Homework 5

Problem	1
Training Set	5000
Testing Set	10000
Mini Batch Size	32
Number of Hidden Layers	1
Number of Hidden units	128
Total Number of Parameters	101770
Optimizer	Adam
Initializer	Glorot
Learning Rate	0.001
Epochs	25
Training Accuracy	1
Testing Accuracy	0.9423
r	0.296
Hidden Layer Activation	Relu
Output Layer	Softmax

Model Summary

```
Model: "sequential_1"
_____
Layer (type)                 Output Shape              Param #
=================================================================
flatten_1 (Flatten)          multiple                  0
_____
dense_2 (Dense)              multiple                  100480
_____
dense_3 (Dense)              multiple                  1290
=================================================================
Total params: 101,770
Trainable params: 101,770
Non-trainable params: 0
_____
```

Training and Testing accuracy
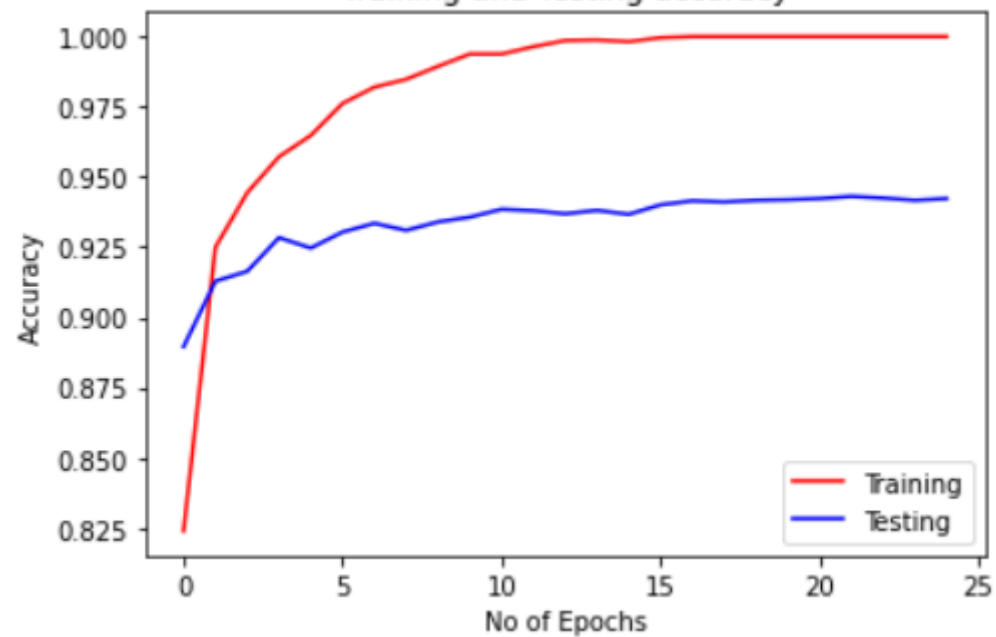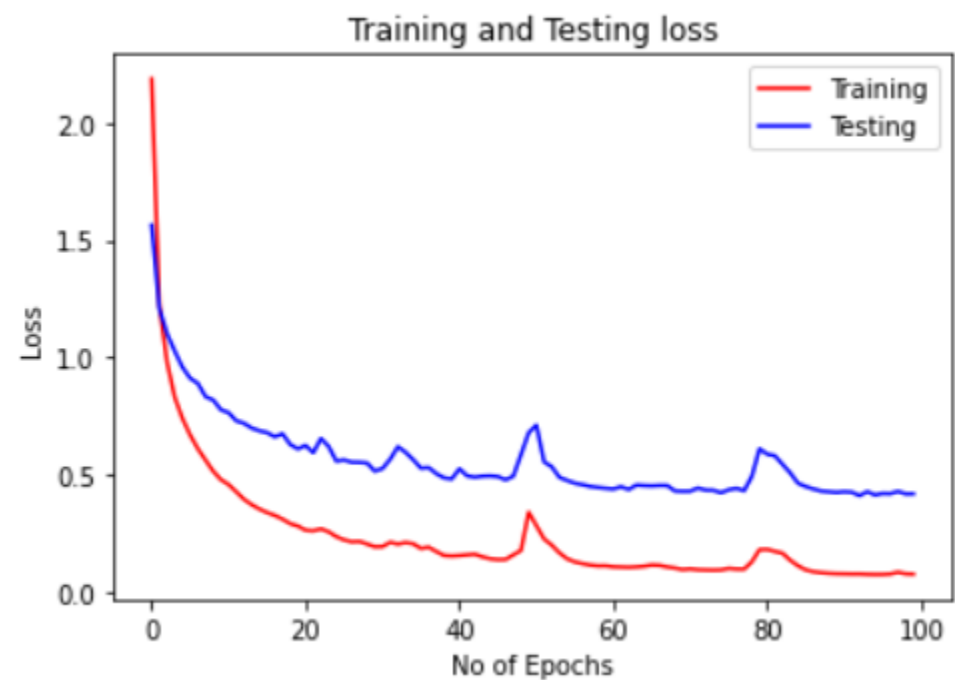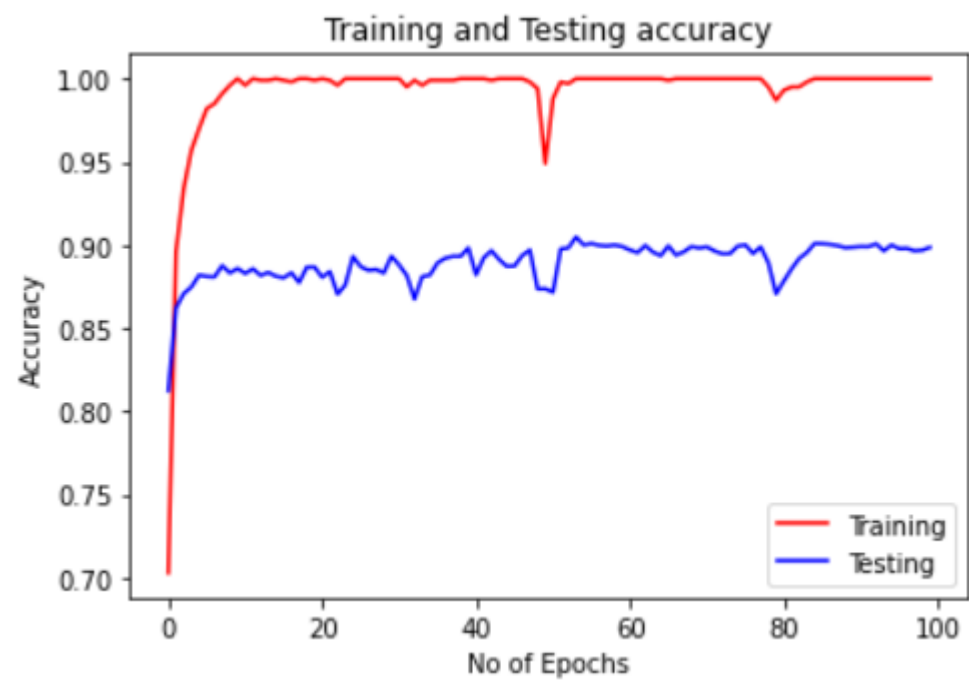
Training and Testing loss
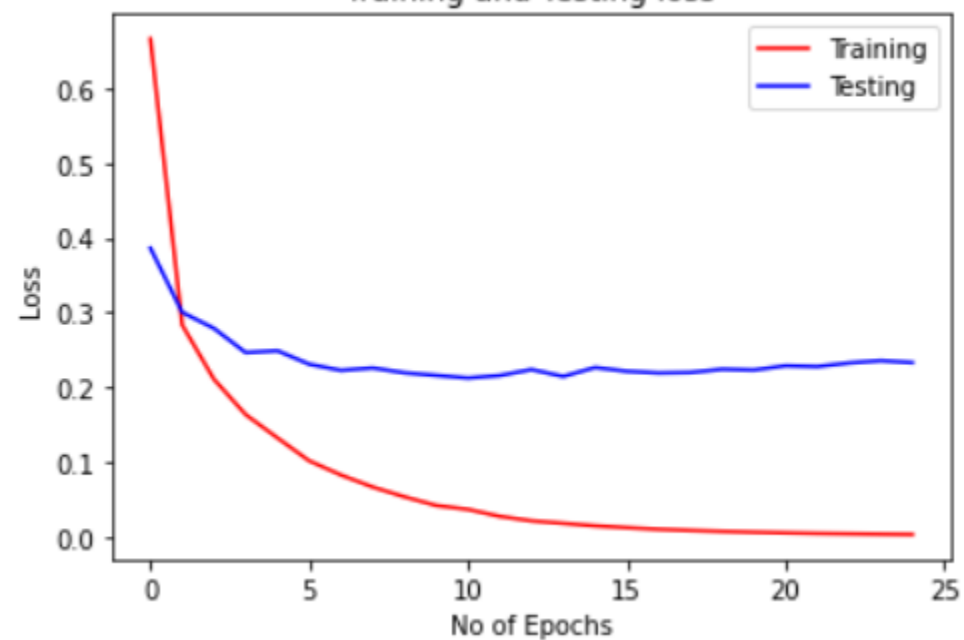
Problem	2
Training Set	1000
Testing Set	10000
Mini Batch Size	32
Number of Hidden Layers	1
Number of Hidden units	512
Total Number of Parameters	407050
Optimizer	Adam
Initializer	Glorat
Learning Rate	0.001
Epochs	100
Regularization	L1(0.0001)
Training Accuracy	1
Testing Accuracy	0.899
r	0.244
Hidden Layer Activation	Relu
Output Layer	Softmax

