

Assignment requirements/suggestions:

Email me your code that implements or solves the given problems with each problem in a separate file.

Please reuse code between different problems and do not cut and paste. Include functions that are used in multiple problems in their own file.

Make your code clean and readable, including comments where appropriate.

Make any plots and figures professional looking and readable. Label things appropriately (axes, legends, etc.) and present the data in a clear manner.

Ensure your code runs and provide an code example that shows how I would run your code for different inputs. I will return code that throws an error to you to fix.

Try to make your code efficient but do not spend too much time optimizing the code for speed.

Please provide any specific results in a Word or PDF formats.

1. [10 points] Write a code that implements the penalty method or the augmented Lagrangian method for  $N$ -dimensional problems with equality constraints.
2. [10 points] Write a code that implements the penalty method or the augmented Lagrangian method for  $N$ -dimensional problems with inequality constraints.
3. [10 points] Write a code that implements the penalty method or the augmented Lagrangian method for  $N$ -dimensional problems with both equality and inequality constraints.
4. [50 points] Write codes that find the local minimum of the Rosenbrock function subject to the following constraints
  - (a)  $c(\mathbf{x}) = \|\mathbf{x}\|_2^2 - 1 = 0$ .
  - (b)  $c(\mathbf{x}) = \|\mathbf{x} - \mathbf{C}\|_2^2 - 1 = 0$  with  $\mathbf{C} = [-1, 1, \dots, 1]^T \in \mathbb{R}^N$ .
  - (c)  $c(\mathbf{x}) = 1 - \|\mathbf{x}\|_2^2 \geq 0$ .
  - (d)  $c(\mathbf{x}) = 1 - \|\mathbf{x} - \mathbf{C}\|_2^2 \geq 0$  with  $\mathbf{C} = [-1, 1, \dots, 1]^T \in \mathbb{R}^N$ .
  - (e)  $c_1(\mathbf{x}) = 1 - \|\mathbf{x}\|_2^2 \geq 0$  and  $c_2(\mathbf{x}) = \|\mathbf{x} - \mathbf{C}\|_2^2 - 1 = 0$  with  $\mathbf{C} = (1/2)[-1, 1, \dots, 1]^T \in \mathbb{R}^N$ .