Team Control Number

**23479442**

Problem Chosen

**E**

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**Summary Sheet**

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Distinguishing related animal species can be a hard but essential task. Biologists often rely upon sets of characteristics to do classifications. In this problem, we are provided with the data of 564 lizardsdivided into eight species and all belonged to genus *Darevskia*. The chart provided contains the data of twenty three characteristics, some are pholidosis characteristics, and others are morphometric characteristics. We need to use the data and develop criteria for the biologists to classify these kinds of lizards.

Our major model is based on **logistic regression**. By fitting the data into a sigmoid function, we are able to provide biologists Sigmoid functions to calculate the probability that the lizard belongs to the target species. This method has a huge advantage since it's pretty easy for biologists to calculate on a graphing calculator and classify the lizards.

In problem 1, we are asked to develop a criterion to differentiate the #5 lizard from other species only with FPNr data. This is a binary classification problem and we use training samples to apply our **logistic regression model** and obtain the **one dimensional sigmoid function**. By simply compare the result to 0.5, the biologist can determine the species the lizard belongs to.

In problem 2, we need to differentiate the #5 lizard from other species using two variables out of the measured morphometric and pholidosis characteristics. First, we need to determine the variable pair we are going to use. We do an exhaustive search and examine every possible variable pair. At last, we find out that SCGr and PL together produce the highest mean accuracy. We use these two variables to apply our logistic regression model, which now extends to a **two dimensional sigmoid function**. This time we have a **line decision boundary**.

In problem 3, we need to determine the lizards' sex regardless of their species types and consider their morphometric and pholidosis characteristics. We are implied that these variables might have some linear correlations. Our first method is to do an exhausive search over all possible ratios of two random variables and use the ratio as the variable of the sigmoid function, and as we did before, we use logistic regression to find the coefficients and the intercept. This method already yields a good accuracy rate. Our second method considers all the twenty-three characteristics to achieve a higher accuracy rate. We use **multi-dimensional logistic regression**.

In problem 4, we use the similar method we used in problem 3. This time we get a new set of training samples and test samples for each subgroup listed in the problem. The set only contains the data of the species in the specific subgroup. Controlling the set of samples can help us have a more accurate result. Then, as before, we apply our multi-dimensional logistic regression model to get the sigmoid functions. We introduce the concept of **multinomial logistic regression** while classifying subgroup c.

In problem 5, we are required to have a criterion that can predict both the lizards' sex and species. Our first method is to develop two **multi-dimensional logistic regression models**,

one for sex, and the other for species. Our second method is to use **decision tree model**. To improve the accuracy of the second method, we use **random forest model**.

# Contents

# 1 Introduction

## 1.1 Background

Sorting an animal into different species is crucial to Biology study. However, many closely related animal species are hard to distinguish from each other by their exterior appearance, and it is difficult to find some "key features". Therefore, we need to develop criteria to sort different species mathematically with only simple measurements. In this report, we take lizards as an example and we developed a series of criteria to sort different species of lizards as accurately as possible with the given data.

## 1.2 Problem Restatement

We are provided with the measured morphometric and pholidosis characteristics of the lizards, and we need to differentiate the species and sex of the lizards by processing the data.

- **Problem 1:**Build a criterion to differentiate the #5 lizard from other species only with FPNr data.
- **Problem 2:**Build a criterion to differentiate the #5 lizard from all the other species using two variables out of the measured morphometric and pholidosis characteristics.
- **Problem 3:**Build a criterion to predict the lizard's sex regardless of their biological species based on the morphometric and pholidosis characteristics and their ratios.
- **Problem 4:**Build a set of criteria to sort lizards from subgroups below: #6 and #7; #1 and #2; #3, #4, and #5.
- **Problem 5:**Build a criterion or a set of criteria to predict the lizards' species and sex in their entire population.

## 1.3 Assumption and Justification

**Assumption**The data provided in the question is representative enough.

**Justification:** We need representative data to find a universal criterion. If the data has limitations, the criterion couldn't be used, leading to a huge bias between the theory and reality.

# 2 The Development of Models

## 2.1 Variables

| Symbol | Description | Unit |
|---|---|---|
| $z$ | Original data | N/A |
| $z'$ | Processed data | N/A |
| $C$ | Covariance matrix | N/A |
| $\mu$ | Mean of the training sample | N/A |
| $s$ | The standard deviation of the training sample | N/A |
| $bl$ | boundary line | N/A |
| $P(x)$ | The index for whether the lizard belongs to the target or not | N/A |
| $\sigma(x)$ | The sigmoid function, used to obtain the possibility that the lizard belongs to the traget from the data | N/A |
| $f(x)$ | The linear equation calculated for the Sigmoid function | N/A |
| $x_i$ | When i=1,2,3,4,..,23, in succession, $x_i$ represents the scaled values of a lizard's MBS, VSN, CSN, GSN, FPNr, SDLr, SCSr, SCGr, SMr, MTr, PA, PTMr, aNDSr, SVL, TRL, HL, PL, ESD, HW, HH, MO, FFL, HFL | N/A |
| $w_i$ | The coefficient of $x_i$ | N/A |
| $G$ | The Gini Impurity | N/A |

## 2.2 Variable Weight Consideration

To calculate the weight of the 23 variables given, we perform the principal component analysis.

Principal component analysis generates the number of principal components equal as the total number of variables. Each principal component is a linear combination of 23 variables and a weight will be given to each principal component based on its contribution on the variation of data.

To perform PCA, we first need to standardize the data using the following formula:

$$z' = \frac{z - \mu}{s} \tag{2.1}$$

where $z$ is the processed data, $x$ is the training sample, $\mu$ is the mean of the training sample and $s$ is the standard deviation of the training sample. We minus the mean of the training sample, and thus center the data in the coordinate system. By dividing the standard deviation of the training sample, we can scale the data into a unified base unit.

After standardizing the data, we need to calculate the covariance matrix of the data. We name this matrix as $C$. Here, $C_{i,j}$ represents the covariance of variable $i$ and variable $j$. The covariance matrix of the data is shown in the appendix.

Then, we calculate all the 23 eigenvalues of the covariance matrix, since there are a total of 23 variables in the data to describe a lizard: $\lambda_1 \geq \lambda_2 \geq \lambda_3 \geq .. \geq \lambda_{23}$, and their corresponding eigenvectors $u_1$, $u_2$, $u_3..u_{23}$. We define $u_{i,j}$ as the $j^{th}$ component of $u_i$. The 23 principal components are therefore:

$$\begin{cases} PC1 = \sum_{j=1}^{23} u_{1,j}x_j \\ PC2 = \sum_{j=1}^{23} u_{2,j}x_j \\ \\ \dots \\ \\ PC23 = \sum_{j=1}^{23} u_{23,j}x_j \end{cases} \tag{2.2}$$

Here, the eigenvectors $u_1$, $u_2$, $u_3..u_{23}$ are shown in the appendix.

The weight of each PC is calculated by the formula:

$$W_{PCi} = \frac{\lambda_i}{\sum_{j=1}^{23} \lambda_j} \tag{2.3}$$

Therefore the score of each variable $S_{xi}$ to the variance of the whole data is calculated by the formula:

$$S_{xi} = \sum_{j=1}^{23} |W_{PCj} \cdot u_{j,i}| \tag{2.4}$$

The calculated weight of each variable $W_{xi}$ is thus:

$$W_{xi} = \frac{S_{xi}}{\sum_{j=1}^{23} S_{xj}} \tag{2.5}$$

The calculated weight of each variable using the given data set is shown below:

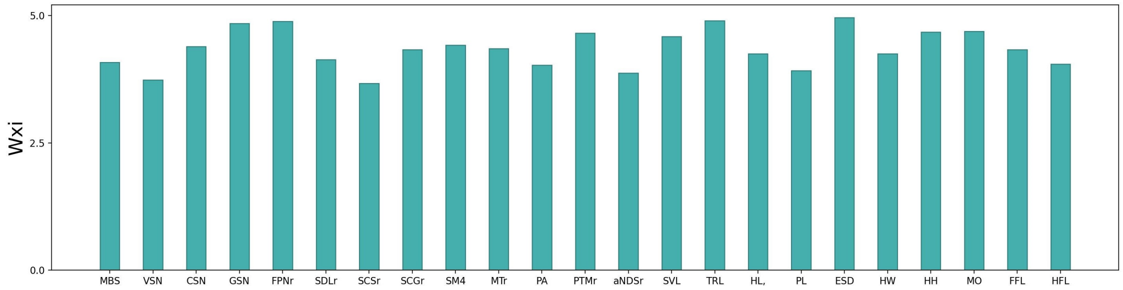

Figure 1: Variable weight

From the graph, it can be seen that the weight of each variable is almost evenly distributed. The variable that contributes the most is ESD, with a weight of 0.0492, and the variable that contributes the least is SCSr, with a weight of 0.0370.

This result sets two guidelines for our following modeling: 1): Because both the range and the variance of the weight of each variable is too small, we decide NOT to consider the weight of the variable in the following modeling. 2): Because each variable contributes almost an equal amount to the final data variance, it is hard to discard any of these variables without lowering the precision. Therefore, we choose NOT to consider removing variables that contribute very little to the result and use the set of 23 variables for modeling.

## 2.3 Data Visualization

By using the principal component analysis, as discussed in the previous section, we can represent the 23-dimensional data by using the first two principal components, which contribute to over 46 percents of the variation of the data.

Below is the graph of the data set drawn using the first two principal components:

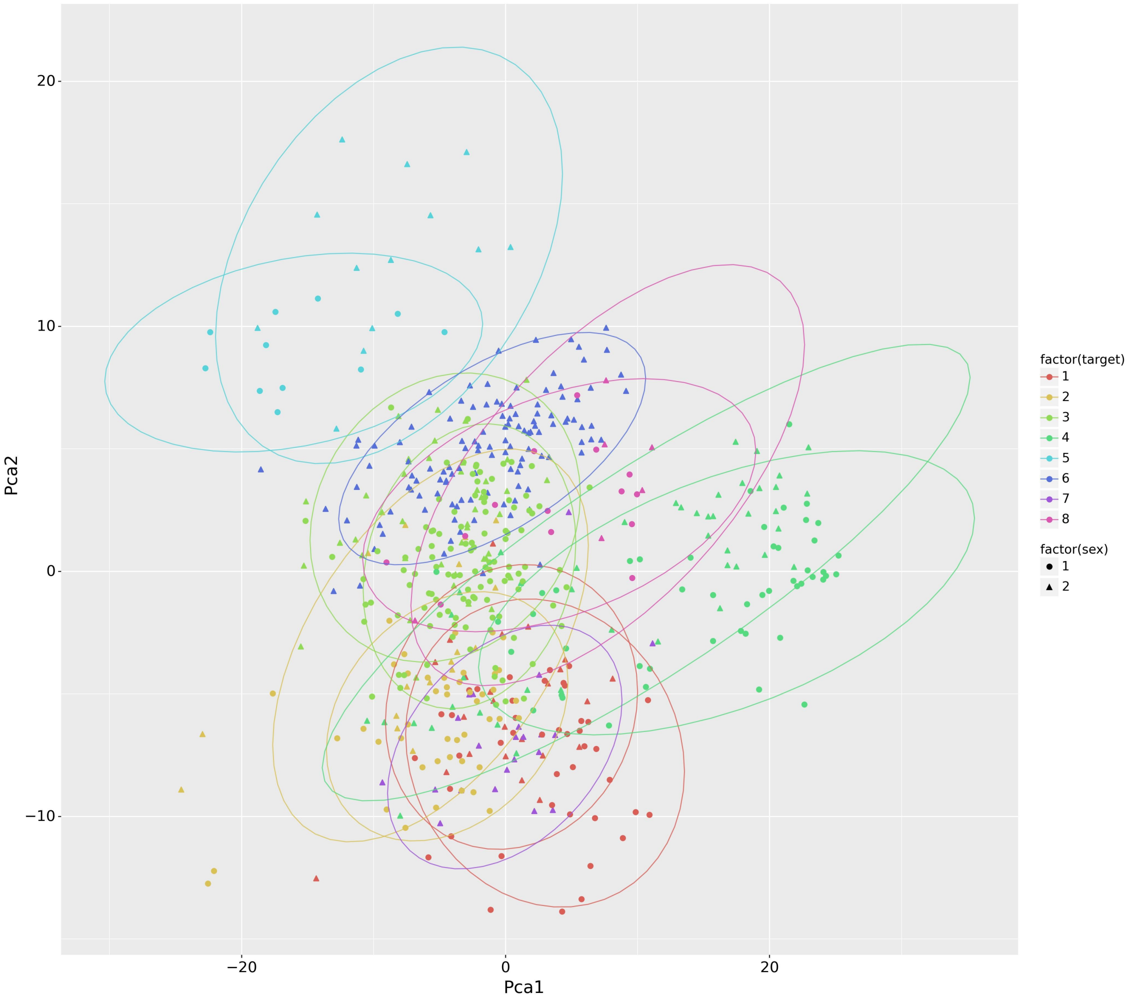

Figure 2: Data set drawn using the first two principal components

## 2.4 Model Overview

Our model is based on logistic regression. In these problems, logistic regression has a huge advantage since it can sort the data by fitting the model into a Sigmoid Function. By providing the biologists a Sigmoid function, they can calculate the probability and easily categorize the lizards.

We divide the original data into training samples and test samples by a racial of six to four.

In this model, first, as we did in the previous part, we need to fit and scale the data to make the calculation easier.

Then, we have $P(x)$ to show the result of the classification. For data that belongs to the target, $P(x) = 1$ and for data that does not belong to the target, $P(x) = 0$, and this could be shown as below:

$$P(x) = \begin{cases} 1, & if\ the\ lizard\ belongs\ to\ the\ target \\ 0, & if\ the\ lizard\ does\ not\ belong\ to\ the\ target \end{cases} \tag{2.6}$$

Thus we can plot the training samples according to their data values and $P(x)$ values in a coordinate system. After that, we use a Sigmoid function $\sigma(x)$ to fit the graph of training samples and obtain f(x). The Sigmoid function describes the possibility that the data belongs to the target, and it could be shown as:

$$\sigma(x) = \frac{1}{1 + e^{-f(x)}}, \text{ where } f(x) = b + \sum_{i=1}^{n} w_i x_i \tag{2.7}$$

This function has a threshold of $\sigma(x) = 0.5$, which means that if $\sigma(x) \geq 0.5$, then the data belongs to the target; if $\sigma(x) < 0.5$, then the data does not belong to the target.

In order to measure how the model can predict data, we run the model on test samples and we divide the outcome into four categories: True Positive($TP$), False Positive($FP$), True Negative($TN$), and False Negative($FN$). We have two methods to compare different models, accuracy, and f1-score.

Accuracy for a model is easier to interpret. It is calculated as:

$$Accuracy = \frac{TP + TN}{TP + TN + FN + FP} \tag{2.8}$$

The F1-Score for a model is a bit more complicated. We first need to calculate the Precision and Recall for the model.

$$Precision = \frac{TP}{TP + FP} = \frac{TP}{Total\ Predicted\ Positive} \tag{2.9}$$

$$Recall = \frac{TP}{TP + FN} = \frac{TP}{Total\ Actual\ Positive} \tag{2.10}$$

Then we can calculate the F1-Score for the model as:

$$F1 - Score = 2 \times \frac{Precision \times Recall}{Precision + Recall} \tag{2.11}$$

The accuracy is easier to interpret, but it does not take the distribution of the data into account. F1-Score is harder to interpret, but it takes the distribution of the data into account.

Besides logistic regression, we further use other methods, such as decision tree and random forest in problem five. We will discuss them in detail in our next part.

# 3 Solution

## 3.1 Problem 1

### 3.1.1 One Dimensional Logistic Regression

In problem 1, we are asked to differentiate lizards of species #5 from all other species and consider or use only the FPNr data. This is a binary classification problem and we can just simply apply our basic model, logistic regression, to solve this problem.

Since for this single task, we just need to consider the value of $x_5$, which is the scaled value of FPNr, we can simplify our model to the following form:

$$f(x) = ax_5 + b$$
$$\sigma(x) = \frac{1}{1+e^{-ax_5-b}}$$

By applying our model, we obtain

$$\begin{aligned} f(x) &= -2.752x_5 - 6.715 \\ \sigma(x) &= \frac{1}{1+e^{-2.752x_5-6.715}} \end{aligned} \tag{3.1}$$

We can see there is a decision boundary when $\sigma(x) = 0.5$, $x_5 = -2.440$. In this case, the decision boundary is a single point. Therefore, our result can be shown as:

$$\begin{cases} x < -2.199\ ,\ \sigma(x) \geq 0.5\ ,\ P(x) = 1 \\ x \geq -2.199\ ,\ \sigma(x) < 0.5\ ,\ P(x) = 0 \end{cases} \tag{3.2}$$

We use the test samples to examine the expression and get a precision of 1.00 and an F1-Score of 1.00. We believe that such high accuracy can be attributed to the large difference in values between the FPNr data of #5 species and other species.

### 3.1.2 Results

The results are shown below.

| | True species #5 | True species #1-4, 6-8 |
|---|---|---|
| Classified as species #5 | 214 | 0 |
| Classified as species #1-4, 6-8 | 1 | 11 |

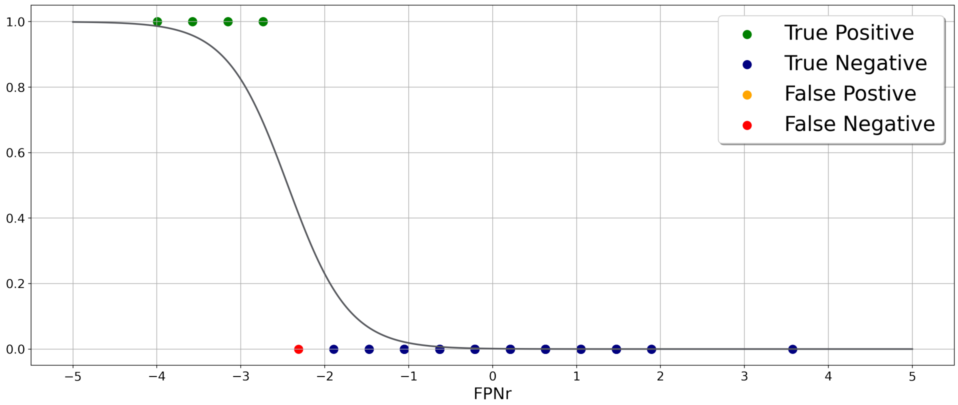

Figure 3: The result of Problem 1

## 3.2 Problem 2

### 3.2.1 Two Dimensional Logistic Regression

In problem 2, we are asked to differentiate lizards of species #5 from all other species and consider or use two variables out of the measured morphometric and pholidosis characteristics.

For this problem, we need to first find out the variable pair we are going to use. We do an exhaustive search to perform logistic regression. The morphometric characteristics group and the pholidosis characteristic group, every time we take one variable from each side, and use two dimensional Sigmoid function to apply logistic regression:

$$f(x) = ax_i + bx_j + c$$

$$\sigma(x) = \frac{1}{1 + e^{-ax_i - bx_j - c}}$$

We need to consider two independent values: $x_i$ and $x_j$. And our decision boundary is no longer a single point, we have a line decision boundary:

$$\frac{1}{1 + e^{-ax_i - bx_j - c}} = 0.5$$

$$ax_i + bx_j + c = 0$$

$$\begin{cases} ax_i + bx_j + c \geq 0 \ , \ \sigma(x) \geq 0.5 \ , \ P(x) = 1 \\ ax_i + bx_j + c < 0 \ , \ \sigma(x) < 0.5 \ , \ P(x) = 0 \end{cases} \tag{3.3}$$

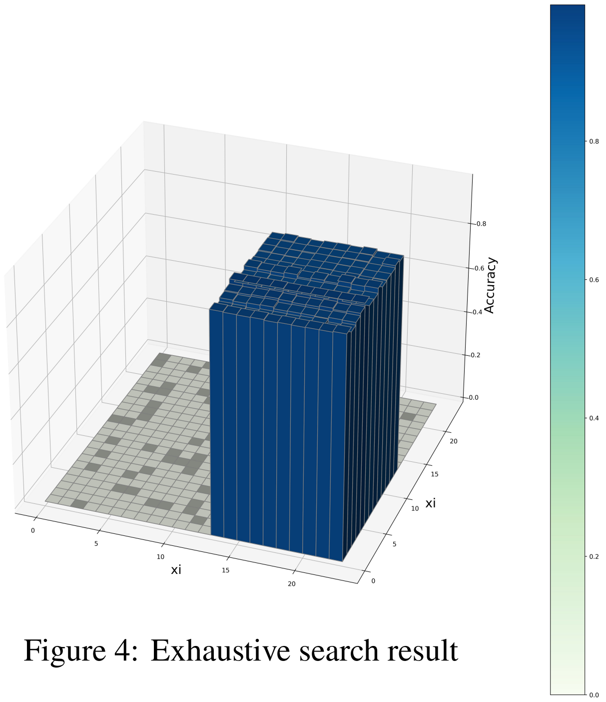

Figure 4: Exhaustive search result

After we try every possible combination of the variables from two sides, as shown in the graph above, we determine that by using the pair of SCGr($x_8$) and PL($x_{17}$), we will obtain the largest mean accuracy of 0.99 and F1-score of 0.99 while using the test samples, and the resulting Sigmoid function is:

$$\sigma(x) = \frac{1}{1 + e^{-2.889x_8 - 0.661x_{17} - 6.924}}$$

$$\begin{cases} -2.889x_8 - 0.661x_{17} - 6.924 \geq 0 \ , \ \sigma(x) \geq 0.5 \ , \ P(x) = 1 \\ -2.889x_8 - 0.661x_{17} - 6.924 < 0 \ , \ \sigma(x) < 0.5 \ , \ P(x) = 0 \end{cases} \tag{3.4}$$

### 3.2.2 Results

The results are shown below.

| | True species #5 | True species #1-4, 6-8 |
|---|---|---|
| Classified as species #5 | 217 | 0 |
| Classified as species #1-4, 6-8 | 0 | 9 |

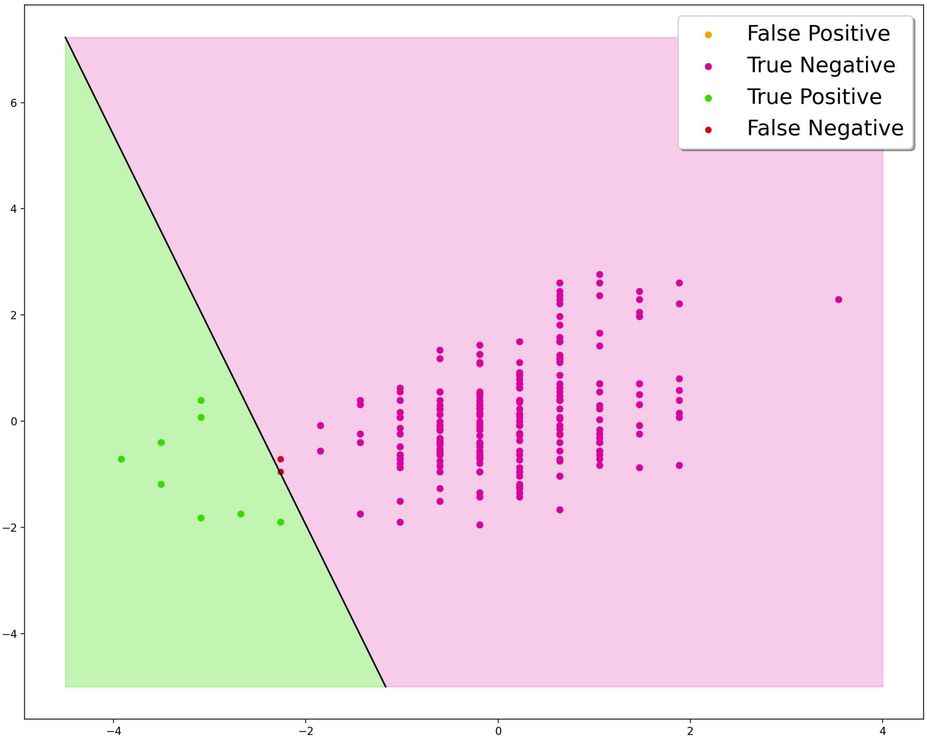

Figure 5: The result of Problem 2

## 3.3 Problem 3

### 3.3.1 Multi-Dimensional Logistic Regression: method 1

In problem 3, we are required to separate the two genders, which is a binary classification problem, and we want to determine the criterion with the greatest accuracy while remaining simple.

We do an exhaustive search over all the possible ratios of two random variables in the data list, and apply a logistic regression to find the ratio with the highest accuracy rate. (Some columns are missing here because these columns contain 0 value, which can not be a divisor.)

