

**CME 304 and MS& E 315 PROJECT: 2007****The Siting of Wild Bee Sites to Pollinate Crops**

The purpose of the project is to gain some experience in the difficulties of defining a problem, implementing an algorithm and interpreting output. Also to gain some appreciate that good optimization algorithms are necessary.

You will be asked to develop an algorithm that will solve the problem of minimizing a nonlinear function subject to bounds on the variables. The linesearch algorithm you have written is a key part. You will need to model the problem below to fit that format. However, should you wish you may develop a different algorithm to solve the problem.

Pollination depends heavily on bees. The usual approach is to truck domesticated bees to areas needing pollination. An alternative is to leave some land free that suits wild bees. The issue is how many sites and how to distribute them. This is a very common problem called the “facility location problem”. We shall make the problem simple in that we assume the region to be rectangular. One possibility is to cover the region by a grid and have some of the “squares” be for bees. The issue is then which squares and how many. The problem with that approach is there are integer variables. The number of bee sites will be integer but that can be found easily if the location for a given number can be solved. Things you need to do:

- Estimate an upper and lower bound for the number of sites
- Determine a model for the distance bees polinate crops. One approach is to assume that within a known range there is 100% fertilization and outside that it declines to zero for some other known range.
- Define a cost function. You can assume the benefit is proportional to the amount of crops planted and the rate of polination. The cost is the loss of land and the cost of establishing and possibly maintaining the site for the wild bees.

It is clear there is a solution since having no bees give no revenue and covering the area with bees costs money with no revenue.

Try seeing how big a problem you can solve. I have also attached some material related to this problem.

I am not interested in your code and it should not be part of your submission. Also you need to organize your output that you put in report in such a manner that it is not overwhelming. You need to include in your report how you confirmed you have the correct solution and how you checked the correctness of you code. The report is due in the final week of the quarter.