CPE407/ECG607 Biometrics

Spring 2008, 3 credits Test#3

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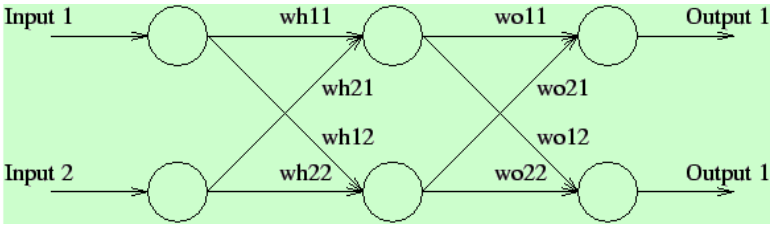
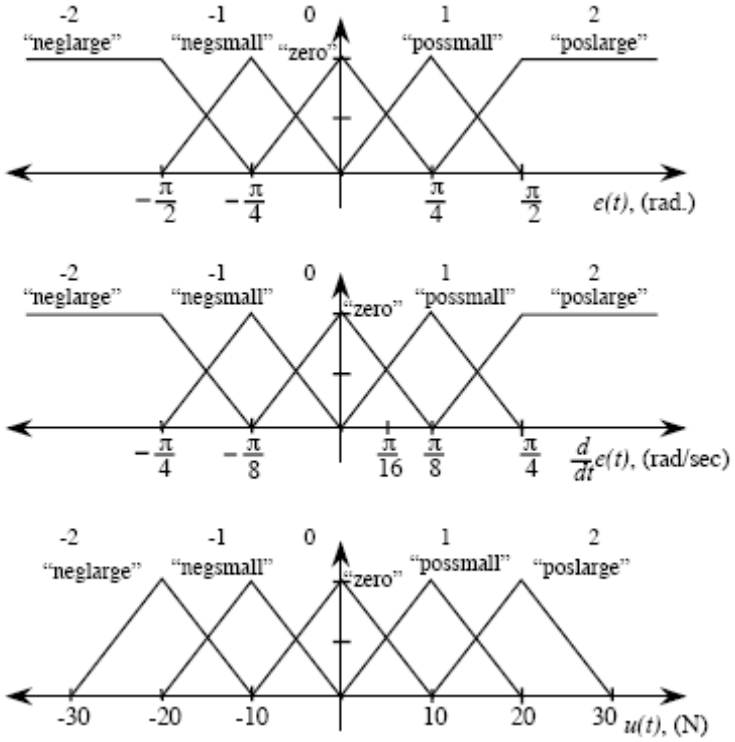
1. Find the output of the following **neural network** when the input vector is [0, 1], and all the weights are 1. (5 points)



Assume that the nonlinear function at the hidden and output layers is $sgm(x) = \frac{1}{1+e^{-x}}$

2. The membership functions in a **fuzzy logic** system are given for two variables in the figure below for error $e(t)$, rate of change of error, and control input $u(t)$. Suppose the actual measurement of error is *0* rad, and for rate of change of error is $\frac{3}{32}\pi$ rad/sec. Moreover, the system has fuzzy rules given below the figure. Find the output of the fuzzy control. (10 points)

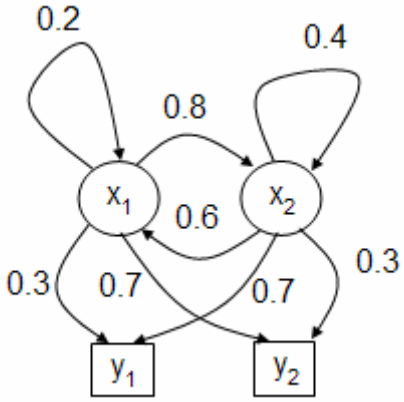


Fuzzy Rules: **If** error is zero **and** change-in-error is zero **Then** force is zero

If error is zero **and** change-in-error is possmall **Then** force is negsmall

3. In a given **genetic algorithm** solution, apply one point crossover in the middle to two strings given by 00110101 and 11011100. If each string represents a decimal number obtained by changing the binary to decimal number, and if the problem is to obtain the minimum number, find out if the offspring strings are better than the parent strings or not. Apply a mutation to string 00111011, where it is known that the mutation operator only operates on bit 0. Find out of this mutation has improved the string or not. (5 points)

4. Given the following state diagram for a **Hidden Markov Model** problem, find out which input string has the maximum likelihood of producing the output y_1y_2. (10 points)



5. In a **Bayesian** system, prior probability of a hypothesis is 0.25. The probability of the evidence is 0.5. The probability of the evidence given the hypothesis is 0.2. What is the updated probability of the hypothesis, i.e. what is the probability of the hypothesis given the evidence? (2 points)
6. If the parameter space for a search is as given in the figure below, and the initial guess is given as the ball. Should you apply **simulated annealing** or a gradient based search. (1 point)