Machine Learning- Assignment 4

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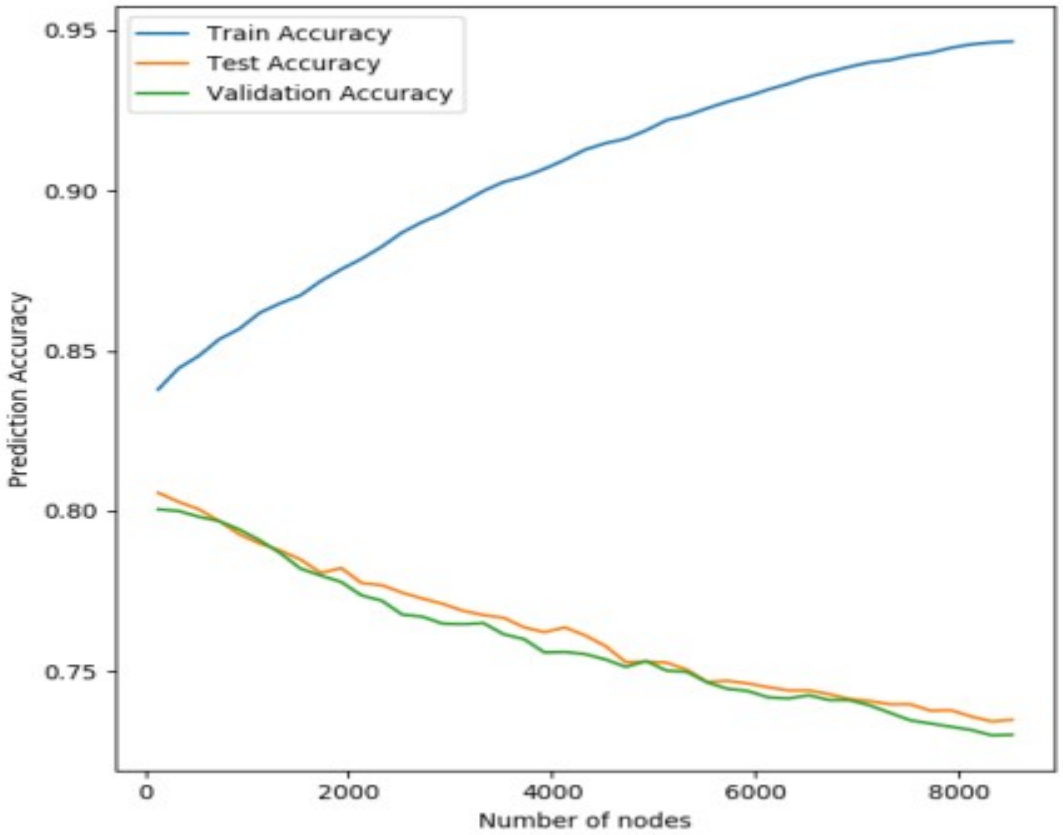
Decison Tree:

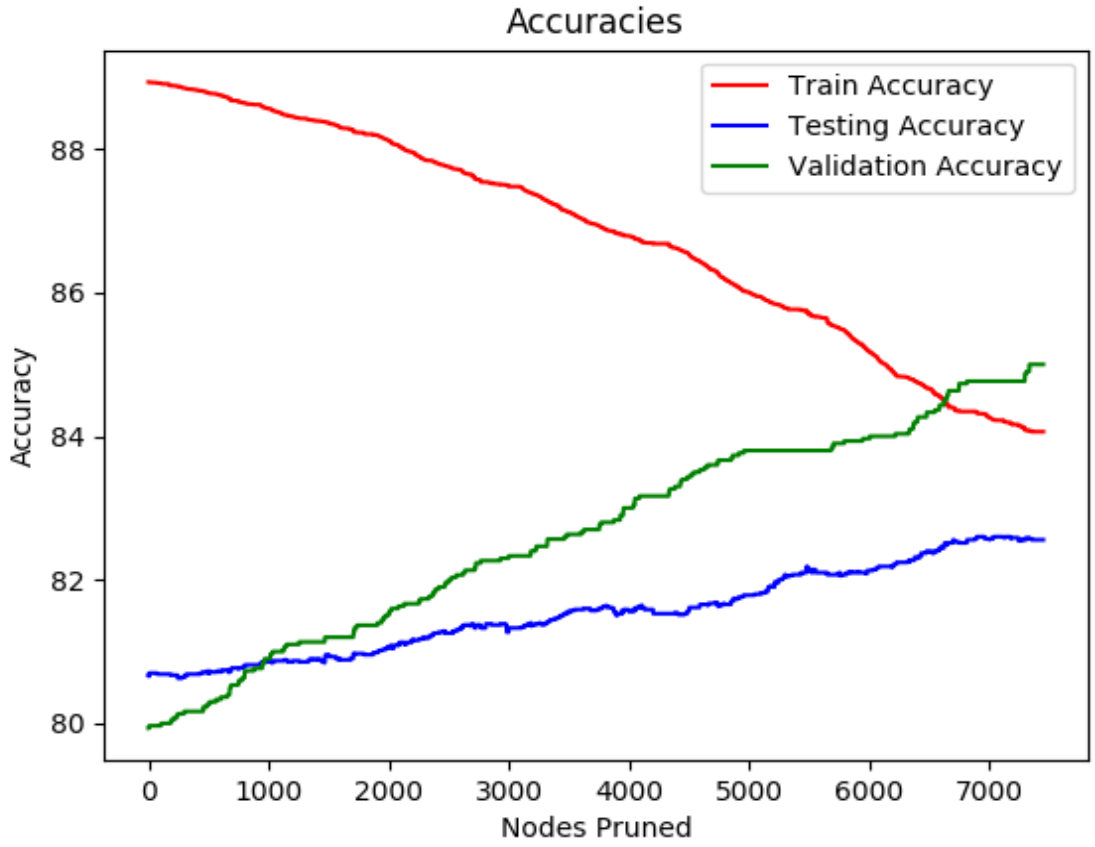
part-A:



Data	Accuracy
Training data	94.72%
Test data	72.43%
Validation data	71.98%

Increasing the number of nodes inceases training accuracy but decreases test and validation accuracy. This shows that incresing number of nodes cause overfitting