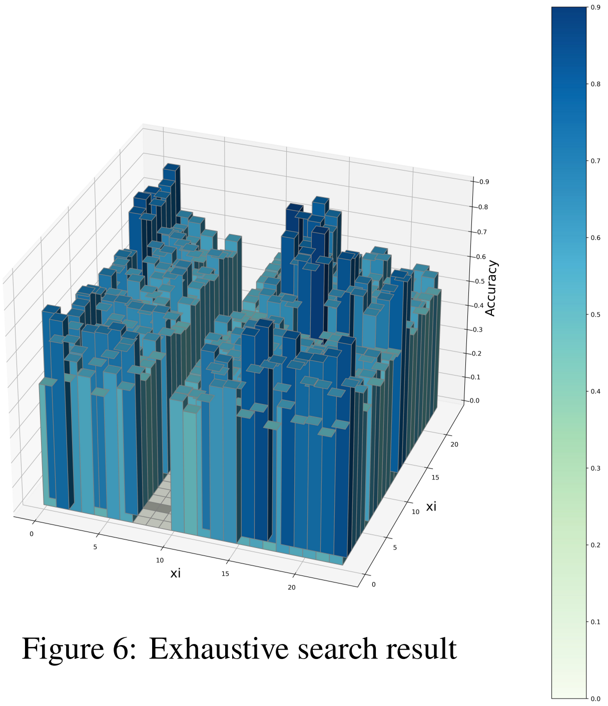

Figure 6: Exhaustive search result

We find that the best data to differentiate the gender is the ratio between SVL and PL and it reach an accuracy rate of 0.907. The f(x) and $\sigma(x)$ obtained from the calculation are:

$$\sigma(x) = \frac{1}{1+e^{-f(x)}}, \text{where } f(x) = 2.621\frac{SVL}{PL} + 0.490 \tag{3.5}$$

### 3.3.2 Results: method 1

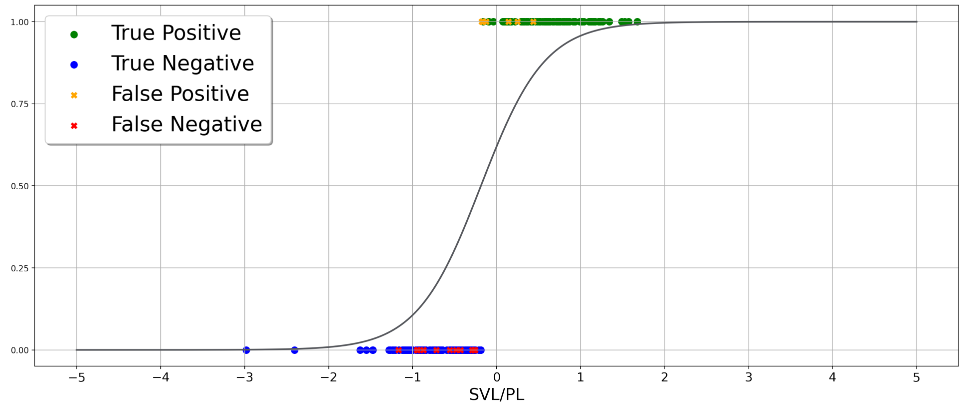

Figure 7: The result of Problem 3 using ratio

| | True Male | True Female |
|---|---|---|
| Classified as Male | 112 | 9 |
| Classified as Female | 12 | 93 |

Multi-Dimensional Logistic Regression: method 2 Then we try to achieve a higher accuracy rate, therefore we use all 23 variables and apply a logistic regression. This method has an accuracy of 92.9%. The f(x) and $\sigma(x)$ obtained from the calculation is:

$$\sigma(x) = \frac{1}{1+e^{-f(x)}}, \text{where } f(x) = 0.208 + \sum_{i=1}^{23} w_i x_i \tag{3.6}$$

$c$ in the chart below represents the intercept of the function, $x_i$ represents the scaled value of the $i$th variable given by the question and $w_i$ represents the coefficient of $x_i$. The value of $w_i$ is shown in the table below.

| $x_i$ | MMS | VSN | CSN | GSN | FPNr | SDLr | SCSr | SCGr |
|---|---|---|---|---|---|---|---|---|
| $w_i$ | -0.263 | 1.634 | 0.287 | 0.45 | -0.072 | -0.218 | 0.086 | -0.918 |
| $x_i$ | SMr | MTr | PA | PTMr | aNDSr | SVL | TRL | HL |
| $w_i$ | -0.036 | 0.046 | 0.425 | -0.304 | -0.396 | 1.333 | 1.103 | -0.104 |
| $x_i$ | PL | ESD | HW | HH | MO | FFL | HFL | $c$ |
| $w_i$ | -0.396 | 0.26 | -1.441 | -0.967 | -0.29 | -0.846 | -0.867 | 0.305 |

### 3.3.3 Results: method 2

$$\begin{cases} \sigma(x) \geq 0.5 \ , \ male \\ \sigma(x) < 0.5 \ , \ female \end{cases} \tag{3.7}$$

| | True Male | True Female |
|---|---|---|
| Classified as Male | 111 | 2 |
| Classified as Female | 9 | 104 |

Hence for this problem, we develop two criteria. Although both of them are quite precise while doing classification, the second one is comparatively more accurate but less convenient, and the first one is more convenient but less accurate. The biologists can choose the criterion depending on the circumstance.

## 3.4 Problem 4

### 3.4.1 Multi-dimensional Logistic Regression

In problem 4, we are required to differentiate species in a certain subgroup. Solving this problem requires multi-dimensional logistic regression.

In order to obtain the best possible accuracy rate, we get a new set of training samples and test samples for each subgroup listed in the problem. The set contains only the data of the species in the corresponding subgroup. After that we apply our multi-dimensional logistic regression model described in problem 3.

For subgroup a (species #6 and #7) and subgroup b (species #1 and #2), we use multi-dimensional logistic regression as we did in problem 3. We can treat it as a binary classification problem: for instance, for subgroup a, if the lizard belongs to species #7, $P(x) = 1$; if the lizard belongs to species #6, $P(x) = 0$. We take all the twenty three characteristics into consideration:

For Subgroup A:

$$\sigma(x) = \frac{1}{1 + e^{-f(x)}}, \text{ where } f(x) = -4.465 + \sum_{i=1}^{23} w_i x_i \tag{3.8}$$

| $x_i$ | MMS | VSN | CSN | GSN | FPNr | SDLr | SCSr | SCGr |
|---|---|---|---|---|---|---|---|---|
| $w_i$ | 0.758 | 0.453 | 0.462 | 0.552 | 0.437 | 0.08 | -0.024 | 0.72 |
| $x_i$ | SMr | MTr | PA | PTMr | aNDSr | SVL | TRL | HL |
| $w_i$ | 0.527 | 0.596 | 0.276 | 0.401 | 0.148 | 0.108 | 0.037 | 0.035 |
| $x_i$ | PL | ESD | HW | HH | MO | FFL | HFL | $c$ |
| $w_i$ | 0.05 | -0.031 | -0.265 | -0.333 | 0.003 | 0.019 | -0.014 | -4.465 |

$$\begin{cases} \sigma(x) \geq 0.5\ ,\ species\#7 \\ \sigma(x) < 0.5\ ,\ species\#6 \end{cases} \tag{3.9}$$

Results: Subgroup A

We have an accuracy rate of 0.997.

| | True species #6 | True species #7 |
|---|---|---|
| Classified as species #6 | 35 | 0 |
| Classified as species #7 | 0 | 7 |

For Subgroup B:

$$\sigma(x) = \frac{1}{1+e^{-f(x)}}, \text{ where } f(x) = -0.797 + \sum_{i=1}^{23} w_i x_i \tag{3.10}$$

| $x_i$ | MMS | VSN | CSN | GSN | FPNr | SDLr | SCSr | SCGr |
|---|---|---|---|---|---|---|---|---|
| $w_i$ | -0.706 | -0.432 | 0.12 | 0.048 | -0.413 | -0.52 | -0.627 | 0.246 |
| $x_i$ | SMr | MTr | PA | PTMr | aNDSr | SVL | TRL | HL |
| $w_i$ | 0.299 | -0.835 | -1.533 | 1.226 | 0.143 | -0.604 | -0.006 | -0.447 |
| $x_i$ | PL | ESD | HW | HH | MO | FFL | HFL | $c$ |
| $w_i$ | -0.461 | 0.071 | 0.133 | 0.128 | 0.371 | -0.403 | -0.691 | -0.797 |

$$\begin{cases} \sigma(x) \geq 0.5\ ,\ species\#2 \\ \sigma(x) < 0.5\ ,\ species\#1 \end{cases} \tag{3.11}$$

Results: Subgroup B

We have an accuracy rate of 0.929.

| | True species #1 | True species #2 |
|---|---|---|
| Classified as species #1 | 16 | 0 |
| Classified as species #2 | 3 | 9 |

### 3.4.2 Multinomial Logistic Regression

For subgroup c: species #3, #4, and #5, we still use logistic regression as the basic algorithm, but it is modified to do more complicated calculations and sorting. As we need to differentiate every species, the task is no longer a binary classification problem. It turns out to be a multi-classification problem. However, we still use logistic regression in the same way as we did before, but the only difference is that this time we consider every data outside the target as a whole. This means that only for the target $P(x) = 1$ and for the rest, $P(x) = 0$.

Then, we apply logistic regression models in the same way as we did in our second method in problem 3. If we need to classify $n$ species, we have to repeat the process of doing binary regression $n$ times. As we repeat this process three times for the three species in subgroup c, we obtain three functions, each for a species in the subgroup:

$$\begin{cases} \sigma_{species\#3}(x) = \frac{1}{1+e^{-f(x)}}, \text{ where } f(x) = 2.456 + \sum_{i=1}^{23} w_i x_i; \\ \sigma_{species\#4}(x) = \frac{1}{1+e^{-f(x)}}, \text{ where } f(x) = 0.439 + \sum_{i=1}^{23} w_i x_i; \\ \sigma_{species\#5}(x) = \frac{1}{1+e^{-f(x)}}, \text{ where } f(x) = -2.895 + \sum_{i=1}^{23} w_i x_i. \end{cases} \tag{3.12}$$

| | Species and Gender Types | | |
|---|---|---|---|
| $x_i$ | #3 | #4 | #5 |
| MMS | 0.042 | 0.487 | -0.529 |
| VSN | 0.305 | 0.208 | -0.513 |
| CSN | 0.06 | 0.306 | -0.366 |
| GSN | -0.481 | 0.994 | -0.513 |
| FPNr | 0.008 | 0.747 | -0.755 |
| SDLr | 0.435 | 0.045 | -0.48 |
| SCSr | -0.215 | 0.39 | -0.175 |
| SCGr | 1.234 | -0.655 | -0.579 |
| SMr | 0.036 | 0.161 | -0.197 |
| MTr | -0.385 | 0.36 | 0.025 |
| PA | 0.22 | -0.15 | -0.071 |
| PTMr | 0.666 | -0.49 | -0.175 |
| aNDSr | 0.463 | -0.249 | -0.214 |
| SVL | -0.122 | 0.198 | -0.076 |
| TRL | -0.175 | 0.231 | -0.056 |
| HL | 0.195 | -0.066 | -0.129 |
| PL | -0.067 | 0.219 | -0.152 |
| ESD | 0.19 | -0.109 | -0.081 |
| HW | -0.334 | 0.361 | -0.027 |
| HH | -0.347 | 0.212 | 0.135 |
| MO | 0.014 | -0.002 | -0.012 |
| FFL | 0.016 | 0.145 | -0.161 |
| HFL | -0.045 | 0.303 | -0.259 |
| $c$ | 2.456 | 0.439 | -2.895 |

After we get the functions, we are able to do multi-classification. By plugging the scaled values of variables into the three functions, we will get three results. By comparing the results and find out the largest one, the species corresponding to the function is the one for the lizard. Remember that our sigmoid function's results are probabilities, hence we can compare those probabilities. A lizard is claimed to belong to that species when it is most likely to belong that species.

For instance, here is a list of the unscaled values of variables for a lizard.

| MMS | VSN | CSN | GSN | FPNr | SDLr | SCSr | SCGr |
|---|---|---|---|---|---|---|---|
| 52.0 | 25.0 | 11.0 | 30.0 | 20.0 | 26.0 | 6.0 | 4.0 |
| SMr | MTr | PA | PTMr | aNDSr | SVL | TRL | HL |
| 2.0 | 2.0 | 1.0 | 1.0 | 2.5 | 54.0 | 28.0 | 19.8 |
| PL | ESD | HW | HH | MO | FFL | HFL | |
| 3.0 | 8.2 | 8.3 | 5.9 | 9.7 | 20.0 | 32.3 | |

We scale them and plug the scaled values into the three functions and get the results:

$$\begin{cases} \sigma_{species\#3}(x) = 0.990; \\ \sigma_{species\#4}(x) = 0.999; \\ \sigma_{species\#5}(x) = 6.253 * 10^{-14}. \end{cases} \tag{3.13}$$

The second function yields the greatest result. Hence, we can say that this lizard belongs to species 4.

Results: Subgroup C

We have an accuracy rate of 0.985.

| | True species #3 | True species #4 | True species #5 |
|---|---|---|---|
| Classified as species #3 | 48 | 1 | 0 |
| Classified as species #4 | 0 | 28 | 0 |
| Classified as species #5 | 1 | 0 | 4 |

## 3.5 Problem 5

### 3.5.1 Logistic Regression

We split the question into 2 parts. We first develop a multinomial logistic regression model to determine the species of the lizard, then we do the same to determine the gender.

$$\sigma(x) = \frac{1}{1 + e^{-f(x)}}, \text{ where } f(x) = c + \sum_{i=1}^{23} w_i x_i \tag{3.14}$$

And the coefficients and intercepts for all the functions are shown in the tables below. We need to have fourteen functions to be able to classify all the lizards' species and sex. Note that M represents Male and F represents Female.

After we get the functions, we are able to do multi-classification. By plugging the values of variables into fourteen functions, we will get fourteen results. The same as we did for problem 4 subgroup c, by comparing the results and find out the largest one, the type corresponding to the function is the one for the lizard.

| | Species and Gender Types | | | | | | |
|---|---|---|---|---|---|---|---|
| $x_i$ | #1M | #1F | #2M | #2F | #3M | #3F | #4M |
| MMS | 0.883 | 0.749 | 0.649 | -0.116 | -0.420 | -0.910 | -0.202 |
| VSN | -0.587 | 0.269 | -0.445 | 0.115 | -0.511 | 0.114 | -1.117 |
| CSN | -0.251 | 0.203 | 0.022 | 0.037 | -0.350 | -0.578 | -0.005 |
| GSN | -0.206 | -0.751 | 0.006 | -0.025 | -0.422 | -0.008 | 0.992 |
| FPNr | 0.143 | 0.930 | 0.048 | -0.129 | -0.386 | -0.111 | 0.390 |
| SDLr | 0.564 | 0.587 | 0.331 | 0.241 | -0.040 | 0.872 | -0.21 |
| SCSr | 0.420 | 0.455 | -0.381 | -0.364 | -0.103 | -0.387 | 0.298 |
| SCGr | 0.585 | 0.074 | 0.809 | 0.711 | 0.688 | 0.590 | -0.720 |
| SMr | 0.002 | 0.142 | -0.053 | 0.223 | 0.111 | 0.081 | -0.076 |
| MTr | 0.990 | 0.682 | -0.004 | -0.246 | -0.269 | -0.659 | 0.099 |
| PA | 0.193 | 0.612 | -0.957 | -0.320 | 0.469 | 0.786 | -0.547 |
| PTMr | -0.242 | -0.434 | 1.004 | 0.651 | 0.377 | -0.235 | -0.510 |
| aNDSr | -0.371 | -0.208 | -0.308 | 0.021 | 0.757 | 0.868 | 0.137 |
| SVL | -0.122 | 0.440 | -0.603 | 0.165 | -0.951 | 0.384 | -0.317 |
| TRL | -0.569 | 0.400 | -0.551 | 1.111 | -0.451 | 0.764 | -0.603 |
| HL | 0.840 | -0.028 | -0.361 | -0.787 | 0.252 | -0.273 | 0.226 |
| PL | 0.870 | -0.389 | 0.294 | -0.602 | 0.720 | -0.852 | 0.769 |
| ESD | -0.347 | -0.857 | -0.379 | -0.894 | 1.201 | 0.006 | 1.075 |
| HW | 0.805 | -0.495 | 0.616 | -0.601 | -0.120 | -0.811 | 0.458 |
| HH | -0.362 | -0.294 | -0.011 | -0.721 | 0.596 | -0.067 | 0.823 |
| MO | 0.749 | 0.132 | 0.666 | -0.089 | -0.281 | -1.436 | -0.242 |
| FFL | -0.329 | -0.549 | -0.154 | -0.780 | 0.414 | 0.079 | 0.817 |
| HFL | 1.009 | 0.146 | -0.464 | -0.786 | 0.507 | -0.359 | 1.013 |
| $c$ | -0.262 | 0.392 | 0.557 | -1.858 | 3.310 | -0.248 | -0.457 |

| | Species and Gender Types | | | | | | |
|---|---|---|---|---|---|---|---|
| $x_i$ | #4F | #5M | #5F | #6F | #7F | #8M | #8F |
| MMS | 0.202 | -0.479 | -0.433 | -0.610 | 0.885 | -0.396 | 0.199 |
| VSN | 0.128 | -0.826 | -0.066 | 0.794 | 0.979 | 0.117 | 1.036 |
| CSN | 0.181 | -0.702 | -0.445 | 0.381 | 0.961 | 0.538 | 0.009 |
| GSN | 1.340 | -0.845 | -0.408 | -0.469 | 0.483 | 0.338 | -0.024 |
| FPNr | 0.529 | -0.563 | -1.832 | 0.379 | 0.390 | 0.105 | 0.106 |
| SDLr | 0.312 | -0.08 | -0.422 | -0.849 | -0.581 | -0.961 | 0.244 |
| SCSr | 0.430 | 0.099 | -0.288 | -0.055 | -0.012 | -0.082 | -0.029 |
| SCGr | -0.832 | -0.657 | -0.556 | -1.000 | 0.675 | 0.218 | -0.580 |
| SMr | 0.503 | -0.365 | -0.204 | -0.238 | 0.112 | -0.165 | -0.074 |
| MTr | 0.092 | -0.082 | -0.040 | -0.954 | 0.213 | 0.028 | 0.149 |
| PA | 0.128 | -0.075 | 0.399 | -0.177 | 0.485 | -0.783 | -0.214 |
| PTMr | -0.725 | -0.736 | -0.061 | -0.048 | 0.514 | -0.023 | 0.468 |
| aNDSr | -0.012 | 0.044 | -0.132 | -0.806 | -0.042 | 0.198 | -0.146 |
| SVL | 0.784 | -0.528 | 0.253 | 0.414 | 0.066 | -0.037 | 0.052 |
| TRL | 0.688 | -0.629 | 0.461 | -0.182 | -0.285 | -0.282 | 0.129 |
| HL | -0.106 | 0.085 | -0.270 | -0.093 | 0.009 | 0.460 | 0.047 |
| PL | -0.237 | 0.036 | -0.469 | -0.091 | -0.052 | 0.221 | -0.217 |
| ESD | 0.267 | 0.105 | -0.276 | 0.939 | 0.418 | -0.663 | -0.596 |
| HW | 0.147 | 0.211 | -0.267 | -0.545 | -0.422 | 0.923 | 0.103 |
| HH | -0.246 | 0.150 | 0.137 | -0.310 | -0.269 | 0.503 | 0.069 |
| MO | 0.255 | -0.103 | -0.209 | 0.562 | 0.053 | 0.188 | -0.245 |
| FFL | 0.000 | -0.073 | -0.189 | -0.106 | 0.080 | 0.304 | 0.487 |
| HFL | -0.127 | -0.073 | -0.418 | -0.503 | -0.143 | 0.034 | 0.166 |
| $c$ | 1.076 | -1.346 | -1.745 | 1.261 | -0.600 | 0.381 | -0.462 |

### 3.5.2 Results: method 1

The accuracy rate is 0.903 and the results in table below:

| True<br>Classify | #1M | #1F | #2M | #2F | #3M | #3F | #4M | #4F | #5M | #5F | #6F | #7F | #8M | #8F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| #1M | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #1F | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #2M | 1 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #2F | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #3M | 0 | 0 | 0 | 0 | 34 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #3F | 0 | 0 | 0 | 0 | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #4M | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| #4F | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| #5M | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 |
| #5F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| #6F | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 |
| #7F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| #8M | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| #8F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |

### 3.5.3 Decision Tree

A major issue with logistic regression is that this method is too complicated for biologists as it requires the biologists to get the results of fourteen functions. Therefore, we have another possible method to solve this problem, which is the decision tree. The decision tree is a flowchart-like structure in which each internal node represents a test on an attribute and each branch represents the outcome of the test.

We built this tree with Gini Impurity, and this building method is based on the greedy algorithm. We only consider the best decision in the current step. We need to calculate the Gini Impurity for each leaf under this node first, which is calculated as below:

$$G_{leaf} = 1 - \sum_{i=1}^{J} p(i) \tag{3.15}$$

where $p(i)$ is the probability of each element sorted after the test and $J$ is the number of classes in this leaf or node. Then, we can calculate the Gini Impurity for this node as the weighted average of all the Gini Impurities of the leaves under this node, which can be written as:

$$G_{node} = \frac{\sum_{i=1}^{J} p(i) G_{leaf}(J)}{J} \tag{3.16}$$

It is easy to observe that the closer the Gini Impurity is to 0, the better this node can sort elements. When the Gini Impurity equals 0, the element was completely sorted.

Then, we need to find the test criterion with the least Gini Impurity of the node for the greedy algorithm. For a classification feature, we need to sort them from lowest to highest first, then calculate the average of all adjacent data, and calculate the Gini Impurity for each average value, and find the lowest one. We need to repeat this process for every classification feature to find the feature and value with the lowest Gini Impurity as the criterion on this node.

Finally, we need to consider all the leaves as a new node and repeat the previous process until all the leaves have a Gini Impurity of 0.

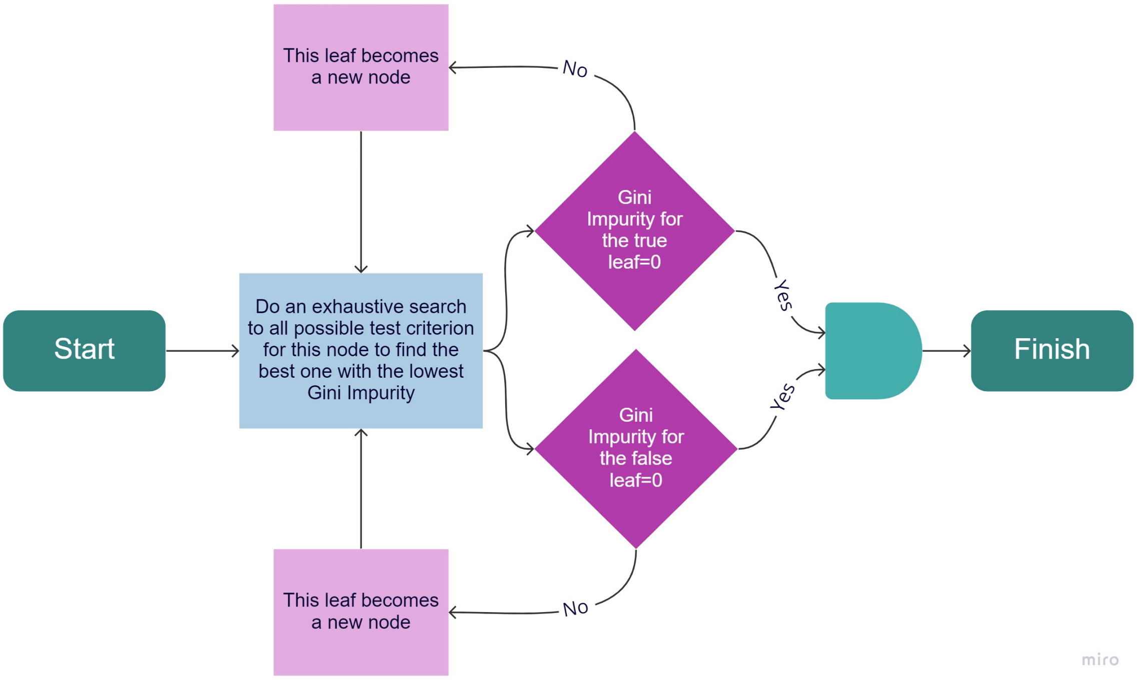

Figure 8: The construction process of a Decision Tree

One of the great advantages of decision trees is that they are easy to use. For biologists, it is so convenient to look at the samples they have obtained and then at the graph to determine the lizard species even without any calculations.

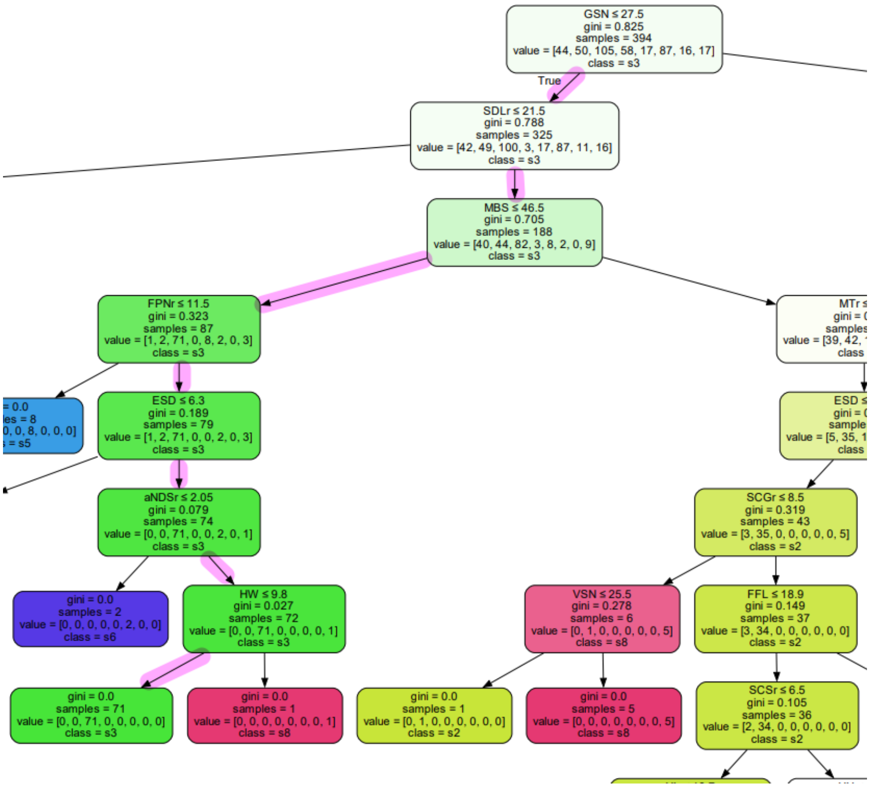

Figure 9: Example of using Decision Tree

| #3 | MMS | VSN | CSN | GSN | FPNr | SDLr | SCSr | SCGr | SMr | MTr | PA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 45 | 23 | 7 | 21 | 16 | 26 | 6 | 7 | 1 | 2 | 2 |
| PTMr | aNDSr | SVL | TRL | HL | PL | ESD | HW | HH | MO | FFL | HFL |
| 3 | 3 | 57.5 | 30.6 | 19.8 | 13 | 8.7 | 8.5 | 6 | 9 | 20.2 | 31.8 |

We will take this row of data from the given data set as a sample taken by a biologist. We start from the root node of the decision tree: whether the $GSN$ is less than or equal to 27.5. From the table, we know that this proposition is true, so we move along the left sub-tree of the root node. When this child node is reached, we continue to judge whether $SDLr$ is less than or equal to 21.5. According to the table, we found that the $SDLr$ of this sample is 26 greater than 21.5, so we proceed along the right sub-tree of its points, and so on. Eventually, we stopped at the leaf node in the lower left corner of the picture, where the path is highlighted in pink. The leaf node implies that the species of this sample should be Species #3, which is the same as the given data.

