

Homework #2, ChEg 542

■ Due 9/17/97

1. V&M, 1.18
2. Linear optimization

Suppose that you wish to maximize the profit for a fertilizer manufacturing operation. You can make two different grades of fertilizer which have different formulations and also different profit margins. The first fertilizer is 10-9-6 (where the "10" is the wt.% of equivalent Nitrogen, the "9" is the wt. % of equivalent Phosphorous (as P_2O_5) and the "6" is the wt. % of Potassium as K_2O). The second is 7-10-18. The profit on the first is \$35/ton and the second is \$30/ton. You have available enough material for 1500 tons of (equivalent) Nitrogen, 1500 tons of P_2O_5 and 1900 tons of K_2O .

- a. How much of each fertilizer should you make to obtain the maximum profit?
- b. Which ingredient is limiting further profit the most?
- c. How much are you willing to pay for (how much of) this ingredient to increase your objective function until something else becomes limiting (what is this second one?). Assume that you will want to make 50% profit (charge 2 times what it cost) on the marginal increased production (above the original optimal answer).

3. Dimensional analysis

There is a new product on the market to keep leaves and other debris from getting into the gutters of houses. It simply consists of an aluminum sheet that extends from the roof part way across the gutter. The idea is that water can run in but leaves can't.

- a. What are the important variables for water running off of a roof, across the gutter guard and into the gutter?
- b. What are the dimensionless groups?
- c. What experiments would you do and what would you plot to make a universal relation for designing this type of gutter guard?