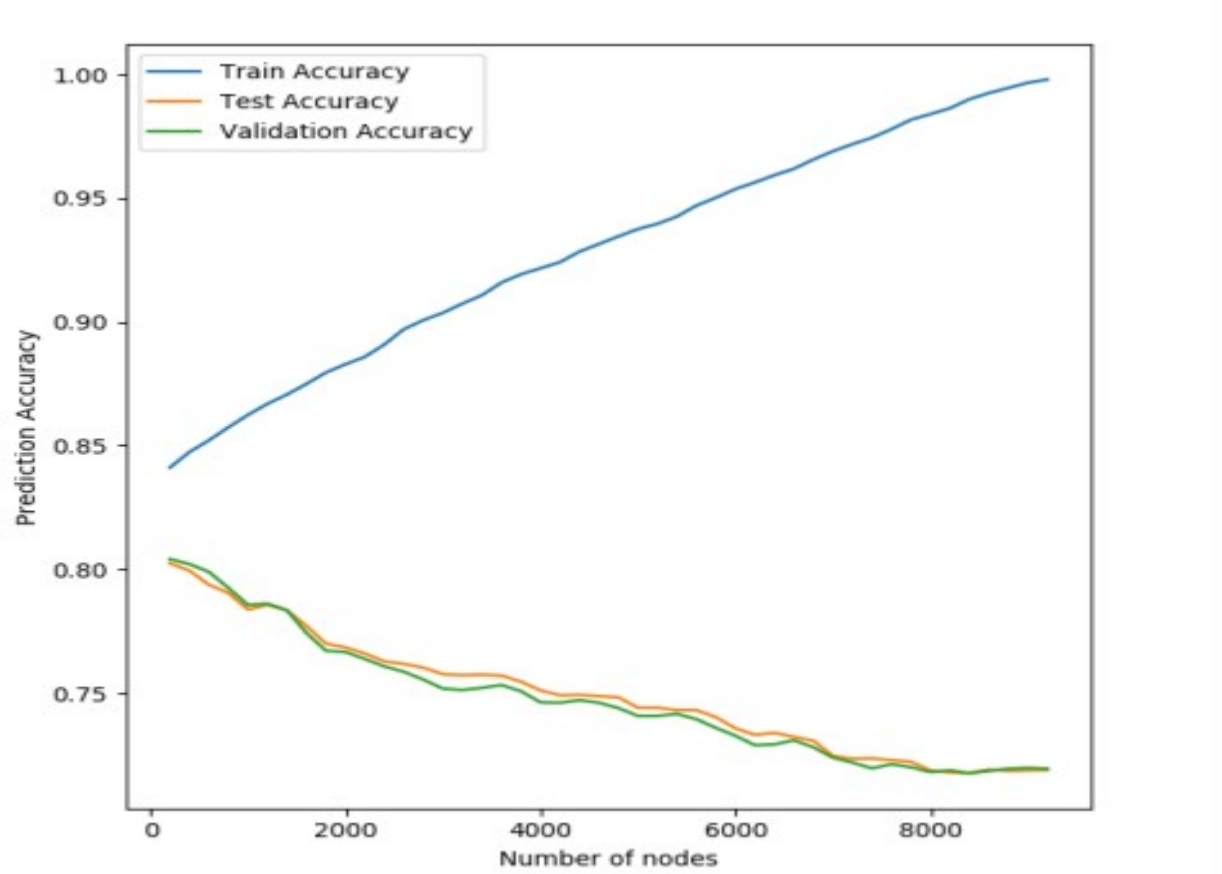
Part-B:



Data	Accuracy
Training data	84%
Test data	85%
Validation data	81%

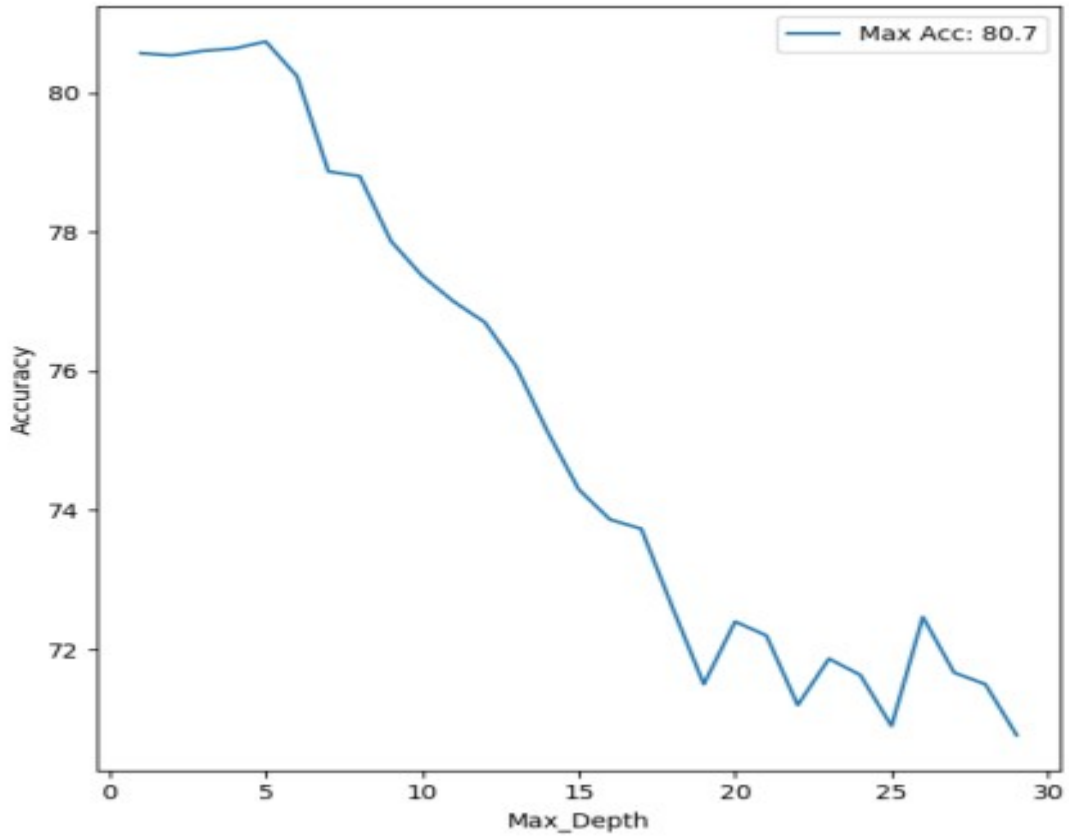
As the tree is pruned the number of nodes decrease and hence the training accuracy decrases while test and validation accuracy increases.