### 3.5.4 Results: method 2

This method has an accuracy of 0.889 and the results are shown below:

| True<br>Classify | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
|---|---|---|---|---|---|---|---|---|
| #1 | 21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| #2 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 3 |
| #3 | 0 | 0 | 48 | 0 | 0 | 2 | 0 | 1 |
| #4 | 0 | 1 | 1 | 31 | 0 | 0 | 0 | 2 |
| #5 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 |
| #6 | 0 | 0 | 3 | 0 | 0 | 29 | 0 | 1 |
| #7 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 0 |
| #8 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |

### 3.5.5 Random Forest

Decision Tree Algorithm has a high requirement on the training samples and could easily lead to over-fitting a model. Therefore, we used the Random Forest Algorithm to have higher accuracy and less bias.

The random forest consists of several decision trees. However, there is no direct connection between any decision trees. When we are doing classification works, and the new sample is input, thus every decision tree in the random forest will judge and classify it. Every decision tree will result in its result. If which classification made by all decision trees is the most, then the random forest will take this classification as the final output of the whole random forest.

The number of features is approximately the square root of the original number of features, which in this problem, is 5. Thus in our model, we have five decision trees within a single random forest.

When the training sample with a size of $N$ is input, a random forest will randomly select $N$ samples with replacement, which means the sample repetition may exist. Thus these $N$ samples will be used to train a single decision tree.

When each sample has $M$ attributes, every node of the decision tree needs to be split, and the random forest will randomly select $m(m < M)$ details. Then a certain strategy is adopted from the m attributes to choose one attribute as the splitting attribute of the node. During the formation of the decision tree, each node must be split according to the previous stage until it can no longer be split. It constructs the five decision trees by repeating the previous steps, thus forming the random forest.

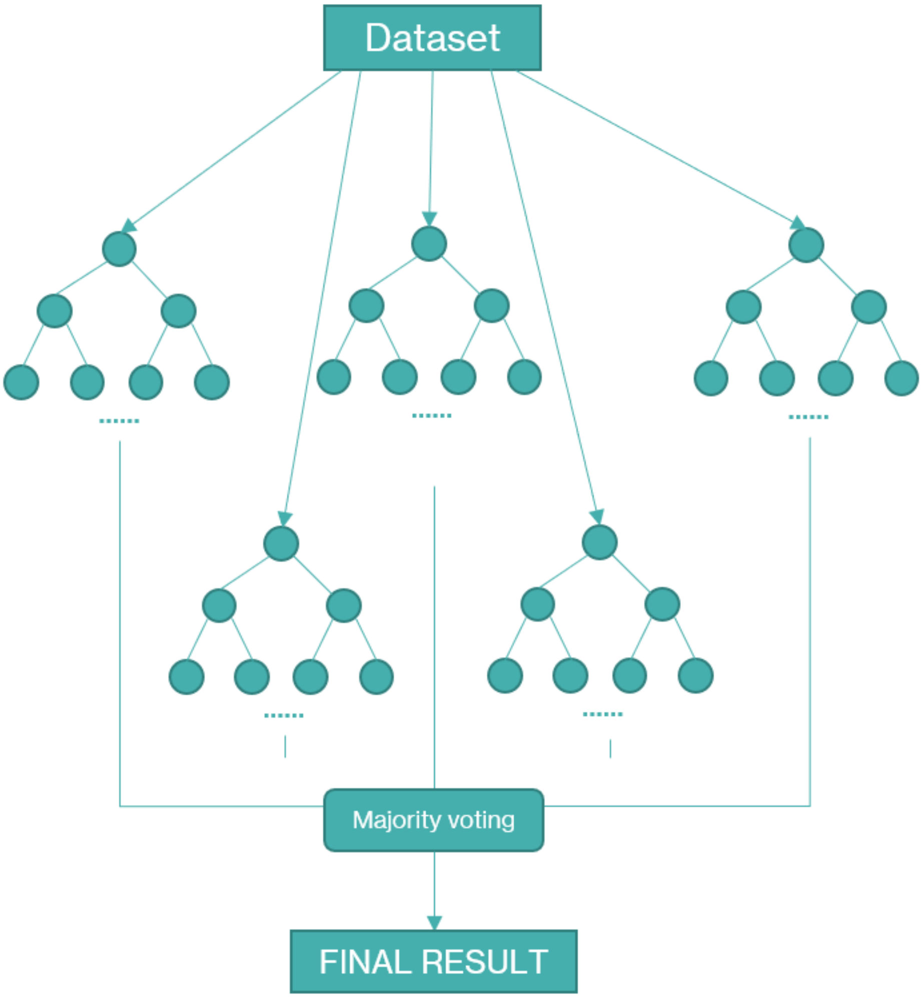

Figure 10: Schematic Diagram of a Random Forest

### 3.5.6 Results: method 3

This method has an accuracy of 0.918 and the results are shown below:

| True / Classify | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 |
|---|---|---|---|---|---|---|---|---|
| #1 | 14 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| #2 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 3 |
| #3 | 1 | 0 | 41 | 0 | 0 | 2 | 0 | 1 |
| #4 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 2 |
| #5 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| #6 | 0 | 0 | 3 | 0 | 0 | 40 | 0 | 0 |
| #7 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| #8 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 1 |

| | True Male | True Female |
|---|---|---|
| Classified as Male | 64 | 8 |
| Classified as Female | 9 | 89 |

#### 3.5.7 Discussion of the results

Multinomial logistic regression already helped us develop a criterion composed of several functions to help the biologists divide lizards. However, in this case, it requires the biologists to calculate the results of fourteen functions. This can be inconvenient for the biologists in some circumstances.

Therefore, we introduce another method, decision trees, because it is almost computationally non-existent relative to other algorithms and is one of the most convenient classification methods available to biologists. Of course, using only decision trees sacrifices some accuracy, hence we further develops the random forests model. The accuracy of the results obtained by the five decision trees separately after the main vote will be higher than that of a single decision tree.

# 4 Strengths and Weaknesses

## 4.1 Strengths

Our logistic regression model provides the biologists Sigmoid functions so that they can easily calculate the results of the functions on a graphing calculator and compare the values of the results to classify the lizards.

All the results of our model yield high accuracy. Moreover, we introduce several different options for the biologists to let them decide whether to emphasize on convenience or accuracy in different situations.

## 4.2 Weaknesses

Our logistic regression model is most suitable when the number of variables is relatively small and when it faces a binary classification problem. When the number of variables become larger-for instance, in problem 3,4, and 5, we consider all 23 characteristics-it becomes a little bit more complicated for the biologists to plug in the data. When we face multi-classification problems, in problem 5, we need to get the results of fourteen functions, which is a huge amount of work. (That's why we introduce the decision tree and random forests model.)

Our accuracy while predicting some certain species, especially species#8, is not satisfying enough, not reaching 100%.

# 5 Conclusion

In conclusion, simplicity and accuracy are two important factors we need to consider while developing the criteria for the biologists to categorize the lizards into different sex and species.

Our model is mainly based on logistic regression. It provides the biologists Sigmoid functions. By calculating the results of the functions on a graphing calculator and compare the values of the results, the biologists can classify the lizards.

In the first question, we use one dimensional logistic regression model to differentiate species #5 from other species. In problem 2, we extend to two dimensional logistic regression model since this time we need to consider a pair of variables. In problem 3, we introduce multi-dimensional logistic regression model and take all the twenty three characteristics into consideration. In problem 4, we use binary classification logistic regression model to classify species in subgroup a and b. And then we introduce our multinomial logistic regression model to divide subgroup c. Finally, in problem 5, we first use our multinomial logistic regression model to classify all the lizards' species and sex. Realizing that the process turns out to be a little bit more complicated, we introduce other methods to help the biologists. We introduce the decision tree model and further improve it to random forests.

Our models are suitable for biologists to get the results only using a graphing calculator. For multi-dimensional and multinomial problems, we provide the biologists various options to choose depending on the circumstances.

# 6 Bibliography

- Hosmer, David W. and Stanley Lemeshow. "Applied Logistic Regression." (1991).[1]
- Hanson, Roger K.. "Logistic regression." Prediction statistics for psychological assessment. (2022): n. pag.[2]

# 7 Appendix

## 7.1 PCA Coefficient

```
PCA Covariance Matrix:[[ 1.00000000e+00 -4.85806321e-02 4.45640743e-01 4.96539154e-01 6.38247825e-01 2.99497469e-01 2.36984595e-01 4.68159858e-01 3.78413480e-01
5.15360601e-01 -1.59245841e-01 8.35412416e-02 -1.86899930e-02 1.46340639e-01 6.81210876e-02 1.93601242e-01 2.66228502e-01 -1.17531649e-01 2.40550131e-01 -4.21084529e-02
3.15467567e-01 5.55411265e-02 2.69134957e-01] [-4.85806321e-02 1.00000000e+00 2.26166575e-01 1.03875814e-01 7.65432256e-02 -4.08171881e-01 3.76457674e-03 -2.01916909e-01
-5.28113918e-02 -1.90278229e-01 -1.18238797e-01 8.62223349e-02 -2.44982554e-01 1.88989381e-01 2.20140090e-01 -1.56345397e-01 -2.17628065e-01 -7.11574348e-02 -2.63573476e-
01 -1.33284178e-01 -3.61191636e-02 -4.72470740e-02 -2.07743642e-01] [ 4.45640743e-01 2.26166575e-01 1.00000000e+00 3.20662453e-01 4.58325701e-01 -3.13779674e-02 1.04399892e-
01 1.04426763e-01 1.73856098e-01 1.92718938e-01 -2.49031848e-01 9.45017062e-02 -3.08987661e-01 2.89725004e-01 1.35518868e-01 2.02818537e-01 2.68791246e-01 6.69536953e-03
1.94092212e-01 5.90381352e-04 3.89591214e-01 1.50271838e-01 2.82789930e-01] [ 4.96539154e-01 1.03875814e-01 3.20662453e-01 1.00000000e+00 6.37428183e-01 1.70903590e-01
2.58929840e-01 -5.98439931e-02 3.09524167e-01 2.40170225e-01 -2.57213463e-01 -3.30537832e-01 1.43709142e-01 4.40054024e-01 3.35478369e-01 4.02635967e-01 4.71786829e-01
2.63322172e-01 4.74244434e-01 3.82132801e-01 2.21025698e-01 4.70272058e-01 5.37248053e-01] [ 6.38247825e-01 7.65432256e-02 4.58325701e-01 6.37428183e-01 1.00000000e+00
2.56916930e-01 2.53443886e-01 2.35975826e-01 2.91655041e-01 3.06758284e-01 -2.80313836e-01 -5.18899322e-02 3.66923585e-02 3.39476246e-01 2.00938169e-01 3.54325020e-01
4.35117915e-01 6.77100467e-02 3.87834990e-01 1.61366639e-01 4.01075976e-01 3.33091225e-01 4.75522747e-01] [ 2.99497469e-01 -4.08171881e-01 -3.13779674e-02 1.70903590e-01
2.56916930e-01 1.00000000e+00 1.70983127e-01 2.74619052e-01 1.82643315e-01 3.07614153e-01 1.54190230e-01 -1.90864380e-01 2.61566153e-01 -2.11520489e-02 5.21374713e-02
1.47724093e-01 1.67394442e-01 -1.82092370e-03 2.33305205e-01 9.67371356e-02 -7.65886449e-02 4.30683233e-02 2.23789986e-01] [ 2.36984595e-01 3.76457674e-03 1.04399892e-01
2.58929840e-01 2.53443886e-01 1.70983127e-01 1.00000000e+00 1.22696010e-01 1.80223507e-01 2.86410192e-01 -2.61026936e-02 -1.76748012e-01 1.11437730e-01 1.05948599e-01
8.54561860e-02 1.29503292e-01 1.38552094e-01 6.45191995e-02 1.69106399e-01 1.56197660e-01 -9.64276617e-03 1.49944746e-01 2.12552817e-01] [ 4.68159858e-01 -2.01916909e-01
1.04426763e-01 -5.98439931e-02 2.35975826e-01 2.74619052e-01 1.22696010e-01 1.00000000e+00 2.32172872e-01 2.84487988e-01 1.94872977e-01 3.58062376e-01 1.34420822e-01 -
2.37308909e-01 -1.75890025e-01 -7.80074463e-02 -7.69123418e-02 -2.48543821e-01 -1.33311560e-01 -3.31626801e-01 4.95743881e-02 -2.77562320e-01 -9.23692435e-02] [ 3.78413480e-
01 -5.28113918e-02 1.73856098e-01 3.09524167e-01 2.91655041e-01 1.82643315e-01 1.80223507e-01 2.32172872e-01 1.00000000e+00 4.88720844e-01 -3.06579502e-02 7.18099771e-03
4.59793702e-02 9.34269946e-02 1.26179827e-01 1.06241416e-01 1.49414641e-01 -4.29566301e-02 1.62665974e-01 4.00073245e-02 9.29682817e-02 9.06420818e-02 1.62245742e-01]
[ 5.15360601e-01 -1.90278229e-01 1.92718938e-01 2.40170225e-01 3.06758284e-01 3.07614153e-01 2.86410192e-01 2.84487988e-01 4.88720844e-01 1.00000000e+00 6.61739577e-02
-4.13350384e-02 3.08144127e-02 9.86339936e-02 1.04026922e-01 1.48134377e-01 1.87530264e-01 -1.45865886e-01 2.27575342e-01 1.84426704e-02 1.40662265e-01 -2.46652964e-03
1.76740736e-01] [-1.59245841e-01 -1.18238797e-01 -2.49031848e-01 -2.57213463e-01 -2.80313836e-01 1.54190230e-01 -2.61026936e-02 1.94872977e-01 -3.06579502e-02 6.61739577e-
02 1.00000000e+00 1.29678714e-01 2.56834054e-01 -1.86204487e-01 -6.98152297e-02 -1.52681915e-01 -1.94120980e-01 3.48730904e-02 -2.56728597e-01 -1.24061827e-01 -2.58304321e-
01 -1.64903529e-01 -1.93185700e-01] [ 8.35412416e-02 8.62223349e-02 9.45017062e-02 -3.30537832e-01 -5.18899322e-02 -1.90864380e-01 -1.76748012e-01 3.58062376e-01 7.18099771e-
03 -4.13350384e-02 1.29678714e-01 1.00000000e+00 -1.10261914e-01 -2.71204522e-01 -2.62337535e-01 -2.77966559e-01 -2.63345573e-01 -2.29739270e-01 -3.44272666e-01 -3.91256780e-
01 9.15390277e-02 -3.51318639e-01 -3.39240404e-01] [-1.86899930e-02 -2.44982554e-01 -3.08987661e-01 1.43709142e-01 3.66923585e-02 2.61566153e-01 1.11437730e-01 1.34420822e-
01 4.59793702e-02 3.08144127e-02 2.56834054e-01 -1.10261914e-01 1.00000000e+00 -2.40347076e-02 3.55140922e-02 1.06045911e-01 1.01930274e-01 2.54525817e-01 8.70954363e-02
2.07073776e-01 -1.65350105e-01 1.55511892e-01 1.11611455e-01] [ 1.46340639e-01 1.88989381e-01 2.89725004e-01 4.40054024e-01 3.39476246e-01 -2.11520489e-02 1.05948599e-01
-2.37308909e-01 9.34269946e-02 9.86339936e-02 -1.86204487e-01 -2.71204522e-01 -2.40347076e-02 1.00000000e+00 8.62771321e-01 7.30227401e-01 7.51341870e-01 4.78171268e-01
6.93728008e-01 6.35064253e-01 5.10610979e-01 7.32462134e-01 7.03165012e-01] [ 6.81210876e-02 2.20140090e-01 1.35518868e-01 3.35478369e-01 2.00938169e-01 5.21374713e-02
8.54561860e-02 -1.75890025e-01 1.26179827e-01 1.04026922e-01 -6.98152297e-02 -2.62337535e-01 3.55140922e-02 8.62771321e-01 1.00000000e+00 5.42942190e-01 5.42706798e-01
3.70427873e-01 5.18395240e-01 5.30308200e-01 3.16704484e-01 5.46908534e-01 4.98600711e-01] [ 1.93601242e-01 -1.56345397e-01 2.02818537e-01 4.02635967e-01 3.54325020e-01
1.47724093e-01 1.29503292e-01 -7.80074463e-02 1.06241416e-01 1.48134377e-01 -1.52681915e-01 -2.77966559e-01 1.06045911e-01 7.30227401e-01 5.42942190e-01 1.00000000e+00
8.51337419e-01 4.83641451e-01 7.47424451e-01 6.34480197e-01 5.58930841e-01 7.22587001e-01 7.40537453e-01] [ 2.66228502e-01 -2.17628065e-01 2.68791246e-01 4.71786829e-01
4.35117915e-01 1.67394442e-01 1.38552094e-01 -7.69123418e-02 1.49414641e-01 1.87530264e-01 -1.94120980e-01 -2.63345573e-01 1.01930274e-01 7.51341870e-01 5.42706798e-01
8.51337419e-01 1.00000000e+00 5.22764238e-01 8.58047943e-01 6.55312887e-01 6.06882935e-01 7.63605817e-01 8.43012503e-01] [-1.17531649e-01 -7.11574348e-02 6.69536953e-03
2.63322172e-01 6.77100467e-02 -1.82092370e-03 6.45191995e-02 -2.48543821e-01 -4.29566301e-02 -1.45865886e-01 3.48730904e-02 -2.29739270e-01 2.54525817e-01 4.78171268e-01
3.70427873e-01 4.83641451e-01 5.22764238e-01 1.00000000e+00 4.05722788e-01 5.13246199e-01 1.96137793e-01 5.88003731e-01 4.86408747e-01] [ 2.40550131e-01 -2.63573476e-01
1.94092212e-01 4.74244434e-01 3.87834990e-01 2.33305205e-01 1.69106399e-01 -1.33311560e-01 1.62665974e-01 2.27575342e-01 -2.56728597e-01 -3.44272666e-01 8.70954363e-02
6.93728008e-01 5.18395240e-01 7.47424451e-01 8.58047943e-01 4.05722788e-01 1.00000000e+00 7.22661895e-01 4.69207722e-01 7.02760288e-01 8.01018973e-01] [-4.21084529e-02
-1.33284178e-01 5.90381352e-04 3.82132801e-01 1.61366639e-01 9.67371356e-02 1.56197660e-01 -3.31626801e-01 4.00073245e-02 1.84426704e-02 -1.24061827e-01 -3.91256780e-01
2.07073776e-01 6.35064253e-01 5.30308200e-01 6.34480197e-01 6.55312887e-01 5.13246199e-01 7.22661895e-01 1.00000000e+00 2.56374675e-01 7.18276521e-01 6.45625665e-01] [
3.15467567e-01 -3.61191636e-02 3.89591214e-01 2.21025698e-01 4.01075976e-01 -7.65886449e-02 -9.64276617e-03 4.95743881e-02 9.29682817e-02 1.40662265e-01 -2.58304321e-01
9.15390277e-02 -1.65350105e-01 5.10610979e-01 3.16704484e-01 5.58930841e-01 6.06882935e-01 1.96137793e-01 4.69207722e-01 2.56374675e-01 1.00000000e+00 4.44386132e-01
5.13607086e-01] [ 5.55411265e-02 -4.72470740e-02 1.50271838e-01 4.70272058e-01 3.33091225e-01 4.30683233e-02 1.49944746e-01 -2.77562320e-01 9.06420818e-02 -2.46652964e-03
-1.64903529e-01 -3.51318639e-01 1.55511892e-01 7.32462134e-01 5.46908534e-01 7.22587001e-01 7.63605817e-01 5.88003731e-01 7.02760288e-01 7.18276521e-01 4.44386132e-01
1.00000000e+00 7.98107508e-01] [ 2.69134957e-01 -2.07743642e-01 2.82789930e-01 5.37248053e-01 4.75522747e-01 2.23789986e-01 2.12552817e-01 -9.23692435e-02 1.62245742e-01
1.76740736e-01 -1.93185700e-01 -3.39240404e-01 1.11611455e-01 7.03165012e-01 4.98600711e-01 7.40537453e-01 8.43012503e-01 4.86408747e-01 8.01018973e-01 6.45625665e-01
5.13607086e-01 7.98107508e-01 1.00000000e+00]]
```

```
Eigen Vectors:[[ 0.124 -0.034 0.121 0.234 0.2 0.073 0.089 -0.049 0.085 0.088 -0.095 -0.138 0.042 0.307 0.243 0.308 0.331 0.197 0.317 0.27 0.211 0.306 0.325] [ 0.45 -0.06 0.234
0.156 0.317 0.211 0.16 0.384 0.293 0.356 -0.022 0.153 -0.027 -0.116 -0.119 -0.056 -0.023 -0.234 -0.025 -0.206 0.08 -0.157 -0.006] [-0.057 -0.443 -0.36 -0.041 -0.115 0.395 0.118 0.139
0.06 0.134 0.319 -0.167 0.437 -0.15 -0.082 0.034 0.031 0.111 0.078 0.124 -0.236 0.017 0.054] [ 0.011 0.351 -0.034 0.362 0.104 0.032 0.363 -0.278 0.153 0.074 -0.128 -0.449 0.072 0.001
0.091 -0.187 -0.199 -0.044 -0.088 0.059 -0.413 -0.009 -0.075] [-0.01 0.405 -0.006 -0.035 -0.052 -0.132 0.064 0.205 0.174 0.079 0.542 0.301 0.237 0.247 0.391 0.012 -0.045 0.187 -0.171
-0.022 -0.033 0.03 -0.092] [ 0.115 0.104 0.078 0.273 0.338 -0.033 0.034 0.155 -0.344 -0.472 -0.075 0.156 0.435 -0.143 -0.258 -0.037 -0.009 0.278 -0.123 -0.056 -0.009 0.093 0.048] [-0.08
-0.045 0.11 -0.24 -0.107 -0.154 0.848 0.083 -0.279 0.044 0.078 0.058 -0.173 -0.035 -0.138 0.057 0.036 0.061 0.007 0.031 0.089 0.029 0.059] [-0.082 -0.117 -0.163 0.071 -0.087 -0.521 0.085
-0.101 0.573 0.112 -0.231 0.231 0.206 -0.159 -0.267 -0.03 0.022 0.185 0.005 0.093 0.078 0.116 -0.013] [-0.028 -0.104 0.51 0.115 -0.047 0.039 -0.14 -0.256 0.124 0.064 0.459 -0.125 -0.252
-0.14 -0.3 -0.063 0.017 0.406 -0.092 -0.078 -0.084 0.071 0.105] [ 0.173 0.009 -0.131 0.17 0.049 -0.43 -0.128 -0.181 -0.408 0.442 0.283 -0.23 0.227 -0.023 -0.143 0.061 0.031 -0.228 -0.014
-0.038 0.245 -0.03 -0.031] [ 0.046 -0.019 -0.165 -0.045 -0.068 -0.198 -0.019 0.435 0.152 -0.163 -0.039 -0.603 -0.121 0.013 0.055 0.152 0.035 0.246 -0.192 -0.388 0.177 -0.005 0.002] [
0.107 -0.091 0.392 -0.156 -0.286 -0.028 -0.065 0.036 -0.199 0.331 -0.409 -0.041 0.333 0.09 0.182 -0.029 -0.006 0.375 -0.003 -0.046 -0.141 -0.239 -0.153] [ 0.277 -0.032 -0.515 0.196 0.072
0.065 0.001 -0.092 -0.193 0.196 -0.06 0.246 -0.423 0.02 0.048 -0.066 -0.003 0.499 -0.013 -0.052 -0.077 -0.094 -0.09 ] [-0.199 0.14 -0.09 -0.197 0.178 0.4 0.104 -0.416 0.09 0.133 -0.095
0.001 0.203 -0.022 -0.008 0.022 -0.033 0.131 -0.222 -0.321 0.517 0.025 -0.055] [ 0.271 -0.413 0.061 0.3 -0.284 -0.032 0.16 -0.206 0.06 -0.342 0.102 0.021 0.058 0.091 0.327 -0.324 -0.107
-0.081 -0.065 -0.028 0.334 -0.145 -0.029] [ 0.297 0.304 -0. 0.056 -0.325 0.188 0.017 -0.03 0.094 -0.16 0.044 -0.068 -0.003 -0.146 -0.237 0.417 0.032 0.033 0.023 0.382 0.212 -0.225 -0.37
] [ 0.075 0.054 0.003 -0.279 0.196 0.008 -0.093 0.2 -0.016 0.089 -0.005 -0.204 -0.055 -0.073 0.01 -0.494 -0.257 0.156 -0.077 0.569 0.289 0.143 -0.013] [-0.394 -0.24 0.075 0.095 0.493
-0.138 0.041 0.014 0.045 -0.045 0.096 -0.054 -0.049 0.005 0.145 0.136 0.05 0.094 0.093 0.165 0.048 -0.524 -0.355] [-0.51 0.07 0.037 0.564 -0.301 0.158 -0.028 0.326 -0.124 0.224 -0.103
0.088 -0.083 -0.092 -0.012 -0.03 -0.108 -0.011 -0.113 0.079 0.232 0.04 0.076] [ 0.068 -0.329 0.076 0.014 0.113 -0.022 -0.005 -0.049 -0.041 0.055 -0.079 0.06 -0.073 0.04 0.13 0.416 -0.258
-0.089 -0.6 0.165 -0.121 0.372 -0.197] [-0.038 -0.052 0.068 0.066 -0.005 0.04 0.025 0.068 -0.039 0.008 0.033 -0.026 -0.019 -0.017 0.012 -0.156 0.086 -0.002 0.376 -0.198 0.026 0.523 -0.7
] [ 0.015 -0.021 0.016 -0.012 0.026 -0.037 -0.01 -0.007 0.007 -0.016 0.037 0.019 0.023 0.042 -0.014 0.267 -0.819 0.095 0.452 -0.13 0.066 0.005 0.121] [-0.043 -0.078 -0.042 0.036 -0.022
0.071 0.007 0.055 0.038 -0.011 -0.01 -0.019 0.022 0.828 -0.502 -0.111 -0.061 -0.02 -0.089 0.022 -0.007 -0.073 -0.105]]
```