Model Summary

```
Model: "sequential_4"
_____
Layer (type)                 Output Shape              Param #
=================================================================
flatten_4 (Flatten)          multiple                  0
_____
dense_8 (Dense)              multiple                  401920
_____
dense_9 (Dense)              multiple                  5130
=================================================================
Total params: 407,050
Trainable params: 407,050
Non-trainable params: 0
_____
```

Problem	3
Training Set	60000
Testing Set	10000
Mini Batch Size	128
Number of Hidden Layers	2
Number of Hidden units each Layer	512
Total Number of Parameters	669706
Optimizer	Adam
Initializer	Glorat
Learning Rate	0.001
Epochs	100
Regularization	L1(0.0001)
Training Accuracy	0.945
Testing Accuracy	0.9147
r	0.237
Hidden Layer Activation	Relu
Output Layer	Softmax

Model Summary

```
Model: "sequential_15"
_____
Layer (type)                 Output Shape              Param #
=================================================================
flatten_15 (Flatten)         multiple                  0
_____
dense_42 (Dense)             multiple                  401920
_____
dense_43 (Dense)             multiple                  262656
_____
dense_44 (Dense)             multiple                  5130
=================================================================
Total params: 669,706
Trainable params: 669,706
Non-trainable params: 0
_____
```

Training and Testing accuracy

Training and Testing loss
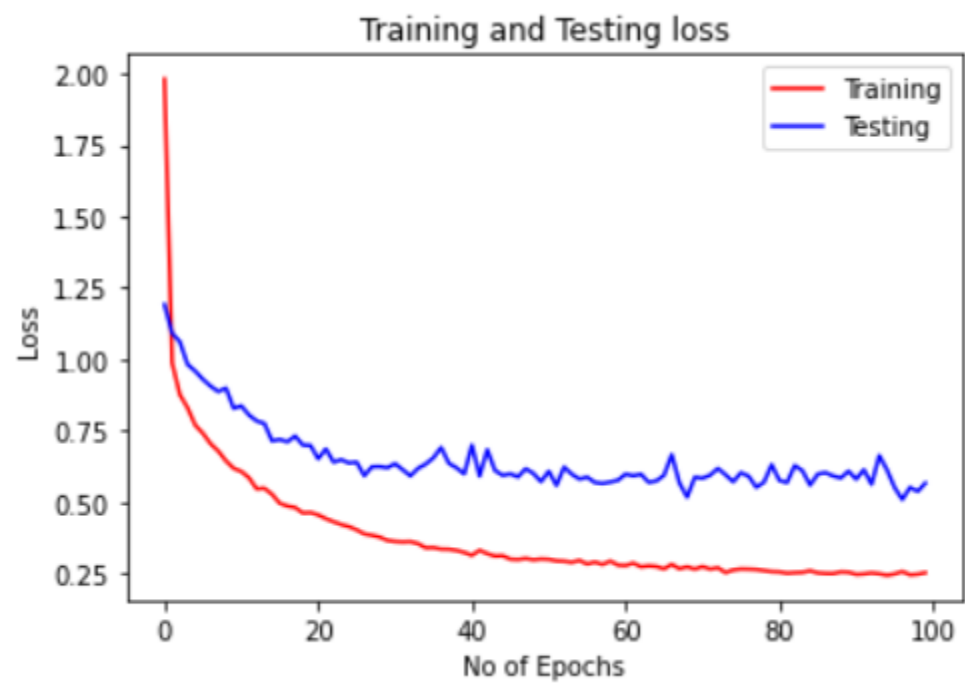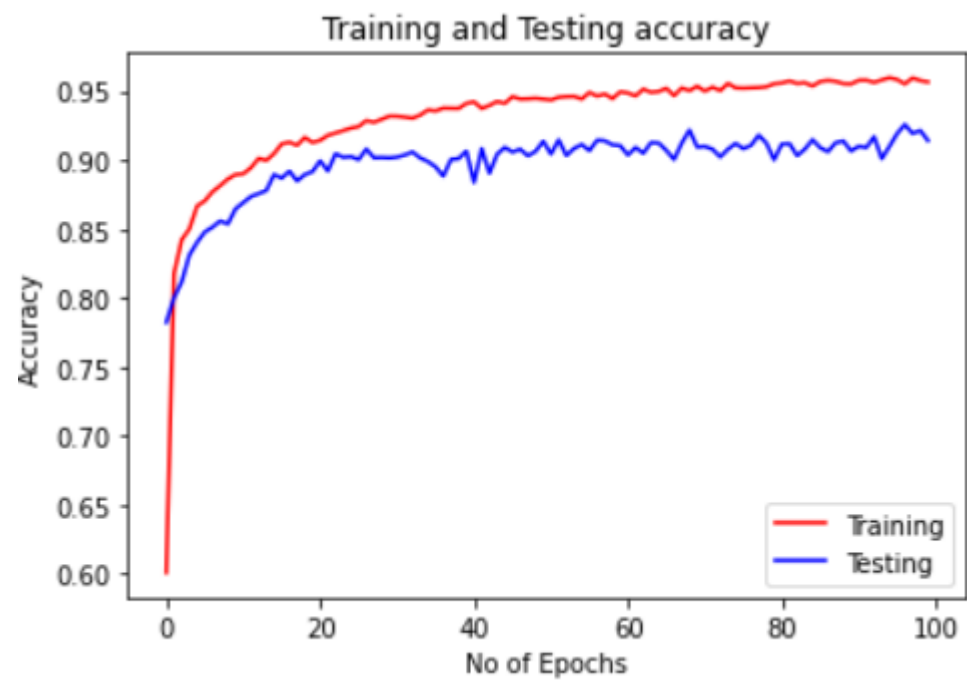
Problem	4
Training Set	40000
Testing Set	8000
Mini Batch Size	128
Number of Hidden Layers	5
Hidden Layer 1	512
Hidden Layer 2	512
Hidden Layer 3	2048
Hidden Layer 4	1024
Hidden Layer 5	1024
Total Number of Parameters	6690792
Optimizer	Adam
Initializer	Glorat
Learning Rate	0.0001
Epochs	100
Regularization	L1(0.001)
Training Accuracy	0.962
Testing Accuracy	0.8175
r	0.169

