Homework 3 Due on Feb. 5

a) Develop a code using Newton's method to solve a system of two equations with two unknowns: $f_i(x_1, x_2) = 0$ for $i = 1, 2$; b) Discuss how you test your code and why your computed solution is correct; c) Construct two examples to show the iteration converges quadratically; d) Apply your method to finding the steady state solutions of the following two-gene network with cross-activation:

$$\frac{dx}{dt} = \alpha_{\min} + (\alpha_{\max} - \alpha_{\min})\frac{y^n}{e_{cy}^n + y^n} - \alpha_{\deg} x$$

$$\frac{dy}{dt} = \beta_{\min} + (\beta_{\max} - \beta_{\min})\frac{x^n}{e_{cx}^n + x^n} - \beta_{\deg} y$$

f) Discuss how you test your code. Why do you believe your code is correct? g) Find at least one parameter regime that shows bistablity of the system, meaning for particular, there are two stable solutions. (x, y) are the unknowns and all the rest are parameters for you to choose.