## 7.2 Training Samples and Test Samples for each question

Question 1:

```
TrainX: [17.0, 20.0, 17.0, 16.0, 14.0, 15.0, 18.0, 16.0, 17.0, 16.0, 19.0, 20.0, 17.0, 16.0, 17.0, 17.0, 15.0, 17.0, 15.0, 15.0, 17.0, 7.0, 19.0, 18.0, 17.0, 15.0, 10.0, 16.0, 17.0, 15.0, 15.0,
17.0, 19.0, 15.0, 17.0, 18.0, 16.0, 16.0, 16.0, 15.0, 17.0, 16.0, 20.0, 15.0, 16.0, 21.0, 17.0, 16.0, 18.0, 14.0, 14.0, 17.0, 20.0, 17.0, 17.0, 14.0, 18.0, 15.0, 18.0, 15.0, 16.0, 18.0, 15.0, 15.0,
```

14.0, 18.0, 16.0, 16.0, 15.0, 15.0, 17.0, 16.0, 17.0, 16.0, 16.0, 15.0, 20.0, 16.0, 16.0, 17.0, 18.0, 22.0, 16.0, 21.0, 15.0, 14.0, 19.0, 16.0, 19.0, 18.0, 18.0, 21.0, 17.0, 17.0, 16.0, 13.0, 19.0, 17.0, 17.0, 17.0, 17.0, 14.0, 8.0, 15.0, 17.0, 17.0, 19.0, 15.0, 15.0, 18.0, 17.0, 16.0, 16.0, 8.0, 17.0, 18.0, 18.0, 18.0, 18.0, 16.0, 14.0, 19.0, 17.0, 19.0, 15.0, 21.0, 17.0, 18.0, 17.0, 17.0, 19.0, 15.0, 15.0, 16.0, 18.0, 21.0, 14.0, 15.0, 16.0, 17.0, 20.0, 14.0, 13.0, 16.0, 20.0, 17.0, 18.0, 21.0, 15.0, 14.0, 15.0, 17.0, 18.0, 18.0, 15.0, 13.0, 15.0, 14.0, 17.0, 8.0, 14.0, 16.0, 20.0, 9.0, 14.0, 19.0, 19.0, 17.0, 18.0, 18.0, 14.0, 14.0, 18.0, 18.0, 15.0, 15.0, 16.0, 15.0, 19.0, 18.0, 18.0, 15.0, 16.0, 17.0, 19.0, 17.0, 18.0, 15.0, 10.0, 21.0, 15.0, 14.0, 17.0, 16.0, 18.0, 21.0, 18.0, 14.0, 14.0, 15.0, 13.0, 18.0, 16.0, 20.0, 12.0, 16.0, 20.0, 17.0, 16.0, 15.0, 15.0, 19.0, 18.0, 18.0, 14.0, 19.0, 14.0, 19.0, 19.0, 16.0, 20.0, 10.0, 18.0, 18.0, 8.0, 15.0, 19.0, 21.0, 15.0, 16.0, 18.0, 14.0, 16.0, 15.0, 18.0, 15.0, 11.0, 9.0, 15.0, 20.0, 15.0, 16.0, 17.0, 18.0, 16.0, 19.0, 15.0, 18.0, 21.0, 17.0, 13.0, 20.0, 18.0, 18.0, 16.0, 16.0, 14.0, 18.0, 15.0, 14.0, 19.0, 17.0, 17.0, 16.0, 16.0, 17.0, 16.0, 14.0, 18.0, 10.0, 18.0, 16.0, 19.0, 18.0, 17.0, 19.0, 16.0, 19.0, 20.0, 14.0, 18.0, 19.0, 17.0, 17.0, 17.0, 18.0, 18.0, 16.0, 17.0, 15.0, 16.0, 21.0, 18.0, 18.0, 16.0, 15.0, 18.0, 18.0, 16.0, 19.0, 11.0, 17.0, 15.0, 18.0, 17.0, 16.0, 20.0, 15.0, 15.0, 18.0, 17.0, 19.0, 16.0, 16.0, 20.0, 16.0, 15.0, 17.0, 15.0, 15.0, 18.0, 17.0, 17.0, 17.0, 12.0, 14.0, 16.0, 20.0, 18.0, 16.0, 17.0, 17.0, 15.0, 18.0, 15.0, 18.0, 17.0, 18.0]

TrainY: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]

TestX: [20.0, 8.0, 19.0, 14.0, 17.0, 14.0, 18.0, 11.0, 20.0, 18.0, 18.0, 16.0, 16.0, 18.0, 14.0, 14.0, 16.0, 16.0, 17.0, 14.0, 18.0, 18.0, 16.0, 16.0, 19.0, 16.0, 18.0, 17.0, 15.0, 20.0, 14.0, 20.0, 19.0, 17.0, 18.0, 16.0, 17.0, 17.0, 15.0, 19.0, 10.0, 17.0, 16.0, 16.0, 17.0, 15.0, 20.0, 13.0, 18.0, 17.0, 17.0, 15.0, 16.0, 14.0, 17.0, 17.0, 17.0, 17.0, 15.0, 8.0, 20.0, 16.0, 18.0, 15.0, 20.0, 16.0, 19.0, 15.0, 16.0, 21.0, 15.0, 19.0, 18.0, 18.0, 16.0, 17.0, 19.0, 18.0, 15.0, 15.0, 15.0, 17.0, 15.0, 19.0, 15.0, 16.0, 18.0, 25.0, 15.0, 17.0, 20.0, 20.0, 16.0, 18.0, 18.0, 16.0, 16.0, 16.0, 14.0, 17.0, 19.0, 14.0, 14.0, 16.0, 17.0, 15.0, 16.0, 13.0, 19.0, 16.0, 16.0, 18.0, 15.0, 15.0, 18.0, 19.0, 16.0, 7.0, 14.0, 16.0, 15.0, 17.0, 16.0, 14.0, 15.0, 20.0, 20.0, 18.0, 16.0, 16.0, 13.0, 16.0, 16.0, 16.0, 20.0, 18.0, 14.0, 19.0, 17.0, 16.0, 17.0, 15.0, 17.0, 18.0, 9.0, 18.0, 19.0, 18.0, 8.0, 17.0, 16.0, 7.0, 19.0, 18.0, 18.0, 15.0, 17.0, 9.0, 17.0, 21.0, 19.0, 16.0, 17.0, 20.0, 21.0, 20.0, 18.0, 20.0, 17.0, 18.0, 16.0, 17.0, 17.0, 16.0, 18.0, 17.0, 18.0, 18.0, 17.0, 15.0, 17.0, 16.0, 15.0, 16.0, 18.0, 10.0, 20.0, 15.0, 15.0, 17.0, 19.0, 17.0, 15.0, 15.0, 16.0, 15.0, 14.0, 17.0, 13.0, 18.0, 16.0, 10.0, 18.0, 14.0, 16.0, 19.0, 18.0, 18.0, 18.0, 16.0, 15.0, 16.0, 17.0, 17.0, 17.0, 17.0, 18.0, 16.0, 16.0, 9.0, 12.0, 18.0, 20.0, 16.0, 17.0, 18.0]

TestY: [0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0]

# Question 2:

TrainX: [[18.0, 57.0], [17.0, 70.0], [20.0, 61.7], [15.0, 59.0], [15.0, 48.0], [15.0, 56.2], [15.0, 52.2], [18.0, 56.6], [15.0, 66.0], [15.0, 53.2], [16.0, 51.5], [19.0, 62.0], [18.0, 52.0], [18.0, 57.8], [20.0, 70.0], [17.0, 56.5], [18.0, 64.2], [21.0, 53.4], [17.0, 61.5], [15.0, 55.0], [16.0, 56.0], [16.0, 54.0], [19.0, 59.0], [17.0, 59.5], [15.0, 55.0], [15.0, 57.8], [18.0, 72.5], [14.0, 53.0], [17.0, 62.5], [10.0, 61.0], [18.0, 48.0], [9.0, 60.0], [17.0, 59.4], [15.0, 51.8], [16.0, 53.0], [15.0, 53.4], [18.0, 68.0], [16.0, 60.5], [18.0, 67.5], [15.0, 58.0], [17.0, 42.0], [18.0, 69.0], [19.0, 57.7], [15.0, 56.9], [16.0, 57.0], [16.0, 54.5], [20.0, 68.5], [17.0, 49.5], [15.0, 54.0], [16.0, 50.0], [15.0, 53.5], [17.0, 50.5], [15.0, 50.0], [15.0, 50.0], [17.0, 64.5], [18.0, 60.0], [15.0, 57.0], [16.0, 52.0], [15.0, 62.4], [16.0, 57.2], [16.0, 63.0], [17.0, 58.4], [16.0, 47.5], [17.0, 49.0], [15.0, 56.6], [8.0, 56.5], [10.0, 72.0], [15.0, 48.0], [16.0, 62.3], [16.0, 61.0], [12.0, 57.0], [17.0, 52.0], [15.0, 58.5], [17.0, 59.0], [15.0, 62.4], [15.0, 53.0], [18.0, 47.0], [20.0, 75.5], [12.0, 53.0], [14.0, 61.5], [17.0, 60.8], [15.0, 55.0], [19.0, 72.0], [18.0, 56.2], [19.0, 74.0], [18.0, 58.3], [16.0, 60.8], [17.0, 57.6], [18.0, 71.0], [16.0, 58.4], [18.0, 64.6], [18.0, 55.0], [17.0, 60.5], [19.0, 55.0], [10.0, 46.0], [15.0, 53.0], [16.0, 57.0], [17.0, 50.0], [18.0, 55.0], [18.0, 67.0], [16.0, 45.2], [12.0, 54.0], [16.0, 57.5], [19.0, 52.7], [17.0, 57.3], [10.0, 46.5], [16.0, 60.6], [16.0, 56.5], [18.0, 53.0], [18.0, 55.9], [16.0, 51.8], [17.0, 57.5], [17.0, 58.6], [15.0, 56.5], [14.0, 52.0], [14.0, 56.0], [16.0, 56.5], [14.0, 56.0], [18.0, 58.0], [21.0, 59.6], [15.0, 52.5], [16.0, 55.0], [14.0, 50.0], [16.0, 49.0], [18.0, 71.5], [18.0, 67.0], [17.0, 48.5], [17.0, 55.2], [17.0, 63.0], [14.0, 55.9], [15.0, 60.0], [20.0, 71.0], [16.0, 56.9], [17.0, 52.2], [17.0, 50.5], [8.0, 62.0], [14.0, 58.0], [16.0, 57.0], [17.0, 56.0], [18.0, 63.7], [8.0, 60.0], [14.0, 53.5], [14.0, 58.0], [17.0, 58.4], [14.0, 60.0], [17.0, 56.0], [20.0, 61.5], [17.0, 39.0], [17.0, 55.8], [16.0, 58.8], [17.0, 62.0], [15.0, 55.0], [20.0, 70.0], [18.0, 69.0], [14.0, 50.5], [17.0, 62.5], [14.0, 57.0], [11.0, 53.0], [21.0, 59.8], [17.0, 61.5], [16.0, 53.4], [18.0, 65.4], [19.0, 59.0], [15.0, 66.5], [16.0, 55.0], [16.0, 56.6], [16.0, 61.6], [16.0, 51.4], [8.0, 53.0], [17.0, 58.0], [20.0, 60.0], [19.0, 60.0], [9.0, 58.0], [17.0, 53.3], [19.0, 60.6], [8.0, 55.0], [19.0, 72.5], [15.0, 53.5], [16.0, 58.0], [18.0, 57.0], [19.0, 54.0], [17.0, 56.0], [15.0, 57.0], [10.0, 50.0], [15.0, 55.0], [16.0, 58.2], [15.0, 53.6], [18.0, 69.0], [14.0, 53.5], [17.0, 53.0], [15.0, 54.7], [17.0, 53.5], [7.0, 53.0], [16.0, 56.5], [16.0, 52.5], [17.0, 53.0], [15.0, 62.0], [16.0, 59.4], [17.0, 56.0], [18.0, 53.0], [18.0, 55.9], [18.0, 56.5], [16.0, 61.0], [17.0, 60.1], [18.0, 73.0], [21.0, 61.2], [16.0, 64.2], [21.0, 59.0], [13.0, 59.5], [17.0, 52.7], [16.0, 53.0], [17.0, 59.7], [18.0, 73.0], [15.0, 59.5], [16.0, 65.5], [18.0, 60.1], [15.0, 55.2], [18.0, 65.0], [16.0, 51.5], [20.0, 61.5], [17.0, 53.6], [16.0, 59.5], [18.0, 55.0], [20.0, 62.0], [19.0, 39.1], [15.0, 62.0], [19.0, 56.5], [16.0, 60.0], [19.0, 48.5], [16.0, 69.0], [16.0, 75.0], [14.0, 55.0], [16.0, 54.8], [15.0, 52.8], [15.0, 57.5], [17.0, 59.8], [15.0, 55.5], [18.0, 55.2], [16.0, 58.6], [17.0, 65.2], [17.0, 58.8], [17.0, 59.0], [17.0, 58.6], [18.0, 51.0], [17.0, 54.0], [20.0, 73.0], [19.0, 55.0], [16.0, 48.5], [17.0, 51.5], [15.0, 48.0], [15.0, 56.5], [14.0, 52.5], [16.0, 57.5], [16.0, 57.2], [16.0, 55.8], [17.0, 57.0], [18.0, 56.8], [15.0, 53.0], [18.0, 69.5], [16.0, 57.0], [18.0, 70.5], [17.0, 58.5], [15.0, 59.5], [15.0, 57.0], [21.0, 64.0], [16.0, 53.9], [17.0, 64.9], [20.0, 70.5], [19.0, 57.5], [15.0, 53.5], [18.0, 59.5], [17.0, 52.0], [18.0, 55.0], [18.0, 51.5], [14.0, 58.0], [15.0, 59.0], [16.0, 55.0], [20.0, 53.5], [14.0, 56.0], [17.0, 67.0], [20.0, 62.0], [16.0, 60.0], [17.0, 57.0], [17.0, 55.0], [20.0, 73.0], [14.0, 54.5], [19.0, 61.5], [18.0, 65.0], [16.0, 59.3], [18.0, 52.1], [18.0, 56.0], [14.0, 57.0], [19.0, 56.0], [17.0, 54.8], [15.0, 56.4], [17.0, 54.0], [15.0, 58.9], [15.0, 47.0], [21.0, 52.3], [15.0, 58.8], [14.0, 59.5], [14.0, 53.0], [18.0, 58.2], [20.0, 52.0], [20.0, 63.0], [18.0, 50.0], [13.0, 66.0], [18.0, 39.3], [19.0, 53.5], [18.0, 70.0], [10.0, 45.5], [18.0, 70.0], [13.0, 46.5], [16.0, 61.0], [19.0, 58.0], [16.0, 58.5], [18.0, 62.5], [15.0, 52.5], [18.0, 57.0], [18.0, 55.0], [16.0, 61.4], [15.0, 57.0], [18.0, 64.5], [15.0, 59.0], [14.0, 56.0], [17.0, 55.0], [16.0, 60.6], [17.0, 55.2], [7.0, 51.0], [15.0, 54.0], [17.0, 56.1], [21.0, 71.5], [17.0, 54.0], [14.0, 56.0], [14.0, 58.0], [16.0, 52.5], [17.0, 52.7], [19.0, 62.8]]

TrainY: [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]

TestX: [[19.0, 59.4], [15.0, 53.0], [18.0, 60.0], [17.0, 60.0], [9.0, 46.0], [14.0, 48.0], [16.0, 63.5], [16.0, 57.2], [18.0, 61.0], [20.0, 52.0], [14.0, 57.5], [20.0, 58.0], [19.0, 61.5], [14.0, 53.5], [20.0, 57.0], [15.0, 56.5], [20.0, 54.0], [18.0, 74.0], [18.0, 57.0], [17.0, 51.0], [18.0, 51.0], [18.0, 54.0], [16.0, 51.5], [18.0, 74.0], [15.0, 58.3], [15.0, 60.0], [17.0, 51.9], [18.0, 60.5], [18.0, 73.0], [16.0, 59.0], [17.0, 64.5], [10.0, 46.5], [20.0, 56.0], [15.0, 54.2], [19.0, 75.0], [17.0, 59.3], [20.0, 71.0], [18.0, 60.0], [15.0, 57.1], [18.0, 58.0], [18.0, 51.0], [18.0, 68.5], [20.0, 59.5], [15.0, 56.7], [16.0, 57.5], [8.0, 50.0], [14.0, 59.2], [16.0, 64.0], [16.0, 59.4], [17.0, 60.0], [16.0, 59.0], [17.0, 55.0], [15.0, 56.0], [17.0, 61.0], [15.0, 61.0], [15.0, 50.0], [18.0, 59.0], [20.0, 55.0], [20.0, 45.8], [19.0, 57.7], [18.0, 67.0], [14.0, 51.0], [15.0, 61.0], [19.0, 68.0], [11.0, 51.5], [17.0, 62.0], [17.0, 49.7], [16.0, 54.0], [15.0, 55.5], [15.0, 59.4], [19.0, 76.0], [13.0, 58.5], [17.0, 57.5], [15.0, 55.5], [16.0, 65.5], [17.0, 58.2], [14.0, 53.5], [17.0, 56.0], [18.0, 71.0], [19.0, 57.0], [18.0, 64.5], [16.0, 54.2], [15.0, 57.0], [18.0, 72.0], [18.0, 61.0], [13.0, 60.0], [22.0, 59.0], [15.0, 55.0], [20.0, 56.0], [18.0, 56.0], [17.0, 58.0], [17.0, 52.9], [18.0, 62.0], [18.0, 72.5], [15.0, 51.5], [17.0, 56.5], [19.0, 62.0], [16.0, 54.0], [17.0, 55.8], [19.0, 52.2], [19.0, 50.0], [16.0, 51.0], [16.0, 51.0], [16.0, 50.0], [16.0, 59.6], [16.0, 56.0], [21.0, 60.0], [18.0, 54.5], [18.0, 60.0], [18.0, 72.0], [15.0, 57.0], [16.0, 56.0], [16.0, 53.5], [16.0, 63.0], [19.0, 52.3], [16.0, 62.7], [13.0, 55.0], [13.0, 56.0], [17.0, 54.7], [20.0, 56.6], [19.0, 57.2], [16.0, 58.5], [14.0, 56.0], [19.0, 54.0], [17.0, 51.5], [14.0, 56.7], [25.0, 72.0], [7.0, 43.0], [19.0, 72.5], [14.0, 58.6], [16.0, 66.6], [16.0, 64.5], [16.0, 56.5], [21.0, 74.0], [19.0, 55.0], [14.0, 45.5], [17.0, 65.5], [16.0, 53.2], [18.0, 54.0], [20.0, 59.0], [14.0, 59.8], [17.0, 62.0], [17.0, 51.0], [17.0, 54.2], [17.0, 62.0], [14.0, 60.0], [17.0, 56.3], [17.0, 49.2], [17.0, 54.2], [18.0, 56.3], [18.0, 49.3], [8.0, 50.0], [16.0, 58.2], [13.0, 58.0], [15.0, 60.0], [15.0, 57.8], [15.0, 65.0], [18.0, 73.0], [16.0, 51.0], [18.0, 53.6], [16.0, 51.7], [17.0, 56.7], [18.0, 52.8], [17.0, 60.0], [16.0, 52.0], [14.0, 53.0], [17.0, 57.0], [16.0, 53.3], [20.0, 57.0], [17.0, 55.3], [16.0, 54.9], [21.0, 62.6], [15.0, 57.0], [20.0, 72.0], [19.0, 53.0], [21.0, 56.5], [11.0, 45.5], [18.0, 53.0], [17.0, 62.8], [15.0, 55.0], [21.0, 58.5], [15.0, 55.1], [14.0, 58.0], [15.0, 49.5], [19.0, 66.5], [15.0, 65.0], [14.0, 61.0], [17.0, 58.0], [9.0, 38.0], [16.0, 49.0], [20.0, 55.0], [15.0, 55.2], [13.0, 56.0], [18.0, 65.3], [14.0, 48.0], [19.0, 61.0], [17.0, 59.0], [16.0, 58.5], [18.0, 61.5], [20.0, 60.7], [19.0, 54.8], [17.0, 57.0], [16.0, 59.0], [17.0, 63.3], [18.0, 55.0], [16.0, 64.4], [18.0, 63.0], [18.0, 61.2], [19.0, 64.5], [16.0, 70.0], [18.0, 57.0], [18.0, 70.0], [18.0, 72.0], [16.0, 64.5], [18.0, 56.5], [19.0, 55.5], [19.0, 62.3], [17.0, 54.0], [9.0, 51.5], [21.0, 58.0], [16.0, 55.0], [14.0, 56.0], [16.0, 62.0], [17.0, 53.5], [16.0, 59.0], [20.0, 70.5]]

TestY: [0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0]

# Question 3 ratio:

TrainX:

