ECE 421 Programming Assignment Question
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Part 3 Questions:
Part 3 Code:

```
# Part 3 Question
def test_Part3():
    from sklearn.datasets import load_iris
    X_train, y_train = load_iris(return_X_y = True)
    X_train, X_test, y_train, y_test = train_test_split(X_train[50:], y_train[50:],
test_size = 0.2, random_state = 1)

    for i in range(80):
        if y_train[i] == 1:
            y_train[i] = -1
        else:
            y_train[i] = 1
    for j in range(20):
        if y_test[j] == 1:
            y_test[j] = -1
        else:
            y_test[j] = 1

    list = [(5, 5), (10, 10), (30, 10)]
    for item in list:
      NN = MLPClassifier(solver='adam', alpha=0.00001, hidden_layer_sizes=item,
random_state=1)
      NN.fit(X_train, y_train)

      NN_pred = NN.predict(X_test)
      sciKit = confusion_matrix(y_test, NN_pred)
      NN_pred = NN.predict(X_train)
      scikkit = confusion_matrix(y_train, NN_pred)
      print("For ", item)
      print("Confusion Matrix for train data from Part 3 question is", scikkit)
      print("Confusion Matrix for test data from Part 3 question is:", sciKit)

test_Part3()
```

Terminal Output:

```
For  (5, 5)
Confusion Matrix for train data from Part 3 question is [[42  0]
 [38  0]]
Confusion Matrix for test data from Part 3 question is: [[ 8  0]
 [12  0]]
For  (10, 10)
Confusion Matrix for train data from Part 3 question is [[40  2]
 [ 1 37]]
Confusion Matrix for test data from Part 3 question is: [[ 7  1]
 [ 0 12]]
For  (30, 10)
Confusion Matrix for train data from Part 3 question is [[39  3]
 [ 0 38]]
Confusion Matrix for test data from Part 3 question is: [[ 7  1]
 [ 1 11]]
```

Training Accuracy:

- (5, 5) training accuracy is 52.5%, test accuracy is 40%
- (10, 10) training accuracy is 96.25%, test accuracy is 95%
- (30, 10) training accuracy is 96.25%, test accuracy is 90%

Confusion Matrix:

- (5, 5)

(5, 5) Training Confusion Matrix			
	Predicted		
Label		-1	+1
	-1	42	0
	+1	38	0

$$Training\ Accuracy = \frac{42}{42 + 38} = 52.5\%$$

(5, 5) Testing Confusion Matrix			
	Predicted		
Label		-1	+1
	-1	8	0
	+1	12	0

$$Testing\ Accuracy = \frac{8}{8 + 12} = 40\%$$

- (10, 10)

(10, 10) Training Confusion Matrix			
	Predicted		
Label		-1	+1
	-1	40	2
	+1	1	37

$$Training\ Accuracy = \frac{40 + 37}{40 + 2 + 1 + 37} = 96.25\%$$

(10, 10) Testing Confusion Matrix			
	Predicted		
Label		-1	+1
	-1	7	1
	+1	0	12

$$Testing\ Accuracy = \frac{7 + 12}{7 + 1 + 12} = 95\%$$

- (30, 10)

(30, 10) Training Confusion Matrix			
	Predicted		
Label		-1	+1
	-1	39	3
	+1	0	38

$$Training\ Accuracy = \frac{39 + 38}{39 + 3 + 38} = 96.25\%$$

(30, 10) Testing Confusion Matrix			
	Predicted		
Label		-1	+1
	-1	7	1
	+1	1	11

$$Testing\ Accuracy = \frac{7 + 11}{7 + 1 + 1 + 11} = 90\%$$