**RESULTS OBTAINED FOR DECISION TREE**

**TABLE REPORTING ACCURACIES ON THE TEST DATA FOR THE TWO DIFFERENT HEURISTIC APPROACHES USED IN THE ALGORITHM**

**FOR DATASET-1**

1. **USING INFORMATION GAIN HEURISTIC**

|  |  |  |
| --- | --- | --- |
| **[L,K]** | **BEFORE PRUNING** | **AFTER PRUNING** |
| **5,5** | 0.751624187906047 | 0.7556221889055472 |
| **10,5** | 0.751624187906047 | 0.7511244377811095 |
| **20,5** | 0.751624187906047 | 0.7456271864067966 |
| **20,10** | 0.751624187906047 | 0.750624687656172 |
| **30,10** | 0.751624187906047 | 0.7616191904047976 |
| **10,10** | 0.751624187906047 | 0.7596201899050474 |
| **40,10** | 0.751624187906047 | 0.7581209395302348 |
| **20,20** | 0.751624187906047 | 0.7581209395302348 |
| **30,30** | 0.751624187906047 | 0.7541229385307346 |
| **15,5** | 0.751624187906047 | 0.7611194402798601 |

1. **USING VARIANCE IMPURITY GAIN HEURISTIC**

|  |  |  |
| --- | --- | --- |
| **[L,K]** | **BEFORE PRUNING** | **AFTER PRUNING** |
| **5,5** | 0.7611194402798601 | 0.7611194402798601 |
| **10,5** | 0.7611194402798601 | 0.7616191904047976 |
| **20,5** | 0.7611194402798601 | 0.768615692153923 |
| **20,10** | 0.7611194402798601 | 0.7661169415292354 |
| **30,10** | 0.7611194402798601 | 0.7706146926536732 |
| **10,10** | 0.7611194402798601 | 0.7551224387806097 |
| **40,10** | 0.7611194402798601 | 0.768615692153923 |
| **20,20** | 0.7611194402798601 | 0.7591204397801099 |
| **30,30** | 0.7611194402798601 | 0.7491254372813593 |
| **15,5** | 0.7611194402798601 | 0.769615192403798 |

**RESULTS OF THE PRINTED DECISION TREE SHOWN FOR L=20 AND K=10 USING BOTH THE APPROACHES (TAKEN FROM THE CONSOLE)**

Decision tree printed using Information Gain heuristic Approach:

Accuracy of orginal tree is 0.7426286856571714

Accuracy obtained after pruning the tree is 0.7501249375312344

Accuracy computed for the testing data 0.751624187906047

Accuracy computed for testing data using pruned trees 0.750624687656172

Resultant Tree obtained before pruning

XO= 0 :

| XM= 0 :

| | XF= 0 :

| | | XB= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XC= 0 : 1

| | | | | | | XC= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XP= 0 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 : 1

| | | | | | XP= 1 : 0

| | | XB= 1 :

| | | | XD= 0 : 0

| | | | XD= 1 :

| | | | | XI= 0 : 0

| | | | | XI= 1 :

| | | | | | XN= 0 : 0

| | | | | | XN= 1 : 1

| | XF= 1 : 0

| XM= 1 :

| | XB= 0 :

| | | XF= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 : 1

| | | | | XD= 1 :

| | | | | | XC= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | | XC= 1 : 0

| | | XF= 1 :

| | | | XS= 0 :

| | | | | XQ= 0 :

| | | | | | XI= 0 : 0

| | | | | | XI= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 : 1

| | | | | XQ= 1 :

| | | | | | XI= 0 : 1

| | | | | | XI= 1 :

| | | | | | | XL= 0 : 1

| | | | | | | XL= 1 :

| | | | | | | | XT= 0 : 0

| | | | | | | | XT= 1 : 1

| | | | XS= 1 :

| | | | | XR= 0 :

| | | | | | XD= 0 : 1

| | | | | | XD= 1 :

| | | | | | | XP= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XQ= 0 : 0

| | | | | | | | | XQ= 1 : 1

| | | | | | | | XT= 1 : 1

| | | | | | | XP= 1 : 0

| | | | | XR= 1 :

| | | | | | XI= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 : 0

| | | | | | XI= 1 :

| | | | | | | XG= 0 :

| | | | | | | | XQ= 0 :

| | | | | | | | | XJ= 0 :

| | | | | | | | | | XU= 0 : 1

| | | | | | | | | | XU= 1 : 0

| | | | | | | | | XJ= 1 : 1

| | | | | | | | XQ= 1 : 0

| | | | | | | XG= 1 : 1

| | XB= 1 :

| | | XI= 0 : 0

| | | XI= 1 :

| | | | XK= 0 :

| | | | | XD= 0 : 0

| | | | | XD= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 :

| | | | | | | | | XN= 0 : 0

| | | | | | | | | XN= 1 : 1

| | | | | | | XS= 1 : 0

| | | | XK= 1 : 0

XO= 1 :

| XI= 0 :

| | XM= 0 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XH= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 : 1

| | | | | XH= 1 : 1

| | | | XF= 1 : 0

| | | XQ= 1 :

| | | | XJ= 0 :

| | | | | XN= 0 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XU= 0 : 0

| | | | | | | XU= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | | XN= 1 : 0

| | | | XJ= 1 :

| | | | | XL= 0 :

| | | | | | XH= 0 : 0

| | | | | | XH= 1 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XK= 0 : 0

| | | | | | | | XK= 1 : 1

| | | | | XL= 1 : 1

| | XM= 1 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XL= 0 :

| | | | | | XC= 0 : 1

| | | | | | XC= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XU= 0 :

| | | | | | | | | XR= 0 :

| | | | | | | | | | XT= 0 : 0

| | | | | | | | | | XT= 1 : 1

| | | | | | | | | XR= 1 : 0

| | | | | | | | XU= 1 : 1

| | | | | XL= 1 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 :

| | | | | | | XT= 0 : 1

| | | | | | | XT= 1 :

| | | | | | | | XJ= 0 : 1

| | | | | | | | XJ= 1 : 0

| | | | XF= 1 : 0

| | | XQ= 1 : 0

| XI= 1 :

| | XT= 0 :

| | | XH= 0 :

| | | | XP= 0 :

| | | | | XF= 0 : 0

| | | | | XF= 1 :

| | | | | | XR= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XR= 1 :

| | | | | | | XQ= 0 : 1

| | | | | | | XQ= 1 : 0

| | | | XP= 1 :

| | | | | XS= 0 :

| | | | | | XD= 0 :

| | | | | | | XC= 0 :

| | | | | | | | XU= 0 :

| | | | | | | | | XQ= 0 : 1

| | | | | | | | | XQ= 1 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XG= 0 : 1

| | | | | | | | | XG= 1 : 0

| | | | | | | XC= 1 : 0

| | | | | | XD= 1 :

| | | | | | | XM= 0 :

| | | | | | | | XJ= 0 : 0

| | | | | | | | XJ= 1 : 1

| | | | | | | XM= 1 : 1

| | | | | XS= 1 : 1

| | | XH= 1 :

| | | | XJ= 0 :

| | | | | XC= 0 :

| | | | | | XN= 0 : 1

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| | | | | | | XG= 1 : 0

| | | | | XC= 1 :

| | | | | | XM= 0 : 0

| | | | | | XM= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XR= 0 : 1

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| | | | | | | XS= 1 : 1

| | | | XJ= 1 :

| | | | | XS= 0 : 1

| | | | | XS= 1 :

| | | | | | XG= 0 :

| | | | | | | XB= 0 : 0

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| | XT= 1 :

| | | XS= 0 :

| | | | XQ= 0 :

| | | | | XK= 0 :

| | | | | | XC= 0 :

| | | | | | | XR= 0 :

| | | | | | | | XH= 0 :

| | | | | | | | | XE= 0 : 0

| | | | | | | | | XE= 1 : 1

| | | | | | | | XH= 1 : 1

| | | | | | | XR= 1 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XL= 0 : 0

| | | | | | | | | XL= 1 : 1

| | | | | | XC= 1 : 1

| | | | | XK= 1 :

| | | | | | XD= 0 :

| | | | | | | XJ= 0 : 0

| | | | | | | XJ= 1 : 1

| | | | | | XD= 1 : 0

| | | | XQ= 1 :

| | | | | XM= 0 :

| | | | | | XN= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 : 0

| | | | | | XN= 1 :

| | | | | | | XR= 0 : 1

| | | | | | | XR= 1 :

| | | | | | | | XL= 0 : 1

| | | | | | | | XL= 1 : 0

| | | | | XM= 1 : 0

| | | XS= 1 :

| | | | XL= 0 :

| | | | | XD= 0 :

| | | | | | XU= 0 : 1

| | | | | | XU= 1 :

| | | | | | | XQ= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 : 0

| | | | | | | XQ= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XL= 1 :

| | | | | XH= 0 :

| | | | | | XQ= 0 :

| | | | | | | XD= 0 : 0

| | | | | | | XD= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 : 1

| | | | | | XQ= 1 :

| | | | | | | XM= 0 : 1

| | | | | | | XM= 1 : 0

| | | | | XH= 1 : 0

Resultant Tree obtained after pruning:

