

① ⑥ Accuracy of training data :

93.4524	at $C = 100000000$.
93.4524	at $C = 1000000$
"	at $C = 100000$
"	at $C = 10000$
93.1548	at $C = 1000$
93.4524	at $C = 100$
<u>91.369</u>	at $C = 10$.

② Validation set accuracy:

accuracy is best at $C=100$, 92.9412

at $C=10$, accuracy = 91.7647

at $C=100$ accuracy = 92.9412

at $C=1000$ accuracy = 90.5882

at $C=10000$ "

at $C=100000$ accuracy = 89.4118

at $C=1000000$ accuracy = 89.4118

at $C=100000000$ accuracy = 89.4118.

③ Accuracy of Test data = 96.6216.

② Dist SVM:

⑥ accuracy with	$C=1, \sigma=0.1$: 100
"	$C=1, \sigma=1$: 99.7024
	$C=1, \sigma=10$: 89.2857
	$C=1, \sigma=100$: 88.0952
	$C=1, \sigma=1000$: 83.631
	$C=10, \sigma=0.1$: 100
	$\sigma=1$: 100
	$\sigma=10$: 96.131
	$\sigma=100$: 88.0952
	$\sigma=1000$: 81.25
	$C=100, \sigma=0.1$: 100
	$\sigma=1$: 100
	$\sigma=10$: 98.2143
	$\sigma=100$: 87.5
	$\sigma=1000$: 84.5238
	$C=1000, \sigma=0.1$: 100
	$\sigma=1$: 100
	$\sigma=10$: 99.4048
	$\sigma=100$: 90.7736
	$\sigma=1000$: 85.119
	$C=10000, \sigma=0.1$: 100
	$\sigma=1$: 100
	$\sigma=10$: 100
	$\sigma=100$: 91.369
	$\sigma=1000$: 74.4048

$$C = 10^5$$

$\sigma = 0.1$:	100
$\sigma = 1$:	100
$\sigma = 10$:	100
$\sigma = 100$:	83.631
$\sigma = 1000$:	84.8214

$$C = 10^6$$

$\sigma = 0.1$:	100
$\sigma = 1$:	100
$\sigma = 10$:	100
$\sigma = 100$:	85.7143
$\sigma = 1000$:	88.6905

$$C = 10^7$$

$\sigma = 0.1$:	100
$\sigma = 1$:	100
$\sigma = 10$:	100
$\sigma = 100$:	82.7381
$\sigma = 1000$:	62.5

$$C = 10^8$$

$\sigma = 0.1$:	100
$\sigma = 1$:	100
$\sigma = 10$:	100
$\sigma = 100$:	91.0714
$\sigma = 1000$:	53.869

$\odot \quad c=1 \quad \sigma=0.1 : 60$
 $\sigma=\phi : 60$
 $\sigma=10 : 89.4118$
 $\sigma=100 : 90.5882$
 $\sigma=1000 : 85.8824$

$c=10 \quad \sigma=0.1 : 60$
 $\sigma=1 : 58.8235$
 $\sigma=10 : 87.0588$
 $\sigma=100 : 90.5882$
 $\sigma=1000 : 83.5294$

$c=100 \quad \sigma=0.1 : 60$
 $\sigma=1 : 58.8235$
 $\sigma=10 : 88.2353$
 $\sigma=100 : 89.4118$
 $\sigma=1000 : 85.8824$

$c=1000 \quad \sigma=0.1 : 60$
 $\sigma=1 : 58.8235$
 $\sigma=10 : 87.0588$
 $\sigma=100 : 89.4118$
 $\sigma=1000 : 85.8824$

$c=10^4 \quad \sigma=0.1 : 60$
 $\sigma=1 : 58.8235$
 $\sigma=10 : 84.7059$
 $\sigma=100 : 92.9412$
 $\sigma=1000 : 80$

$c=10^5$
 $\sigma=0.1 : 60$
 $\sigma=1 : 58.8235$
 $\sigma=10 : 84.7059$
 $\sigma=100 : 84.7059$

$\sigma=1000 : 83.5294$

$$C = 10^6$$

$\sigma = 0.1$: 60
$\sigma = 1$: 58.8235
$\sigma = 10$: 84.7059
$\sigma = 100$: 82.3529
$\sigma = 1000$: 89.4118

$$C = 10^7$$

$\sigma = 0.1$: 60
$\sigma = 1$: 58.8235
$\sigma = 10$: 84.7059
$\sigma = 100$: 78.8235
$\sigma = 1000$: 71.7647

$$C = 10^8$$

$\sigma = 0.1$: 60
$\sigma = 1$: 58.8235
$\sigma = 10$: 84.7059
$\sigma = 100$: 81.1765
$\sigma = 1000$: 50.5882

With validation data, max accuracy is at

$$C = 10000, \sigma = 100$$

$$\text{accuracy} = 92.9412$$

d) Accuracy on test data = 87.8378

③ Accuracy of KNN on Valid data :

