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CS 3600-A
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Project 4: Questions 5 and 6

Project 4

Question 5

Written code (can also be found in question5.py):

```
from Testing import testPenData, testCarData, average, stDeviation

penList = []
carList = []

for i in range(5):
    penResults = testPenData()
    penList.append(penResults[1])
    carResults = testCarData()
    carList.append(carResults[1])

print 'Pen', penList
print 'Car', carList
penAverage = average(penList)
penStDev = stDeviation(penList)
penMax = max(penList)

carAverage = average(carList)
carStDev = stDeviation(carList)
carMax = max(carList)

print 'Pen:', penAverage, penStDev, penMax
print 'Car:', carAverage, carStDev, carMax
```

Raw Data:

	Testing Accuracies				
Pen	0.88421955403	0.89079473985	0.89908519153	0.90651801029	0.90337335620
Car	0.87696335078	0.88350785340	0.87565445026	0.8874345549	0.88219895287

Results:

	Average	Standard Deviation	Maximum
Pen	0.896798170383	0.00821220542448	0.906518010292
Car	0.881151832461	0.00433323176891	0.887434554974

Question 6

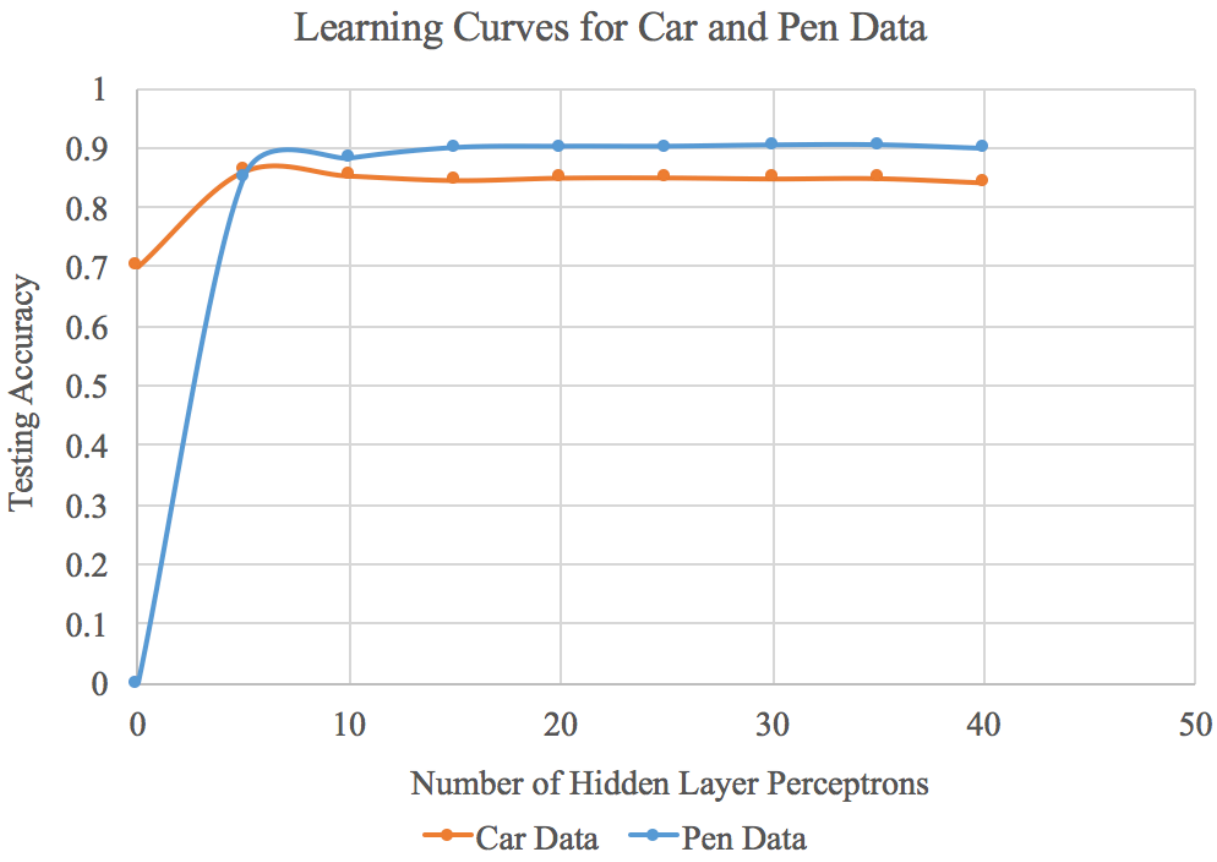
Written code (can also be found in question6.py):

```
from Testing import testPenData, testCarData, average, stDeviation

finalPenList = []
finalCarList = []

for i in range(0,45,5):
    tempPenList = []
    tempCarList = []
    for j in range(5):
        penResults = testPenData([i])
        carResults = testCarData([i])
        tempPenList.append(penResults[1])
        tempCarList.append(carResults[1])
    finalPenList.append(tuple([i, average(tempPenList), stDeviation(tempPenList),
max(tempPenList)]))
    finalCarList.append(tuple([i, average(tempCarList), stDeviation(tempCarList),
max(tempCarList)]))

print 'Pen List:', finalPenList
print 'Car List:', finalCarList
```

Results:

Pen			
Hidden Layer Perceptrons	Average	Standard Deviation	Maximum
0	0	0	0
5	0.848770726	0.013512067	0.872784448
10	0.880960549	0.002382237	0.882504288
15	0.898913665	0.006490367	0.905660377
20	0.901086335	0.007088382	0.910806175
25	0.901086335	0.005950102	0.9053745
30	0.903259005	0.001123321	0.9053745
35	0.903544883	0.003573356	0.907661521
40	0.897484277	0.007697703	0.906232133

Car			
Hidden Layer Perceptrons	Average	Standard Deviation	Maximum
0	0.70026178	0	0.70026178
5	0.860471204	0.003734383	0.865183246
10	0.853272251	0.017183028	0.878926702
15	0.845811518	0.014602309	0.859947644
20	0.84986911	0.015969659	0.867801047
25	0.85026178	0.011702771	0.863874346
30	0.848560209	0.007661262	0.859947644
35	0.84908377	0.009597017	0.859293194
40	0.841884817	0.006945811	0.85013089



Within the first 10 hidden layer perceptrons for each data set, there appears to be a positive correlation between the number of hidden layer perceptrons and the testing accuracy of the neural net. That is to say, increasing the number of hidden layer perceptrons will increase the accuracy of the neural net within the domain of the first 10 perceptrons. After the first 10 hidden layer perceptrons, there appears to be no change in the testing accuracy of the neural nets for both data sets. The neural network for the pen data set approaches an asymptote around 0.9 (90% accuracy), and the neural network for the car data set approaches an asymptote around 0.85 (85 %). One noticeable difference between the two data sets is that just before reaching its steady-state asymptotic value, the accuracy of the pen data neural net appears to slightly decrease (at around 10 hidden layer perceptrons) before slightly increasing to the steady-state value, whereas the accuracy of the car data neural net appears to slightly increase (between 5 and 10 hidden layer perceptrons) before slightly decreasing to the steady-state value.