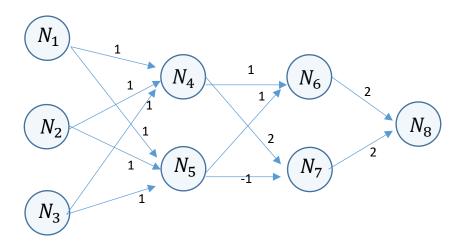# Homework #1 (due 9/8) by 3:05pm

1. Build the following using M&P neurons similar to what we covered in class. Show the inputs, weights, and outputs.
   a. 3-input OR
   b. 3-input AND
2. For the pictured net below and a threshold of 2 for every neuron except for N_5 which has a threshold of 3:
   a. Define the response of the output neuron at a given time (t) in terms of the activations of the input neurons (the input neurons can take on the value of 1 or 0) at an appropriate earlier time dictated by the structure of the network.
   b. Show the activation of each neuron that results from an input of (1, 1, 0) – that is, show how each neuron in the net reacts at each time step in a fashion similarly to what is displayed on pages 34 and 35 of the Fausett text.

3. Modify the "Hot & Cold" M&P model to require that cold stimulus be present for 4 time steps before cold is indicated.

4. Given the competitive layer show in Fig 1.6 and discussed in class last week and:

$$a_j(new) = activation \; of \; node \; A_j$$

$$a_j(0) = initial \; value \; of \; node, j = 1:4$$

$$w_{i,j} = \begin{cases} 1, & if \; i = j \\ -\epsilon, & if \; i \neq j \end{cases}$$

Perform the following:
   a) Update the activation of each node for j = 1,2,3,4 using:

$$a_j(new) = f\left[a_j(old) - \epsilon \sum_{j \neq k} a_k(old) \right]$$

$$a_j(old) = a_j(new), j = 1:4$$

   b) If only one node has a positive activation value, stop, else update again.

Where,

$$f(x) = \begin{cases} x, & if \; x > 0 \\ 0, & otherwise \end{cases}$$

And given:

$$a_1(0) = 0.3; \; a_2(0) = 1.2; \; a_3(0) = 0.6; \; a_4(0) = 0.9$$

$$\epsilon = 0.2$$

5. Construct an alternative M&P net XOR architecture (i.e. not the same as in Fig. 1.17).