XO= 0 :

| XM= 0 :

| | XF= 0 :

| | | XB= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XC= 0 : 1

| | | | | | | XC= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XP= 0 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 : 1

| | | | | | XP= 1 : 0

| | | XB= 1 :

| | | | XD= 0 : 0

| | | | XD= 1 :

| | | | | XI= 0 : 0

| | | | | XI= 1 :

| | | | | | XN= 0 : 0

| | | | | | XN= 1 : 1

| | XF= 1 : 0

| XM= 1 :

| | XB= 0 :

| | | XF= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 : 1

| | | | | XD= 1 :

| | | | | | XC= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | | XC= 1 : 0

| | | XF= 1 : 1

| | XB= 1 :

| | | XI= 0 : 0

| | | XI= 1 :

| | | | XK= 0 :

| | | | | XD= 0 : 0

| | | | | XD= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 :

| | | | | | | | | XN= 0 : 0

| | | | | | | | | XN= 1 : 1

| | | | | | | XS= 1 : 0

| | | | XK= 1 : 0

XO= 1 :

| XI= 0 :

| | XM= 0 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XH= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 : 1

| | | | | XH= 1 : 1

| | | | XF= 1 : 0

| | | XQ= 1 :

| | | | XJ= 0 :

| | | | | XN= 0 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XU= 0 : 0

| | | | | | | XU= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | | XN= 1 : 0

| | | | XJ= 1 :

| | | | | XL= 0 :

| | | | | | XH= 0 : 0

| | | | | | XH= 1 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XK= 0 : 0

| | | | | | | | XK= 1 : 1

| | | | | XL= 1 : 1

| | XM= 1 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XL= 0 :

| | | | | | XC= 0 : 1

| | | | | | XC= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XU= 0 :

| | | | | | | | | XR= 0 :

| | | | | | | | | | XT= 0 : 0

| | | | | | | | | | XT= 1 : 1

| | | | | | | | | XR= 1 : 0

| | | | | | | | XU= 1 : 1

| | | | | XL= 1 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 :

| | | | | | | XT= 0 : 1

| | | | | | | XT= 1 :

| | | | | | | | XJ= 0 : 1

| | | | | | | | XJ= 1 : 0

| | | | XF= 1 : 0

| | | XQ= 1 : 0

| XI= 1 :

| | XT= 0 :

| | | XH= 0 :

| | | | XP= 0 :

| | | | | XF= 0 : 0

| | | | | XF= 1 :

| | | | | | XR= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XR= 1 : 0

| | | | XP= 1 :

| | | | | XS= 0 :

| | | | | | XD= 0 :

| | | | | | | XC= 0 :

| | | | | | | | XU= 0 :

| | | | | | | | | XQ= 0 : 1

| | | | | | | | | XQ= 1 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XG= 0 : 1

| | | | | | | | | XG= 1 : 0

| | | | | | | XC= 1 : 0

| | | | | | XD= 1 :

| | | | | | | XM= 0 :

| | | | | | | | XJ= 0 : 0

| | | | | | | | XJ= 1 : 1

| | | | | | | XM= 1 : 1

| | | | | XS= 1 : 1

| | | XH= 1 :

| | | | XJ= 0 : 1

| | | | XJ= 1 :

| | | | | XS= 0 : 1

| | | | | XS= 1 :

| | | | | | XG= 0 :

| | | | | | | XB= 0 : 0

| | | | | | | XB= 1 :

| | | | | | | | XN= 0 : 1

| | | | | | | | XN= 1 :

| | | | | | | | | XU= 0 : 1

| | | | | | | | | XU= 1 : 0

| | | | | | XG= 1 :

| | | | | | | XQ= 0 : 1

| | | | | | | XQ= 1 :

| | | | | | | | XU= 0 : 1

| | | | | | | | XU= 1 : 0

| | XT= 1 :

| | | XS= 0 :

| | | | XQ= 0 :

| | | | | XK= 0 :

| | | | | | XC= 0 :

| | | | | | | XR= 0 :

| | | | | | | | XH= 0 :

| | | | | | | | | XE= 0 : 0

| | | | | | | | | XE= 1 : 1

| | | | | | | | XH= 1 : 1

| | | | | | | XR= 1 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XL= 0 : 0

| | | | | | | | | XL= 1 : 1

| | | | | | XC= 1 : 1

| | | | | XK= 1 : 0

| | | | XQ= 1 :

| | | | | XM= 0 :

| | | | | | XN= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 : 0

| | | | | | XN= 1 :

| | | | | | | XR= 0 : 1

| | | | | | | XR= 1 :

| | | | | | | | XL= 0 : 1

| | | | | | | | XL= 1 : 0

| | | | | XM= 1 : 0

| | | XS= 1 :

| | | | XL= 0 :

| | | | | XD= 0 :

| | | | | | XU= 0 : 1

| | | | | | XU= 1 :

| | | | | | | XQ= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 : 0

| | | | | | | XQ= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XL= 1 :

| | | | | XH= 0 :

| | | | | | XQ= 0 :

| | | | | | | XD= 0 : 0

| | | | | | | XD= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 : 1

| | | | | | XQ= 1 :

| | | | | | | XM= 0 : 1

| | | | | | | XM= 1 : 0

| | | | | XH= 1 : 0

Decision tree printed using Variance Impurity heuristic Approach:

Accuracy of orginal tree is 0.7461269365317341

Accuracy obtained after pruning the tree is 0.7566216891554223

Accuracy computed for the testing data 0.7611194402798601

Accuracy computed for testing data using pruned trees 0.7661169415292354

Resultant Tree obtained before pruning

XO= 0 :

| XM= 0 :

| | XF= 0 :

| | | XB= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XC= 0 : 1

| | | | | | | XC= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XP= 0 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 : 1

| | | | | | XP= 1 : 0

| | | XB= 1 :

| | | | XD= 0 : 0

| | | | XD= 1 :

| | | | | XI= 0 : 0

| | | | | XI= 1 :

| | | | | | XN= 0 : 0

| | | | | | XN= 1 : 1

| | XF= 1 : 0

| XM= 1 :

| | XB= 0 :

| | | XF= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 : 1

| | | | | XD= 1 :

| | | | | | XC= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | | XC= 1 : 0

| | | XF= 1 :

| | | | XS= 0 :

| | | | | XQ= 0 :

| | | | | | XI= 0 : 0

| | | | | | XI= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 : 1

| | | | | XQ= 1 :

| | | | | | XI= 0 : 1

| | | | | | XI= 1 :

| | | | | | | XL= 0 : 1

| | | | | | | XL= 1 :

| | | | | | | | XT= 0 : 0

| | | | | | | | XT= 1 : 1

| | | | XS= 1 :

| | | | | XR= 0 :

| | | | | | XD= 0 : 1

| | | | | | XD= 1 :

| | | | | | | XP= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XQ= 0 : 0

| | | | | | | | | XQ= 1 : 1

| | | | | | | | XT= 1 : 1

| | | | | | | XP= 1 : 0

| | | | | XR= 1 :

| | | | | | XI= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 : 0

| | | | | | XI= 1 :

| | | | | | | XQ= 0 :

| | | | | | | | XJ= 0 :

| | | | | | | | | XN= 0 : 1

| | | | | | | | | XN= 1 : 0

| | | | | | | | XJ= 1 : 1

| | | | | | | XQ= 1 :

| | | | | | | | XG= 0 : 0

| | | | | | | | XG= 1 : 1

| | XB= 1 :

| | | XI= 0 : 0

| | | XI= 1 :

| | | | XK= 0 :

| | | | | XD= 0 : 0

| | | | | XD= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 :

| | | | | | | | | XN= 0 : 0

| | | | | | | | | XN= 1 : 1

| | | | | | | XS= 1 : 0

| | | | XK= 1 : 0

XO= 1 :

