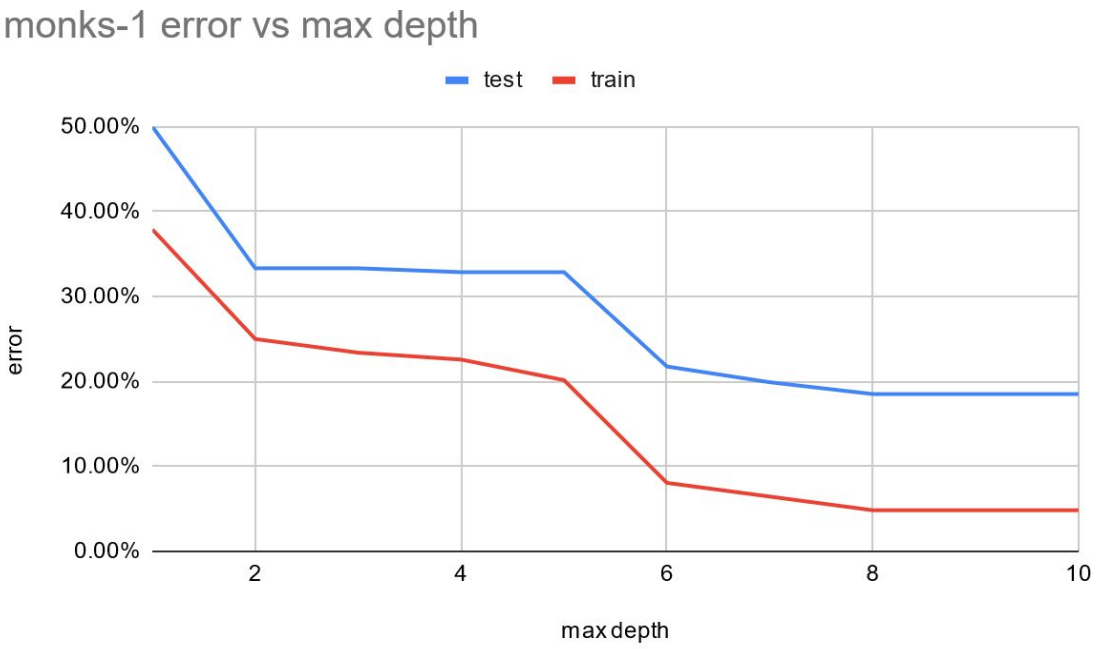
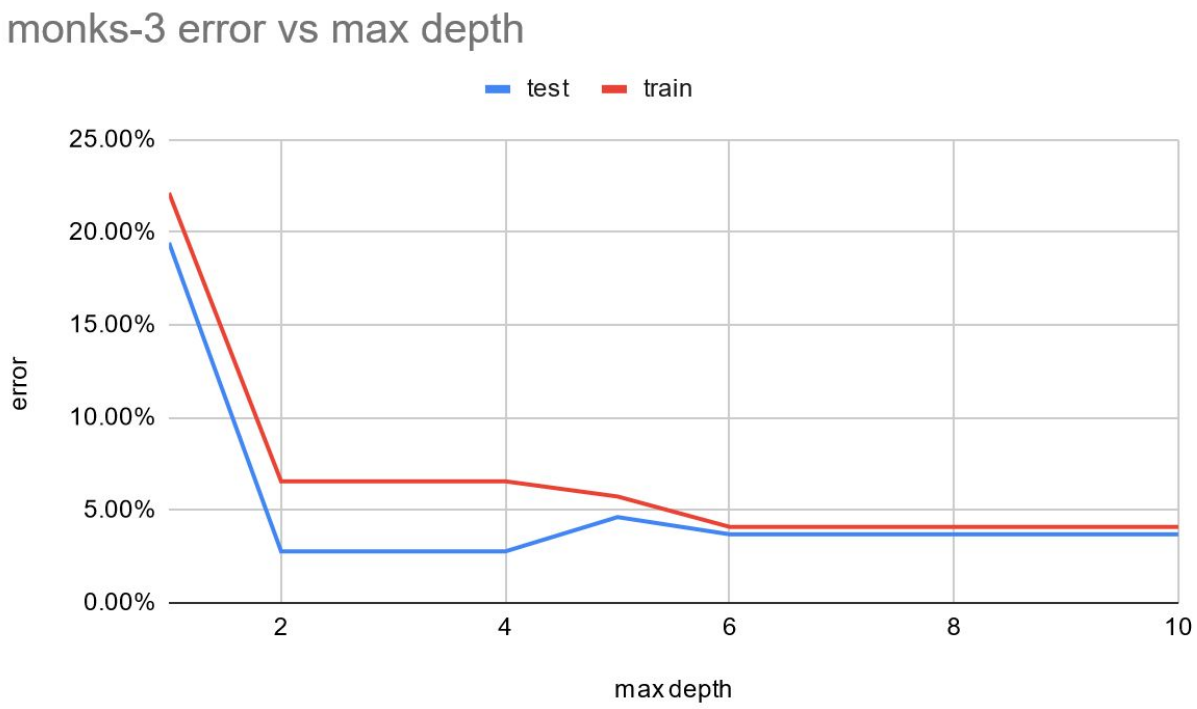
Programming assignment 1:
I wrote my program to be able to switch between the parts fairly seamlessly with switches at the top of main to run one at a time.

