Homework 9

Due: Friday, April 27, 2018 at 2 p.m.

- TA office hours are Tuesdays 4–6pm in CIT 207.
- If you absolutely can’t go to office hours, you can contact the staff at cs1951gtas@cs.brown.edu.
- If you work together on the homework, include your partners’ names at the top of your handin. However, your solutions must be written independently. The full collaboration policy can be found in the syllabus.

Project 2

In this small project, you will implement two variants of the interior point algorithm, for a specific quadratic programming problem.

Specification

a. Follow the directions of Exercise 7.14 from the book Optimization Methods in Finance, page 137. Your code must be able to take the value of the parameters $\sigma_{\text{max}}$, $\sigma_{\text{min}}$ and $\gamma$ from the command line (see the input and output specification below). Experiment and comment on how runtime, number of iterations, evolution of the current solution (and any other metric of interest you deem worth discussing) are affected by different choices of the parameters and different starting points.

b. Implement the variant described in Sect. 7.3.7, page 135 of the same book, for the same quadratic programming problem as the variant above. Your code must be able to take the value of the parameters $\sigma_{\text{max}}$, $\sigma_{\text{min}}$ and $\gamma$ from the command line (see the input and output specification below). Experiment and comment on how runtime, number of iterations, evolution of the current solution, (and any other metric of interest you deem worth discussing) are affected by different choices of the parameters and different starting points, including infeasible ones.
c. Compare the two algorithms for the same starting points and value of the parameters. Report on their comparison, including how fast they converge to the optimal solution, and whether they choose a similar current solution at each iteration.

**Input and Output** We will run your code as

```
./runMyIPMSolverA MAX MIN GAMMA
```

(for the variant in a. above)

```
./runMyIPMSolverB MAX MIN GAMMA
```

(for the variant in b. above). MAX is a value for $\sigma_{\text{max}}$, MIN is a value for $\sigma_{\text{min}}$, and GAMMA is a value for $\gamma$. You can assume that only valid values for the parameters will be passed in input.

Your code must output, one per line, the solutions “touched” by the algorithm (including the initial solution), in the following format:

```
x1 = VALUE, x2 = VALUE, x3 = VALUE, x4 = VALUE, obj = VALUE
```

(there are no spaces around the “=” signs, there is a single space after each comma). The value after each “x*” is the value for that variable at the current solution. The value after “obj” is the objective value at the solution. Your code must not output anything else.

**Submission** Submit your code and your writeup using the `cs1951g_handin` script: `cd` into the main code directory and run `cs1951g_handin ipm_project`.

You must submit the source of your program. If compilation is necessary, you should have a `Makefile` file at the top level of your submission, and the compilation must happen when running `make` (we will not run any other command).

Your code must run out-of-the-box on any departmental machine, e.g., any of the Sun Lab machines. You can not require the installation of any additional software.

We will run your code as described in the input and output specification, so there must be binaries (after compilation) or scripts named `runMyIPMSolverA` `runMyIPMSolverB` in your directory.
Evaluation  We will evaluate the correctness of your code, focusing its ability to compute the optimal solution with different parameters. We will inspect your code, so please leave a sufficient number of comments for us to understand the code. In particular, we want to be able to easily understand how to set different starting points. You can include a README file describing how to do it.