| XI= 0 :

| | XM= 0 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XH= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 : 1

| | | | | XH= 1 : 1

| | | | XF= 1 : 0

| | | XQ= 1 :

| | | | XJ= 0 :

| | | | | XN= 0 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XU= 0 : 0

| | | | | | | XU= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | | XN= 1 : 0

| | | | XJ= 1 :

| | | | | XH= 0 :

| | | | | | XL= 0 : 0

| | | | | | XL= 1 : 1

| | | | | XH= 1 :

| | | | | | XU= 0 : 1

| | | | | | XU= 1 :

| | | | | | | XG= 0 : 1

| | | | | | | XG= 1 : 0

| | XM= 1 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XL= 0 :

| | | | | | XC= 0 : 1

| | | | | | XC= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XU= 0 :

| | | | | | | | | XR= 0 :

| | | | | | | | | | XT= 0 : 0

| | | | | | | | | | XT= 1 : 1

| | | | | | | | | XR= 1 : 0

| | | | | | | | XU= 1 : 1

| | | | | XL= 1 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 :

| | | | | | | XT= 0 : 1

| | | | | | | XT= 1 :

| | | | | | | | XJ= 0 : 1

| | | | | | | | XJ= 1 : 0

| | | | XF= 1 : 0

| | | XQ= 1 : 0

| XI= 1 :

| | XT= 0 :

| | | XH= 0 :

| | | | XP= 0 :

| | | | | XF= 0 : 0

| | | | | XF= 1 :

| | | | | | XR= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XR= 1 :

| | | | | | | XQ= 0 : 1

| | | | | | | XQ= 1 : 0

| | | | XP= 1 :

| | | | | XS= 0 :

| | | | | | XD= 0 :

| | | | | | | XC= 0 :

| | | | | | | | XU= 0 :

| | | | | | | | | XQ= 0 : 1

| | | | | | | | | XQ= 1 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XG= 0 : 1

| | | | | | | | | XG= 1 : 0

| | | | | | | XC= 1 : 0

| | | | | | XD= 1 :

| | | | | | | XK= 0 :

| | | | | | | | XR= 0 :

| | | | | | | | | XN= 0 : 1

| | | | | | | | | XN= 1 : 0

| | | | | | | | XR= 1 : 1

| | | | | | | XK= 1 : 0

| | | | | XS= 1 : 1

| | | XH= 1 :

| | | | XJ= 0 :

| | | | | XC= 0 :

| | | | | | XN= 0 : 1

| | | | | | XN= 1 :

| | | | | | | XG= 0 :

| | | | | | | | XF= 0 : 1

| | | | | | | | XF= 1 : 0

| | | | | | | XG= 1 : 0

| | | | | XC= 1 :

| | | | | | XM= 0 : 0

| | | | | | XM= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | | | XS= 1 : 1

| | | | XJ= 1 :

| | | | | XS= 0 : 1

| | | | | XS= 1 :

| | | | | | XG= 0 :

| | | | | | | XB= 0 : 0

| | | | | | | XB= 1 :

| | | | | | | | XN= 0 : 1

| | | | | | | | XN= 1 :

| | | | | | | | | XU= 0 : 1

| | | | | | | | | XU= 1 : 0

| | | | | | XG= 1 :

| | | | | | | XQ= 0 : 1

| | | | | | | XQ= 1 :

| | | | | | | | XU= 0 : 1

| | | | | | | | XU= 1 : 0

| | XT= 1 :

| | | XS= 0 :

| | | | XQ= 0 :

| | | | | XK= 0 :

| | | | | | XC= 0 :

| | | | | | | XR= 0 :

| | | | | | | | XH= 0 :

| | | | | | | | | XE= 0 : 0

| | | | | | | | | XE= 1 : 1

| | | | | | | | XH= 1 : 1

| | | | | | | XR= 1 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XL= 0 : 0

| | | | | | | | | XL= 1 : 1

| | | | | | XC= 1 : 1

| | | | | XK= 1 :

| | | | | | XD= 0 :

| | | | | | | XJ= 0 : 0

| | | | | | | XJ= 1 : 1

| | | | | | XD= 1 : 0

| | | | XQ= 1 :

| | | | | XM= 0 :

| | | | | | XN= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 : 0

| | | | | | XN= 1 :

| | | | | | | XR= 0 : 1

| | | | | | | XR= 1 :

| | | | | | | | XL= 0 : 1

| | | | | | | | XL= 1 : 0

| | | | | XM= 1 : 0

| | | XS= 1 :

| | | | XL= 0 :

| | | | | XD= 0 :

| | | | | | XU= 0 : 1

| | | | | | XU= 1 :

| | | | | | | XQ= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 : 0

| | | | | | | XQ= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XL= 1 :

| | | | | XE= 0 :

| | | | | | XU= 0 : 0

| | | | | | XU= 1 :

| | | | | | | XJ= 0 : 1

| | | | | | | XJ= 1 :

| | | | | | | | XM= 0 : 0

| | | | | | | | XM= 1 : 1

| | | | | XE= 1 :

| | | | | | XQ= 0 : 0

| | | | | | XQ= 1 :

| | | | | | | XM= 0 : 1

| | | | | | | XM= 1 : 0

Resultant Tree obtained after pruning:

XO= 0 :

| XM= 0 :

| | XF= 0 :

| | | XB= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XC= 0 : 1

| | | | | | | XC= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XP= 0 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 : 1

| | | | | | XP= 1 : 0

| | | XB= 1 :

| | | | XD= 0 : 0

| | | | XD= 1 :

| | | | | XI= 0 : 0

| | | | | XI= 1 :

| | | | | | XN= 0 : 0

| | | | | | XN= 1 : 1

| | XF= 1 : 0

| XM= 1 :

| | XB= 0 :

| | | XF= 0 :

| | | | XG= 0 : 0

| | | | XG= 1 :

| | | | | XD= 0 : 1

| | | | | XD= 1 :

| | | | | | XC= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | | XC= 1 : 0

| | | XF= 1 :

| | | | XS= 0 :

| | | | | XQ= 0 :

| | | | | | XI= 0 : 0

| | | | | | XI= 1 : 1

| | | | | XQ= 1 :

| | | | | | XI= 0 : 1

| | | | | | XI= 1 :

| | | | | | | XL= 0 : 1

| | | | | | | XL= 1 :

| | | | | | | | XT= 0 : 0

| | | | | | | | XT= 1 : 1

| | | | XS= 1 :

| | | | | XR= 0 :

| | | | | | XD= 0 : 1

| | | | | | XD= 1 :

| | | | | | | XP= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XQ= 0 : 0

| | | | | | | | | XQ= 1 : 1

| | | | | | | | XT= 1 : 1

| | | | | | | XP= 1 : 0

| | | | | XR= 1 :

| | | | | | XI= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 : 0

| | | | | | XI= 1 :

| | | | | | | XQ= 0 :

| | | | | | | | XJ= 0 : 1

| | | | | | | | XJ= 1 : 1

| | | | | | | XQ= 1 :

| | | | | | | | XG= 0 : 0

| | | | | | | | XG= 1 : 1

| | XB= 1 :

| | | XI= 0 : 0

| | | XI= 1 :

| | | | XK= 0 :

| | | | | XD= 0 : 0

| | | | | XD= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 :

| | | | | | | | | XN= 0 : 0

| | | | | | | | | XN= 1 : 1

| | | | | | | XS= 1 : 0

| | | | XK= 1 : 0

XO= 1 :

| XI= 0 :

| | XM= 0 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XH= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 : 1

| | | | | XH= 1 : 1

| | | | XF= 1 : 0

| | | XQ= 1 :

| | | | XJ= 0 :

| | | | | XN= 0 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XU= 0 : 0

| | | | | | | XU= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | | XN= 1 : 0

| | | | XJ= 1 :

| | | | | XH= 0 :

| | | | | | XL= 0 : 0

| | | | | | XL= 1 : 1

| | | | | XH= 1 :

| | | | | | XU= 0 : 1

| | | | | | XU= 1 :

| | | | | | | XG= 0 : 1

| | | | | | | XG= 1 : 0

| | XM= 1 :

| | | XQ= 0 :

| | | | XF= 0 :

| | | | | XL= 0 :

| | | | | | XC= 0 : 1

| | | | | | XC= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XU= 0 :

| | | | | | | | | XR= 0 :