A: Learning curves:





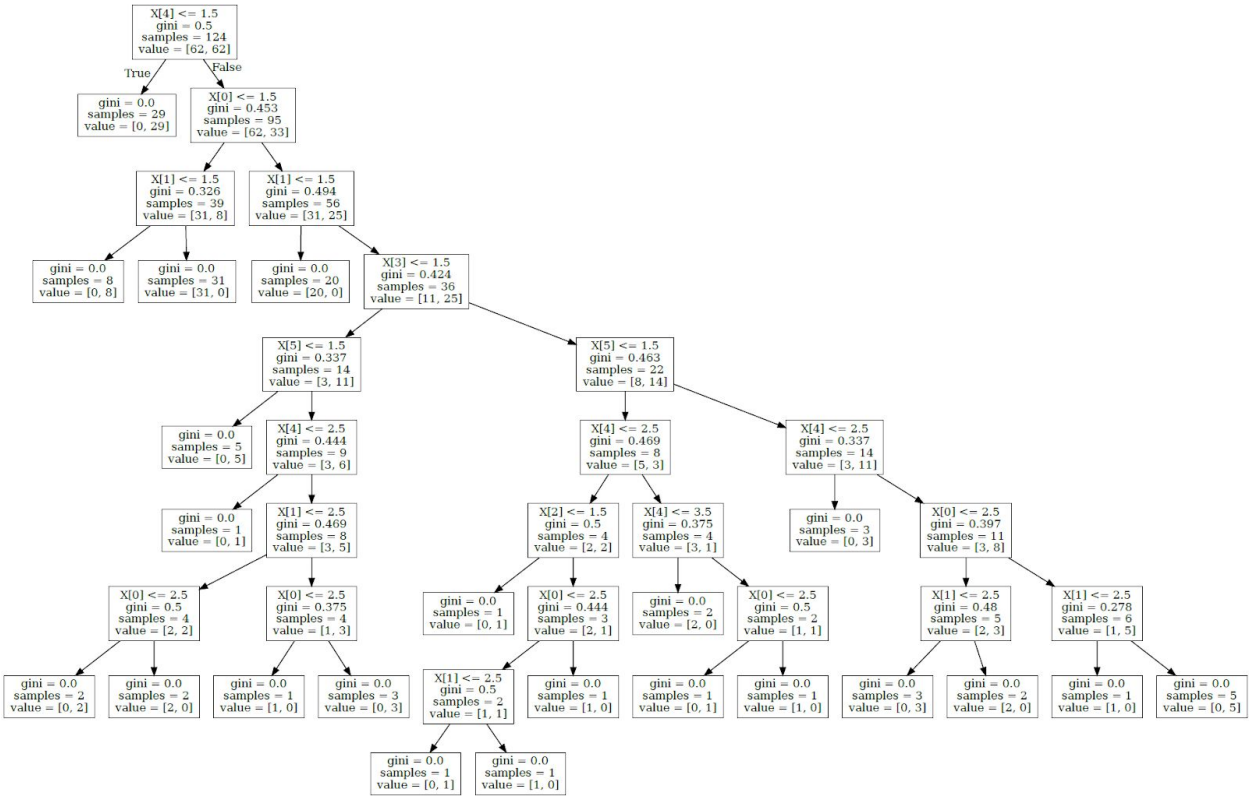
B: Weak Learners:

```
TREE
+-- [SPLIT: x1 = 3]
|       +-- [LABEL = 0]
+-- [SPLIT: x1 = 3]
|       +-- [LABEL = 1]
monks-1, depth = 1
true positive  = 72 false negative = 144
false positive = 72  true negative = 144
```

```
TREE
+-- [SPLIT: x1 = 3]
|       +-- [SPLIT: x5 = 1]
|       |       +-- [LABEL = 0]
|       +-- [SPLIT: x5 = 1]
|       |       +-- [LABEL = 1]
+-- [SPLIT: x1 = 3]
|       +-- [SPLIT: x4 = 2]
|       |       +-- [LABEL = 1]
|       +-- [SPLIT: x4 = 2]
|       |       +-- [LABEL = 0]
monks-1, depth = 2
true positive  = 120 false negative = 96
false positive = 48  true negative = 168
```

