Numerical Optimization with Python (2024B) Programming Assignment 02

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Abstract

This report details my implementation of interior point method. This is homework for optimization course.

1 Linear Programming (LP)

1.1 Problem Definition

The linear programming problem is defined as follows:

$$
\begin{aligned}
\text{maximize} \quad & x + y \\
\text{subject to} \quad & y \geq -x + 1 \\
& y \leq 1 \\
& x \leq 2 \\
& y \geq 0
\end{aligned}
$$

1.2 Results

```
Final solution: [1.99999995 0.99997752]
Objective value at the final solution: -3.000
Constraint 1 value at the final solution: -2.000
Constraint 2 value at the final solution: -0.000
Constraint 3 value at the final solution: -0.000
Constraint 4 value at the final solution: -1.000
```

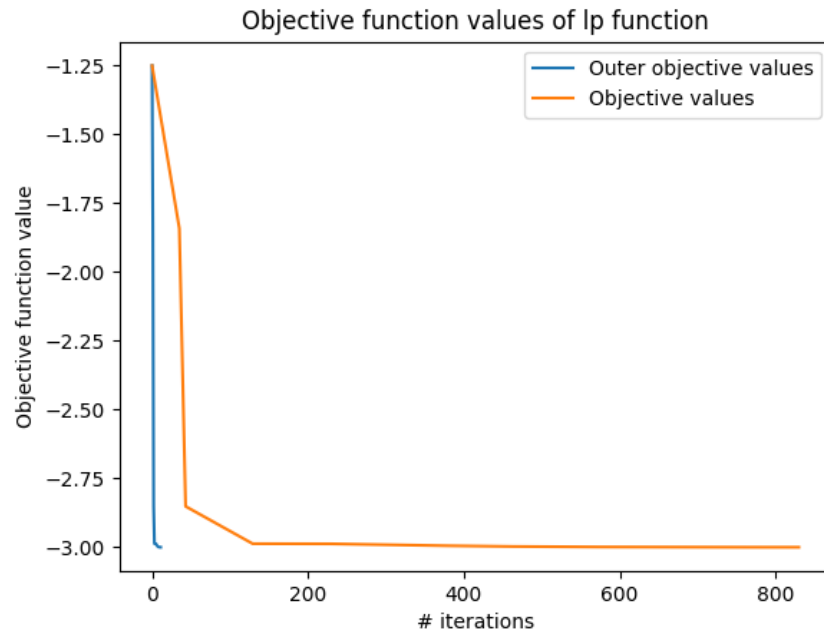Figure 1: results for LP

1.3 Plots

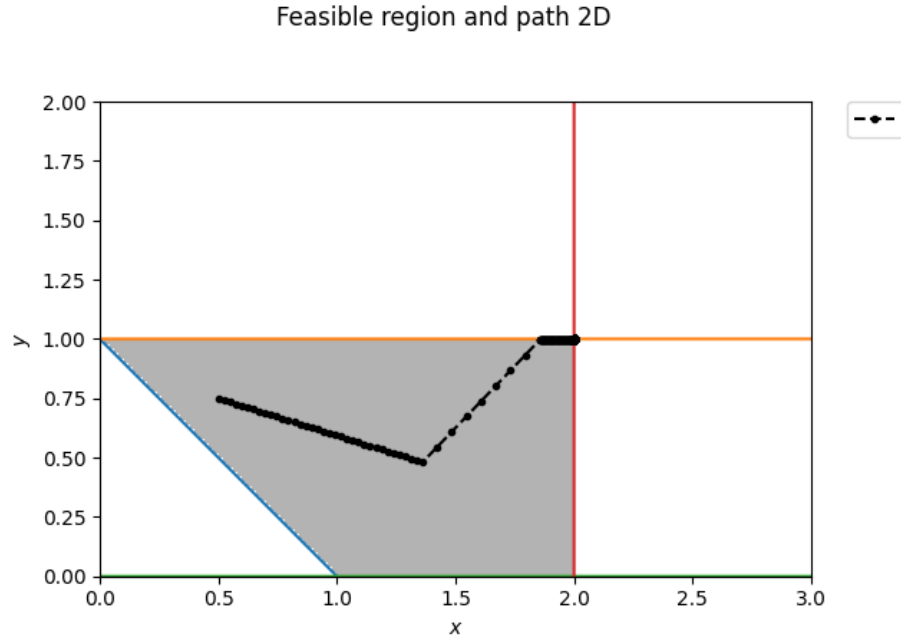Figure 2: objective value vs. outer iteration number for linear programming case.