| | | | | | | | | | XT= 0 : 0

| | | | | | | | | | XT= 1 : 1

| | | | | | | | | XR= 1 : 0

| | | | | | | | XU= 1 : 1

| | | | | XL= 1 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 : 1

| | | | XF= 1 : 0

| | | XQ= 1 : 0

| XI= 1 :

| | XT= 0 :

| | | XH= 0 :

| | | | XP= 0 :

| | | | | XF= 0 : 0

| | | | | XF= 1 :

| | | | | | XR= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XU= 0 : 0

| | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XR= 1 :

| | | | | | | XQ= 0 : 1

| | | | | | | XQ= 1 : 0

| | | | XP= 1 :

| | | | | XS= 0 :

| | | | | | XD= 0 :

| | | | | | | XC= 0 :

| | | | | | | | XU= 0 :

| | | | | | | | | XQ= 0 : 1

| | | | | | | | | XQ= 1 : 0

| | | | | | | | XU= 1 :

| | | | | | | | | XG= 0 : 1

| | | | | | | | | XG= 1 : 0

| | | | | | | XC= 1 : 0

| | | | | | XD= 1 : 1

| | | | | XS= 1 : 1

| | | XH= 1 :

| | | | XJ= 0 :

| | | | | XC= 0 : 1

| | | | | XC= 1 :

| | | | | | XM= 0 : 0

| | | | | | XM= 1 :

| | | | | | | XS= 0 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | | | XS= 1 : 1

| | | | XJ= 1 :

| | | | | XS= 0 : 1

| | | | | XS= 1 :

| | | | | | XG= 0 :

| | | | | | | XB= 0 : 0

| | | | | | | XB= 1 :

| | | | | | | | XN= 0 : 1

| | | | | | | | XN= 1 :

| | | | | | | | | XU= 0 : 1

| | | | | | | | | XU= 1 : 0

| | | | | | XG= 1 : 1

| | XT= 1 :

| | | XS= 0 : 1

| | | XS= 1 :

| | | | XL= 0 :

| | | | | XD= 0 :

| | | | | | XU= 0 : 1

| | | | | | XU= 1 :

| | | | | | | XQ= 0 :

| | | | | | | | XG= 0 : 1

| | | | | | | | XG= 1 : 0

| | | | | | | XQ= 1 :

| | | | | | | | XH= 0 : 0

| | | | | | | | XH= 1 : 1

| | | | | XD= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XL= 1 : 0

**FOR DATASET-2**

1. **USING INFORMATION GAIN HEURISTIC APPROACH**

|  |  |  |
| --- | --- | --- |
| **[L,K]** | **BEFORE PRUNING** | **AFTER PRUNING** |
| **20,10** | 0.7454242928452579 | 0.7554076539101497 |
| **10,10** | 0.7454242928452579 | 0.7554076539101497 |
| **5,10** | 0.7454242928452579 | 0.7537437603993344 |
| **5,20** | 0.7454242928452579 | 0.7603993344425957 |
| **20,30** | 0.7454242928452579 | 0.7454242928452579 |
| **10,20** | 0.7454242928452579 | 0.7254575707154742 |
| **5,5** | 0.7454242928452579 | 0.7470881863560732 |
| **10,30** | 0.7454242928452579 | 0.7454242928452579 |
| **10,10** | 0.7454242928452579 | 0.7437603993344426 |
| **20,20** | 0.7454242928452579 | 0.7537437603993344 |

1. **USING VARIANCE IMPURITY HEURISTIC APPROACH**

|  |  |  |
| --- | --- | --- |
| **[L,K]** | **BEFORE PRUNING** | **AFTER PRUNING** |
| **20,10** | 0.7420965058236273 | 0.7454242928452579 |
| **10,10** | 0.7420965058236273 | 0.7504159733777038 |
| **5,10** | 0.7420965058236273 | 0.7420965058236273 |
| **5,20** | 0.7420965058236273 | 0.7454242928452579 |
| **20,30** | 0.7420965058236273 | 0.7653910149750416 |
| **10,20** | 0.7420965058236273 | 0.7420965058236273 |
| **5,5** | 0.7420965058236273 | 0.7653910149750416 |
| **10,30** | 0.7420965058236273 | 0.7703826955074875 |
| **10,10** | 0.7420965058236273 | 0.7420965058236273 |
| **20,20** | 0.7420965058236273 | 0.7254575707154742 |

**RESULTS OF THE PRINTED DECISION TREE SHOWN FOR L=20 AND K=10 USING BOTH THE APPROACHES (TAKEN FROM THE CONSOLE)**

Decision tree printed using Information Gain heuristic Approach:

Accuracy of orginal tree is 0.7653910149750416

Accuracy obtained after pruning the tree is 0.7803660565723793

Accuracy computed for the testing data 0.7454242928452579

Accuracy computed for testing data using pruned trees 0.7554076539101497

Resultant Tree obtained before pruning

XI= 0 :

| XU= 0 :

| | XQ= 0 :

| | | XF= 0 :

| | | | XO= 0 :

| | | | | XJ= 0 : 0

| | | | | XJ= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XO= 1 :

| | | | | XB= 0 :

| | | | | | XD= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 : 1

| | | | | | XD= 1 : 0

| | | | | XB= 1 :

| | | | | | XL= 0 : 1

| | | | | | XL= 1 :

| | | | | | | XH= 0 :

| | | | | | | | XS= 0 :

| | | | | | | | | XK= 0 :

| | | | | | | | | | XN= 0 : 1

| | | | | | | | | | XN= 1 : 0

| | | | | | | | | XK= 1 : 1

| | | | | | | | XS= 1 : 0

| | | | | | | XH= 1 : 1

| | | XF= 1 : 0

| | XQ= 1 :

| | | XB= 0 :

| | | | XT= 0 :

| | | | | XL= 0 :

| | | | | | XR= 0 :

| | | | | | | XN= 0 :

| | | | | | | | XP= 0 : 1

| | | | | | | | XP= 1 :

| | | | | | | | | XG= 0 : 1

| | | | | | | | | XG= 1 :

| | | | | | | | | | XS= 0 :

| | | | | | | | | | | XO= 0 : 1

| | | | | | | | | | | XO= 1 : 0

| | | | | | | | | | XS= 1 : 0

| | | | | | | XN= 1 : 0

| | | | | | XR= 1 : 1

| | | | | XL= 1 :

| | | | | | XF= 0 : 0

| | | | | | XF= 1 :

| | | | | | | XC= 0 :

| | | | | | | | XH= 0 : 1

| | | | | | | | XH= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | XC= 1 :

| | | | | | | | XJ= 0 : 0

| | | | | | | | XJ= 1 :

| | | | | | | | | XK= 0 : 1

| | | | | | | | | XK= 1 :

| | | | | | | | | | XM= 0 : 1

| | | | | | | | | | XM= 1 : 0

| | | | XT= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XM= 0 :

| | | | | | | XH= 0 :

| | | | | | | | XL= 0 : 0

| | | | | | | | XL= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 :

| | | | | | | | | | XR= 0 : 1

| | | | | | | | | | XR= 1 : 0

| | | | | | | XH= 1 : 1

| | | | | | XM= 1 : 0

| | | XB= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XM= 0 :

| | | | | | XF= 0 :

| | | | | | | XP= 0 :

| | | | | | | | XL= 0 :

| | | | | | | | | XC= 0 : 1

| | | | | | | | | XC= 1 :

| | | | | | | | | | XK= 0 :

| | | | | | | | | | | XT= 0 :

| | | | | | | | | | | | XS= 0 :

| | | | | | | | | | | | | XR= 0 :

| | | | | | | | | | | | | | XN= 0 :

| | | | | | | | | | | | | | | XJ= 0 : 0

| | | | | | | | | | | | | | | XJ= 1 :

| | | | | | | | | | | | | | | | XH= 0 : 0

| | | | | | | | | | | | | | | | XH= 1 :

| | | | | | | | | | | | | | | | | XG= 0 :

| | | | | | | | | | | | | | | | | | XE= 0 :

| | | | | | | | | | | | | | | | | | | XD= 0 :

| | | | | | | | | | | | | | | | | | | | 0

| | | | | | | | | | | | | | | | | | | | 0

| | | | | | | | | | | | | | | | | | | XD= 1 : 0

| | | | | | | | | | | | | | | | | | XE= 1 : 0

| | | | | | | | | | | | | | | | | XG= 1 : 0

| | | | | | | | | | | | | | XN= 1 : 0

| | | | | | | | | | | | | XR= 1 : 0

| | | | | | | | | | | | XS= 1 : 0

| | | | | | | | | | | XT= 1 : 0

| | | | | | | | | | XK= 1 : 1

| | | | | | | | XL= 1 : 0

| | | | | | | XP= 1 : 1

| | | | | | XF= 1 : 0

| | | | | XM= 1 : 0

| XU= 1 :