Part-C:

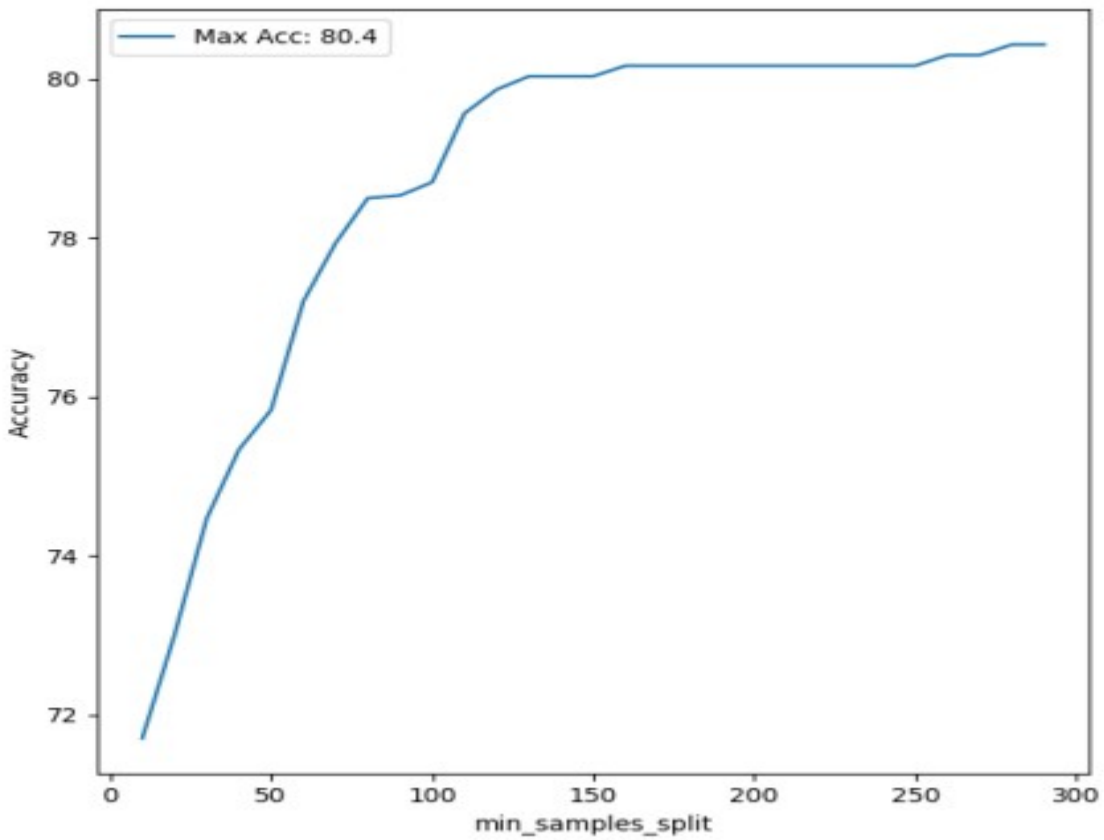


Data	Accuracy
Training data	99.7
Test data	71.23
Validation data	71
Number of nodes	1623
height	18