[5.036231884057971, 4.6415094339622645, 4.351851851851852, 4.776785714285714, 4.825174825174825, 8.043478260869566, 4.435483870967742, 4.285714285714286, 4.042553191489362, 4.265734265734266, 5.105691056910569, 4.448818897637795, 4.365079365079366, 4.318181818181818, 4.32, 4.966101694915254, 4.790322580645161, 4.453781512605042, 4.521739130434782, 4.584070796460177, 4.852173913043478, 4.696969696969697, 4.768518518518518, 4.62809917355372, 4.745454545454546, 5.0, 4.2734375, 4.769230769230769, 4.84375, 4.270833333333333, 5.076923076923077, 4.64, 4.803149606299213, 4.314516129032258, 4.444444444444445, 4.666666666666667, 4.908256880733945, 3.5, 4.467213114754099, 4.479452054794521, 4.483606557377049, 4.4071428571428575, 5.176991150442477, 4.517543859649122, 4.609375, 4.11578947368421, 4.741379310344827, 4.918032786885246, 4.811965811965812, 4.4296875, 4.417475728155339, 4.201388888888888, 4.274193548387097, 4.683760683760684, 4.026845637583892, 4.869565217391305, 4.946902654867256, 4.645669291338583, 4.2481203007518795, 4.6, 4.214876033057851, 4.672897196261682, 4.465648854961832, 4.20353982300885, 4.395833333333333, 5.0703125, 4.964788732394366, 4.213836477987421, 5.043103448275862, 4.556390977443609, 4.375, 4.341085271317829, 7.122641509433962, 4.214876033057851, 4.632478632478633, 4.104938271604938, 4.573643410852713, 4.126506024096385, 4.583333333333333, 4.638655462184874, 4.5, 5.321100917431193, 5.041322314049587, 4.878048780487805, 4.793388429752066, 4.827586206896552, 4.9298245614035086, 4.23728813559322, 4.402985074626866, 5.126050420168067, 4.236641221374046, 4.846153846153847, 4.793388429752066, 5.148760330578512, 4.078947368421053, 4.743119266055046, 4.082191780821918, 4.663934426229508, 5.140845070422536, 4.436619718309859, 4.263565891472868, 4.456692913385827, 4.5528455284552845, 4.322033898305085, 4.28448275862069, 4.912, 4.275362318840579, 4.094202898550725, 4.273504273504273, 4.9692307692307685, 4.278688524590164, 4.351145038167939, 5.084745762711864, 4.1735537190082646, 4.867256637168142, 4.186046511627906, 4.471544715447155, 4.9576271186440675, 4.4639999999999995, 4.547826086956522, 4.301470588235294, 4.892086330935252, 4.790322580645161, 4.793893129770992, 4.444444444444444, 4.608695652173913, 4.264705882352941, 4.621848739495798, 4.164062499999999, 5.193798449612403, 4.453125, 4.918032786885246, 4.960629921259843, 4.333333333333333, 5.140186915887851, 5.0, 4.172661870503597, 4.3604651162790695, 4.2063492063492065, 4.2617449664429525, 4.507936507936508, 4.3359375, 4.354838709677419, 4.655172413793103, 4.351145038167939, 4.672727272727273, 4.758620689655173, 4.32, 5.034965034965035, 4.36936936936937, 4.403846153846153, 5.125, 4.5, 4.827586206896552, 4.338235294117647, 4.966666666666667, 4.424778761061947, 4.901785714285714, 4.351851851851851, 4.646017699115044, 4.227642276422764, 4.695652173913044, 4.959677419354839, 4.168, 4.8196721311475414, 4.253731343283582, 4.416666666666667, 4.924242424242425, 4.235294117647059, 4.2024539877300615, 4.503448275862069, 4.298780487804878, 5.040322580645161, 4.423076923076923, 4.4921875, 4.724409448818898, 3.2544378698224854, 4.583333333333333, 4.444444444444445, 4.953703703703703, 5.309090909090909, 4.762711864406779, 5.0769230769230775, 4.842105263157895, 4.161849710982659, 4.17910447761194, 4.761467889908257, 4.9590163934426235, 4.715447154471544, 5.136752136752137, 4.333333333333333, 4.306569343065694, 4.378698224852071, 4.390243902439024, 4.5528455284552845, 4.830508474576271, 4.951923076923077, 4.386792452830189, 4.285714285714286, 4.705882352941177, 4.855072463768115, 4.516129032258064, 5.391304347826087, 4.8062015503875966, 4.47457627118644, 4.688524590163935, 5.1171875, 4.5038167938931295, 5.140186915887851, 4.3283582089552235, 4.354838709677419, 4.316546762589928, 5.0, 5.306306306306307, 4.710743801652892, 4.95575221238938, 4.423076923076923, 4.672897196261682, 5.188034188034188, 4.292035398230088, 4.678899082568807, 4.071942446043166, 4.246153846153846, 5.126126126126126, 4.852459016393444, 4.226190476190476, 4.982758620689655, 4.958333333333333, 4.444444444444444, 4.322033898305085, 5.152, 5.073529411764706, 4.630252100840336, 4.504273504273505, 4.363636363636363, 4.296296296296297, 4.478527607361963, 4.155405405405405, 4.24, 5.142857142857143, 4.256198347107438, 4.764227642276422, 4.349593495934959, 4.900763358778626, 4.442622950819673, 4.95575221238938, 4.377049180327869, 4.206896551724138, 5.438095238095238, 4.401785714285714, 4.681818181818182, 5.083333333333333, 4.8999999999999995, 4.349593495934959, 4.95, 4.962686567164179, 4.967213114754099, 4.858490566037736, 4.716981132075472, 4.75177304964539, 4.576923076923077, 4.566929133858268, 4.700854700854701, 4.9523809523809526, 4.830508474576271, 5.078740157480315, 4.391666666666667, 4.745762711864407, 4.734513274336283, 4.360655737704919, 4.782258064516129, 5.263157894736842, 4.186046511627907, 4.833333333333333, 4.72, 4.051724137931035, 4.269005847953216, 4.1875, 4.841269841269842, 4.419642857142858, 4.728070175438596, 4.990566037735849, 5.0390625, 4.8, 4.431818181818182, 4.6875, 3.971223021582734, 4.660869565217391, 4.3076923076923075, 4.846153846153847, 4.765217391304348, 4.80672268907563, 4.289940828402367, 5.0, 4.428571428571429, 4.292857142857143, 4.365079365079366, 4.576271186440677, 4.428571428571429, 5.0, 4.2105263157894735, 4.205882352941177, 4.444444444444445, 5.0, 4.244604316546763, 4.838709677419355, 4.325925925925926, 4.421487603305785, 4.366197183098592, 4.52991452991453, 4.782608695652174, 4.37037037037037, 4.28099173553719, 4.322033898305085, 4.818181818181818, 4.961240310077519, 4.358108108108108, 4.7101449275362315, 4.453125, 5.0476190476190474, 5.1000000000000005, 5.138888888888888, 4.8196721311475414, 5.241379310344827, 4.507575757575758, 4.869565217391305, 4.887096774193548, 4.88, 4.439655172413794, 4.552238805970149, 4.9765625, 4.242424242424242, 4.340740740740741, 4.982300884955752, 4.3283582089552235, 5.184466019417475, 4.1610738255033555, 4.9504950495049505]

TrainY:

[2, 1, 1, 2, 2, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 2, 1, 1, 2, 2, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 1, 2, 1, 1, 2, 2, 1, 1, 1, 1, 1, 2, 2, 1, 1, 2, 2, 2, 1, 2, 1, 1, 2, 1, 2, 2, 2, 1, 2, 1, 2, 1, 1, 1, 2, 2, 1, 2, 1, 2, 1, 1, 1, 2, 1, 2, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1, 1, 1, 1, 2, 2, 2, 1, 2, 1, 2, 2, 1, 2, 1, 1, 1, 1, 2, 1, 2, 1, 2, 1, 1, 2, 2, 2, 1, 1, 2, 1, 2, 1, 2, 2, 2, 2, 1, 1, 2, 1, 2, 1, 2, 2, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 2, 1, 2, 2, 1, 2, 1, 2, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 2, 1, 2, 1, 2, 2, 1, 1, 1, 1, 2, 1, 1, 2, 2, 1, 2, 2, 2, 2, 2, 2, 1, 1, 2, 2, 2, 2, 1, 1, 1, 1, 1, 2, 2, 1, 1, 2, 2, 1, 2, 2, 1, 2, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 1, 2, 2, 2, 1, 1, 1, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 2, 2, 1, 1, 1, 1, 2, 1, 2, 1, 2, 1, 2, 1, 1, 2, 1, 2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 1, 1, 1, 2, 2, 2, 2, 2, 2, 1, 2, 2, 1, 2, 2, 2, 1, 1, 2, 1, 2, 2, 2, 2, 2, 1, 1, 2, 1, 2, 2, 2, 1, 2, 1, 1, 2, 2, 1, 2, 2, 1, 1, 2, 1, 2, 1, 2, 1, 1, 2, 1, 1, 1, 2, 2, 1, 2, 1, 2, 2, 2, 2, 2, 1, 2, 2, 2, 1, 1, 2, 1, 1, 2, 1, 2, 1, 2]

TestX: [5.1652892561983474, 4.444444444444445, 4.833333333333333, 4.365079365079366, 4.663461538461538, 4.796610169491525, 4.322314049586777, 4.5200000000000005, 4.833333333333333, 4.1923076923076925, 4.941666666666666, 4.404580152671756, 4.798387096774193, 5.258064516129032, 4.927007299270073, 4.153846153846154, 4.921875, 4.992, 4.69672131147541, 4.461538461538462, 5.0, 4.431137724550898, 4.477611940298507, 4.861111111111111, 5.133928571428572, 4.1571428571428575, 4.871794871794872, 3.6551724137931036, 4.479166666666667, 3.4234234234234235, 4.346153846153846, 4.444444444444445, 4.32, 4.402985074626866, 4.516666666666667, 4.8125, 4.2, 4.333333333333333, 4.7478991596638656, 5.225225225225225, 4.140740740740741, 4.8344370860927155, 4.3076923076923075, 4.241379310344828, 4.1732283464566935, 4.108527131782946, 4.545454545454546, 4.765625, 4.681818181818182, 5.1190476190476195, 4.857142857142857, 4.444444444444445, 4.23728813559322, 4.574468085106383, 4.910714285714286, 4.862385321100917, 4.458333333333333, 4.4298245614035086, 4.251497005988024, 4.507042253521127, 4.899159663865546, 4.303278688524591, 4.515624999999999, 4.56, 4.768595041322315, 4.916666666666667, 4.4, 4.862385321100917, 4.029850746268656, 5.090909090909091, 4.587155963302752, 4.174757281553398, 5.114035087719298, 4.929577464788733, 4.538461538461538, 4.333333333333333, 4.3362831858407085, 4.124999999999999, 4.660194174757281, 4.345794392523365, 4.246031746031746, 4.931034482758621, 4.4523809523809526, 4.155405405405405, 4.447852760736196, 4.5, 4.426229508196721, 4.273504273504273, 4.655172413793103, 4.285714285714286, 4.214876033057851, 3.9696969696969693, 4.2578125, 4.523809523809524, 5.0260869565217385, 5.1171875, 4.754098360655738, 4.918032786885246, 4.1317829457364335, 4.274193548387097, 4.870689655172414, 4.586206896551724, 4.675925925925926, 4.431818181818182, 4.741379310344827, 4.416666666666667, 4.522292993630574, 4.56, 4.28, 4.949152542372881, 4.263565891472868, 4.333333333333333, 4.770491803278689, 5.0, 4.556451612903226, 4.453125, 4.6875, 4.923664122137405, 4.661016949152542, 4.185185185185185, 4.693548387096774, 5.0673076923076925, 4.357142857142857, 4.713178294573643, 4.397163120567376, 4.5528455284552845, 5.123076923076923, 4.965986394557824, 4.916666666666667, 4.25, 4.2063492063492065, 4.491803278688525, 4.423076923076923, 4.846153846153846, 4.776785714285714, 4.278688524590164, 4.0, 4.8545454545454545, 4.4140625, 4.346153846153846, 4.549180327868853, 4.662162162162162, 4.75206611570248, 5.06993006993007, 4.4, 5.082644628099174, 4.115107913669065, 4.2477876106194685, 5.096153846153846, 5.09009009009009, 4.406779661016949, 5.118110236220473, 4.758064516129032, 4.974358974358975, 4.40251572327044, 4.881355932203389, 4.444444444444445, 5.044247787610619, 4.507692307692308, 4.555555555555555, 4.323308270676692, 4.440298507462686, 4.330708661417323, 5.3, 4.188034188034188, 4.608333333333333, 4.8, 4.678899082568807, 4.549180327868853, 4.336283185840708, 5.0344827586206895, 4.461538461538462, 5.024193548387096, 4.366197183098592, 4.921739130434783, 4.471544715447155, 4.318181818181818, 4.318181818181818, 4.305555555555555, 4.862068965517241, 4.503597122302159, 4.3076923076923075, 4.285714285714286, 4.259259259259259, 4.032258064516129, 4.323308270676692, 5.0, 4.724409448818898, 4.205882352941177, 5.097560975609756, 4.303030303030303, 4.178571428571429, 4.521739130434782, 4.5588235294117645, 4.821428571428572, 4.198473282442748, 4.174311926605505, 4.222222222222222, 4.671874999999999, 4.263565891472868, 4.385964912280701, 4.78740157480315, 5.073529411764706, 4.2748091603053435, 4.2682926829268295, 4.4186046511627906, 4.516666666666667, 4.861111111111111, 4.89344262295082, 4.958333333333333, 5.24, 5.076923076923077, 4.430379746835443, 4.830508474576271, 4.222222222222222, 4.879032258064516, 4.4186046511627906, 4.3277310924369745, 4.495798319327731, 4.484126984126984, 4.661016949152542, 4.351145038167939, 4.878048780487805, 4.285714285714286, 4.484126984126984, 4.357723577235772]

TestY: [2, 1, 2, 1, 2, 2, 1, 1, 2, 1, 2, 1, 2, 2, 2, 2, 2, 2, 2, 1, 2, 1, 1, 2, 2, 1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 2, 1, 1, 2, 2, 1, 2, 1, 2, 1, 1, 1, 2, 1, 2, 2, 1, 1, 1, 2, 2, 1, 2, 1, 1, 2, 1, 1, 2, 2, 2, 2, 2, 2, 1, 2, 2, 1, 2, 2, 1, 1, 2, 1, 2, 1, 1, 2, 2, 1, 1, 1, 1, 2, 2, 1, 1, 1, 1, 1, 2, 2, 2, 2, 1, 2, 2, 2, 2, 1, 2, 1, 1, 1, 1, 2, 1, 1, 2, 2, 1, 1, 2, 2, 2, 1, 2, 2, 1, 2, 1, 1, 2, 2, 2, 1, 1, 1, 1, 2, 2, 1, 1, 2, 1, 1, 1, 2, 2, 2, 1, 2, 1, 2, 2, 2, 1, 2, 2, 2, 1, 2, 1, 2, 2, 1, 1, 1, 1, 2, 1, 2, 1, 2, 1, 1, 2, 1, 2, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 2, 1, 1, 2, 1, 1, 2, 1, 2, 1, 1, 1, 2, 1, 1, 2, 2, 1, 1, 1, 1, 2, 2, 2, 2, 2, 1, 2, 1, 2, 1, 1, 1, 1, 2, 1, 2, 1, 1, 1]

## Question 3 Logistic Regression:

TrainX: [[43.0, 25.0, 7.0, 25.0, 16.0, 28.0, 5.0, 9.0, 1.0, 1.0, 3.0, 4.0, 2.8, 56.0, 32.2, 19.3, 12.8, 8.4, 7.3, 5.4, 9.8, 18.8, 29.5], [46.0, 28.0, 9.0, 32.0, 18.0, 23.0, 7.0, 6.0, 2.0, 3.0, 2.0, 3.0, 2.1, 60.0, 32.6, 17.2, 12.2, 7.7, 8.3, 5.6, 7.9, 20.4, 32.4], [43.0, 27.0, 9.0, 24.0, 15.0, 19.0, 7.0, 6.0, 1.0, 1.0, 2.0, 3.0, 2.0, 55.2, 28.3, 17.7, 11.9, 7.7, 7.1, 4.8, 11.5, 19.6, 28.9], [46.0, 23.0, 10.0, 24.0, 17.0, 25.0, 6.0, 10.0, 0.0, 1.0, 1.0, 4.0, 2.2, 52.0, 27.0, 16.5, 11.5, 6.0, 7.7, 4.5, 9.8, 16.0, 28.8], [49.0, 26.0, 10.0, 22.0, 17.0, 26.0, 5.0, 10.0, 2.0, 2.0, 2.0, 6.0, 2.3, 56.0, 30.0, 16.8, 11.0, 5.8, 6.4, 4.0, 10.5, 17.0, 27.5], [48.0, 25.0, 7.0, 21.0, 15.0, 23.0, 5.0, 9.0, 2.0, 2.0, 2.0, 4.0, 2.7, 55.5, 30.0, 18.3, 12.2, 8.2, 7.0, 5.1, 9.2, 20.0, 30.2], [44.0, 25.0, 9.0, 24.0, 15.0, 21.0, 5.0, 7.0, 0.0, 0.0, 2.0, 5.0, 2.7, 53.0, 27.8, 17.2, 12.7, 8.2, 7.6, 4.7, 9.5, 19.0, 30.5], [48.0, 26.0, 9.0, 22.0, 17.0, 23.0, 6.0, 12.0, 1.0, 2.0, 1.0, 4.0, 2.3, 42.0, 20.8, 13.2, 9.0, 4.8, 5.0, 2.9, 6.7, 12.5, 20.2], [45.0, 24.0, 8.0, 23.0, 15.0, 25.0, 6.0, 12.0, 2.0, 2.0, 3.0, 3.0, 3.0, 54.0, 30.8, 18.7, 12.3, 8.3, 7.7, 5.4, 9.5, 21.0, 30.0], [38.0, 26.0, 7.0, 23.0, 7.0, 16.0, 6.0, 2.0, 1.0, 3.0, 3.0, 3.0, 2.0, 51.0, 31.0, 17.0, 10.5, 7.0, 6.2, 4.8, 9.0, 15.3, 24.0], [48.0, 24.0, 9.0, 23.0, 17.0, 24.0, 7.0, 12.0, 2.0, 2.0, 2.0, 2.0, 2.8, 48.5, 27.8, 16.5, 11.1, 7.7, 6.8, 4.8, 8.8, 17.8, 26.8], [50.0, 23.0, 8.0, 30.0, 19.0, 23.0, 6.0, 5.0, 1.0, 2.0, 1.0, 1.0, 2.6, 74.0, 40.4, 23.2, 16.9, 10.5, 12.0, 8.8, 11.4, 26.7, 40.3], [47.0, 23.0, 8.0, 29.0, 18.0, 24.0, 6.0, 7.0, 1.0, 2.0, 1.0, 3.0, 2.7, 72.0, 35.5, 24.6, 17.0, 10.7, 11.8, 8.0, 11.3, 26.0, 39.3], [42.0, 28.0, 10.0, 21.0, 16.0, 20.0, 6.0, 6.0, 1.0, 1.0, 2.0, 3.0, 1.9, 59.6, 32.4, 18.0, 12.0, 8.1, 7.0, 4.9, 10.2, 20.2, 26.7], [44.0, 26.0, 8.0, 23.0, 15.0, 23.0, 5.0, 7.0, 2.0, 2.0, 3.0, 4.0, 2.7, 60.0, 35.7, 18.1, 12.0, 7.3, 7.9, 5.5, 9.0, 17.0, 25.4], [48.0, 24.0, 10.0, 31.0, 21.0, 24.0, 7.0, 8.0, 2.0, 2.0, 1.0, 1.0, 2.5, 56.5, 31.5, 19.7, 13.5, 8.5, 8.5, 6.2, 9.1, 21.1, 34.2], [46.0, 28.0, 9.0, 23.0, 20.0, 28.0, 7.0, 13.0, 2.0, 2.0, 2.0, 3.0, 2.2, 60.7, 34.0, 18.8, 11.7, 5.8, 7.2, 5.1, 9.3, 18.8, 26.9], [46.0, 25.0, 8.0, 22.0, 16.0, 27.0, 5.0, 7.0, 1.0, 2.0, 2.0, 3.0, 2.9, 53.5, 31.5, 18.8, 12.3, 8.0, 7.2, 5.4, 9.3, 19.2, 28.3], [45.0, 26.0, 7.0, 24.0, 15.0, 27.0, 5.0, 9.0, 1.0, 2.0, 2.0, 2.0, 3.0, 55.0, 31.7, 30.0, 16.9, 11.4, 7.3, 5.2, 17.1, 18.0, 26.8], [51.0, 25.0, 9.0, 22.0, 16.0, 23.0, 6.0, 12.0, 1.0, 4.0, 2.0, 4.0, 2.3, 53.3, 29.1, 18.7, 12.9, 6.8, 8.3, 5.8, 9.8, 17.7, 30.7], [44.0, 26.0, 9.0, 21.0, 16.0, 20.0, 6.0, 3.0, 0.0, 1.0, 2.0, 4.0, 2.3, 53.9, 27.4, 17.6, 11.4, 7.5, 7.0, 5.0, 9.6, 17.5, 26.0], [48.0, 23.0, 10.0, 32.0, 20.0, 24.0, 7.0, 3.0, 2.0, 3.0, 1.0, 1.0, 2.8, 71.0, 36.9, 25.0, 16.5, 10.4, 11.0, 7.7, 11.7, 26.6, 41.3], [53.0, 26.0, 8.0, 25.0, 18.0, 25.0, 7.0, 14.0, 2.0, 4.0, 2.0, 4.0, 2.1, 61.2, 32.4, 18.6, 12.0, 6.1, 7.4, 4.0, 9.1, 18.0, 29.0], [47.0, 28.0, 8.0, 27.0, 21.0, 22.0, 6.0, 8.0, 1.0, 2.0, 1.0, 3.0, 2.3, 62.6, 35.6, 22.9, 13.9, 6.7, 9.8, 6.5, 10.0, 23.6, 32.4], [43.0, 23.0, 7.0, 20.0, 16.0, 24.0, 5.0, 9.0, 0.0, 0.0, 2.0, 4.0, 2.7, 56.5, 27.5, 19.1, 12.6, 8.4, 7.5, 5.7, 9.7, 20.0, 29.5], [42.0, 27.0, 9.0, 22.0, 15.0, 19.0, 6.0, 4.0, 0.0, 0.0, 2.0, 3.0, 2.2, 59.4, 31.2, 16.8, 11.7, 7.3, 6.9, 4.7, 9.6, 19.0, 28.2], [38.0, 21.0, 6.0, 16.0, 10.0, 25.0, 6.0, 0.0, 1.0, 2.0, 3.0, 1.0, 2.7, 46.5, 22.7, 15.7, 10.6, 7.3, 7.7, 5.1, 8.7, 16.5, 24.3], [44.0, 29.0, 9.0, 25.0, 16.0, 21.0, 6.0, 5.0, 1.0, 1.0, 2.0, 4.0, 2.5, 51.8, 24.7, 12.7, 11.3, 7.4, 7.1, 4.7, 9.3, 17.6, 28.0], [40.0, 21.0, 7.0, 20.0, 11.0, 16.0, 5.0, 4.0, 0.0, 1.0, 2.0, 4.0, 2.2, 45.5, 25.0, 16.8, 10.5, 7.3, 6.5, 5.1, 9.2, 17.0, 24.8], [49.0, 25.0, 9.0, 30.0, 19.0, 25.0, 7.0, 5.0, 1.0, 2.0, 1.0, 3.0, 2.0, 72.5, 38.6, 23.8, 16.9, 10.7, 10.9, 7.6, 14.2, 24.7, 42.9], [49.0, 23.0, 9.0, 22.0, 17.0, 21.0, 5.0, 11.0, 1.0, 2.0, 1.0, 4.0, 2.2, 57.0, 31.8, 18.0, 12.8, 7.2, 8.2, 4.8, 11.2, 17.8, 30.0], [42.0, 27.0, 8.0, 23.0, 16.0, 19.0, 5.0, 7.0, 0.0, 0.0, 2.0, 3.0, 2.2, 58.2, 33.6, 18.3, 12.2, 7.9, 7.1, 4.9, 10.8, 21.1, 27.8], [43.0, 28.0, 8.0, 23.0, 16.0, 18.0, 5.0, 5.0, 1.0, 1.0, 1.0, 2.0, 2.3, 60.8, 28.5, 18.6, 12.7, 8.4, 7.6, 5.6, 10.6, 19.8, 31.0], [45.0, 24.0, 9.0, 29.0, 18.0, 26.0, 6.0, 4.0, 2.0, 2.0, 1.0, 3.0, 2.5, 57.0, 28.9, 21.0, 13.3, 8.5, 8.3, 5.3, 9.7, 22.0, 33.7], [42.0, 26.0, 7.0, 21.0, 17.0, 21.0, 5.0, 4.0, 1.0, 1.0, 2.0, 3.0, 2.7, 62.8, 33.1, 19.0, 13.1, 8.4, 7.7, 4.2, 11.7, 21.2, 31.0], [36.0, 25.0, 7.0, 17.0, 9.0, 16.0, 5.0, 3.0, 1.0, 2.0, 3.0, 3.0, 2.2, 60.0, 36.0, 16.9, 11.4, 7.3, 6.5, 5.2, 10.1, 18.2, 26.0], [51.0, 26.0, 8.0, 31.0, 19.0, 25.0, 8.0, 6.0, 1.0, 2.0, 1.0, 1.0, 2.6, 72.5, 32.5, 24.4, 17.0, 10.7, 10.9, 7.8, 11.9, 25.6, 38.5], [51.0, 28.0, 9.0, 30.0, 18.0, 23.0, 7.0, 4.0, 2.0, 3.0, 2.0, 2.0, 2.7, 70.0, 42.8, 21.5, 14.5, 9.2, 9.7, 6.8, 9.3, 22.7, 35.5], [41.0, 27.0, 7.0, 21.0, 14.0, 24.0, 5.0, 6.0, 0.0, 0.0, 2.0, 1.0, 2.5, 55.0, 32.5, 17.3, 11.6, 7.5, 7.0, 5.2, 7.7, 18.2, 26.6], [49.0, 23.0, 10.0, 31.0, 19.0, 23.0, 6.0, 6.0, 1.0, 2.0, 1.0, 1.0, 2.5, 56.5, 28.6, 20.3, 13.8, 9.0, 9.0, 6.4, 9.8, 22.4, 35.5], [50.0, 24.0, 11.0, 30.0, 20.0, 20.0, 6.0, 7.0, 2.0, 2.0, 1.0, 1.0, 2.2, 71.0, 33.5, 24.0, 16.7, 10.6, 11.3, 8.0, 12.6, 24.3, 35.2], [51.0, 25.0, 8.0, 24.0, 17.0, 23.0, 6.0, 12.0, 1.0, 2.0, 1.0, 4.0, 2.8, 49.7, 27.9, 16.6, 11.6, 6.0, 7.4, 4.7, 9.7, 15.8, 25.5], [42.0, 25.0, 11.0, 21.0, 14.0, 25.0, 6.0, 11.0, 2.0, 2.0, 3.0, 3.0, 2.1, 58.0, 34.4, 18.2, 12.3, 7.8, 7.8, 6.0, 8.2, 18.6, 27.4], [40.0, 26.0, 6.0, 22.0, 15.0, 23.0, 6.0, 10.0, 1.0, 2.0, 2.0, 3.0, 2.6, 55.0, 30.1, 16.6, 11.5, 7.3, 7.2, 4.8, 7.0, 19.1, 28.0], [47.0, 27.0, 10.0, 24.0, 17.0, 23.0, 6.0, 5.0, 1.0, 2.0, 2.0, 4.0, 2.1, 64.5, 32.6, 22.9, 14.4, 7.0, 10.1, 6.2, 11.0, 23.7, 34.1], [43.0, 24.0, 7.0, 22.0, 14.0, 25.0, 6.0, 5.0, 1.0, 2.0, 2.0, 3.0, 2.8, 56.0, 32.3, 17.6, 11.6, 7.7, 7.4, 5.2, 8.3, 18.2, 28.3], [45.0, 22.0, 8.0, 23.0, 15.0, 26.0, 6.0, 7.0,

