FRA640 Homework #10

1. Consider the simple two-spring system shown in the figure 1. The springs are assumed to be linearly elastic and the loads $p_1 = 5N$ ans $p_2 = 5N$ are constant. This is a geometrically nonlinear problem because the resistance to the load is a function of the deformed position. The original length of the two springs are $l_1 = 10cm$ and $l_2 = 10cm$, and the two spring constants are $k_1 = 8N/cm$ and $k_2 = 1N/cm$

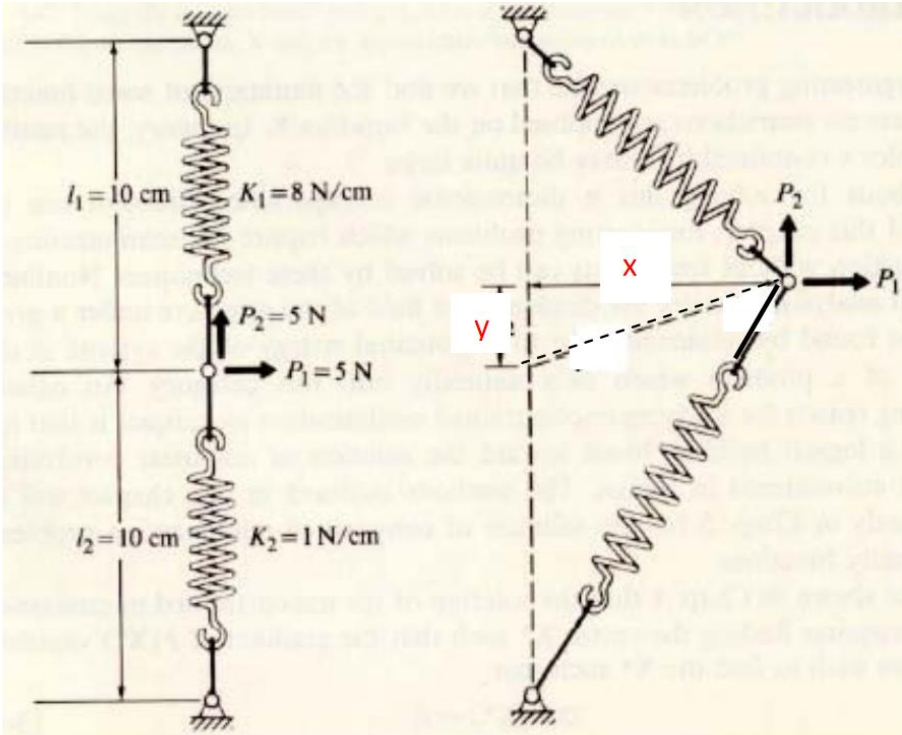

Figure 1

$$E(x,y) = \frac{1}{2}k_1\left(\sqrt{x^2 + (l_1 - y)^2} - l_1\right)^2 + \frac{1}{2}k_2\left(\sqrt{x^2 + (l_2 - y)^2} - l_2\right)^2 - p_1x - p_2x$$

Write a program that determines the equilibrium position by minimizing the total energy, using the univariate search. In your univariate search start your search in the x direction by using golden section search. Run your multi-dimensional optimization until your get the best minimum 4-digits precision of Energy value.

To show that your program is properly implemented, your program must generate:

(1) a text file, output.txt, that contains your student ID number and the numerical results showing the convergence process. It should have 7 columns showing numerical results
   a. running number of iterations of univariate search
   b. final number of iterations of your golden section search
   c. last error approximation result of your golden section search
   d. X coordinate result of current iteration of univariate search
   e. Y coordinate result of current iteration of univariate search
   f. Energy value result of current iteration of univariate search
   g. current approximation result of your univariate search

What to hand in:
- Source code files and header files
- Executable file (if needs to run on the teacher computer)
- A text file (output.txt)