demand for X .
2. Calculate the output supply of Y.
3. Calculate the profits.

Summarize your results in a table.

iii. If the grower is currently using *furrow irrigation* and the cost of *converting to drip irrigation* is $5,000 dollars (the fixed cost of the equipment plus the cost of learning how to farm with *drip irrigation*), will the grower switch to *drip irrigation*?

iv. Is it possible for the grower to use more water under a higher precision irrigation system? Explain why or why not. Does the grower in part i. use less water with the higher precision system?

2. This question was inspired from the article "Steep Prices at Tea Garden" by Yumi Wilson, which appeared in the SF Chronicle on 02/26/99 [http://www.sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/1999/02/26/MN102467.DTL] You don't need the article to complete the numerical exercises below. It may serve you as background reading for the essay question. (This is not necessary, though.) *Note: You are not asked to explain your answers to parts a - g of this question. You are required to SHOW YOUR WORK. Save your explanations for the essay that follows.*

Every year, there are two categories of potential visitors to the Japanese Tea Garden in San Francisco's Golden Gate Park: tourists and locals. There are also two types of locals: those that place a "high" value on their visit to the Garden and those that place a "low" value on their visit to the Garden. Imagine, for the time being, that there could be more than one garden. The marginal benefit for an individual in each of the three groups of potential visitors are given by their demand curves for Q, the number of gardens visited. These are,

Tourists: $P_t = MB_t = 10 - 5Q$
"high" value locals: $P_h = MB_h = 20/3 - (4/3)Q$
"low" value locals: $P_l = MB_l = 10/3 - (2/3)Q$

(a) Draw these curves on the same graph. What is the most money each type of visitor is willing to pay to visit one garden?

(b) If there are 15 "high"-type locals, 15 "low"-type locals and 45 tourists, what is the aggregate marginal benefit (AMB) curve for tea gardens? Write the two equations that define the AMB curve and specify the range of Q for which each equation is valid. Graph this AMB curve.

(c) Suppose the annual marginal costs of maintaining the gardens are MC = 30 + 315Q. What is the efficient number of gardens, Q*, to provide? What is the total cost of providing Q*?

(d) If the entry fee is $2.50, how many visitors will the Garden get? What are the Garden's total revenues and total profits under this pricing policy?

(e) Suppose the entry fee is increased to $3.50. How many visitors will the Garden get? What is the highest fee the Recreation and Park Commission could charge and not exclude any of the potential visitors? What are the total revenues and profits under both of these fees?

(f) How much of an admission fee would a monopoly concessionaire charge?

(g) Could the Garden still cover its costs by allowing locals to enter free but still charging tourists? Show how it could or could not.

3. (**Essay Question**) Assume that all of the information in the numerical exercise reflects the true costs and benefits of the Japanese Tea Garden. Write a brief (less than one page) economics-inspired essay arguing whether or not residents of San Francisco should have free access to the Garden. At a *minimum*, you should address whether the Tea Garden is a public good and what are the net benefits under a free and a fee policy. You may also choose to discuss (i) other pricing policies, (ii) who the users will be under each policy, (iii) the quality of the experience under each policy (e.g., crowding), (iv) cost-recovery, (v) concession licensing of the gate and of the teahouse/café, (vi) anything else you think may be economically relevant.