Management Sciences Topics: Convex Optimization
Homework 5: Due May 2nd (11:59 pm)

Problem 1: Reformulate the overlapping group regularized logistic regression problem in Problem 2 of Homework 3 into an optimization model that allows using linearized augmented Lagrangian method. In particular, reformulate as

$$\min g(x) + h(x) \quad \text{s.t., } Ax = b.$$

You need to explicitly define what A and b are.

By the same definition in Homework 3, we define

$$w_g = C_g x,$$

where $C_g \in \mathbb{R}^{|g| \times d}$, and

$$(C_g)_{ij} = \begin{cases} 1, & j = g^i \\ 0, & \text{others} \end{cases}$$

Then let

$$C = [C_{g_1}, \ldots, C_{g_{|G|}}]^\top, \quad b = [x_{g_1}^1, \ldots, x_{g_1}^{|g_1|}, x_{g_2}^1, \ldots, x_{g_2}^{|g_2|}, \ldots, x_{g_{|G|}}^1, \ldots, x_{g_{|G|}}^{|g_{|G|}|}]^\top,$$

then we have $Cx = b$.

(But, if we define b as above, it will change in the iterations.)

Problem 2: Apply the linearized augmented Lagrangian method to the new formulation of the overlapping group regularized logistic regression problem in Problem 1. The data and the parameters for the problem are the same as Problem 2 of Homework 3. Plot the objective value and the infeasibility measure in all iterates. You can manually tune β and ρ to achieve a good performance.