| | XG= 0 :

| | | XS= 0 :

| | | | XJ= 0 :

| | | | | XN= 0 :

| | | | | | XB= 0 :

| | | | | | | XF= 0 : 0

| | | | | | | XF= 1 : 1

| | | | | | XB= 1 :

| | | | | | | XK= 0 :

| | | | | | | | XT= 0 : 0

| | | | | | | | XT= 1 : 1

| | | | | | | XK= 1 : 0

| | | | | XN= 1 : 0

| | | | XJ= 1 :

| | | | | XN= 0 :

| | | | | | XQ= 0 : 0

| | | | | | XQ= 1 :

| | | | | | | XO= 0 :

| | | | | | | | XR= 0 :

| | | | | | | | | XM= 0 : 0

| | | | | | | | | XM= 1 : 1

| | | | | | | | XR= 1 : 0

| | | | | | | XO= 1 :

| | | | | | | | XM= 0 : 1

| | | | | | | | XM= 1 : 0

| | | | | XN= 1 :

| | | | | | XE= 0 :

| | | | | | | XD= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XR= 0 : 0

| | | | | | | | | XR= 1 : 1

| | | | | | | | XT= 1 : 0

| | | | | | | XD= 1 : 1

| | | | | | XE= 1 : 1

| | | XS= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XL= 0 :

| | | | | | XN= 0 :

| | | | | | | XR= 0 : 0

| | | | | | | XR= 1 : 1

| | | | | | XN= 1 : 1

| | | | | XL= 1 : 0

| | XG= 1 : 0

XI= 1 :

| XK= 0 :

| | XC= 0 :

| | | XS= 0 :

| | | | XG= 0 :

| | | | | XM= 0 : 1

| | | | | XM= 1 :

| | | | | | XT= 0 : 1

| | | | | | XT= 1 :

| | | | | | | XR= 0 :

| | | | | | | | XQ= 0 :

| | | | | | | | | XO= 0 : 0

| | | | | | | | | XO= 1 :

| | | | | | | | | | XU= 0 : 1

| | | | | | | | | | XU= 1 : 0

| | | | | | | | XQ= 1 : 1

| | | | | | | XR= 1 :

| | | | | | | | XQ= 0 : 1

| | | | | | | | XQ= 1 : 0

| | | | XG= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XL= 0 :

| | | | | | | XH= 0 : 0

| | | | | | | XH= 1 : 1

| | | | | | XL= 1 : 0

| | | XS= 1 :

| | | | XR= 0 :

| | | | | XN= 0 : 1

| | | | | XN= 1 :

| | | | | | XH= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XJ= 0 :

| | | | | | | | | XD= 0 : 0

| | | | | | | | | XD= 1 : 1

| | | | | | | | XJ= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XT= 0 : 0

| | | | | | | XT= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | XR= 1 :

| | | | | XG= 0 :

| | | | | | XM= 0 :

| | | | | | | XH= 0 : 0

| | | | | | | XH= 1 :

| | | | | | | | XB= 0 : 1

| | | | | | | | XB= 1 :

| | | | | | | | | XF= 0 : 1

| | | | | | | | | XF= 1 : 0

| | | | | | XM= 1 :

| | | | | | | XD= 0 : 0

| | | | | | | XD= 1 : 1

| | | | | XG= 1 : 0

| | XC= 1 :

| | | XD= 0 :

| | | | XS= 0 :

| | | | | XF= 0 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 :

| | | | | | | XR= 0 : 0

| | | | | | | XR= 1 : 1

| | | | | XF= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 :

| | | | | | | | | XU= 0 :

| | | | | | | | | | XQ= 0 : 1

| | | | | | | | | | XQ= 1 : 0

| | | | | | | | | XU= 1 : 1

| | | | XS= 1 :

| | | | | XJ= 0 :

| | | | | | XQ= 0 :

| | | | | | | XM= 0 : 0

| | | | | | | XM= 1 :

| | | | | | | | XL= 0 : 1

| | | | | | | | XL= 1 :

| | | | | | | | | XT= 0 : 1

| | | | | | | | | XT= 1 :

| | | | | | | | | | XP= 0 : 0

| | | | | | | | | | XP= 1 : 1

| | | | | | XQ= 1 : 0

| | | | | XJ= 1 :

| | | | | | XO= 0 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XN= 0 : 0

| | | | | | | | XN= 1 : 1

| | | | | | XO= 1 :

| | | | | | | XR= 0 :

| | | | | | | | XP= 0 :

| | | | | | | | | XT= 0 : 0

| | | | | | | | | XT= 1 : 1

| | | | | | | | XP= 1 : 1

| | | | | | | XR= 1 : 1

| | | XD= 1 :

| | | | XF= 0 : 0

| | | | XF= 1 :

| | | | | XS= 0 :

| | | | | | XQ= 0 : 1

| | | | | | XQ= 1 : 0

| | | | | XS= 1 : 0

| XK= 1 :

| | XD= 0 :

| | | XT= 0 :

| | | | XF= 0 :

| | | | | XB= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XO= 0 : 1

| | | | | | | | XO= 1 : 0

| | | | | XB= 1 :

| | | | | | XO= 0 : 0

| | | | | | XO= 1 : 1

| | | | XF= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XH= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XS= 0 : 0

| | | | | | | | XS= 1 :

| | | | | | | | | XU= 0 : 0

| | | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XN= 0 :

| | | | | | | | XM= 0 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | | XM= 1 : 1

| | | | | | | XN= 1 : 1

| | | XT= 1 :

| | | | XB= 0 :

| | | | | XF= 0 :

| | | | | | XM= 0 : 1

| | | | | | XM= 1 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | XF= 1 :

| | | | | | XH= 0 : 1

| | | | | | XH= 1 :

| | | | | | | XU= 0 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 :

| | | | | | | | | XQ= 0 : 1

| | | | | | | | | XQ= 1 : 0

| | | | | | | XU= 1 : 1

| | | | XB= 1 : 0

| | XD= 1 : 0

Resultant Tree obtained after pruning:

XI= 0 :

| XU= 0 :

| | XQ= 0 :

| | | XF= 0 :

| | | | XO= 0 :

| | | | | XJ= 0 : 0

| | | | | XJ= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XO= 1 :

| | | | | XB= 0 : 0

| | | | | XB= 1 :

| | | | | | XL= 0 : 1

| | | | | | XL= 1 :

| | | | | | | XH= 0 :

| | | | | | | | XS= 0 :

| | | | | | | | | XK= 0 :

| | | | | | | | | | XN= 0 : 1

| | | | | | | | | | XN= 1 : 0

| | | | | | | | | XK= 1 : 1

| | | | | | | | XS= 1 : 0

| | | | | | | XH= 1 : 1

| | | XF= 1 : 0

| | XQ= 1 :

| | | XB= 0 :

| | | | XT= 0 :

| | | | | XL= 0 : 1

| | | | | XL= 1 :

| | | | | | XF= 0 : 0

| | | | | | XF= 1 :

| | | | | | | XC= 0 :

| | | | | | | | XH= 0 : 1

| | | | | | | | XH= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | XC= 1 :

| | | | | | | | XJ= 0 : 0

| | | | | | | | XJ= 1 :

| | | | | | | | | XK= 0 : 1

| | | | | | | | | XK= 1 :

| | | | | | | | | | XM= 0 : 1

| | | | | | | | | | XM= 1 : 0

| | | | XT= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XM= 0 :

| | | | | | | XH= 0 :

| | | | | | | | XL= 0 : 0

| | | | | | | | XL= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 :

| | | | | | | | | | XR= 0 : 1

| | | | | | | | | | XR= 1 : 0

| | | | | | | XH= 1 : 1

| | | | | | XM= 1 : 0

| | | XB= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XM= 0 :

| | | | | | XF= 0 :

| | | | | | | XP= 0 :

| | | | | | | | XL= 0 :

| | | | | | | | | XC= 0 : 1

| | | | | | | | | XC= 1 :

| | | | | | | | | | XK= 0 :

| | | | | | | | | | | XT= 0 :

| | | | | | | | | | | | XS= 0 :

| | | | | | | | | | | | | XR= 0 :