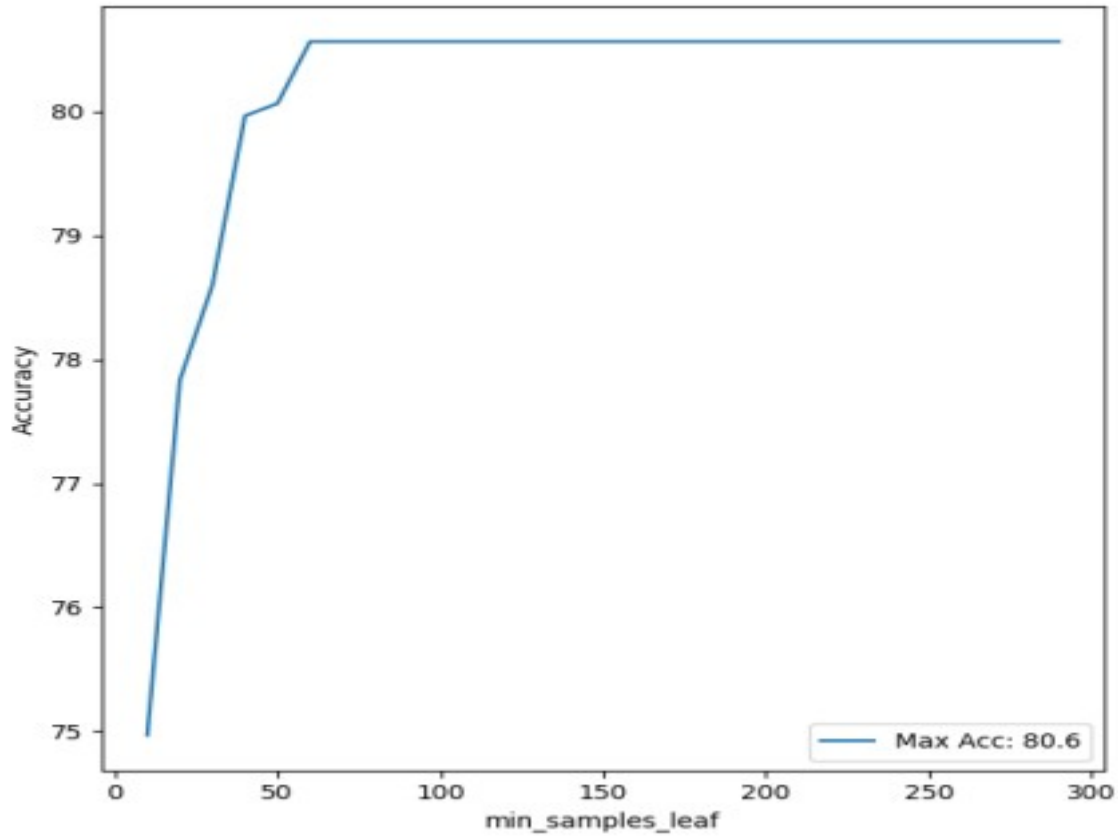
Part-D:



increasing the depth of tree means splitting the data and so it causes overfitting



increasing the minimum number of samples to split the attribute, the accuracy starts to increase



Data	Accuracy
Training data	84
Test data	80
Validation data	80

parameters	values
Min samples split	50
Min samples leaf	50
Max depth	4

Part-E:

Data	Accuracy
Training data	84
Test data	79
Validation data	77

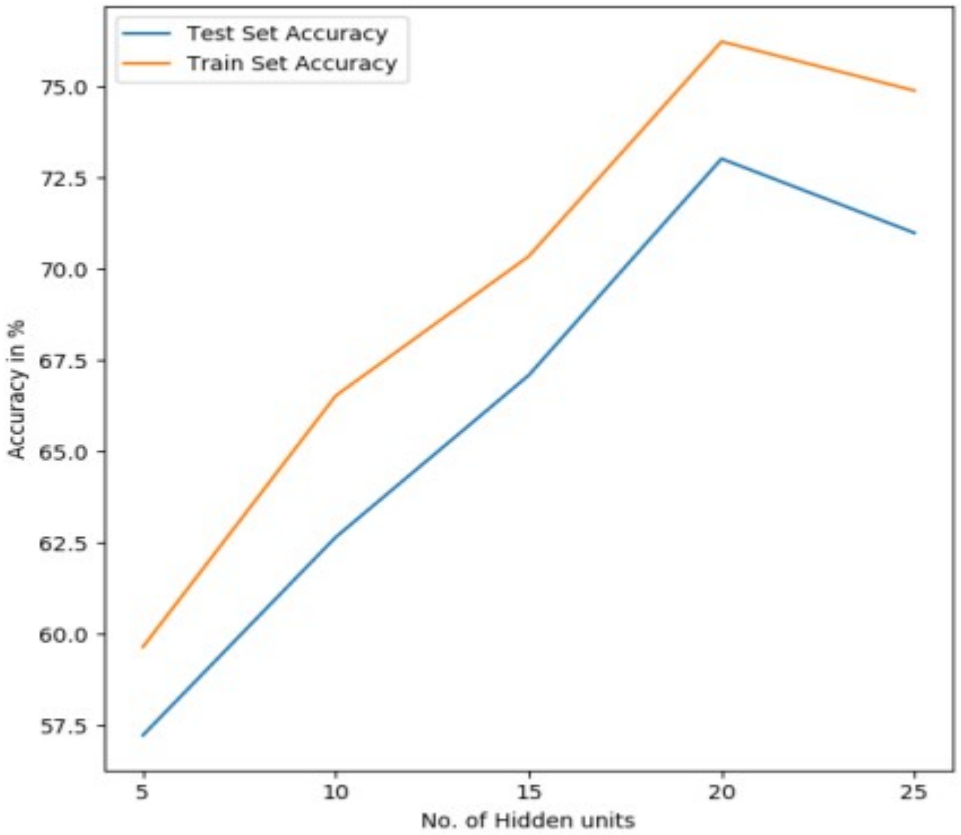
Part-F:

Data	Accuracy
Training data	94
Test data	78
Validation data	79

parameters	values
N parameters	100
boottstrap	True
Max depth	10

Neural Networks:

part-c:



Stopping Criteria : 1000 epocs
Total time taken : ~35 minutes.
Number of perceptrons 5, 10, 15, 20, 25
For training data- 59.45, 65.82, 69.24 , 75.12 , 74.18
For testing data- 56.62 , 62.84 , 66.48 , 72.91, 70.78

increasing the number of layers and units per layer increase the accuracy

n=5

```
[[9723 2770    0    0    0    0    0    0    0    0]
 [5152 5447    0    0    0    0    0    0    0    0]
 [ 460  746    0    0    0    0    0    0    0    0]
 [ 147  366    0    0    0    0    0    0    0    0]
 [  46   47    0    0    0    0    0    0    0    0]
 [  43   11    0    0    0    0    0    0    0    0]
 [   8   28    0    0    0    0    0    0    0    0]
 [   0    6    0    0    0    0    0    0    0    0]
 [   5    0    0    0    0    0    0    0    0    0]
 [   3    2    0    0    0    0    0    0    0    0]]
```