1.0, 2.0, 2.0, 4.0, 2.8, 50.0, 24.9, 16.2, 11.3, 7.4, 7.8, 5.4, 8.3, 17.2, 27.4], [51.0, 26.0, 10.0, 22.0, 16.0, 26.0, 7.0, 10.0, 1.0, 2.0, 2.0, 3.0, 2.4, 57.0, 31.0, 16.9, 11.3, 5.2, 6.8, 4.1, 9.0, 16.9,
26.9], [43.0, 27.0, 8.0, 23.0, 15.0, 19.0, 6.0, 5.0, 1.0, 1.0, 3.0, 3.0, 2.2, 48.0, 22.9, 16.7, 11.3, 7.3, 6.9, 4.8, 9.3, 16.6, 26.0], [48.0, 23.0, 12.0, 28.0, 18.0, 25.0, 6.0, 7.0, 1.0, 3.0, 1.0, 1.0, 2.6,
67.0, 37.8, 22.3, 15.9, 10.1, 11.5, 8.0, 10.9, 19.3, 38.3], [47.0, 26.0, 9.0, 30.0, 17.0, 23.0, 6.0, 3.0, 1.0, 2.0, 2.0, 3.0, 2.2, 67.0, 37.3, 21.6, 14.1, 9.2, 9.3, 6.8, 9.3, 20.4, 32.3], [43.0, 27.0, 9.0,
23.0, 16.0, 20.0, 5.0, 3.0, 1.0, 1.0, 1.0, 3.0, 2.3, 58.8, 31.9, 18.6, 12.2, 7.9, 7.0, 5.1, 11.2, 19.2, 29.5], [48.0, 24.0, 7.0, 30.0, 18.0, 25.0, 6.0, 6.0, 2.0, 3.0, 2.0, 1.0, 2.9, 47.0, 24.2, 16.4, 11.6,
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18.6, 7.4, 5.2, 9.1, 18.5, 30.2], [56.0, 22.0, 11.0, 27.0, 18.0, 28.0, 8.0, 15.0, 1.0, 2.0, 2.0, 3.0, 2.0, 55.9, 27.3, 19.9, 13.5, 7.0, 8.5, 5.1, 11.2, 17.2, 28.9], [49.0, 23.0, 10.0, 31.0, 20.0, 24.0, 8.0, 7.0, 2.0, 2.0, 1.0, 2.0, 2.5, 68.5, 35.3, 22.2, 16.3, 10.2, 10.8, 7.4, 12.3, 25.2, 37.4], [50.0, 28.0, 9.0, 28.0, 19.0, 15.0, 6.0, 6.0, 2.0, 2.0, 2.0, 4.0, 2.6, 76.0, 39.5, 21.6, 14.5, 9.5, 9.0, 6.3, 11.0, 23.0, 33.0], [40.0, 26.0, 9.0, 19.0, 15.0, 26.0, 7.0, 7.0, 1.0, 1.0, 2.0, 2.0, 2.5, 61.0, 36.2, 18.5, 12.0, 8.1, 7.6, 5.6, 8.3, 19.0, 28.9], [44.0, 25.0, 9.0, 23.0, 17.0, 14.0, 8.0, 10.0, 1.0, 2.0, 1.0, 2.0, 2.0, 58.4, 28.0, 21.4, 13.5, 4.4, 8.5, 5.9, 10.55, 20.0, 30.2], [48.0, 23.0, 8.0, 26.0, 17.0, 26.0, 6.0, 11.0, 1.0, 2.0, 2.0, 4.0, 2.6, 56.5, 29.6, 19.0, 13.0, 8.7, 8.5, 5.9, 7.9, 19.2, 31.6], [51.0, 24.0, 9.0, 31.0, 19.0, 24.0, 6.0, 7.0, 1.0, 2.0, 2.0, 3.0, 2.0, 61.5, 34.7, 20.0, 14.8, 9.2, 10.2, 6.7, 9.5, 23.0, 35.9], [49.0, 23.0, 8.0, 32.0, 19.0, 24.0, 6.0, 6.0, 2.0, 2.0, 1.0, 1.0, 2.9, 62.0, 30.9, 20.4, 14.2, 9.1, 9.7, 7.2, 10.1, 23.2, 37.4], [44.0, 27.0, 9.0, 23.0, 17.0, 20.0, 6.0, 4.0, 1.0, 1.0, 1.0, 4.0, 2.1, 58.4, 31.3, 17.4, 11.8, 7.6, 7.1, 4.8, 9.7, 18.7, 28.3], [43.0, 27.0, 8.0, 23.0, 16.0, 20.0, 7.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.2, 59.0, 31.0, 18.1, 12.9, 8.4, 7.1, 5.8, 10.1, 20.8, 29.8], [48.0, 25.0, 9.0, 21.0, 18.0, 28.0, 6.0, 9.0, 1.0, 3.0, 2.0, 3.0, 2.3, 55.0, 29.0, 15.6, 11.2, 6.0, 6.8, 3.5, 9.2, 15.5, 29.0], [44.0, 23.0, 7.0, 23.0, 14.0, 24.0, 7.0, 8.0, 1.0, 3.0, 3.0, 4.0, 2.6, 53.0, 26.0, 17.5, 10.9, 6.9, 6.7, 5.4, 7.6, 18.5, 29.2], [47.0, 25.0, 10.0, 27.0, 18.0, 25.0, 6.0, 4.0, 0.0, 0.0, 1.0, 1.0, 2.7, 71.0, 37.6, 24.2, 15.7, 11.1, 9.9, 7.2, 11.3, 25.3, 42.0], [43.0, 28.0, 10.0, 26.0, 17.0, 19.0, 6.0, 4.0, 0.0, 1.0, 1.0, 3.0, 2.5, 52.7, 24.8, 17.5, 12.0, 7.7, 7.5, 5.0, 10.6, 19.0, 29.8], [43.0, 27.0, 9.0, 23.0, 18.0, 21.0, 6.0, 4.0, 0.0, 1.0, 2.0, 3.0, 2.0, 55.0, 27.8, 17.5, 11.6, 7.4, 6.8, 5.1, 9.8, 19.0, 28.7], [44.0, 24.0, 9.0, 23.0, 15.0, 25.0, 5.0, 11.0, 2.0, 2.0, 2.0, 2.0, 2.5, 55.5, 29.9, 19.5, 12.2, 8.4, 7.3, 5.5, 9.5, 20.2, 30.7], [52.0, 22.0, 10.0, 24.0, 18.0, 27.0, 5.0, 9.0, 2.0, 3.0, 2.0, 4.0, 2.3, 61.0, 30.5, 20.2, 14.5, 7.1, 8.1, 5.1, 13.3, 19.5, 34.8], [51.0, 28.0, 11.0, 26.0, 18.0, 20.0, 6.0, 11.0, 1.0, 2.0, 2.0, 5.0, 2.0, 60.0, 30.4, 19.2, 12.2, 7.7, 7.1, 4.5, 10.5, 20.2, 30.0], [54.0, 22.0, 10.0, 25.0, 18.0, 27.0, 6.0, 10.0, 1.0, 4.0, 2.0, 3.0, 2.0, 52.8, 25.8, 18.0, 12.8, 6.2, 7.9, 4.8, 10.5, 17.2, 31.5], [38.0, 24.0, 5.0, 19.0, 8.0, 23.0, 5.0, 1.0, 0.0, 0.0, 2.0, 1.0, 2.1, 55.0, 29.4, 17.9, 10.7, 7.5, 6.9, 5.1, 7.0, 17.4, 25.1], [49.0, 24.0, 8.0, 31.0, 20.0, 24.0, 6.0, 5.0, 2.0, 2.0, 1.0, 1.0, 2.6, 55.0, 28.7, 20.0, 12.9, 8.3, 8.6, 5.8, 8.4, 21.2, 32.7], [47.0, 25.0, 9.0, 28.0, 18.0, 25.0, 5.0, 7.0, 1.0, 2.0, 2.0, 1.0, 2.7, 70.0, 37.2, 20.8, 14.0, 8.7, 8.1, 6.4, 9.5, 22.8, 34.2], [43.0, 27.0, 9.0, 22.0, 16.0, 19.0, 6.0, 6.0, 1.0, 2.0, 2.0, 3.0, 2.3, 51.4, 26.0, 16.1, 11.0, 6.7, 6.0, 4.5, 9.0, 16.8, 23.7], [43.0, 24.0, 8.0, 21.0, 14.0, 25.0, 6.0, 11.0, 0.0, 0.0, 2.0, 1.0, 3.0, 58.0, 32.7, 18.9, 12.1, 7.9, 7.5, 5.3, 8.0, 18.3, 28.4], [48.0, 25.0, 8.0, 28.0, 14.0, 25.0, 5.0, 9.0, 2.0, 2.0, 2.0, 4.0, 2.6, 56.0, 32.2, 17.5, 12.3, 7.9, 8.5, 6.0, 7.8, 17.5, 29.0], [48.0, 26.0, 8.0, 23.0, 18.0, 26.0, 5.0, 12.0, 1.0, 1.0, 1.0, 5.0, 2.2, 53.0, 28.8, 15.6, 10.5, 5.3, 6.6, 3.5, 8.0, 16.7, 27.0], [46.0, 24.0, 9.0, 24.0, 16.0, 27.0, 6.0, 6.0, 1.0, 1.0, 2.0, 4.0, 2.2, 57.0, 32.1, 18.1, 11.7, 7.5, 7.3, 5.3, 9.2, 19.0, 26.7], [49.0, 24.0, 10.0, 24.0, 15.0, 25.0, 6.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.0, 53.2, 25.0, 19.2, 12.2, 6.2, 7.2, 4.0, 11.2, 18.9, 32.2], [51.0, 22.0, 9.0, 27.0, 17.0, 25.0, 5.0, 9.0, 2.0, 4.0, 2.0, 3.0, 2.1, 53.3, 26.0, 19.4, 12.8, 6.8, 8.0, 4.8, 11.1, 19.2, 30.0], [50.0, 22.0, 10.0, 28.0, 19.0, 26.0, 7.0, 6.0, 2.0, 2.0, 1.0, 3.0, 2.2, 66.5, 33.9, 22.0, 16.2, 11.2, 11.0, 8.6, 10.8, 25.7, 38.3], [53.0, 24.0, 8.0, 23.0, 18.0, 26.0, 6.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.7, 60.1, 35.3, 20.5, 14.0, 7.6, 9.7, 5.8, 11.4, 19.0, 32.4], [44.0, 27.0, 8.0, 25.0, 17.0, 19.0, 5.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.6, 62.0, 32.4, 18.4, 12.4, 7.9, 6.9, 5.0, 11.1, 19.8, 29.6], [42.0, 26.0, 8.0, 21.0, 15.0, 21.0, 6.0, 8.0, 1.0, 1.0, 2.0, 4.0, 2.2, 56.0, 27.5, 20.0, 13.1, 8.9, 7.1, 5.4, 10.7, 21.2, 32.5], [42.0, 27.0, 8.0, 24.0, 16.0, 19.0, 5.0, 4.0, 0.0, 1.0, 2.0, 4.0, 2.3, 51.7, 25.0, 16.0, 10.9, 7.0, 6.4, 4.4, 9.7, 17.0, 25.7], [43.0, 25.0, 7.0, 29.0, 20.0, 19.0, 6.0, 10.0, 2.0, 2.0, 2.0, 4.0, 3.0, 52.0, 28.1, 16.2, 11.8, 7.8, 6.6, 5.0, 9.7, 20.1, 28.2], [39.0, 24.0, 8.0, 17.0, 8.0, 16.0, 6.0, 9.0, 1.0, 2.0, 3.0, 3.0, 2.0, 62.0, 38.0, 18.3, 11.5, 7.4, 6.4, 5.4, 10.6, 18.5, 28.3], [46.0, 22.0, 7.0, 23.0, 15.0, 26.0, 6.0, 9.0, 1.0, 2.0, 3.0, 3.0, 2.6, 57.0, 29.0, 19.3, 13.1, 8.7, 7.5, 5.4, 10.5, 20.0, 28.8], [51.0, 26.0, 9.0, 27.0, 19.0, 26.0, 8.0, 11.0, 2.0, 5.0, 2.0, 4.0, 3.0, 54.8, 32.0, 17.3, 11.5, 5.7, 6.7, 5.1, 9.4, 15.8, 26.8], [49.0, 25.0, 8.0, 29.0, 18.0, 22.0, 7.0, 4.0, 2.0, 2.0, 1.0, 1.0, 2.5, 69.0, 43.0, 22.1, 14.8, 9.0, 9.7, 6.3, 9.8, 22.4, 35.2], [54.0, 28.0, 9.0, 27.0, 19.0, 20.0, 6.0, 11.0, 1.0, 3.0, 2.0, 4.0, 2.1, 52.7, 26.3, 17.6, 11.7, 7.5, 6.4, 3.9, 9.3, 17.4, 28.0], [51.0, 23.0, 8.0, 32.0, 19.0, 27.0, 7.0, 7.0, 2.0, 3.0, 1.0, 1.0, 2.6, 48.5, 23.7, 16.8, 11.3, 7.3, 7.0, 5.2, 8.0, 17.6, 28.4], [46.0, 24.0, 7.0, 25.0, 15.0, 20.0, 6.0, 10.0, 1.0, 2.0, 2.0, 2.0, 2.4, 55.5, 28.0, 19.4, 12.8, 8.3, 7.6, 5.0, 10.6, 18.3, 26.4], [52.0, 29.0, 10.0, 26.0, 18.0, 20.0, 6.0, 13.0, 2.0, 2.0, 2.0, 4.0, 2.1, 67.0, 37.7, 19.2, 12.9, 8.4, 7.5, 5.0, 11.0, 20.6, 31.4], [51.0, 28.0, 8.0, 22.0, 21.0, 27.0, 8.0, 10.0, 2.0, 3.0, 2.0, 3.0, 3.0, 61.2, 37.0, 19.3, 11.9, 6.8, 7.8, 5.1, 9.8, 16.6, 27.9], [48.0, 25.0, 9.0, 32.0, 20.0, 23.0, 6.0, 7.0, 1.0, 2.0, 1.0, 3.0, 2.5, 70.0, 35.7, 24.6, 15.8, 10.0, 10.2, 6.8, 11.4, 26.2, 37.5], [47.0, 24.0, 8.0, 31.0, 18.0, 24.0, 5.0, 4.0, 1.0, 1.0, 1.0, 1.0, 2.0, 65.0, 35.4, 21.2, 15.0, 9.4, 10.0, 7.1, 10.3, 24.0, 37.5], [42.0, 26.0, 8.0, 23.0, 16.0, 19.0, 5.0, 3.0, 1.0, 1.0, 1.0, 4.0, 2.0, 62.3, 32.7, 20.2, 12.4, 8.5, 7.5, 5.2, 10.5, 20.4, 30.1], [44.0, 27.0, 8.0, 25.0, 15.0, 19.0, 6.0, 3.0, 2.0, 1.0, 2.0, 3.0, 2.0, 56.6, 26.3, 18.7, 11.5, 7.4, 7.2, 5.1, 9.4, 18.9, 29.0], [43.0, 26.0, 8.0, 22.0, 18.0, 19.0, 5.0, 6.0, 1.0, 1.0, 1.0, 4.0, 2.1, 63.7, 33.5, 20.2, 12.8, 8.3, 8.0, 5.3, 10.9, 20.0, 30.8], [41.0, 26.0, 7.0, 22.0, 14.0, 20.0, 6.0, 6.0, 1.0, 2.0, 1.0, 3.0, 2.3, 58.6, 29.8, 18.3, 13.0, 8.6, 7.8, 4.4, 12.0, 19.3, 29.6], [52.0, 25.0, 11.0, 30.0, 20.0, 26.0, 6.0, 4.0, 2.0, 2.0, 1.0, 1.0, 2.5, 54.0, 28.0, 19.8, 13.0, 8.2, 8.3, 5.9, 9.7, 20.0, 32.3], [43.0, 23.0, 9.0, 20.0, 14.0, 26.0, 7.0, 12.0, 0.0, 2.0, 2.0, 1.0, 2.6, 50.0, 26.7, 16.2, 11.4, 7.6, 6.5, 4.8, 8.7, 19.0, 27.5], [49.0, 23.0, 10.0, 27.0, 18.0, 23.0, 6.0, 6.0, 1.0, 3.0, 1.0, 1.0, 2.6, 56.5, 28.9, 12.6, 13.3, 8.3, 8.2, 5.8, 9.2, 21.5, 33.3], [48.0, 24.0, 9.0, 28.0, 17.0, 22.0, 6.0, 12.0, 2.0, 3.0, 1.0, 5.0, 2.7, 53.6, 31.3, 18.6, 12.3, 6.0, 8.3, 5.5, 12.0, 17.3, 29.0], [44.0, 24.0, 8.0, 21.0, 18.0, 24.0, 6.0, 12.0, 2.0, 2.0, 3.0, 4.0, 2.6, 57.0, 32.7, 19.5, 12.9, 8.2, 8.5, 6.1, 8.7, 19.3, 29.7], [52.0, 25.0, 9.0, 22.0, 19.0, 27.0, 6.0, 8.0, 2.0, 4.0, 2.0, 2.0, 2.2, 62.8, 35.3, 17.9, 12.3, 7.6, 8.0, 4.2, 10.3, 17.0, 27.8], [51.0, 23.0, 8.0, 21.0, 16.0, 20.0, 5.0, 7.0, 2.0, 4.0, 2.0, 5.0, 2.8, 62.0, 31.4, 20.9, 13.6, 8.8, 7.6, 5.3, 11.0, 21.2, 31.8], [40.0, 25.0, 8.0, 23.0, 13.0, 25.0, 6.0, 8.0, 1.0, 2.0, 2.0, 4.0, 2.7, 46.5, 23.6, 16.2, 10.7, 6.9, 6.8, 4.6, 7.0, 17.5, 26.6], [47.0, 23.0, 9.0, 32.0, 21.0, 25.0, 6.0, 5.0, 1.0, 2.0, 1.0, 1.0, 2.1, 71.5, 35.0, 24.7, 17.0, 10.7, 11.4, 7.6, 11.9, 25.7, 41.1], [51.0, 22.0, 10.0, 23.0, 19.0, 25.0, 6.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.2, 57.2, 28.5, 20.5, 13.9, 5.5, 8.0, 4.3, 12.2, 19.2, 32.2], [48.0, 24.0, 13.0, 23.0, 18.0, 27.0, 7.0, 10.0, 2.0, 4.0, 2.0, 3.0, 2.3, 58.2, 30.6, 19.9, 14.0, 7.0, 8.5, 4.5, 12.0, 20.2, 34.5], [55.0, 26.0, 11.0, 27.0, 17.0, 20.0, 5.0, 11.0, 1.0, 2.0, 2.0, 5.0, 2.8, 61.5, 31.4, 18.6, 12.4, 7.7, 6.7, 4.4, 9.8, 18.5, 29.4], [44.0, 27.0, 8.0, 21.0, 16.0, 20.0, 5.0, 3.0, 1.0, 1.0, 2.0, 4.0, 2.0, 66.6, 35.3, 20.4, 13.0, 8.5, 7.7, 5.9, 12.8, 20.5, 32.5], [42.0, 27.0, 11.0, 23.0, 17.0, 20.0, 5.0, 5.0, 1.0, 1.0, 1.0, 3.0, 2.1, 62.5, 30.5, 20.0, 12.4, 7.8, 7.8, 5.4, 10.7, 20.5, 28.0], [41.0, 24.0, 9.0, 23.0, 17.0, 23.0, 5.0, 9.0, 2.0, 2.0, 2.0, 5.0, 2.3, 59.0, 33.8, 18.1, 13.4, 9.1, 8.7, 6.3, 9.3, 19.5, 28.1], [50.0, 25.0, 10.0, 31.0, 16.0, 25.0, 6.0, 5.0, 2.0, 3.0, 2.0, 1.0, 2.8, 70.0, 40.0, 21.8, 14.4, 9.0, 9.4, 6.4, 10.0, 22.5, 33.0], [50.0, 24.0, 10.0, 30.0, 20.0, 26.0, 8.0, 10.0, 2.0, 3.0, 1.0, 1.0, 3.0, 70.5, 33.3, 22.3, 16.2, 10.2, 10.7, 7.5, 11.2, 24.7, 40.6], [40.0, 25.0, 7.0, 21.0, 12.0, 24.0, 6.0, 7.0, 1.0, 2.0, 3.0, 2.0, 2.1, 53.0, 30.6, 17.0, 10.9, 7.1, 6.8, 5.1, 7.6, 18.3, 26.2], [40.0, 23.0, 7.0, 21.0, 18.0, 26.0, 7.0, 8.0, 0.0, 1.0, 2.0, 4.0, 2.9, 57.0, 30.8, 20.2, 13.1, 8.5, 8.5, 6.1, 11.0, 19.0, 28.7], [41.0, 27.0, 9.0, 21.0, 16.0, 20.0, 3.0, 6.0, 1.0, 1.0, 2.0, 3.0, 2.0, 65.5, 35.3, 18.3, 12.5, 7.9, 7.3, 5.8, 10.4, 20.3, 29.6], [47.0, 23.0, 9.0, 24.0, 20.0, 26.0, 4.0, 10.0, 0.0, 1.0, 1.0, 4.0, 2.6, 56.6, 28.3, 19.5, 13.9, 6.2, 8.2, 4.2, 12.8, 18.8, 31.0], [45.0, 27.0, 9.0, 22.0, 15.0, 21.0, 5.0, 5.0, 0.0, 1.0, 1.0, 3.0, 2.2, 56.2, 30.0, 17.1, 11.8, 7.5, 7.2, 4.6, 9.8, 17.0, 26.6], [42.0, 23.0, 8.0, 22.0, 15.0, 24.0, 6.0, 8.0, 1.0, 1.0, 2.0, 5.0, 2.8, 57.0, 29.2, 19.9, 13.1, 8.9, 9.0, 6.0, 9.6, 19.8, 31.0], [45.0, 25.0, 7.0, 23.0, 13.0, 23.0, 6.0, 10.0, 0.0, 0.0, 3.0, 4.0, 2.7, 58.5, 32.7, 17.9, 11.6, 7.3, 7.0, 5.0, 7.9, 16.9, 27.0], [47.0, 24.0, 8.0, 31.0, 17.0, 24.0, 7.0, 2.0, 2.0, 2.0, 1.0, 1.0, 2.3, 62.0, 32.7, 22.0, 14.9, 9.2, 10.0, 6.6, 9.7, 23.5, 35.5], [43.0, 24.0, 7.0, 21.0, 14.0, 24.0, 7.0, 7.0, 1.0, 1.0, 2.0, 2.0, 2.8, 58.0, 27.9, 18.8, 12.5, 8.3, 8.7, 5.8, 8.5, 19.2, 31.0], [50.0, 25.0, 11.0, 24.0, 20.0, 27.0, 7.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.8, 56.0, 27.6, 19.5, 13.3, 6.5, 8.5, 6.0, 11.6, 19.4, 33.0], [45.0, 24.0, 9.0, 27.0, 14.0, 19.0, 5.0, 7.0, 2.0, 3.0, 2.0, 4.0, 2.7, 56.0, 27.5, 19.7, 13.0, 8.3, 7.4, 5.3, 10.2, 18.5, 29.7], [39.0, 25.0, 9.0, 21.0, 8.0, 16.0, 5.0, 4.0, 1.0, 1.0, 2.0, 3.0, 2.0, 60.0, 33.7, 18.0, 11.8, 7.7, 7.0, 5.6, 9.8, 17.0, 27.4]]