Figure 3: Feasible region and the path taken by the algorithm (LP).

2 Quadratic Programming (QP)

2.1 Problem Definition

The quadratic programming problem is defined as follows:

$$
\begin{aligned}
\text{minimize} \quad & x^2 + y^2 + (z+1)^2 \\
\text{subject to} \quad & x + y + z = 1 \\
& x \geq 0 \\
& y \geq 0 \\
& z \geq 0
\end{aligned}
$$

2.2 Results

```
Final solution: [0.32097619 0.67356423 0.00545958]
Objective value at the final solution: 1.568
Constraint 1 value at the final solution: -0.321
Constraint 2 value at the final solution: -0.674
Constraint 3 value at the final solution: -0.005
Equality constraint 4 value at the final solution: 1.000
```
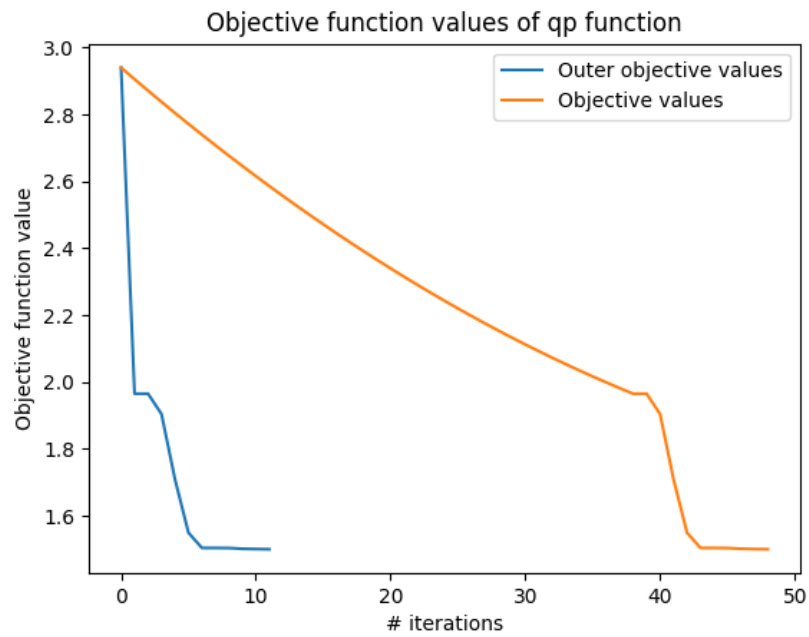
Figure 4: Results qp

2.3 Plots

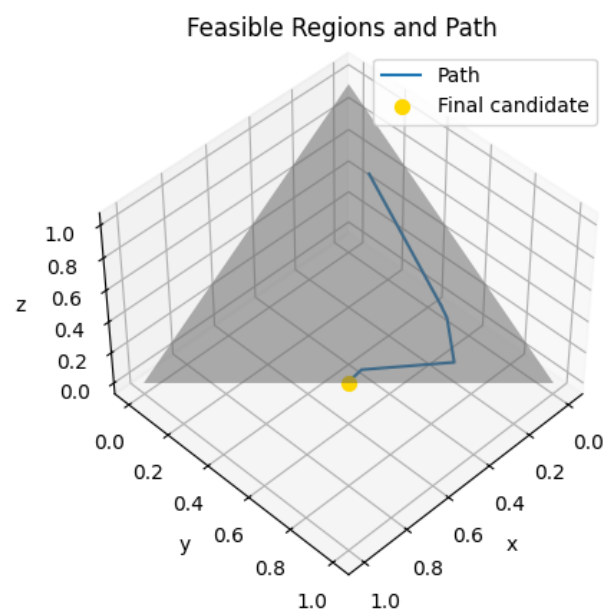Figure 5: Objective value vs. outer iteration number (QP)

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Figure 6: Feasible region and the path taken by the algorithm (QP)