

# Artificial Neural Networks:

## Exercise Set 4

Antonio Peters

July 18, 2016

### 1 Question 3

As shown by the data given, new inputs which vary from the original  $P$  generate the same output as that of  $P$ , even though this is incorrect for the new data, it is due to the fact that the network has been trained to generate the  $T$  of  $P$  and not on the relationship between  $P$  and  $T$ .

### 2 Question 9

If there is only one pattern and one target then our equation

$$t = f(Wq + b) \tag{1}$$

need only fit the target perfectly, with no need to interpolate new data. Since  $t, f$  and  $q$  are already known, all that is needed is to solve for  $W$  and  $b$ .  $W$  and  $b$  can be combined into  $V$  where  $V = [Wb]$  by appending  $p$  into  $q$  with  $q = [p; 1]$ . This then transforms the equation into

$$t = f(Vq) \tag{2}$$

Thereby leaving us with only one unknown,  $V$ . The equation can then be easily transformed to solve for  $V$

$$\begin{aligned} t &= f(Vq) \\ Vq &= f^{-1}(t) \\ V &= f^{-1}(t)/q \end{aligned} \tag{3}$$

Since this equation has an exact solution, a perfect fitting from  $p$  to  $t$  can be found by solving for  $V$ . As stated before, this solution will be ill-advised for a neural network as it only fits these data points and cannot properly equate any new points in the system.

### 3 Question 10

$2a$  has the best time, averaging 4 iterations while  $2b$  and  $3b$  have 7,  $3a$  takes 10.  $1a$  and  $1b$  fail to converge as the number of neurons in the layer are too few.

## 4 Question 11

With the given data the solution converges but never perfectly to the target within 100 iterations.