## Question 4 Subset a:

TrainX: [[42.0, 27.0, 8.0, 23.0, 15.0, 20.0, 6.0, 3.0, 0.0, 1.0, 1.0, 3.0, 2.1, 58.0, 28.5, 18.8, 12.0, 7.8, 6.7, 4.8, 10.5, 19.2, 28.2], [44.0, 26.0, 9.0, 24.0, 14.0, 22.0, 5.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.3, 56.0, 28.3, 18.2, 11.8, 7.7, 7.7, 5.5, 10.6, 19.3, 29.0], [45.0, 26.0, 10.0, 23.0, 17.0, 19.0, 6.0, 7.0, 1.0, 1.0, 1.0, 4.0, 2.1, 60.0, 29.8, 19.8, 12.7, 7.9, 7.8, 5.3, 10.3, 19.2, 29.4], [44.0, 27.0, 8.0, 24.0, 15.0, 21.0, 6.0, 4.0, 1.0, 2.0, 1.0, 4.0, 2.2, 49.5, 25.1, 16.7, 11.0, 7.3, 6.5, 4.8, 10.0, 17.0, 5.0], [43.0, 26.0, 8.0, 23.0, 16.0, 18.0, 6.0, 4.0, 1.0, 2.0, 1.0, 3.0, 2.1, 61.0, 31.8, 18.7, 12.7, 8.7, 7.7, 5.3, 11.1, 21.2, 29.8], [43.0, 27.0, 8.0, 23.0, 17.0, 20.0, 5.0, 5.0, 1.0, 1.0, 1.0, 3.0, 2.1, 58.2, 29.5, 18.6, 11.7, 7.6, 7.0, 4.8, 9.8, 19.0, 27.5], [42.0, 25.0, 11.0, 20.0, 14.0, 19.0, 4.0, 3.0, 1.0, 1.0, 2.0, 4.0, 2.0, 50.5, 23.1, 17.2, 12.1, 7.8, 7.3, 5.2, 9.5, 17.6, 28.1], [44.0, 27.0, 9.0, 23.0, 16.0, 20.0, 6.0, 5.0, 1.0, 1.0, 1.0, 4.0, 2.0, 59.4, 30.3, 19.0, 12.4, 8.1, 7.8, 5.1, 10.6, 19.7, 31.7], [44.0, 26.0, 10.0, 25.0, 15.0, 20.0, 6.0, 4.0, 1.0, 1.0, 1.0, 3.0, 2.2, 59.5, 30.0, 19.6, 12.4, 8.0, 6.8, 4.7, 10.0, 20.5, 27.0], [42.0, 27.0, 8.0, 24.0, 16.0, 19.0, 5.0, 4.0, 0.0, 1.0, 2.0, 4.0, 2.3, 51.7, 25.0, 16.0, 10.9, 7.0, 6.4, 4.4, 9.7, 17.0, 25.7], [55.0, 27.0, 11.0, 26.0, 19.0, 19.0, 6.0, 13.0, 2.0, 2.0, 2.0, 6.0, 2.2, 57.7, 31.4, 17.5, 12.1, 7.8, 6.7, 5.0, 9.9, 18.2, 27.6], [42.0, 26.0, 7.0, 21.0, 17.0, 21.0, 5.0, 4.0, 1.0, 1.0, 2.0, 3.0, 2.7, 62.8, 33.1, 19.0, 13.1, 8.4, 7.7, 4.2, 11.7, 21.2, 31.0], [44.0, 27.0, 8.0, 23.0, 16.0, 19.0, 5.0, 5.0, 1.0, 0.0, 3.0, 3.0, 2.6, 59.4, 30.8, 18.1, 12.4, 7.8, 7.2, 5.4, 9.9, 20.5, 28.6], [44.0, 27.0, 10.0, 25.0, 16.0, 22.0, 6.0, 4.0, 1.0, 0.0, 1.0, 3.0, 2.0, 57.5, 28.5, 18.5, 12.1, 7.9, 7.1, 4.9, 9.9, 19.2, 29.7], [43.0, 27.0, 8.0, 23.0, 15.0, 19.0, 6.0, 5.0, 1.0, 1.0, 3.0, 3.0, 2.2, 48.0, 22.9, 16.7, 11.3, 7.3, 6.9, 4.8, 9.3, 16.6, 26.0], [44.0, 27.0, 10.0, 22.0, 15.0, 20.0, 6.0, 7.0, 1.0, 1.0, 2.0, 4.0, 1.8, 66.0, 40.3, 20.2, 13.0, 8.1, 8.4, 6.1, 11.3, 20.5, 29.7], [52.0, 28.0, 10.0, 25.0, 17.0, 20.0, 6.0, 11.0, 2.0, 2.0, 2.0, 3.0, 2.3, 56.3, 29.5, 17.9, 11.7, 7.3, 6.3, 4.0, 9.6, 18.2, 27.4], [42.0, 26.0, 9.0, 25.0, 15.0, 19.0, 6.0, 5.0, 1.0, 2.0, 2.0, 4.0, 2.1, 56.7, 30.0, 18.7, 11.7, 7.6, 7.4, 4.9, 10.7, 18.6, 29.8], [55.0, 28.0, 10.0, 26.0, 17.0, 21.0, 6.0, 10.0, 2.0, 2.0, 2.0, 5.0, 2.0, 59.3, 29.2, 18.5, 12.0, 7.9, 6.7, 4.9, 9.9, 20.1, 28.6], [42.0, 26.0, 8.0, 23.0, 16.0, 19.0, 5.0, 3.0, 1.0, 1.0, 1.0, 4.0, 2.0, 62.3, 32.7, 20.2, 12.4, 8.5, 7.5, 5.2, 10.5, 20.4, 30.1], [42.0, 27.0, 10.0, 24.0, 17.0, 21.0, 6.0, 5.0, 1.0, 1.0, 1.0, 4.0, 2.1, 62.5, 32.0, 19.6, 12.5, 8.0, 7.9, 5.4, 11.0, 20.1, 29.5], [55.0, 28.0, 11.0, 25.0, 17.0, 20.0, 7.0, 12.0, 1.0, 3.0, 2.0, 4.0, 2.1, 59.5, 30.6, 18.8, 12.0, 7.8, 6.5, 4.9, 10.3, 18.6, 26.6], [57.0, 28.0, 11.0, 27.0, 17.0, 20.0, 5.0, 11.0, 1.0, 2.0, 2.0, 5.0, 2.2, 57.0, 30.0, 18.0, 11.8, 7.4, 6.7, 4.1, 9.7, 18.0, 27.0], [42.0, 27.0, 10.0, 25.0, 14.0, 19.0, 6.0, 4.0, 0.0, 1.0, 1.0, 4.0, 2.2, 55.9, 30.5, 16.8, 11.3, 7.3, 6.5, 5.0, 10.0, 18.4, 26.6], [55.0, 26.0, 11.0, 27.0, 17.0, 20.0, 5.0, 11.0, 1.0, 2.0, 2.0, 5.0, 2.8, 61.5, 31.4, 18.6, 12.4, 7.7, 6.7, 4.4, 9.8, 18.5, 29.4], [46.0, 29.0, 9.0, 24.0, 17.0, 19.0, 6.0, 3.0, 0.0, 2.0, 2.0, 3.0, 2.0, 56.0, 27.5, 17.3, 11.3, 7.3, 7.3, 4.8, 9.6, 18.0, 27.7], [45.0, 28.0, 9.0, 25.0, 16.0, 19.0, 6.0, 6.0, 0.0, 1.0, 2.0, 3.0, 2.3, 64.0, 35.0, 19.2, 12.9, 8.4, 7.5, 5.5, 10.5, 20.0, 28.6], [42.0, 24.0, 8.0, 21.0, 14.0, 20.0, 5.0, 6.0, 1.0, 1.0, 2.0, 3.0, 2.2, 59.8, 30.7, 18.4, 12.8, 8.7, 8.7, 4.6, 10.9, 21.5, 30.3], [43.0, 27.0, 8.0, 23.0, 16.0, 20.0, 7.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.2, 59.0, 31.0, 18.1, 12.9, 8.4, 7.1, 5.8, 10.1, 20.8, 29.8], [43.0, 28.0, 10.0, 26.0, 17.0, 19.0, 6.0, 4.0, 0.0, 1.0, 1.0, 3.0, 2.5, 52.7, 24.8, 17.5, 12.0, 7.7, 7.5, 5.0, 10.6, 19.0, 29.8], [44.0, 27.0, 11.0, 24.0, 16.0, 18.0, 5.0, 4.0, 1.0, 1.0, 1.0, 3.0, 2.4, 60.6, 31.6, 18.6, 12.2, 7.8, 7.4, 5.4, 11.0, 19.7, 29.0], [43.0, 27.0, 9.0, 23.0, 16.0, 20.0, 5.0, 3.0, 1.0, 1.0, 1.0, 3.0, 2.3, 58.8, 31.9, 18.6, 12.2, 7.9, 7.0, 5.1, 11.2, 19.2, 29.5], [42.0, 27.0, 10.0, 22.0, 16.0, 19.0, 6.0, 5.0, 1.0, 1.0, 2.0, 4.0, 2.0, 58.2, 33.4, 18.4, 12.4, 7.9, 7.3, 5.0, 10.8, 19.8, 28.5], [42.0, 27.0, 9.0, 21.0, 16.0, 18.0, 6.0, 4.0, 0.0, 1.0, 1.0, 3.0, 2.2, 51.5, 25.0, 16.2, 10.8, 7.2, 6.6, 4.9, 9.7, 17.4, 24.8], [54.0, 28.0, 9.0, 27.0, 19.0, 20.0, 6.0, 11.0, 1.0, 3.0, 2.0, 4.0, 2.1, 52.7, 26.3, 17.6, 11.7, 7.5, 6.4, 3.9, 9.3, 17.4, 28.0], [43.0, 27.0, 9.0, 22.0, 16.0, 19.0, 6.0, 6.0, 1.0, 2.0, 2.0, 3.0, 2.3, 51.4, 26.0, 16.1, 11.0, 6.7, 6.0, 4.5, 9.0, 16.8, 23.7], [43.0, 24.0, 9.0, 24.0, 16.0, 19.0, 6.0, 10.0, 1.0, 1.0, 2.0, 2.0, 2.5, 59.0, 32.0, 18.7, 13.1, 8.8, 7.5, 5.5, 10.1, 21.2, 29.8], [43.0, 27.0, 9.0, 24.0, 17.0, 20.0, 5.0, 4.0, 1.0, 1.0, 1.0, 3.0, 2.3, 53.0, 26.7, 16.5, 11.0, 7.2, 6.5, 4.6, 9.3, 17.8, 28.1], [45.0, 27.0, 9.0, 23.0, 17.0, 20.0, 6.0, 9.0, 1.0, 1.0, 2.0, 4.0, 2.2, 60.8, 31.8, 20.0, 12.9, 8.4, 7.4, 5.5, 11.5, 18.6, 29.0], [44.0, 27.0, 8.0, 25.0, 17.0, 19.0, 5.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.6, 62.0, 32.4, 18.4, 12.4, 7.9, 6.9, 5.0, 11.1, 19.8, 29.6], [46.0, 27.0, 9.0, 23.0, 14.0, 21.0, 6.0, 7.0, 1.0, 2.0, 1.0, 4.0, 2.4, 59.2, 30.9, 18.5, 12.2, 8.1, 7.1, 5.2, 9.7, 19.5, 29.0], [42.0, 27.0, 9.0, 22.0, 16.0, 19.0, 5.0, 6.0, 1.0, 0.0, 2.0, 4.0, 2.2, 56.9, 28.0, 17.7, 12.2, 8.3, 7.2, 5.6, 10.6, 19.0, 29.8], [42.0, 27.0, 10.0, 21.0, 17.0, 18.0, 5.0, 4.0, 1.0, 1.0, 2.0, 3.0, 2.2, 64.5, 36.1, 19.2, 13.1, 8.3, 7.4, 5.1, 11.1, 20.1, 27.0], [42.0, 27.0, 9.0, 21.0, 13.0, 20.0, 5.0, 5.0, 1.0, 1.0, 1.0, 4.0, 2.2, 66.0, 37.0, 20.3, 13.0, 8.8, 8.0, 5.7, 11.0, 21.4, 30.5], [44.0, 26.0, 9.0, 23.0, 15.0, 21.0, 6.0, 7.0, 1.0, 1.0, 1.0, 3.0, 2.3, 61.0, 33.7, 18.9, 12.8, 8.6, 7.8, 5.4, 11.3, 20.0, 29.3], [51.0, 28.0, 11.0, 26.0, 18.0, 20.0, 6.0, 11.0, 1.0, 2.0, 2.0, 5.0, 2.0, 60.0, 30.4, 19.2, 12.2, 7.7, 7.1, 4.5, 10.5, 20.2, 30.0], [42.0, 27.0, 9.0, 24.0, 16.0, 19.0, 5.0, 7.0, 1.0, 1.0, 1.0, 3.0, 2.5, 62.7, 32.5, 19.3, 12.3, 7.8, 7.4, 4.7, 9.6, 20.6, 29.8], [44.0, 29.0, 12.0, 26.0, 18.0, 20.0, 5.0, 10.0, 2.0, 2.0, 2.0, 5.0, 2.5, 64.5, 31.7, 18.9, 12.8, 8.4, 7.2, 5.3, 11.7, 19.4, 28.3], [43.0, 27.0, 9.0, 23.0, 18.0, 21.0, 6.0, 4.0, 0.0, 1.0, 2.0, 3.0, 2.0, 55.0, 27.8, 17.5, 11.6, 7.4, 6.8, 5.1, 9.8, 19.0, 28.7], [55.0, 29.0, 10.0, 28.0, 17.0, 20.0, 7.0, 11.0, 2.0, 3.0, 2.0, 5.0, 2.2, 61.5, 30.5, 18.6, 12.1, 8.0, 6.2, 5.1, 9.9, 18.3, 26.7], [43.0, 27.0, 10.0, 25.0, 16.0, 19.0, 6.0, 6.0, 1.0, 1.0, 1.0, 4.0, 2.0, 57.2, 29.7, 17.4, 11.6, 7.7, 7.3, 4.6, 10.2, 18.5, 28.7], [41.0, 27.0, 9.0, 21.0, 16.0, 20.0, 3.0, 6.0, 1.0, 1.0, 2.0, 3.0, 2.0, 65.5, 35.3, 18.3, 12.5, 7.9, 7.3, 5.8, 10.4, 20.3, 29.6], [55.0, 28.0, 11.0, 27.0, 21.0, 20.0, 6.0, 11.0, 2.0, 2.0, 2.0, 5.0, 2.9, 52.3, 26.8, 17.7, 11.5, 7.3, 6.3, 3.8, 9.4, 18.0, 27.7], [44.0, 28.0, 9.0, 22.0, 16.0, 19.0, 6.0, 5.0, 0.0, 2.0, 1.0, 3.0, 2.3, 64.5, 34.0, 18.8, 12.6, 8.3, 8.5, 6.0, 10.3, 21.2, 29.1], [49.0, 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7.2, 5.1, 9.4, 18.9, 29.0], [44.0, 26.0, 9.0, 21.0, 16.0, 20.0, 6.0, 3.0, 0.0, 1.0, 2.0, 4.0, 2.3, 53.9, 27.4, 17.6, 11.4, 7.5, 7.0, 5.0, 9.6, 17.5, 26.0], [43.0, 27.0, 9.0, 23.0, 16.0, 20.0, 4.0, 7.0, 1.0, 1.0, 1.0, 4.0, 2.0, 54.2, 31.1, 17.1, 11.7, 7.4, 7.2, 5.1, 9.4, 17.8, 27.9], [52.0, 29.0, 10.0, 26.0, 18.0, 20.0, 6.0, 13.0, 2.0, 2.0, 2.0, 4.0, 2.1, 67.0, 37.7, 19.2, 12.9, 8.4, 7.5, 5.0, 11.0, 20.6, 31.4], [43.0, 27.0, 8.0, 24.0, 16.0, 19.0, 5.0, 7.0, 1.0, 1.0, 1.0, 4.0, 2.2, 61.0, 30.8, 19.2, 12.6, 7.8, 7.2, 5.1, 10.4, 20.2, 30.0], [42.0, 27.0, 9.0, 22.0, 15.0, 19.0, 6.0, 4.0, 0.0, 0.0, 2.0, 3.0, 2.2, 59.4, 31.2, 16.8, 11.7, 7.3, 6.9, 4.7, 9.6, 19.0, 28.2], [42.0, 27.0, 10.0, 24.0, 18.0, 21.0, 6.0, 8.0, 0.0, 1.0, 3.0, 4.0, 2.1, 56.3, 28.0, 17.7, 11.3, 7.5, 7.2, 5.2, 10.1, 18.4, 29.0], [46.0, 26.0, 9.0, 23.0, 16.0, 20.0, 5.0, 5.0, 1.0, 1.0, 1.0, 3.0, 2.2, 57.2, 27.0, 19.9, 12.2, 8.0, 7.2, 5.2, 10.4, 19.0, 29.2], [42.0, 27.0, 11.0, 23.0, 17.0, 20.0, 5.0, 5.0, 1.0, 1.0, 1.0, 3.0, 2.1, 62.5, 30.5, 20.0, 12.4, 7.8, 7.8, 5.4, 10.7, 20.5, 28.0], [42.0, 27.0, 8.0, 23.0, 16.0, 19.0, 5.0, 7.0, 0.0, 0.0, 2.0, 3.0, 2.2, 58.2, 33.6, 18.3, 12.2, 7.9, 7.1, 4.9, 10.8, 21.1, 27.8], [44.0, 28.0, 11.0, 21.0, 15.0, 19.0, 6.0, 5.0, 1.0, 0.0, 1.0, 3.0, 2.0, 58.3, 30.8, 17.3, 11.9, 7.5, 7.8, 5.5, 9.9, 19.5, 28.2], [45.0, 27.0, 9.0, 22.0, 15.0, 21.0, 5.0, 5.0, 0.0, 1.0, 1.0, 3.0, 2.2, 56.2, 30.0, 17.1, 11.8, 7.5, 7.2, 4.6, 9.8, 17.0, 26.6], [43.0, 26.0, 9.0, 23.0, 16.0, 19.0, 5.0, 3.0, 1.0, 1.0, 3.0, 5.0, 2.2, 59.3, 29.5, 19.0, 12.4, 8.3, 7.4, 5.4, 10.9, 19.8, 30.5], [46.0, 28.0, 9.0, 25.0, 14.0, 21.0, 5.0, 7.0, 0.0, 0.0, 1.0, 4.0, 2.4, 56.7, 28.6, 17.5, 11.7, 7.6, 6.8, 4.9, 10.0, 17.8, 28.0], [43.0, 27.0, 8.0, 22.0, 17.0, 21.0, 6.0, 5.0, 1.0, 1.0, 1.0, 4.0, 2.0, 49.0, 24.0, 17.5, 11.3, 7.0, 6.3, 4.4, 9.0, 17.8, 26.3], [41.0, 28.0, 10.0, 24.0, 14.0, 19.0, 6.0, 5.0, 1.0, 1.0, 1.0, 4.0, 2.5, 53.5, 27.4, 17.3, 11.2, 7.2, 7.0, 5.0, 10.0, 7.1, 26.8], [44.0, 27.0, 10.0, 22.0, 15.0, 20.0, 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## Question 4 Subset b:

