國立臺北科技大學

九十六學年第二學期電機系博士班資格考試

類神經網路試題

填學生證號碼　　第一頁　共一頁

注意事項：

本試題共【4】題，每題 25 分，配分共 100 分。

1. 請按順序標明題號作答，不必抄題。
2. 全部答案均須答在試卷答案欄內，否則不予計分。
3. 考試時間:二小時。

1. Consider the function $F(\mathbf{x}) = e^{(x_1^2 - x_1 + 2x_2^2 + 4)}$. Take one iteration of Neuron's method from the initial guess $\mathbf{x}_0 = [1\ -2]^T$. How close us this result to the minimum point of $F(\mathbf{x})$? Explain.

2. Consider the function $F(x) = 5x_1^2 - 6x_1x_2 + 5x_2^2 + 4x_1 + 4x_2$. Take two steps of the steepest descent algorithm, minimizing along a line at each step. Use the following initial condition: $x_0 = [\ 0\ -2]^T$.

3. a Hopfield network has the following high-gain Lyapunov function:

   $V(a) = -\frac{1}{2}(7a_1^2 + 12a_1a_2 - 2a_2^2)$.

   (1) Find the weight matrix W, where $V(a) = -\frac{1}{2}a^TWa$.

   (2) Find the gradient vector of the Lyapunov function.

   (3) Find the Hessian matrix of the Lyapunov function.

4. Fig. 1 shows several clusters of normalized vectors. Design the weights of the competitive network shown in Fig.2, so that it classifiers the vectors according to the classes indicated in the diagram and with the minimum number of neurons. Redraw the diagram showing the weights you chose and the decision boundaries that separate the region of each class.

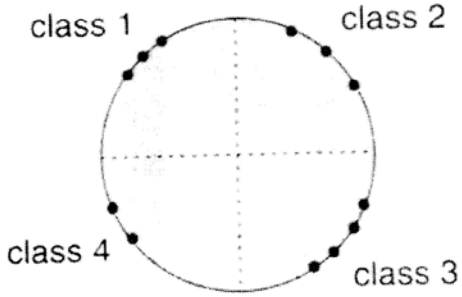

Fig. 1 clusters of input vectors

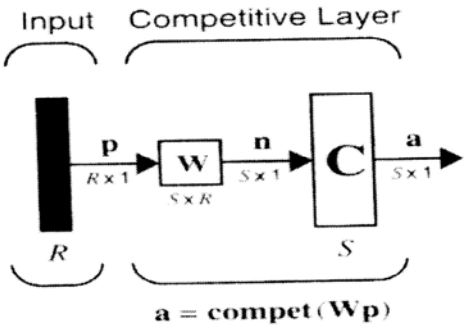

Fig.2 Competitive network