Exam Neural Networks (Theory Part)
January 8, 2007

Please do not use any notes, books, slides, etc.

1. **Perceptron/Adaline**
   - (15 points) Which of the following boolean functions can be represented by a perceptron: AND, OR, COMPLEMENT, XOR? For each of the functions for which you gave a positive answer, give a perceptron that represents it. For each of the functions for which you gave a negative answer, motivate your answer.
   - (5 points) Can Adaline be used for regression? Is the Perceptron an example of supervised or unsupervised learning neural network?
2. **Learning/Feed-Forward Neural Networks (FFNNs)**
   - (15 points) Describe how the weights of a FFNN are computed with the Backprop algorithm.
   - (5 points) Describe stopping criterions for the Backprop algorithm.
3. **Radial Basis Function (RBF) Networks**
   - (10 points) Describe how centers and weights of a RBF network can be computed.
4. **Self Organizing Map (SOM)/Competitive learning/k-means**
   - (10 points) Describe the k-means algorithm.
   - (5 points) Describe how the quality of a clustering algorithm can be measured.
   - (5 points) Describe an application of SOM.
5. **Hopfield Networks**
   - (5 points) Describe how the weights of a discrete Hopfield network are computed.

- (10 points) Show by means of a simple example the execution of a discrete Hopfield network with three neurons and its stable states.

6. **Support Vector Machines (SVM)**

   - (10 points) Compare RBF and SVM.
   - (10 points of which 5 bonus) Describe the SVM "soft-margin hyperplane".

Good luck! E.M.