1. Define Hebbian Learning

A type of synaptic plasticity which depends on pre and post synaptic activity

1. Given a synapse wij = 1.0, a learning rule of the form wij (t+1) = wij(t) + wij; wij = 0.2\*xi\*xj and the following spike trains, graph the evolution of wij for 10 time steps of 10 ms each. Assume that the amplitude of a spike = 1.0.



3. Given a synapse wij = 1.0, a learning rule of the form wij(t+1) = wij(t)\*wij; wij = 0.2\*xi\*xj and the spike trains shown in (2), graph the evolution of wij for 10 time steps of 10 ms each. Assume that the amplitude of a spike = 1.0.

1. Assume the neural network and tuning curves depicted below.



The postsynaptic neuron fires at 40 Hz when food is present. All synapses start at wij = 0.0. Assume that the outputs of all neurons are in Hz. The Hebbian learning rule is wij(t+1) = wij(t) + wij with wij = 0.1\*xi\*xj.

1. What is the activity of the postsynaptic neuron in response to a 300 Hz tone?
2. You give food in the presence of a 300 Hz tone for 2 time steps. You need to recalculate all parameters after each time step. What are the new values for all synapses?
3. What is the activity of the postsynaptic neuron now in response to a 300 Hz tone? What is its activity in response to a 100 or 200 Hz tone?
4. If you wanted to prevent this system from learning to respond to tones it is not conditioned on, what parameters could you change?
5. Now use the following learning rule: wij(t+1) = wij(t) + wij with wij = 0.1\*xi\*(xj-60). Do the same calculations.