Artificial Intelligence (CS571)
Assignment-5: Fuzzy Logic

(Read all the instructions carefully & adhere to them.)

Date: 29-08-2019

"Fuzzy controller for inverted pendulum":

1. The pendulum is in dynamic equilibrium, i.e., it continuously slips from the vertical, and is brought back continuously through the application of torque resulting from the applied current.
2. The applied current i is a function of θ, the angular departure and ω, the angular velocity.
3. The profiles of i, θ and ω are as given in the slides, i.e., *zero, positive/negative small* and *positive/negative medium*.
4. At any instant the θ and ω values are "sensed" and a corrective current is sent as per the control rules. This is a 3 step process:
    a. Fuzzification of sensed values
    b. Getting the values of μ(i) from control rules
    c. Defuzzification to obtain ONE i
5. The torque can be assumed to be proportional to i,. The constant of proportionality will be a parameter to your system.
6. The relationship between torque and θ and ω is governed by a suitable differential equation; do some search and reading on this.
7. Initially, do not assume gravity; after the system has been implemented and tried, introduce gravity.
8. At all points, the parameters of the differential equation, the current-torque relation, the parameter of the profiles should all be easily variable and readable from a file or the GUI. We would like to see the sensitivity of the system wrt the parameters.
9. Plot/tabulate various characteristic of the system. For example, you could show the number of oscillations and time to stability as a function of initial θ and ω. One could also plot the current requirement against initial values, and against time.
10. A good GUI (use PyGame in python) is a must for demonstration.

Instructions:

- Please submit your assignment here: https://bit.ly/2L3NWwi
- The submission file should be as follows:
  Group-NUMBER Assignment-NUMBER.zip