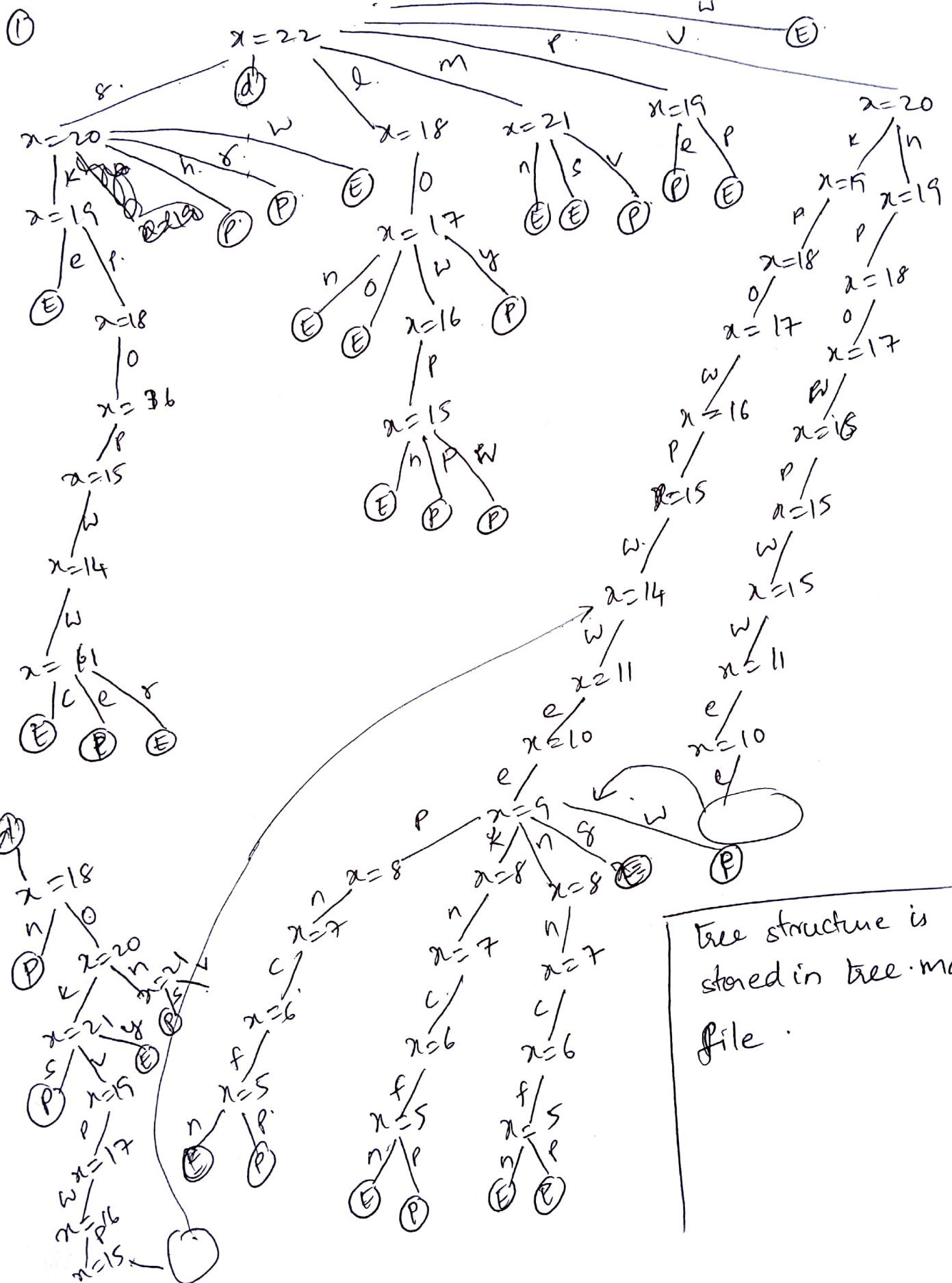
89.4118	$k=1$
95.2941	$k=5$
92.9412	$k=11$
92.9412	$k=15$
96.4706	$k=21$

Accuracy on Testdata :

89.4118	$k=1$
95.2941	$k=5$
92.9412	$k=11$
92.9412	$k=15$
96.4706	$k=21$

④ Accuracy of ^{test} data with primal formulation is 96.6216
Accuracy of ^{test} data with dual formulation is 87.834
Accuracy of KNN on ^{test} data is 96.4706

∴ SVM with slack formulation yields being better accuracy than other two approaches.



② number of nodes in the tree is calculated to be : 216.

③ height = 12 (printed in the output).

④ training set accuracy = 100

⑤ ~~test~~ test set accuracy = 100

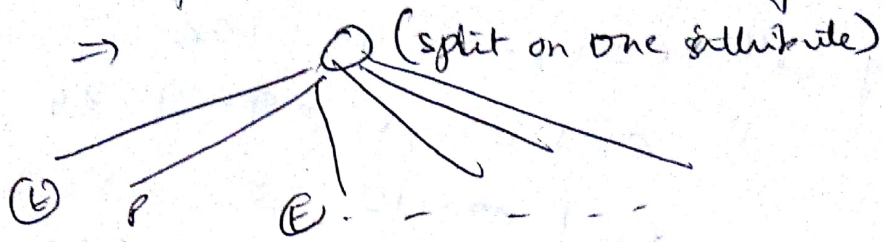
⑥ If the set of rules are not simple enough to determine whether mushroom is edible ~~and~~.

If the complete set is given, since decision tree overfits the data, decision tree could be reliable enough to give accurate data.

⑦ Quality of the decision tree is dependent on the set of rules used to train the tree.

decision tree overfits the training data and is highly reliable on training data. Test data is used to find the accuracy of decision tree. If any data point is missed, probability is used to determine the outcome.

⑤ One non leaf node : root is the non leaf node



leaves are either Edible or Poisonous.

Since greedy heuristic has given depth of atleast 4, exactly one ^{non} leaf node based decision tree would not be the same or better.

P.S.: Used tree provided in
<https://www.mathworks.com/matlabcentral/fileexchange/35693-tree-data-structure-as-a-matlab-class>.

Instructions to run the code:

add `tree3-matlab-tree-3d13d15` to the path and then execute the code in Matlab to generate the tree.