| | | | | | | | | | | | | | XN= 0 :

| | | | | | | | | | | | | | | XJ= 0 : 0

| | | | | | | | | | | | | | | XJ= 1 : 1

| | | | | | | | | | | | | | XN= 1 : 0

| | | | | | | | | | | | | XR= 1 : 0

| | | | | | | | | | | | XS= 1 : 0

| | | | | | | | | | | XT= 1 : 0

| | | | | | | | | | XK= 1 : 1

| | | | | | | | XL= 1 : 0

| | | | | | | XP= 1 : 1

| | | | | | XF= 1 : 0

| | | | | XM= 1 : 0

| XU= 1 :

| | XG= 0 :

| | | XS= 0 :

| | | | XJ= 0 :

| | | | | XN= 0 :

| | | | | | XB= 0 :

| | | | | | | XF= 0 : 0

| | | | | | | XF= 1 : 1

| | | | | | XB= 1 :

| | | | | | | XK= 0 :

| | | | | | | | XT= 0 : 0

| | | | | | | | XT= 1 : 1

| | | | | | | XK= 1 : 0

| | | | | XN= 1 : 0

| | | | XJ= 1 :

| | | | | XN= 0 :

| | | | | | XQ= 0 : 0

| | | | | | XQ= 1 :

| | | | | | | XO= 0 :

| | | | | | | | XR= 0 :

| | | | | | | | | XM= 0 : 0

| | | | | | | | | XM= 1 : 1

| | | | | | | | XR= 1 : 0

| | | | | | | XO= 1 :

| | | | | | | | XM= 0 : 1

| | | | | | | | XM= 1 : 0

| | | | | XN= 1 :

| | | | | | XE= 0 :

| | | | | | | XD= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XR= 0 : 0

| | | | | | | | | XR= 1 : 1

| | | | | | | | XT= 1 : 0

| | | | | | | XD= 1 : 1

| | | | | | XE= 1 : 1

| | | XS= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XL= 0 :

| | | | | | XN= 0 :

| | | | | | | XR= 0 : 0

| | | | | | | XR= 1 : 1

| | | | | | XN= 1 : 1

| | | | | XL= 1 : 0

| | XG= 1 : 0

XI= 1 :

| XK= 0 :

| | XC= 0 :

| | | XS= 0 :

| | | | XG= 0 :

| | | | | XM= 0 : 1

| | | | | XM= 1 : 1

| | | | XG= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XL= 0 :

| | | | | | | XH= 0 : 0

| | | | | | | XH= 1 : 1

| | | | | | XL= 1 : 0

| | | XS= 1 :

| | | | XR= 0 :

| | | | | XN= 0 : 1

| | | | | XN= 1 :

| | | | | | XH= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XJ= 0 :

| | | | | | | | | XD= 0 : 0

| | | | | | | | | XD= 1 : 1

| | | | | | | | XJ= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XT= 0 : 0

| | | | | | | XT= 1 : 1

| | | | XR= 1 :

| | | | | XG= 0 :

| | | | | | XM= 0 : 1

| | | | | | XM= 1 :

| | | | | | | XD= 0 : 0

| | | | | | | XD= 1 : 1

| | | | | XG= 1 : 0

| | XC= 1 :

| | | XD= 0 :

| | | | XS= 0 :

| | | | | XF= 0 : 0

| | | | | XF= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 :

| | | | | | | | | XU= 0 :

| | | | | | | | | | XQ= 0 : 1

| | | | | | | | | | XQ= 1 : 0

| | | | | | | | | XU= 1 : 1

| | | | XS= 1 : 1

| | | XD= 1 :

| | | | XF= 0 : 0

| | | | XF= 1 :

| | | | | XS= 0 :

| | | | | | XQ= 0 : 1

| | | | | | XQ= 1 : 0

| | | | | XS= 1 : 0

| XK= 1 :

| | XD= 0 :

| | | XT= 0 :

| | | | XF= 0 :

| | | | | XB= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XO= 0 : 1

| | | | | | | | XO= 1 : 0

| | | | | XB= 1 :

| | | | | | XO= 0 : 0

| | | | | | XO= 1 : 1

| | | | XF= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XH= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XS= 0 : 0

| | | | | | | | XS= 1 :

| | | | | | | | | XU= 0 : 0

| | | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XN= 0 :

| | | | | | | | XM= 0 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | | XM= 1 : 1

| | | | | | | XN= 1 : 1

| | | XT= 1 :

| | | | XB= 0 :

| | | | | XF= 0 :

| | | | | | XM= 0 : 1

| | | | | | XM= 1 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | XF= 1 :

| | | | | | XH= 0 : 1

| | | | | | XH= 1 : 1

| | | | XB= 1 : 0

| | XD= 1 : 0

Decision tree printed using Variance Impurity heuristic Approach:

Accuracy of orginal tree is 0.7487520798668885

Accuracy obtained after pruning the tree is 0.7653910149750416

Accuracy computed for the testing data 0.7420965058236273

Accuracy computed for testing data using pruned trees 0.7454242928452579

Resultant Tree obtained before pruning

XI= 0 :

| XU= 0 :

| | XQ= 0 :

| | | XF= 0 :

| | | | XO= 0 :

| | | | | XJ= 0 : 0

| | | | | XJ= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XO= 1 :

| | | | | XB= 0 :

| | | | | | XD= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 : 1

| | | | | | XD= 1 : 0

| | | | | XB= 1 :

| | | | | | XL= 0 : 1

| | | | | | XL= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 :

| | | | | | | | XK= 0 :

| | | | | | | | | XE= 0 : 1

| | | | | | | | | XE= 1 : 0

| | | | | | | | XK= 1 : 1

| | | XF= 1 : 0

| | XQ= 1 :

| | | XB= 0 :

| | | | XF= 0 :

| | | | | XS= 0 : 0

| | | | | XS= 1 :

| | | | | | XL= 0 : 1

| | | | | | XL= 1 : 0

| | | | XF= 1 :

| | | | | XT= 0 :

| | | | | | XL= 0 :

| | | | | | | XS= 0 : 1

| | | | | | | XS= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 : 1

| | | | | | XL= 1 :

| | | | | | | XC= 0 :

| | | | | | | | XH= 0 : 1

| | | | | | | | XH= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | XC= 1 :

| | | | | | | | XJ= 0 : 0

| | | | | | | | XJ= 1 :

| | | | | | | | | XK= 0 : 1

| | | | | | | | | XK= 1 :

| | | | | | | | | | XM= 0 : 1

| | | | | | | | | | XM= 1 : 0

| | | | | XT= 1 :

| | | | | | XH= 0 :

| | | | | | | XO= 0 : 1

| | | | | | | XO= 1 :

| | | | | | | | XL= 0 : 0

| | | | | | | | XL= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 :

| | | | | | | | | | XR= 0 : 1

| | | | | | | | | | XR= 1 : 0

| | | | | | XH= 1 : 1

| | | XB= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XM= 0 :

| | | | | | XF= 0 :

| | | | | | | XP= 0 :

| | | | | | | | XL= 0 :

| | | | | | | | | XC= 0 : 1

| | | | | | | | | XC= 1 :

| | | | | | | | | | XK= 0 :

| | | | | | | | | | | XT= 0 :

| | | | | | | | | | | | XS= 0 :

| | | | | | | | | | | | | XR= 0 :

| | | | | | | | | | | | | | XN= 0 :

| | | | | | | | | | | | | | | XJ= 0 : 0

| | | | | | | | | | | | | | | XJ= 1 :

| | | | | | | | | | | | | | | | XH= 0 : 0

| | | | | | | | | | | | | | | | XH= 1 :

| | | | | | | | | | | | | | | | | XG= 0 :

| | | | | | | | | | | | | | | | | | XE= 0 :

| | | | | | | | | | | | | | | | | | | XD= 0 :

| | | | | | | | | | | | | | | | | | | | 0

| | | | | | | | | | | | | | | | | | | | 0

| | | | | | | | | | | | | | | | | | | XD= 1 : 0

| | | | | | | | | | | | | | | | | | XE= 1 : 0

| | | | | | | | | | | | | | | | | XG= 1 : 0

| | | | | | | | | | | | | | XN= 1 : 0

| | | | | | | | | | | | | XR= 1 : 0

| | | | | | | | | | | | XS= 1 : 0

| | | | | | | | | | | XT= 1 : 0

| | | | | | | | | | XK= 1 : 1

| | | | | | | | XL= 1 : 0

| | | | | | | XP= 1 : 1

| | | | | | XF= 1 : 0

| | | | | XM= 1 : 0

| XU= 1 :

