MS&E 114/214 Midterm practice problems
Aut 2024-25

Problem 1
Consider the LP:

Maximize x + y + z
subject to
x,y,z >=0
x + 2y + 4z <= 1
2x + y <= 1
z - 2y >= -1

(a) Write down its dual
(b) You are told that (⅓, ⅓, 0) may be an optimum solution. Assuming that this is indeed correct, find an optimum solution to the dual
(c) Can you now formally claim that (⅓, ⅓, 0) is an optimum solution? Why or why not?

Problem 2
You are asked to solve a regression problem where you have to minimize the average squared error, with a regularization term that is α times the absolute value of the largest coefficient (excluding the intercept term). Formulate this as a quadratic program. Assume that α is given to you.

Problem 3
Which of these is a valid objective for a quadratic program (assuming that x, y, z are decision variables). Assume that the constraints are x+ y +z <= 1, x, y, z >= 0

(a) Minimize $x^2 + y^2$-z
(b) Maximize $x^2 - y^2$-z
(c) Minimize $x^2 + y^2 + 3xy + z$
(d) Maximize $z - x^2 - y^2 - xy$

Problem 4
You are incharge of donating a total amount B to M charities. If charity j receives an amount p, it will generate $p.a_j$ amount of societal utility. You can not donate more than an amount b_j to the j-th charity. Your objective is to maximize the minimum societal utility across charities. Formulate an LP to determine the amount of donation to each charity.

No credit will be given for work where the LP is not defined in a legible and formal fashion (i.e. first clearly define the parameters, then the decision variables, then the constraints and the objective) or where notation use is not consistent. If you do scratch work, clearly separate it from your actual answer.