BF571 Spring 2019, Homework #2
DUE Monday, March 4 by 10am
Please send your work electronically as a PDF.

PART 1 Modify the differential equation scripts used before (in HW1, for solving the logistic growth equations, either in Python or Matlab) to solve numerically the equation for protein expression of a single negative autoregulator (X). As the input function, use the continuous function, rather than the step-wise Boolean approximation.

a. (3 points) Solve the equations using the following parameters, and plot a graph of X as a function of time, until the steady state is reached (attach also your script)

   Beta = 0.5
   K = 3
   n=1 (Hill's coefficient)
   alpha=0.1
   Initial condition: X=0

b. (3 points) Compare the steady state reached by the protein, and the response time (as computed from point a) with the corresponding estimates obtained analytically with the Boolean approximation.

c. (1 point) Show and comment on how the protein dynamics curve varies as you increase *n*

PART 2 Answer the following questions:

a. (1 point) Which of these networks are feed forward loops (FFL):
   (i) X → Y ; Y → Z
   (ii) X → Y ; Y → Z ; Z → X
   (iii) Q → W ; W → H ; Q → H
   (iv) A → B ; B→ C ; C → D
   (v) X1 → X2 ; X3 → X1 ; X3 → X2

b. (2 points) What type of FFL can serve as a noise filter? Specify the signs of the regulatory arrows and the logical gate, describe in a short paragraph why this can act as a noise filter, and explain its biological significance.