ME 260: Structural Optimization: Size, Shape, and Topology		
Assigned: Aug. 25, 2022	Homework 1	Due: Sep. 1, 2022

Problem 1 (10 points)

$$\underset{x,y}{\text{Min}} \quad f = \frac{1}{x} + \frac{1}{y}$$

Subject to

$$\mu_1: \quad g_1 = 4x - 2y - 4 \le 0$$

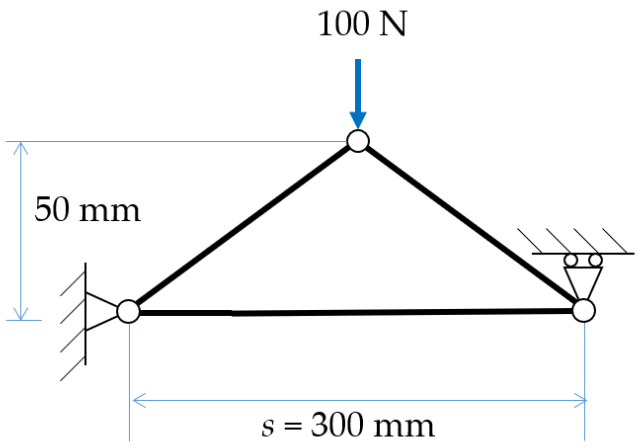
$$\mu_2: \quad g_2 = 2x + y - 6 \le 0$$

(a) Solve the above optimization problem (i) by hand, and (ii) using *fmincon* routine in Matlab, and (iii) graphically by plotting the contours in Matlab. Plot $f(x,y)$ as a surface and see if your answer is indeed a local minimum subject to the constraints. Find also the values of the also the Lagrange multipliers μ_1 and μ_2.

(b) In the active constraint, change the value of the constant (either 4 or 6) by 1%, and compute the change in the optimized value of f without re-solving the problem.

Problem 2 (20 points)

(a) Solve the following three-bar truss problem to find the areas of cross-sections to minimize the strain energy subject to a volume constraint. Use E = Young's modulus = 210 GPa and V^* = upper bound on volume = 30,000 mm^3. Do it by hand and by using *fmincon*.



(b) Now, pose and solve the same problem as a shape optimization problem in one variable wherein the location of the moving pivot is variable from the fixed pivot. That is, 300 mm (call it s) can be varied and its optimum value needs to be found. Plot strain energy and volume as functions of s and verify that the optimum you found is indeed so.