Q 3.1

```
training:
        2999

training:
        3000

cost = 0.049914 training_percent = 0.990000
test accuracy: 0.970000
```

Q 3.2

Confusion Matrix:

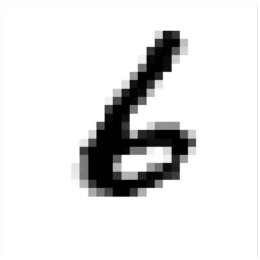
```
>> test_network
    0.9760

>> confusion_matrix

confusion_matrix =

    56     0     0     0     0     0     0     0     0     0
     0    52     0     0     0     0     0     1     0     0
     0     0    52     1     0     0     0     0     0     0
     0     0     0    54     0     0     0     1     0     0
     0     0     0     0    54     0     0     1     0     1
     0     0     0     0     0    34     0     0     0     0
     2     0     0     0     0     0    38     0     0     0
     0     0     2     1     0     0     0    46     1     0
     0     0     0     0     0     0     0     0    52     0
     0     0     0     0     1     0     0     0     0    50
```

I think the system is confused by 2-7 pair sometimes according to the result. But not obvious pairs that can confuse the network as the confusion matrix shows.

Q 3.3

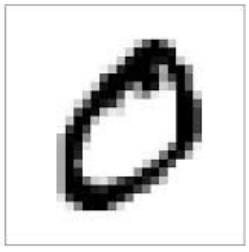
I write 5 digits by myself, and make it 28 x 28, the image look like this after preprocess.
Proprocess step :

- Corp the edge
- Rgb2gray
- Resize to 28*28 and transpose
- Reshape to 784*1
- 255 - pixel value (make background black)



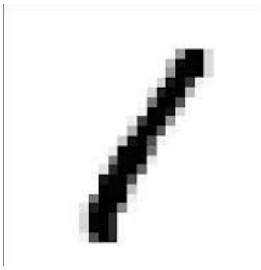
```
     0
     0
     0
     0
     0
     0
1.0000
     0
     0
     0
```

(classify correctly)



```
     0
0.0000
     0
0.0000
     0
     0
     0
     0
     0
1.0000
```

(classify incorrectly)

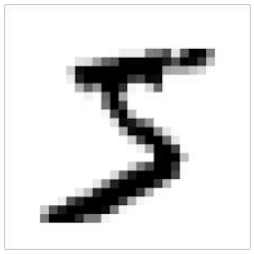


```
     0
1.0000
     0
     0
     0
     0
     0
     0
     0
     0
```

(classify correctly)

```
     0
     0
     0
     0
0.0000
     0
     0
     0
     0
1.0000
```

(classify correctly)



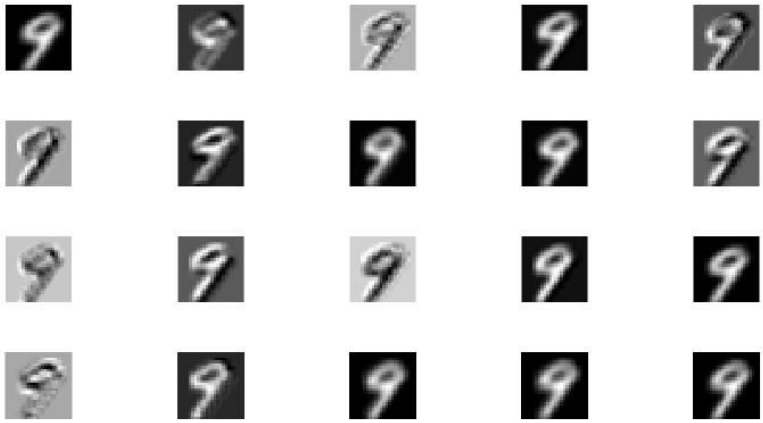
```
     0
0.0000
1.0000
0.0000
     0
     0
     0
0.0000
0.0000
0.0000
```

(classify incorrectly)

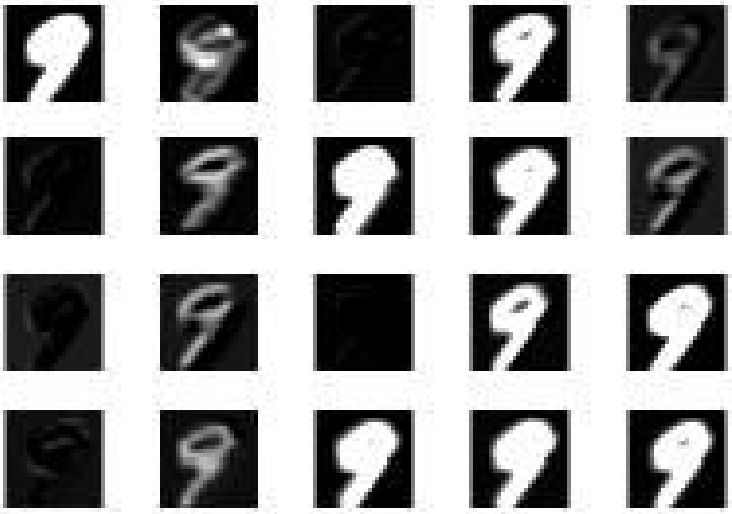
Q 4.1

Original Image:

Second Layer : (rescale to [0,1], to show negative value)



Third Layer:



Q 4.2

Original Image:

Each feature map hide or expose some details of original image. Like seeing the original image in difference scop or point of view.