| | XG= 0 :

| | | XS= 0 :

| | | | XJ= 0 :

| | | | | XB= 0 :

| | | | | | XN= 0 :

| | | | | | | XF= 0 : 0

| | | | | | | XF= 1 : 1

| | | | | | XN= 1 : 0

| | | | | XB= 1 :

| | | | | | XK= 0 :

| | | | | | | XC= 0 : 0

| | | | | | | XC= 1 : 1

| | | | | | XK= 1 : 0

| | | | XJ= 1 :

| | | | | XN= 0 :

| | | | | | XQ= 0 : 0

| | | | | | XQ= 1 :

| | | | | | | XO= 0 :

| | | | | | | | XR= 0 :

| | | | | | | | | XM= 0 : 0

| | | | | | | | | XM= 1 : 1

| | | | | | | | XR= 1 : 0

| | | | | | | XO= 1 :

| | | | | | | | XM= 0 : 1

| | | | | | | | XM= 1 : 0

| | | | | XN= 1 :

| | | | | | XE= 0 :

| | | | | | | XD= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XR= 0 : 0

| | | | | | | | | XR= 1 : 1

| | | | | | | | XT= 1 : 0

| | | | | | | XD= 1 : 1

| | | | | | XE= 1 : 1

| | | XS= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XL= 0 :

| | | | | | XN= 0 :

| | | | | | | XR= 0 : 0

| | | | | | | XR= 1 : 1

| | | | | | XN= 1 : 1

| | | | | XL= 1 : 0

| | XG= 1 : 0

XI= 1 :

| XK= 0 :

| | XC= 0 :

| | | XS= 0 :

| | | | XG= 0 :

| | | | | XM= 0 : 1

| | | | | XM= 1 :

| | | | | | XT= 0 : 1

| | | | | | XT= 1 :

| | | | | | | XR= 0 :

| | | | | | | | XQ= 0 :

| | | | | | | | | XO= 0 : 0

| | | | | | | | | XO= 1 :

| | | | | | | | | | XU= 0 : 1

| | | | | | | | | | XU= 1 : 0

| | | | | | | | XQ= 1 : 1

| | | | | | | XR= 1 :

| | | | | | | | XQ= 0 : 1

| | | | | | | | XQ= 1 : 0

| | | | XG= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XL= 0 :

| | | | | | | XH= 0 : 0

| | | | | | | XH= 1 : 1

| | | | | | XL= 1 : 0

| | | XS= 1 :

| | | | XR= 0 :

| | | | | XN= 0 : 1

| | | | | XN= 1 :

| | | | | | XH= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XJ= 0 :

| | | | | | | | | XD= 0 : 0

| | | | | | | | | XD= 1 : 1

| | | | | | | | XJ= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XT= 0 : 0

| | | | | | | XT= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | XR= 1 :

| | | | | XG= 0 :

| | | | | | XM= 0 :

| | | | | | | XH= 0 : 0

| | | | | | | XH= 1 :

| | | | | | | | XB= 0 : 1

| | | | | | | | XB= 1 :

| | | | | | | | | XF= 0 : 1

| | | | | | | | | XF= 1 : 0

| | | | | | XM= 1 :

| | | | | | | XD= 0 : 0

| | | | | | | XD= 1 : 1

| | | | | XG= 1 : 0

| | XC= 1 :

| | | XD= 0 :

| | | | XS= 0 :

| | | | | XF= 0 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 :

| | | | | | | XR= 0 : 0

| | | | | | | XR= 1 : 1

| | | | | XF= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 :

| | | | | | | | | XU= 0 :

| | | | | | | | | | XQ= 0 : 1

| | | | | | | | | | XQ= 1 : 0

| | | | | | | | | XU= 1 : 1

| | | | XS= 1 :

| | | | | XJ= 0 :

| | | | | | XQ= 0 :

| | | | | | | XM= 0 : 0

| | | | | | | XM= 1 :

| | | | | | | | XL= 0 : 1

| | | | | | | | XL= 1 :

| | | | | | | | | XT= 0 : 1

| | | | | | | | | XT= 1 :

| | | | | | | | | | XP= 0 : 0

| | | | | | | | | | XP= 1 : 1

| | | | | | XQ= 1 : 0

| | | | | XJ= 1 :

| | | | | | XO= 0 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XN= 0 : 0

| | | | | | | | XN= 1 : 1

| | | | | | XO= 1 :

| | | | | | | XR= 0 :

| | | | | | | | XP= 0 :

| | | | | | | | | XT= 0 : 0

| | | | | | | | | XT= 1 : 1

| | | | | | | | XP= 1 : 1

| | | | | | | XR= 1 : 1

| | | XD= 1 :

| | | | XF= 0 : 0

| | | | XF= 1 :

| | | | | XS= 0 :

| | | | | | XQ= 0 : 1

| | | | | | XQ= 1 : 0

| | | | | XS= 1 : 0

| XK= 1 :

| | XD= 0 :

| | | XT= 0 :

| | | | XF= 0 :

| | | | | XB= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XO= 0 : 1

| | | | | | | | XO= 1 : 0

| | | | | XB= 1 :

| | | | | | XO= 0 : 0

| | | | | | XO= 1 : 1

| | | | XF= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XH= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XS= 0 : 0

| | | | | | | | XS= 1 :

| | | | | | | | | XU= 0 : 0

| | | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XN= 0 :

| | | | | | | | XM= 0 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | | XM= 1 : 1

| | | | | | | XN= 1 : 1

| | | XT= 1 :

| | | | XB= 0 :

| | | | | XF= 0 :

| | | | | | XM= 0 : 1

| | | | | | XM= 1 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | XF= 1 :

| | | | | | XR= 0 :

| | | | | | | XU= 0 : 0

| | | | | | | XU= 1 : 1

| | | | | | XR= 1 :

| | | | | | | XM= 0 :

| | | | | | | | XH= 0 : 1

| | | | | | | | XH= 1 : 0

| | | | | | | XM= 1 : 1

| | | | XB= 1 : 0

| | XD= 1 : 0

Resultant Tree obtained after pruning:

XI= 0 :

| XU= 0 :

| | XQ= 0 :

| | | XF= 0 :

| | | | XO= 0 :

| | | | | XJ= 0 : 0

| | | | | XJ= 1 :

| | | | | | XG= 0 : 0

| | | | | | XG= 1 : 1

| | | | XO= 1 :

| | | | | XB= 0 :

| | | | | | XD= 0 :

| | | | | | | XS= 0 : 0

| | | | | | | XS= 1 : 1

| | | | | | XD= 1 : 0

| | | | | XB= 1 :

| | | | | | XL= 0 : 1

| | | | | | XL= 1 :

| | | | | | | XP= 0 : 0

| | | | | | | XP= 1 :

| | | | | | | | XK= 0 :

| | | | | | | | | XE= 0 : 1

| | | | | | | | | XE= 1 : 0

| | | | | | | | XK= 1 : 1

| | | XF= 1 : 0

| | XQ= 1 :

| | | XB= 0 :

| | | | XF= 0 :

| | | | | XS= 0 : 0

| | | | | XS= 1 :

| | | | | | XL= 0 : 1

| | | | | | XL= 1 : 0

| | | | XF= 1 :

| | | | | XT= 0 :

| | | | | | XL= 0 :

| | | | | | | XS= 0 : 1

| | | | | | | XS= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 : 1

| | | | | | XL= 1 :

| | | | | | | XC= 0 :

| | | | | | | | XH= 0 : 1

| | | | | | | | XH= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | XC= 1 :

| | | | | | | | XJ= 0 : 0

| | | | | | | | XJ= 1 :

| | | | | | | | | XK= 0 : 1

| | | | | | | | | XK= 1 :

| | | | | | | | | | XM= 0 : 1

| | | | | | | | | | XM= 1 : 0

| | | | | XT= 1 :

| | | | | | XH= 0 :

| | | | | | | XO= 0 : 1

| | | | | | | XO= 1 :

| | | | | | | | XL= 0 : 0

| | | | | | | | XL= 1 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 :

| | | | | | | | | | XR= 0 : 1

| | | | | | | | | | XR= 1 : 0

| | | | | | XH= 1 : 1

| | | XB= 1 :

| | | | XO= 0 : 0

| | | | XO= 1 :

| | | | | XM= 0 :

| | | | | | XF= 0 :

