

Tutorial for

Introduction to Computational Intelligence in Winter 2009/10

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<http://ls11-www.cs.uni-dortmund.de/people/rudolph/teaching/lectures/CI/WS2009-10/lecture.jsp>**Sheet 4, Block A**

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Return: 11.11.2009, 10 a.m.**Exercise 4.1: BAM (5 Points)**

Let $(x_1, y_1), \dots, (x_m, y_m)$ be m pairs of *bipolar* row vectors that are to be stored in a bidirectional associative memory (BAM) neural network with weight matrix

$$W = \sum_{i=1}^m x_i' y_i.$$

How many pairs can be stored in this BAM under which conditions imposed on the data set?

Hint: First restrict the dimension of $x_i, y_i \in \{-1, +1\}^2$ to 2. Then try to generalize.

Exercise 4.2: Hopfield Network (5 Points)

Consider the optimization problem

$$\text{OneMin}(x) = \sum_{i=1}^n x_i, \quad \text{with } x_i \in \{0, 1\}$$

for minimization by a Hopfield network.

Use bipolar vectors to formulate the energy function. Form the energy function into the standard form and give the weights and threshold values.

Hint: Squaring OneMin in bipolar form is helpful.