Model Summary

```
Model: "sequential_29"
_____
Layer (type)                 Output Shape              Param #
=================================================================
flatten_29 (Flatten)         multiple                  0
_____
dense_103 (Dense)            multiple                  1204736
_____
dense_104 (Dense)            multiple                  262656
_____
dense_105 (Dense)            multiple                  1050624
_____
dense_106 (Dense)            multiple                  2098176
_____
dense_107 (Dense)            multiple                  1049600
_____
dense_108 (Dense)            multiple                  1025000
=================================================================
Total params: 6,690,792
Trainable params: 6,690,792
Non-trainable params: 0
```
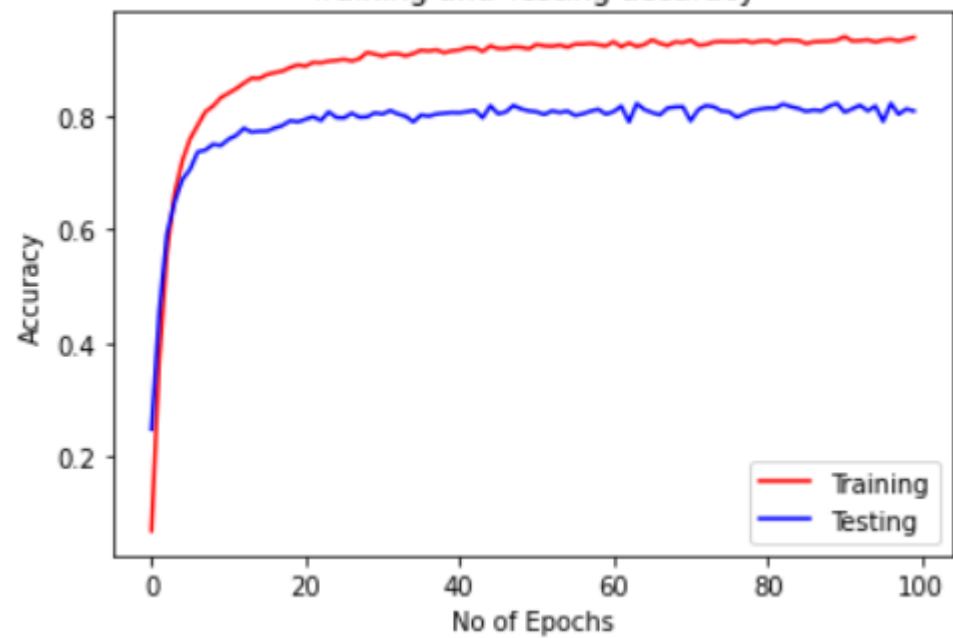
Training and Testing accuracy

Training and Testing loss