| | | | | | | XP= 0 :

| | | | | | | | XL= 0 :

| | | | | | | | | XC= 0 : 1

| | | | | | | | | XC= 1 :

| | | | | | | | | | XK= 0 :

| | | | | | | | | | | XT= 0 :

| | | | | | | | | | | | XS= 0 :

| | | | | | | | | | | | | XR= 0 :

| | | | | | | | | | | | | | XN= 0 :

| | | | | | | | | | | | | | | XJ= 0 : 0

| | | | | | | | | | | | | | | XJ= 1 :

| | | | | | | | | | | | | | | | XH= 0 : 0

| | | | | | | | | | | | | | | | XH= 1 :

| | | | | | | | | | | | | | | | | XG= 0 :

| | | | | | | | | | | | | | | | | | XE= 0 :

| | | | | | | | | | | | | | | | | | | XD= 0 :

| | | | | | | | | | | | | | | | | | | | 0

| | | | | | | | | | | | | | | | | | | | 0

| | | | | | | | | | | | | | | | | | | XD= 1 : 0

| | | | | | | | | | | | | | | | | | XE= 1 : 0

| | | | | | | | | | | | | | | | | XG= 1 : 0

| | | | | | | | | | | | | | XN= 1 : 0

| | | | | | | | | | | | | XR= 1 : 0

| | | | | | | | | | | | XS= 1 : 0

| | | | | | | | | | | XT= 1 : 0

| | | | | | | | | | XK= 1 : 1

| | | | | | | | XL= 1 : 0

| | | | | | | XP= 1 : 1

| | | | | | XF= 1 : 0

| | | | | XM= 1 : 0

| XU= 1 :

| | XG= 0 :

| | | XS= 0 :

| | | | XJ= 0 :

| | | | | XB= 0 :

| | | | | | XN= 0 :

| | | | | | | XF= 0 : 0

| | | | | | | XF= 1 : 1

| | | | | | XN= 1 : 0

| | | | | XB= 1 :

| | | | | | XK= 0 :

| | | | | | | XC= 0 : 0

| | | | | | | XC= 1 : 1

| | | | | | XK= 1 : 0

| | | | XJ= 1 :

| | | | | XN= 0 :

| | | | | | XQ= 0 : 0

| | | | | | XQ= 1 :

| | | | | | | XO= 0 :

| | | | | | | | XR= 0 :

| | | | | | | | | XM= 0 : 0

| | | | | | | | | XM= 1 : 1

| | | | | | | | XR= 1 : 0

| | | | | | | XO= 1 :

| | | | | | | | XM= 0 : 1

| | | | | | | | XM= 1 : 0

| | | | | XN= 1 :

| | | | | | XE= 0 :

| | | | | | | XD= 0 :

| | | | | | | | XT= 0 :

| | | | | | | | | XR= 0 : 0

| | | | | | | | | XR= 1 : 1

| | | | | | | | XT= 1 : 0

| | | | | | | XD= 1 : 1

| | | | | | XE= 1 : 1

| | | XS= 1 : 0

| | XG= 1 : 0

XI= 1 :

| XK= 0 :

| | XC= 0 :

| | | XS= 0 :

| | | | XG= 0 :

| | | | | XM= 0 : 1

| | | | | XM= 1 :

| | | | | | XT= 0 : 1

| | | | | | XT= 1 :

| | | | | | | XR= 0 :

| | | | | | | | XQ= 0 :

| | | | | | | | | XO= 0 : 0

| | | | | | | | | XO= 1 : 1

| | | | | | | | XQ= 1 : 1

| | | | | | | XR= 1 :

| | | | | | | | XQ= 0 : 1

| | | | | | | | XQ= 1 : 0

| | | | XG= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 : 1

| | | XS= 1 :

| | | | XR= 0 :

| | | | | XN= 0 : 1

| | | | | XN= 1 :

| | | | | | XH= 0 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XJ= 0 :

| | | | | | | | | XD= 0 : 0

| | | | | | | | | XD= 1 : 1

| | | | | | | | XJ= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XT= 0 : 0

| | | | | | | XT= 1 :

| | | | | | | | XF= 0 : 0

| | | | | | | | XF= 1 : 1

| | | | XR= 1 :

| | | | | XG= 0 :

| | | | | | XM= 0 :

| | | | | | | XH= 0 : 0

| | | | | | | XH= 1 :

| | | | | | | | XB= 0 : 1

| | | | | | | | XB= 1 :

| | | | | | | | | XF= 0 : 1

| | | | | | | | | XF= 1 : 0

| | | | | | XM= 1 :

| | | | | | | XD= 0 : 0

| | | | | | | XD= 1 : 1

| | | | | XG= 1 : 0

| | XC= 1 :

| | | XD= 0 :

| | | | XS= 0 :

| | | | | XF= 0 :

| | | | | | XP= 0 : 0

| | | | | | XP= 1 :

| | | | | | | XR= 0 : 0

| | | | | | | XR= 1 : 1

| | | | | XF= 1 :

| | | | | | XP= 0 : 1

| | | | | | XP= 1 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XR= 0 : 0

| | | | | | | | XR= 1 :

| | | | | | | | | XU= 0 :

| | | | | | | | | | XQ= 0 : 1

| | | | | | | | | | XQ= 1 : 0

| | | | | | | | | XU= 1 : 1

| | | | XS= 1 :

| | | | | XJ= 0 :

| | | | | | XQ= 0 :

| | | | | | | XM= 0 : 0

| | | | | | | XM= 1 :

| | | | | | | | XL= 0 : 1

| | | | | | | | XL= 1 :

| | | | | | | | | XT= 0 : 1

| | | | | | | | | XT= 1 :

| | | | | | | | | | XP= 0 : 0

| | | | | | | | | | XP= 1 : 1

| | | | | | XQ= 1 : 0

| | | | | XJ= 1 :

| | | | | | XO= 0 :

| | | | | | | XH= 0 : 1

| | | | | | | XH= 1 :

| | | | | | | | XN= 0 : 0

| | | | | | | | XN= 1 : 1

| | | | | | XO= 1 :

| | | | | | | XR= 0 :

| | | | | | | | XP= 0 :

| | | | | | | | | XT= 0 : 0

| | | | | | | | | XT= 1 : 1

| | | | | | | | XP= 1 : 1

| | | | | | | XR= 1 : 1

| | | XD= 1 :

| | | | XF= 0 : 0

| | | | XF= 1 :

| | | | | XS= 0 :

| | | | | | XQ= 0 : 1

| | | | | | XQ= 1 : 0

| | | | | XS= 1 : 0

| XK= 1 :

| | XD= 0 :

| | | XT= 0 :

| | | | XF= 0 :

| | | | | XB= 0 :

| | | | | | XS= 0 : 0

| | | | | | XS= 1 :

| | | | | | | XU= 0 : 1

| | | | | | | XU= 1 :

| | | | | | | | XO= 0 : 1

| | | | | | | | XO= 1 : 0

| | | | | XB= 1 :

| | | | | | XO= 0 : 0

| | | | | | XO= 1 : 1

| | | | XF= 1 :

| | | | | XO= 0 : 1

| | | | | XO= 1 :

| | | | | | XH= 0 :

| | | | | | | XL= 0 :

| | | | | | | | XS= 0 : 0

| | | | | | | | XS= 1 :

| | | | | | | | | XU= 0 : 0

| | | | | | | | | XU= 1 : 1

| | | | | | | XL= 1 : 1

| | | | | | XH= 1 :

| | | | | | | XN= 0 :

| | | | | | | | XM= 0 :

| | | | | | | | | XS= 0 : 1

| | | | | | | | | XS= 1 : 0

| | | | | | | | XM= 1 : 1

| | | | | | | XN= 1 : 1

| | | XT= 1 :

| | | | XB= 0 :

| | | | | XF= 0 :

| | | | | | XM= 0 : 1

| | | | | | XM= 1 :

| | | | | | | XE= 0 : 0

| | | | | | | XE= 1 :

| | | | | | | | XR= 0 : 1

| | | | | | | | XR= 1 : 0

| | | | | XF= 1 :

| | | | | | XR= 0 :

| | | | | | | XU= 0 : 0

| | | | | | | XU= 1 : 1

| | | | | | XR= 1 :

| | | | | | | XM= 0 :

| | | | | | | | XH= 0 : 1

| | | | | | | | XH= 1 : 0

| | | | | | | XM= 1 : 1

| | | | XB= 1 : 0

| | XD= 1 : 0