Assignment #1
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1. 編譯結果

```
root@LAPTOP-M0DL7N82:/mnt/c/Users/Mitzi/Desktop/Neural-Network-XOR# make
cc -g -Wall -Werror -c main.c
cc -pthread -lpthread -o backprop main.o layer.o neuron.o -lm
root@LAPTOP-M0DL7N82:/mnt/c/Users/Mitzi/Desktop/Neural-Network-XOR# gcc main.c -lm layer.c neuron.c
```

(圖一)

2. 執行結果

```
root@LAPTOP-M0DL7N82:/mnt/c/Users/Mitzi/Desktop/Neural-Network-XOR# ./a.out
Enter number of neurons in layer[1]: 2
Enter number of neurons in layer[2]: 4
Enter number of neurons in layer[3]: 4
Enter number of neurons in layer[4]: 1
```

(圖二)使用者輸入各層中神經元的數目

```
Enter the Inputs for training example[0]:0 0
Enter the Desired Outputs for training example[0]: 0

Enter the Inputs for training example[1]:0 1
Enter the Desired Outputs for training example[1]: 1

Enter the Inputs for training example[2]:1 0
Enter the Desired Outputs for training example[2]: 1

Enter the Inputs for training example[3]:1 1
Enter the Desired Outputs for training example[3]: 0
```

(圖三)使用者輸入要訓練的輸入值以及期望輸出值

```
< Training Time: 9998 >
Input: (0.00,0.00)      Output: 0

Input: (0.00,1.00)      Output: 1

Input: (1.00,0.00)      Output: 1

Input: (1.00,1.00)      Output: 0
< Training Time: 9999 >
Input: (0.00,0.00)      Output: 0

Input: (0.00,1.00)      Output: 1

Input: (1.00,0.00)      Output: 1

Input: (1.00,1.00)      Output: 0
< Training Time: 10000 >
Input: (0.00,0.00)      Output: 0

Input: (0.00,1.00)      Output: 1

Input: (1.00,0.00)      Output: 1

Input: (1.00,1.00)      Output: 0
```

(圖四)輸入完訓練次數後系統開始訓練

```
< You can start testing! >
Enter input to test: 0 0
Output: 0

Enter input to test: 1 1
Output: 0

Enter input to test: 1 0
Output: 1
```

(圖五)訓練完成之後即可測試此神經網路

3. 分析

　　因為是做 XOR 的運算，所以初始就把要訓練的 training example 數設成 4 (00 01 10 11)。我發現若訓練次數很少，則訓練出來的神經網路是不正確的，代表 error 還太大，結果不準確。所以訓練次數建議要輸入 10000 以上訓練出的神經網路才會是準確的。

```
Enter the number for training(usually 20000):100
```
(圖六)輸入過少次訓練次數

```
< Training Time: 100 >
Input: (0.00,0.00)      Output: 1

Input: (0.00,1.00)      Output: 1

Input: (1.00,0.00)      Output: 0

Input: (1.00,1.00)      Output: 0
```
(圖七)訓練次數為 100 的訓練結果

```
< You can start testing! >
Enter input to test: 1 0
Output: 0

Enter input to test: 0 1
Output: 1

Enter input to test: 1 1
Output: 0
```
(圖八)訓練次數為 100 的神經網路，測試結果錯誤