

MS& E 315 PROJECT: 2006

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 have been developing an algorithm that will solve the problem of minimizing a nonlinear function subject to bounds on the constraints. You will need to model the problem below to fit that format.

You have some choice in the problem you solve. You can think of the task as being that of drilling a hole of a particular shape. The two possible shapes you may consider are:

- An ellipse whose axis have a ratio of 3 to 1.
- A hole whose cross-section is a five sided polygon. The vertices of the polygon are the points $(0,0)$, $(1,0)$, $(3,5)$, $(3,7)$ and $(0,10)$.

You have some choice on the type of hole you can drill.

- A simple drill of round cross section. The diameter of the hole may vary.
- Instead of a drill you may think of a device that cuts a round hole perhaps by heating by a beam. The difference with the first choice is if you had a drill and cut a hole overlapping another hole it removes no material from the hole already cut. This device removes material from the bottom of the hole already cut.
- Consider a device similar to the second device except the shape of the hole could be varied from being a simple rectangular cross section to one where less material is removed at the sides of the bottom edge. You can decide how it varies.

There is a price to pay for removing more material from the hole, for not removing material and for removing material other than from the desired place. You can decide what the penalty should be.

Assume you have a fixed number of holes you can drill. You can try different values but 15 may be a reasonable choice.

The objective is to remove material to a unit depth only. The variables of the problem are the location of the centers, the diameter, and the depth of the cuts. In the simple drill there is no loss in assuming all cuts are of unit depth.

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.