C: sklearn decision tree

Note: had to switch to linux for easier time with libraries. Will also have a full pdf of tree attached.



Confusion matrix =

```
steven@steven:~/python/Assignment 1$ python3 decision_tree.py
true positive  = 216 false negative = 0
false positive = 24  true negative = 192
```

D: Other Data Sets:

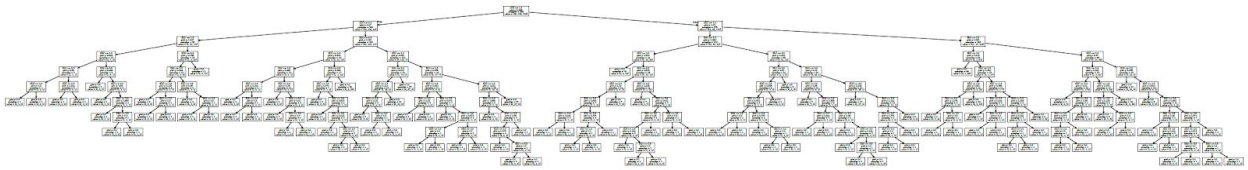
I used the UCI balance scale data:

My tree :

```
TREE
+-- [SPLIT: x2 = 0]
|       +-- [LABEL = 1]
+-- [SPLIT: x2 = 0]
|       +-- [LABEL = 2]
balance-scale, depth = 1
true positive  = 68 false negative = 0
false positive = 58  true negative = 0
```

```
TREE
+-- [SPLIT: x2 = 0]
|       +-- [SPLIT: x4 = 0]
|       |       +-- [LABEL = 1]
|       +-- [SPLIT: x4 = 0]
|       |       +-- [LABEL = 1]
+-- [SPLIT: x2 = 0]
|       +-- [SPLIT: x4 = 4]
|       |       +-- [LABEL = 2]
|       +-- [SPLIT: x4 = 4]
|       |       +-- [LABEL = 2]
balance-scale, depth = 2
true positive  = 68 false negative = 0
false positive = 58  true negative = 0
```

Library tree:



```
library confusion matrix
true positive  = 60 false negative = 18
false positive = 9  true negative = 0
```