## Homework #10 – due Friday, April 16, 2021

1. The Evergreen Fertilizer Company produces two types of fertilizers, Fastgro and Super Two. The company has developed the following nonlinear programming model to determine the optimal number of bags of Fastgro  $(x_1)$  and Super Two  $(x_2)$  that it must produce each day to maximize profit, given a constraint for available potassium:

maximize 
$$Z = \$30x_1 - 2x_1^2 + 25x_2 - 0.5x_2^2$$
  
subject to  $3x_1 + 6x_2 = 300$  lb.  
 $x_1 \ge 0, x_2 \ge 0$ 

Determine the optimal solution to this nonlinear programming model.

- 2. A local newspaper currently sells for \$1.50 per week and has a circulation of 80,000 sub-scribers. Advertising sells for 250/page, and the paper currently sells 350 pages per week (50 pages/day). The management is looking for ways to increase profit. It is estimated that an increase of 10 cents/week in the subscription price will cause a drop of 5,000 subscribers. Increasing the price of advertising by \$100/page will cause the paper to lose approximately 50 pages of advertising in a week. The loss of advertising will also affect circulations, since one of the reasons people buy the newspaper is the advertisements. It is estimated that a loss of 50 pages of advertisements per week will reduce circulation by 1,000 subscribers.
  - (a) Find the weekly subscription price and advertisement price that will maximize the profit. Make sure the objective function you use is clearly visible.
  - (b) Same as (a), but now with the constraint that the advertising price cannot be increased beyond \$400.
- 3. The following is a sample of prices, rounded to the nearest cent, charged per gallon of standard unleaded gasoline in the San Francisco Bay area in June 1997.

137, 139, 141, 137, 144, 141, 139, 137, 144, 141, 143, 143, 141

Represent these data in a frequency table.

4. Choose a book or article and count the number of words in each of the first 70 sentences. Present the data in a histogram. Now choose another book or article, by a different author, and do the same. Do the two histograms look similar? Do you think this could be a viable method for telling whether different articles were written by different authors? What books and authors did you choose?