The Final-exam of the Advanced Course of Neural Networks (24 Jan 2001)
Name [   ]   Student-ID [   ]

1. Assume that we want to store two patterns:

$$\begin{matrix} (+1 & +1 & +1 & +1 & +1 & +1 & +1 & +1 & +1 & +1) \\ (+1 & -1 & +1 & -1 & +1 & -1 & +1 & -1 & +1 & -1) \end{matrix}$$

in the fully connected neural network with 10 neurons. Answer the following questions.

(1) By using the Hebbian learning algorithm, obtain the 10×10 weight matrix.

(2) Under the weights obtained above, calculate the *energy* of the network when a noisy input of one of the stored patterns:

$$(-1 \quad -1 \quad -1 \quad +1 \quad +1 \quad +1 \quad +1 \quad +1 \quad +1 \quad +1)$$

is given to the network.

(3) If you assume that the i-th neuron corresponds to the i-th bit of patterns to be stored and the order of update is according to this i, then which neuron will be first updated under the input of (2).

(4) Obtain also the energy when the input above converges to the original one.

(5) Obtain the Hamming distance of the two stored patterns.

(6) Give me an example of the patterns that is located just at the center of the two energy minimum.