n=10

```
[[10039  2454    0    0    0    0    0    0    0    0]
 [ 3818  6781    0    0    0    0    0    0    0    0]
 [  225   981    0    0    0    0    0    0    0    0]
 [   45   468    0    0    0    0    0    0    0    0]
 [   39    54    0    0    0    0    0    0    0    0]
 [   43    11    0    0    0    0    0    0    0    0]
 [    2    34    0    0    0    0    0    0    0    0]
 [    0     6    0    0    0    0    0    0    0    0]
 [    4     1    0    0    0    0    0    0    0    0]
 [    4     1    0    0    0    0    0    0    0    0]]
```

n=20

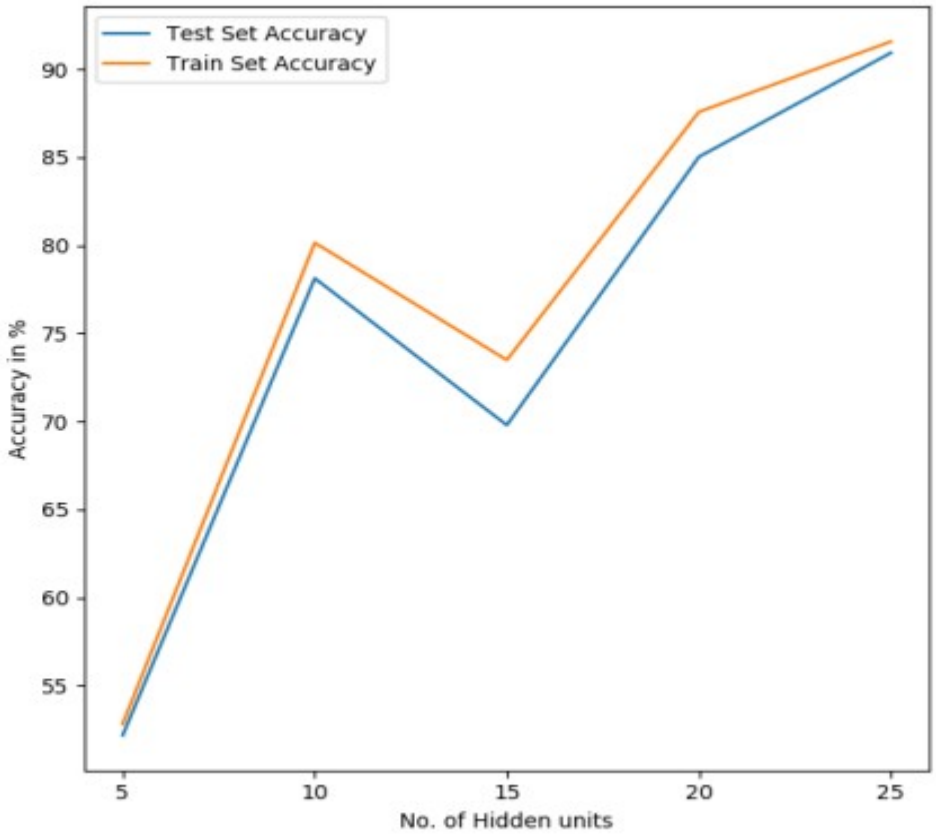
```
[[10722  1771    0    0    0    0    0    0    0    0]
 [ 2874  7725    0    0    0    0    0    0    0    0]
 [  121  1085    0    0    0    0    0    0    0    0]
 [   31   482    0    0    0    0    0    0    0    0]
 [   72    21    0    0    0    0    0    0    0    0]
 [   48     6    0    0    0    0    0    0    0    0]
 [    0    36    0    0    0    0    0    0    0    0]
 [    0     6    0    0    0    0    0    0    0    0]
 [    5     0    0    0    0    0    0    0    0    0]
 [    5     0    0    0    0    0    0    0    0    0]]
```

n=25

```
[[11642   851     0     0     0     0     0     0     0     0]
 [ 2162  8437     0     0     0     0     0     0     0     0]
  [   42  1164     0     0     0     0     0     0     0     0]
  [   28   485     0     0     0     0     0     0     0     0]
  [   81    12     0     0     0     0     0     0     0     0]
  [   50     4     0     0     0     0     0     0     0     0]
  [    0    36     0     0     0     0     0     0     0     0]
  [    0     6     0     0     0     0     0     0     0     0]
  [    4     1     0     0     0     0     0     0     0     0]
  [    5     0     0     0     0     0     0     0     0     0]]
```

