

# Constrained Minimization Using Equality Constraints

Deadline: 3 October 2021

## *SML Lab Assignment3*

**Instruction:** It is valid for all questions.

1. Solve using pen and paper and submit the scan copy.
2. Write the python code and generate the output and submit colab file and pdf file.

**Q.1** A Zomato lunch box is to be made from a 12 inch by 18-inch piece of cardboard by removing a square from each corner of the box and folding up the flaps on each side. What size square should be cut out of each corner to get a box with the maximum volume? Plot and show the relationship between each variable and the objective function through scatter plot.

**Q2.** A rectangular garden behind Humayun tomb in Delhi is to be constructed using a rock wall as one side of the garden and wire fencing for the other three sides. Given 100ft of wire fencing, determine the dimensions that would create a garden of maximum area. What is the maximum area? Plot and show the relationship between each variable and the objective function through bar chart.

**Q3.** Maximize the function  $f(x, y, z) = xy + yz$  subject to the constraints  $x + 2y = 6$  and  $x - 3z = 0$ . Plot and show the relationship between each variable and the objective function through line graph.

**Q4.** Find the minimum of the following quadratic function on  $\mathbb{R}^2$ ,  $f(x) = x^T A x + b^T x + c$ , where  $A = \begin{pmatrix} 13 & 5 \\ 5 & 7 \end{pmatrix}$ ,  $b = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$  and  $c = 2$ ; Under the constraints:  $g(x) = 2x_1 - 5x_2 = 2$  and  $h(x) = x_1 + x_2 = 1$ ; Plot and show the relationship between each variable and the objective function through Box plot.

**Q5.** Find the maximum and minimum of the objective function  $f(x, y) = 5x - 3y$  subject to the constraint  $x^2 + y^2 = 136$ ; Plot and show the relationship between each variable and the objective function through heat graph.

-----All the Best-----