QUIZ - 3

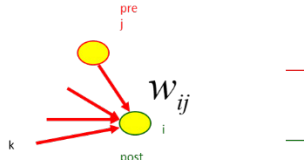
Name: _____

Net-ID:_____

Never do this → 

Question 1: Explain how Hebbian learning works (you may draw a graph just like the one we showed in the lectures, if you want). Is Hebbian learning an unsupervised or supervised learning? (10%+10%)

Question 2: Fill the table with a) 0, for no change in the weight, b) +, for a positive change, or c) -, for a negative change (20% in total, 5% for each row)



1) Standard Hebb rule
2) Hebb with decay
3) Hebb with postsynaptic LTP/LTD threshold
4) Covariance rule.

$$\frac{d}{dt} w_{ij} = a_2^{corr} \nu_j^{pre} \nu_i^{post}$$

$$\frac{d}{dt} w_{ij} = a_2^{corr} \nu_j^{pre} \nu_i^{post} - c$$

$$\frac{d}{dt} w_{ij} = a_2^{corr} \nu_j^{pre} (\nu_i^{post} - \vartheta)$$

$$\frac{d}{dt} w_{ij} = a_2^{corr} (\nu_j^{pre} - \vartheta)(\nu_i^{post} - \vartheta)$$

on	off	on	off
on	on	off	off

Question 3: What is a Hebbian learning rule? Write a Hebbian and an anti-Hebbian rule. (10%+10%)

Question 4: Name a problem that the basic Hebbian learning rule has. How do we correct this? (10%)

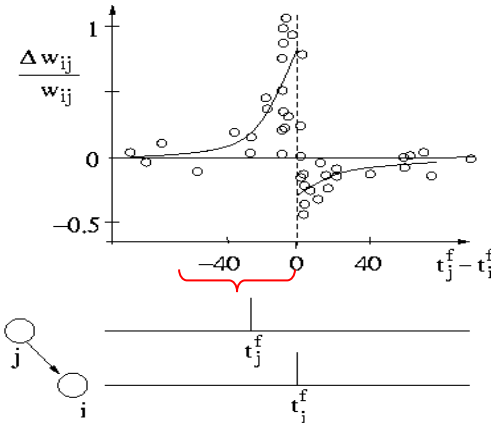
Question 5: Describe the intuitive idea behind the covariance learning rule, shown below (Sejnowski, 1977) (10%)

$$\frac{d}{dtt} w_{ij} = \gamma(v_i - < v_i >)(v_j - < v_j >)$$

Question 6: Is Oja's rule (Oja, 1982) a Hebbian or an anti-Hebbian rule? **Why**? What is the intuitive idea behind Oja's constraint that the sum of the squares of the weights equals 1? (5%+5%+10%)

$$\frac{d}{dtt} w_{ij} = \gamma(v_i v_j - w_{ij} v_i^2) \qquad \sum_j w_{ij}^2 = 1$$

Question 7: [**Bonus**] How does spike-timing-dependent plasticity (STDP) compare to the basic Hebbian learning? Briefly describe the STDP rule (you might want to draw a diagram with the spiking train of the pre- and the post-synaptic neuron and the resulted changes in the weights. The graph below will help you to do this – hopefully!) (20%)



GOOD LUCK!