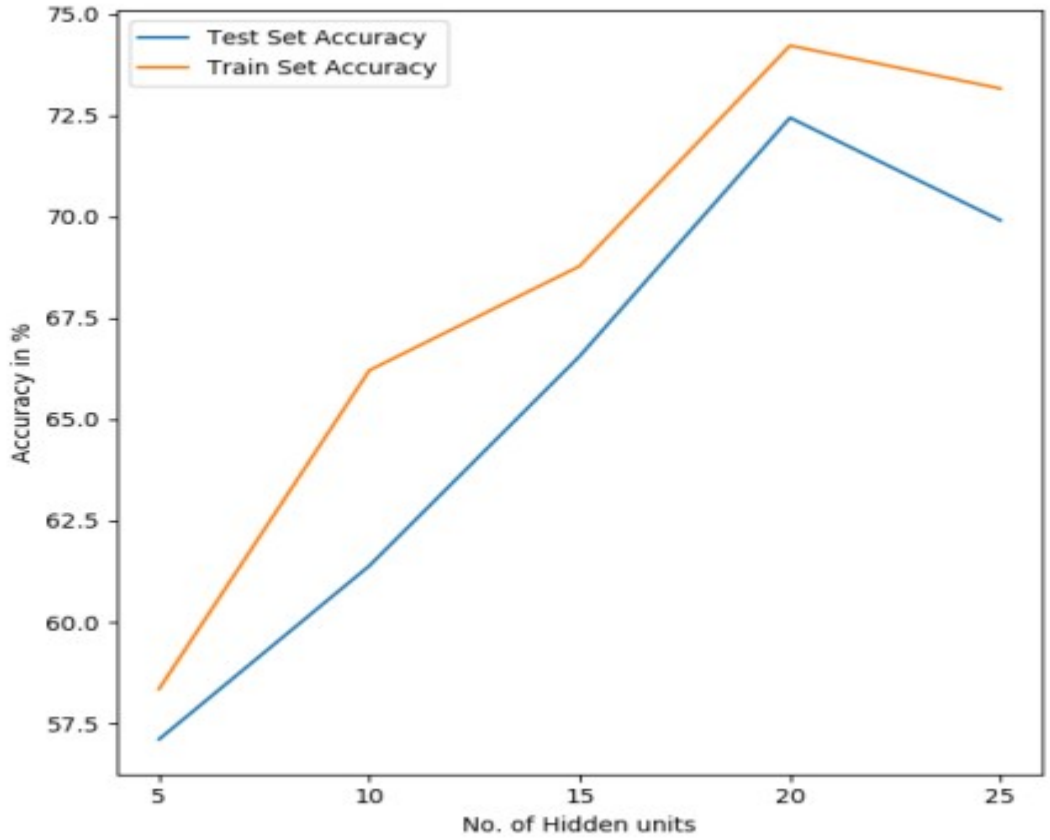
part-d:

Stopping Criteria : 1000 epocs
Number of perceptrons : 5, 10 , 15 , 20 , 25
For training data- 52.71, 79.93 , 73.74 , 87.16 , 91.56
For testing data- 52.46 , 77.81, 69.87, 85.21, 90.92



part-e:

Stopping Criteria : 1000 epocs
Number of perceptrons- 5 ,10 , 15 , 20 , 25
For training data- - 58.15 , 65.91,68.68 , 74.32 , 73.06
For testing data- - 57.31, 61.19 , 66.65 , 72.54 , 69.81



ReLU provides good non linearity and converges faster than sigmoid non linearity. The less number of epochos are required by ReLU for getting good accuracy.