TrainX: [[55.0, 25.0, 8.0, 26.0, 19.0, 24.0, 7.0, 12.0, 1.0, 4.0, 2.0, 3.0, 3.0, 57.7, 32.5, 17.5, 13.1, 6.2, 8.7, 5.8, 12.4, 19.9, 32.9], [52.0, 25.0, 9.0, 24.0, 18.0, 27.0, 7.0, 12.0, 1.0, 4.0, 2.0, 4.0, 2.0, 58.3, 33.8, 17.6, 11.4, 5.6, 6.9, 4.0, 9.0, 18.2, 30.0], [53.0, 23.0, 10.0, 25.0, 19.0, 24.0, 6.0, 11.0, 2.0, 2.0, 1.0, 6.0, 2.1, 52.2, 27.0, 17.0, 12.2, 6.0, 8.2, 4.3, 11.2, 17.0, 29.8], [53.0, 24.0, 8.0, 23.0, 18.0, 26.0, 6.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.7, 60.1, 35.3, 20.5, 14.0, 7.6, 9.7, 5.8, 11.4, 19.0, 32.4], [46.0, 28.0, 7.0, 25.0, 16.0, 22.0, 6.0, 8.0, 2.0, 3.0, 2.0, 5.0, 2.7, 58.5, 37.2, 16.9, 11.3, 5.1, 7.0, 5.0, 9.8, 15.4, 24.8], [52.0, 22.0, 10.0, 24.0, 18.0, 27.0, 5.0, 9.0, 2.0, 3.0, 2.0, 4.0, 2.3, 61.0, 30.5, 20.2, 14.5, 7.1, 8.1, 5.1, 13.3, 19.5, 34.8], [49.0, 25.0, 9.0, 25.0, 17.0, 23.0, 6.0, 12.0, 2.0, 2.0, 2.0, 5.0, 2.4, 39.0, 20.2, 12.1, 8.8, 5.8, 5.0, 3.0, 8.0, 13.0, 19.8], [48.0, 24.0, 9.0, 25.0, 18.0, 22.0, 4.0, 10.0, 1.0, 2.0, 1.0, 4.0, 2.1, 56.8, 31.7, 18.2, 12.6, 6.8, 8.2, 4.5, 10.5, 18.4, 30.5], [49.0, 23.0, 10.0, 25.0, 18.0, 24.0, 5.0, 11.0, 3.0, 3.0, 1.0, 5.0, 2.0, 56.0, 30.5, 18.2, 13.4, 6.5, 8.0, 5.6, 11.5, 17.2, 28.5], [52.0, 23.0, 7.0, 23.0, 17.0, 25.0, 5.0, 10.0, 1.0, 1.0, 1.0, 3.0, 2.7, 51.5, 31.2, 16.0, 10.6, 5.2, 6.6, 4.5, 9.5, 15.8, 23.3], [50.0, 22.0, 9.0, 25.0, 19.0, 27.0, 6.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.4, 59.0, 28.0, 19.8, 13.8, 7.0, 8.8, 4.8, 11.1, 19.2, 34.5], [54.0, 25.0, 11.0, 26.0, 18.0, 25.0, 8.0, 11.0, 3.0, 5.0, 2.0, 3.0, 2.1, 59.0, 31.2, 17.3, 12.0, 6.2, 7.8, 4.1, 9.4, 16.8, 29.2], [52.0, 25.0, 8.0, 24.0, 16.0, 20.0, 6.0, 10.0, 1.0, 1.0, 1.0, 4.0, 2.7, 47.5, 23.8, 16.1, 11.3, 6.1, 7.6, 5.1, 9.4, 16.2, 25.5], [47.0, 30.0, 9.0, 23.0, 16.0, 23.0, 5.0, 8.0, 1.0, 3.0, 2.0, 3.0, 2.1, 58.4, 33.9, 17.5, 11.0, 5.5, 7.5, 4.7, 10.3, 17.6, 26.2], [53.0, 22.0, 8.0, 25.0, 16.0, 24.0, 6.0, 12.0, 2.0, 2.0, 1.0, 4.0, 2.3, 54.0, 26.2, 19.8, 13.4, 6.4, 9.2, 4.9, 13.0, 17.8, 30.5], [43.0, 28.0, 9.0, 24.0, 15.0, 23.0, 6.0, 11.0, 1.0, 1.0, 2.0, 3.0, 2.0, 53.4, 33.3, 15.6, 10.3, 5.3, 6.1, 4.3, 9.2, 15.3, 23.6], [54.0, 22.0, 10.0, 25.0, 18.0, 27.0, 6.0, 10.0, 1.0, 4.0, 2.0, 3.0, 2.0, 52.8, 25.8, 18.0, 12.8, 6.2, 7.9, 4.8, 10.5, 17.2, 31.5], [49.0, 24.0, 10.0, 24.0, 15.0, 25.0, 6.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.0, 53.2, 25.0, 19.2, 12.2, 6.2, 7.2, 4.0, 11.2, 18.9, 32.2], [53.0, 26.0, 8.0, 25.0, 18.0, 25.0, 7.0, 14.0, 2.0, 4.0, 2.0, 4.0, 2.1, 61.2, 32.4, 18.6, 12.0, 6.1, 7.4, 4.0, 9.1, 18.0, 29.0], [51.0, 26.0, 9.0, 27.0, 19.0, 26.0, 8.0, 11.0, 2.0, 5.0, 2.0, 4.0, 3.0, 54.8, 32.0, 17.3, 11.5, 5.7, 6.7, 5.1, 9.4, 15.8, 26.8], [49.0, 22.0, 9.0, 24.0, 17.0, 25.0, 6.0, 11.0, 2.0, 2.0, 2.0, 5.0, 2.1, 55.8, 28.0, 18.8, 12.6, 7.2, 8.2, 4.6, 11.5, 18.2, 31.0], [51.0, 26.0, 9.0, 24.0, 17.0, 26.0, 6.0, 10.0, 2.0, 3.0, 2.0, 3.0, 2.3, 60.5, 33.1, 18.5, 12.2, 5.5, 6.8, 4.5, 11.1, 17.5, 31.5], [47.0, 24.0, 9.0, 26.0, 15.0, 24.0, 6.0, 12.0, 2.0, 2.0, 1.0, 4.0, 2.3, 52.8, 27.5, 17.0, 11.8, 6.0, 7.8, 3.8, 10.2, 18.0, 29.5], [51.0, 22.0, 9.0, 26.0, 18.0, 25.0, 6.0, 12.0, 1.0, 2.0, 1.0, 5.0, 2.3, 49.3, 24.0, 16.6, 11.2, 6.0, 7.0, 4.1, 9.0, 18.0, 29.8], [50.0, 22.0, 9.0, 21.0, 15.0, 22.0, 4.0, 10.0, 1.0, 2.0, 2.0, 4.0, 2.2, 52.2, 26.8, 18.0, 12.2, 6.1, 7.1, 4.0, 10.5, 17.5, 26.0], [50.0, 24.0, 9.0, 24.0, 17.0, 24.0, 6.0, 11.0, 1.0, 4.0, 2.0, 4.0, 2.0, 58.6, 33.4, 20.2, 13.5, 6.8, 9.1, 6.5, 11.8, 20.9, 31.0], [52.0, 27.0, 10.0, 25.0, 18.0, 26.0, 6.0, 12.0, 1.0, 4.0, 2.0, 3.0, 2.8, 62.5, 37.1, 19.4, 12.1, 6.6, 7.2, 4.2, 11.2, 17.5, 29.5], [52.0, 22.0, 11.0, 24.0, 20.0, 26.0, 6.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.4, 59.0, 29.0, 19.9, 13.9, 7.8, 9.1, 4.9, 12.8, 19.5, 35.0], [49.0, 27.0, 7.0, 26.0, 17.0, 24.0, 6.0, 10.0, 2.0, 3.0, 1.0, 5.0, 3.0, 54.7, 28.4, 18.6, 12.2, 6.4, 8.7, 5.5, 10.6, 18.1, 27.9], [56.0, 25.0, 10.0, 25.0, 19.0, 25.0, 8.0, 12.0, 3.0, 6.0, 2.0, 3.0, 2.7, 59.4, 33.1, 20.3, 13.2, 7.1, 9.2, 6.5, 10.7, 20.0, 30.6], [47.0, 22.0, 9.0, 24.0, 19.0, 26.0, 6.0, 12.0, 1.0, 2.0, 1.0, 6.0, 2.3, 55.0, 27.9, 18.6, 12.3, 6.2, 8.4, 4.3, 9.1, 17.3, 28.2], [49.0, 26.0, 10.0, 22.0, 17.0, 26.0, 5.0, 10.0, 2.0, 2.0, 2.0, 6.0, 2.3, 56.0, 30.0, 16.8, 11.0, 5.8, 6.4, 4.0, 10.5, 17.0, 27.5], [49.0, 23.0, 9.0, 25.0, 18.0, 25.0, 6.0, 9.0, 1.0, 2.0, 1.0, 4.0, 2.0, 51.0, 25.1, 18.0, 12.1, 6.0, 8.0, 4.1, 11.3, 17.8, 28.6], [49.0, 22.0, 9.0, 23.0, 15.0, 21.0, 6.0, 11.0, 2.0, 2.0, 2.0, 5.0, 2.1, 51.8, 27.2, 17.2, 12.1, 6.7, 8.1, 4.9, 11.0, 17.0, 28.8], [52.0, 25.0, 8.0, 25.0, 17.0, 26.0, 6.0, 12.0, 2.0, 2.0, 1.0, 5.0, 2.8, 54.2, 30.2, 17.3, 12.0, 6.4, 7.9, 5.4, 10.5, 17.2, 28.8], [51.0, 25.0, 9.0, 22.0, 16.0, 23.0, 6.0, 12.0, 1.0, 4.0, 2.0, 4.0, 2.3, 53.3, 29.1, 18.7, 12.9, 6.8, 8.3, 5.8, 9.8, 17.7, 30.7], [55.0, 24.0, 8.0, 26.0, 17.0, 22.0, 6.0, 10.0, 1.0, 1.0, 1.0, 4.0, 2.8, 54.8, 30.7, 18.6, 12.2, 6.0, 8.3, 5.5, 11.4, 17.1, 28.0], [47.0, 23.0, 9.0, 24.0, 20.0, 26.0, 4.0, 10.0, 0.0, 1.0, 1.0, 4.0, 2.6, 56.6, 28.3, 19.5, 13.9, 6.2, 8.2, 4.2, 12.8, 18.8, 31.0], [52.0, 27.0, 7.0, 22.0, 17.0, 26.0, 7.0, 11.0, 1.0, 2.0, 2.0, 6.0, 2.4, 52.7, 29.7, 16.2, 10.4, 5.1, 6.3, 4.2, 9.4, 14.9, 24.4], [48.0, 23.0, 9.0, 22.0, 17.0, 23.0, 6.0, 12.0, 1.0, 2.0, 1.0, 6.0, 2.2, 53.0, 27.3, 17.4, 12.4, 7.2, 7.8, 4.8, 9.5, 17.1, 31.5], [49.0, 22.0, 10.0, 23.0, 17.0, 24.0, 4.0, 9.0, 2.0, 2.0, 2.0, 4.0, 2.2, 55.2, 27.0, 19.2, 13.0, 7.0, 7.8, 4.2, 11.2, 19.0, 30.0], [48.0, 25.0, 9.0, 21.0, 18.0, 28.0, 6.0, 9.0, 1.0, 3.0, 2.0, 3.0, 2.3, 55.0, 29.0, 15.6, 11.2, 6.0, 6.8, 3.5, 9.2, 15.5, 29.0], [55.0, 22.0, 12.0, 26.0, 18.0, 27.0, 6.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.2, 60.0, 30.0, 20.2, 15.0, 7.8, 9.3, 6.0, 11.9, 20.0, 37.0], [48.0, 24.0, 9.0, 24.0, 17.0, 25.0, 5.0, 12.0, 2.0, 2.0, 2.0, 5.0, 2.0, 49.5, 24.5, 16.2, 11.2, 5.0, 7.1, 4.0, 10.2, 17.0, 27.5], [56.0, 25.0, 11.0, 27.0, 17.0, 26.0, 6.0, 11.0, 2.0, 3.0, 2.0, 2.0, 2.6, 54.2, 28.5, 18.7, 12.2, 6.7, 8.6, 5.0, 10.3, 18.9, 33.1], [57.0, 23.0, 11.0, 27.0, 20.0, 26.0, 6.0, 10.0, 1.0, 2.0, 1.0, 4.0, 2.3, 60.0, 29.0, 21.0, 14.9, 7.8, 9.2, 5.0, 13.0, 18.8, 35.6], [48.0, 24.0, 9.0, 28.0, 17.0, 22.0, 6.0, 12.0, 2.0, 3.0, 1.0, 5.0, 2.7, 53.6, 31.3, 18.6, 12.3, 6.0, 8.3, 5.5, 12.0, 17.3, 29.0], [50.0, 26.0, 8.0, 24.0, 18.0, 27.0, 6.0, 11.0, 1.0, 4.0, 2.0, 2.0, 2.1, 56.2, 30.0, 17.2, 11.4, 6.3, 6.5, 3.9, 9.7, 14.5, 28.8], [55.0, 26.0, 8.0, 28.0, 18.0, 26.0, 6.0, 10.0, 2.0, 4.0, 2.0, 4.0, 2.1, 61.5, 37.8, 17.6, 12.0, 6.2, 7.7, 5.1, 9.9, 17.6, 27.0], [56.0, 23.0, 9.0, 27.0, 20.0, 26.0, 8.0, 13.0, 2.0, 5.0, 3.0, 5.0, 2.8, 62.0, 35.1, 21.1, 14.1, 7.4, 9.1, 7.1, 12.1, 18.8, 33.2], [56.0, 26.0, 7.0, 25.0, 16.0, 23.0, 6.0, 9.0, 3.0, 1.0, 2.0, 3.0, 2.0, 53.4, 29.8, 16.7, 11.0, 5.7, 7.0, 4.8, 9.2, 16.4, 28.0], [49.0, 21.0, 10.0, 22.0, 18.0, 24.0, 5.0, 12.0, 2.0, 4.0, 2.0, 2.0, 2.0, 59.5, 30.0, 28.1, 14.0, 6.6, 9.0, 5.0, 14.0, 20.3, 33.0], [49.0, 21.0, 9.0, 24.0, 17.0, 24.0, 4.0, 10.0, 0.0, 1.0, 1.0, 5.0, 2.0, 58.0, 28.2, 19.9, 13.0, 6.8, 8.2, 4.9, 12.5, 18.0, 30.5], [52.0, 25.0, 9.0, 22.0, 19.0, 27.0, 6.0, 8.0, 2.0, 4.0, 2.0, 2.0, 2.2, 62.8, 35.3, 17.9, 12.3, 7.6, 8.0, 4.2, 10.3, 17.0, 27.8], [50.0, 25.0, 10.0, 27.0, 18.0, 27.0, 5.0, 11.0, 2.0, 4.0, 2.0, 4.0, 2.4, 64.2, 34.0, 22.2, 15.0, 8.2, 10.0, 5.3, 10.5, 20.0, 36.5], [56.0, 22.0, 10.0, 25.0, 22.0, 20.0, 6.0, 11.0, 2.0, 5.0, 2.0, 4.0, 2.5, 59.0, 32.0, 18.8, 12.5, 7.5, 7.6, 4.2, 11.0, 18.0, 29.0], [51.0, 25.0, 8.0, 22.0, 18.0, 24.0, 6.0, 12.0, 2.0, 2.0, 1.0, 3.0, 2.0, 54.5, 26.8, 19.5, 13.0, 6.0, 8.2, 4.6, 11.5, 17.0, 31.2], [50.0, 27.0, 9.0, 22.0, 17.0, 25.0, 6.0, 12.0, 2.0, 2.0, 2.0, 5.0, 2.1, 58.0, 33.8, 15.5, 10.9, 5.4, 7.1, 4.6, 8.8, 14.6, 23.2], [51.0, 28.0, 8.0, 22.0, 21.0, 27.0, 8.0, 10.0, 2.0, 3.0, 2.0, 3.0, 3.0, 61.2, 37.0, 19.3, 11.9, 6.8, 7.8, 5.1, 9.8, 16.6, 27.9], [50.0, 22.0, 9.0, 23.0, 16.0, 22.0, 6.0, 10.0, 2.0, 2.0, 1.0, 5.0, 2.3, 54.0, 26.0, 18.1, 12.2, 6.6, 8.1, 4.1, 10.2, 17.9, 30.0], [50.0, 23.0, 9.0, 25.0, 18.0, 24.0, 6.0, 12.0, 2.0, 2.0, 2.0, 7.0, 2.0, 57.8, 30.7, 19.0, 12.8, 6.8, 8.0, 5.0, 12.0, 17.5, 32.4], [50.0, 23.0, 7.0, 24.0, 18.0, 26.0, 5.0, 14.0, 1.0, 3.0, 2.0, 2.0, 2.2, 60.5, 29.0, 22.0, 14.4, 7.3, 8.8, 5.0, 13.6, 20.9, 34.5], [49.0, 23.0, 9.0, 21.0, 17.0, 25.0, 7.0, 12.0, 1.0, 3.0, 2.0, 3.0, 2.3, 55.8, 27.3, 19.1, 12.5, 6.3, 7.6, 4.3, 10.0, 20.4, 31.1], [51.0, 26.0, 9.0, 26.0, 20.0, 23.0, 6.0, 12.0, 1.0, 4.0, 2.0, 3.0, 2.0, 58.0, 32.0, 17.5, 12.0, 6.0, 7.0, 4.0, 10.0, 16.3, 28.2], [46.0, 23.0, 10.0, 24.0, 17.0, 25.0, 6.0, 10.0, 0.0, 1.0, 1.0, 4.0, 2.2, 52.0, 27.0, 16.5, 11.5, 6.0, 7.7, 4.5, 9.8, 16.0, 28.8], [46.0, 28.0, 9.0, 23.0, 20.0, 28.0, 7.0, 13.0, 2.0, 2.0, 2.0, 3.0, 2.2, 60.7, 34.0, 18.8, 11.7, 5.8, 7.2, 5.1, 9.3, 18.8, 26.9], [50.0, 22.0, 8.0, 25.0, 18.0, 25.0, 6.0, 10.0, 1.0, 2.0, 2.0, 4.0, 2.5, 52.1, 24.0, 18.8, 12.5, 5.8, 7.0, 3.5, 11.5, 16.0, 30.2], [52.0, 24.0, 9.0, 25.0, 18.0, 22.0, 6.0, 12.0, 2.0, 4.0, 1.0, 2.0, 2.4, 52.0, 29.4, 17.9, 11.7, 6.3, 8.0, 5.1, 10.1, 17.0, 28.2], [51.0, 22.0, 9.0, 27.0, 17.0, 25.0, 5.0, 9.0, 2.0, 4.0, 2.0, 3.0, 2.1, 53.3, 26.0, 19.4, 12.8, 6.8, 8.0, 4.8, 11.1, 19.2, 30.0], [48.0, 26.0, 8.0, 23.0, 18.0, 26.0, 5.0, 12.0, 1.0, 1.0, 1.0, 5.0, 2.2, 53.0, 28.8, 15.6, 10.5, 5.3, 6.6, 3.5, 8.0, 16.7, 27.0], [51.0, 26.0, 10.0, 22.0, 16.0, 26.0, 7.0, 10.0, 1.0, 2.0, 2.0, 3.0, 2.4, 57.0, 31.0, 16.9, 11.3, 5.2, 6.8, 4.1, 9.0, 16.9, 26.9], [49.0, 24.0, 11.0, 21.0, 20.0, 25.0, 5.0, 12.0, 2.0, 3.0, 1.0, 4.0, 2.0, 61.5, 29.8, 21.5, 14.8, 7.2, 9.8, 4.8, 11.1, 19.5, 33.2], [52.0, 21.0, 9.0, 21.0, 18.0, 25.0, 7.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.2, 58.0, 32.2, 18.3, 12.1, 5.7, 7.7, 4.3, 10.7, 16.3, 28.0], [49.0, 22.0, 7.0, 24.0, 18.0, 26.0, 6.0, 12.0, 1.0, 2.0, 2.0, 2.0, 2.4, 58.0, 29.0, 20.8, 13.0, 7.2, 8.2, 5.0, 11.2, 19.0, 31.0], [52.0, 26.0, 9.0, 25.0, 20.0, 25.0, 7.0, 10.0, 1.0, 3.0, 1.0, 3.0, 2.3, 61.5, 32.8, 19.2, 13.5, 7.4, 9.7, 6.7, 12.7, 17.4, 33.4], [49.0, 25.0, 12.0, 24.0, 17.0, 25.0, 9.0, 10.0, 2.0, 5.0, 2.0, 2.0, 2.3, 62.0, 29.0, 21.1, 14.0, 7.2, 9.1, 5.1, 10.2, 20.0, 33.0], [49.0, 25.0, 9.0, 22.0, 19.0, 26.0, 5.0, 11.0, 1.0, 2.0, 1.0, 5.0, 2.0, 55.0, 33.6, 17.3, 11.0, 5.4, 6.5, 3.4, 11.6, 16.6, 25.0], [50.0, 22.0, 9.0, 26.0, 19.0, 25.0, 5.0, 7.0, 1.0, 4.0, 3.0, 4.0, 2.0, 56.0, 27.2, 19.2, 16.0, 7.8, 8.6, 4.9, 10.5, 19.2, 34.2], [50.0, 24.0, 11.0, 22.0, 17.0, 24.0, 6.0, 10.0, 1.0, 4.0, 2.0, 3.0, 2.0, 58.5, 28.0, 19.1, 14.0, 7.5, 9.8, 4.5, 12.5, 19.5, 30.5], [52.0, 24.0, 11.0, 25.0, 17.0, 25.0, 5.0, 6.0, 1.0, 2.0, 1.0, 4.0, 2.3, 57.5, 29.0, 19.8, 13.3, 6.8, 8.8, 4.9, 11.5, 17.0, 31.5], [52.0, 22.0, 8.0, 23.0, 18.0, 22.0, 6.0, 14.0, 2.0, 4.0, 2.0, 3.0, 2.1, 53.0, 25.7, 19.5, 14.5, 7.0, 8.0, 5.0, 11.5, 19.0, 31.3], [47.0, 24.0, 9.0, 22.0, 16.0, 24.0, 5.0, 10.0, 2.0, 3.0, 1.0, 3.0, 2.0, 45.2, 21.6, 15.0, 10.0, 5.0, 6.2, 3.1, 9.0, 15.0, 24.3], [59.0, 22.0, 11.0, 23.0, 21.0, 28.0, 5.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.0, 59.8, 30.0, 20.0, 13.8, 7.6, 8.2, 5.1, 12.1, 19.8, 35.2], [49.0, 23.0, 10.0, 25.0, 18.0, 23.0, 6.0, 12.0, 0.0, 1.0, 1.0, 3.0, 2.0, 51.0, 25.0, 17.2, 11.8, 6.2, 7.5, 4.1, 10.4, 17.4, 29.0], [50.0, 25.0, 11.0, 24.0, 20.0, 27.0, 7.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.8, 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TrainY: [1, 1, 2, 1, 2, 1, 2, 2, 2, 2, 1, 1, 2, 1, 2, 2, 1, 1, 1, 1, 2, 1, 2, 2, 2, 1, 1, 1, 2, 1, 2, 2, 2, 2, 2, 1, 2, 2, 2, 2, 2, 1, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 2, 2, 1, 2, 2, 1, 1, 1, 2, 1, 1, 2, 1, 2, 1, 1, 1, 1, 1, 1, 2, 1, 1, 2, 1, 2, 1, 2, 1, 1, 2, 1, 1, 2]

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TestY: [2, 1, 1, 2, 1, 1, 2, 2, 2, 1, 1, 1, 2, 2, 2, 1, 2, 2, 1, 2, 2, 1, 2, 1, 1, 2, 1, 2, 2, 2, 2, 1, 2, 2, 2, 2, 1, 1, 2]

## Question 4 Subset c:

TrainX: [[50.0, 24.0, 10.0, 32.0, 20.0, 26.0, 6.0, 5.0, 1.0, 2.0, 1.0, 1.0, 2.3, 75.5, 39.7, 26.4, 10.6, 11.7, 8.1, 11.7, 11.5, 24.7, 34.7], [40.0, 24.0, 7.0, 20.0, 13.0, 26.0, 6.0, 10.0, 1.0, 1.0, 3.0, 2.0, 2.9, 56.0, 31.8, 19.0, 11.3, 7.3, 7.5, 4.8, 7.9, 17.8, 26.3], [49.0, 24.0, 10.0, 31.0, 18.0, 24.0, 6.0, 6.0, 1.0, 2.0, 1.0, 1.0, 2.9, 71.5, 37.0, 24.1, 17.0, 11.0, 9.5, 7.2, 12.8, 27.4, 40.4], [50.0, 28.0, 9.0, 28.0, 19.0, 15.0, 6.0, 6.0, 2.0, 2.0, 2.0, 4.0, 2.6, 76.0, 39.5, 21.6, 14.5, 9.5, 9.0, 6.3, 11.0, 23.0, 33.0], [48.0, 24.0, 8.0, 23.0, 16.0, 25.0, 6.0, 10.0, 1.0, 1.0, 3.0, 3.0, 2.9, 51.0, 25.2, 18.2, 11.9, 7.8, 7.0, 4.8, 9.5, 19.8, 29.2], [49.0, 25.0, 8.0, 29.0, 18.0, 22.0, 7.0, 4.0, 2.0, 2.0, 1.0, 1.0, 2.5, 69.0, 43.0, 22.1, 14.8, 9.0, 9.7, 6.3, 9.8, 22.4, 35.2], [47.0, 27.0, 10.0, 31.0, 18.0, 25.0, 6.0, 4.0, 2.0, 2.0, 2.0, 1.0, 2.4, 73.0, 42.7, 22.6, 14.7, 9.2, 9.5, 6.5, 10.5, 24.8, 37.2], [41.0, 23.0, 5.0, 18.0, 8.0, 25.0, 5.0, 3.0, 0.0, 2.0, 3.0, 1.0, 2.4, 53.0, 29.7, 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19.3, 13.0, 8.9, 7.6, 5.2, 9.5, 19.3, 29.5], [44.0, 22.0, 8.0, 22.0, 16.0, 27.0, 6.0, 8.0, 1.0, 3.0, 2.0, 4.0, 2.8, 49.0, 23.4, 17.2, 11.7, 7.8, 7.6, 5.5, 7.7, 18.4, 30.0], [45.0, 25.0, 9.0, 28.0, 18.0, 23.0, 6.0, 3.0, 1.0, 3.0, 2.0, 1.0, 2.8, 55.0, 30.9, 18.9, 11.8, 7.5, 7.5, 5.3, 8.5, 19.3, 31.3], [46.0, 24.0, 7.0, 25.0, 15.0, 20.0, 6.0, 10.0, 1.0, 2.0, 2.0, 2.0, 2.4, 55.5, 28.0, 19.4, 12.8, 8.3, 7.6, 5.0, 10.6, 18.3, 26.4], [44.0, 23.0, 7.0, 21.0, 15.0, 27.0, 7.0, 9.0, 1.0, 1.0, 2.0, 4.0, 2.4, 50.0, 28.6, 18.5, 12.4, 8.3, 8.5, 5.4, 8.0, 19.5, 31.2], [52.0, 25.0, 10.0, 31.0, 25.0, 26.0, 6.0, 7.0, 1.0, 2.0, 1.0, 1.0, 2.7, 72.0, 35.7, 24.6, 16.2, 9.8, 10.1, 8.9, 11.6, 26.2, 38.5], [48.0, 24.0, 9.0, 23.0, 17.0, 24.0, 7.0, 12.0, 2.0, 2.0, 2.0, 2.0, 2.8, 48.5, 27.8, 16.5, 11.1, 7.7, 6.8, 4.8, 8.8, 17.8, 26.8], [49.0, 26.0, 8.0, 31.0, 20.0, 22.0, 7.0, 5.0, 1.0, 3.0, 1.0, 1.0, 2.1, 52.0, 29.6, 16.7, 11.7, 7.5, 7.3, 5.2, 8.0, 19.0, 28.5], [49.0, 22.0, 10.0, 27.0, 18.0, 25.0, 6.0, 2.0, 2.0, 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12.6, 8.4, 8.0, 5.8, 9.4, 20.3, 31.5], [40.0, 23.0, 7.0, 21.0, 18.0, 26.0, 7.0, 8.0, 0.0, 1.0, 2.0, 4.0, 2.9, 57.0, 30.8, 20.2, 13.1, 8.5, 8.5, 6.1, 11.0, 19.0, 28.7], [49.0, 24.0, 8.0, 31.0, 20.0, 24.0, 6.0, 5.0, 2.0, 2.0, 1.0, 1.0, 2.6, 55.0, 28.7, 20.0, 12.9, 8.3, 8.6, 5.8, 8.4, 21.2, 32.7], [49.0, 24.0, 8.0, 33.0, 20.0, 27.0, 6.0, 4.0, 2.0, 2.0, 1.0, 1.0, 2.9, 53.5, 27.6, 17.7, 12.1, 8.0, 7.9, 5.4, 9.3, 19.6, 31.5], [50.0, 27.0, 9.0, 33.0, 19.0, 23.0, 6.0, 6.0, 1.0, 2.0, 2.0, 1.0, 2.8, 53.5, 28.7, 17.5, 11.2, 6.9, 7.0, 4.9, 7.4, 18.7, 29.2], [47.0, 23.0, 7.0, 28.0, 16.0, 19.0, 6.0, 12.0, 2.0, 2.0, 3.0, 4.0, 3.3, 51.5, 26.8, 18.2, 12.1, 7.7, 7.1, 5.4, 9.7, 19.8, 29.5], [52.0, 27.0, 7.0, 31.0, 17.0, 25.0, 7.0, 3.0, 2.0, 2.0, 1.0, 1.0, 3.0, 50.5, 26.5, 17.1, 11.4, 7.0, 7.3, 5.2, 7.6, 17.4, 28.6], [42.0, 23.0, 10.0, 24.0, 15.0, 27.0, 6.0, 4.0, 1.0, 2.0, 3.0, 5.0, 2.7, 57.0, 27.3, 17.6, 13.4, 9.3, 7.7, 5.6, 9.8, 20.3, 29.8], [46.0, 25.0, 8.0, 22.0, 16.0, 27.0, 5.0, 7.0, 1.0, 2.0, 2.0, 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8.0, 25.0, 17.0, 19.0, 6.0, 10.0, 2.0, 2.0, 2.0, 3.0, 3.0, 53.5, 27.0, 18.2, 12.6, 8.3, 7.3, 5.3, 10.0, 20.9, 30.0], [47.0, 24.0, 8.0, 31.0, 17.0, 24.0, 7.0, 2.0, 2.0, 2.0, 1.0, 1.0, 2.3, 62.0, 32.7, 22.0, 14.9, 9.2, 10.0, 6.6, 9.7, 23.5, 35.5], [44.0, 23.0, 7.0, 23.0, 14.0, 24.0, 7.0, 8.0, 1.0, 3.0, 3.0, 4.0, 2.6, 53.0, 26.0, 17.5, 10.9, 6.9, 6.7, 5.4, 7.6, 18.5, 29.2], [45.0, 23.0, 7.0, 24.0, 16.0, 27.0, 4.0, 11.0, 1.0, 1.0, 3.0, 2.0, 3.0, 59.5, 30.0, 19.5, 13.2, 8.4, 8.5, 5.8, 9.3, 19.8, 30.5], [45.0, 25.0, 10.0, 28.0, 10.0, 26.0, 5.0, 3.0, 1.0, 2.0, 1.0, 1.0, 2.2, 72.0, 37.4, 26.3, 16.8, 10.5, 11.7, 7.4, 11.5, 25.4, 42.1], [41.0, 23.0, 6.0, 20.0, 8.0, 24.0, 6.0, 6.0, 1.0, 2.0, 3.0, 3.0, 2.6, 50.0, 25.8, 17.3, 10.6, 6.7, 7.2, 5.4, 8.3, 18.2, 25.8], [42.0, 23.0, 9.0, 22.0, 15.0, 22.0, 5.0, 10.0, 1.0, 1.0, 2.0, 4.0, 3.0, 57.0, 32.5, 19.3, 13.2, 9.0, 7.7, 5.9, 10.0, 20.5, 29.5], [45.0, 24.0, 9.0, 29.0, 18.0, 26.0, 6.0, 4.0, 2.0, 2.0, 1.0, 3.0, 2.5, 57.0, 28.9, 21.0, 13.3, 8.5, 8.3, 5.3, 9.7, 22.0, 33.7], [45.0, 22.0, 8.0, 22.0, 15.0, 28.0, 5.0, 4.0, 1.0, 2.0, 2.0, 4.0, 3.2, 59.0, 32.0, 20.5, 13.0, 8.7, 7.7, 5.5, 10.5, 21.0, 30.5], [48.0, 24.0, 9.0, 22.0, 14.0, 26.0, 6.0, 11.0, 1.0, 2.0, 2.0, 1.0, 2.9, 57.0, 32.0, 18.7, 12.5, 8.7, 7.1, 5.6, 10.3, 19.6, 30.3], [46.0, 24.0, 7.0, 23.0, 17.0, 22.0, 6.0, 7.0, 0.0, 2.0, 2.0, 4.0, 2.9, 59.0, 30.7, 19.7, 12.8, 7.8, 7.5, 5.4, 10.6, 20.2, 28.0], [43.0, 25.0, 7.0, 29.0, 20.0, 19.0, 6.0, 10.0, 2.0, 2.0, 2.0, 4.0, 3.0, 52.0, 28.1, 16.2, 11.8, 7.8, 6.6, 5.0, 9.7, 20.1, 28.2], [42.0, 22.0, 9.0, 22.0, 15.0, 24.0, 5.0, 8.0, 1.0, 2.0, 2.0, 3.0, 2.7, 57.0, 29.0, 19.7, 13.5, 8.7, 8.9, 6.1, 9.4, 19.8, 31.2], [45.0, 21.0, 7.0, 24.0, 17.0, 30.0, 7.0, 10.0, 2.0, 2.0, 2.0, 5.0, 3.0, 50.0, 24.7, 18.2, 11.8, 7.8, 7.9, 5.3, 8.7, 20.3, 30.5], [46.0, 25.0, 8.0, 28.0, 15.0, 21.0, 7.0, 10.0, 2.0, 1.0, 2.0, 3.0, 3.0, 54.0, 31.0, 18.8, 12.5, 8.1, 7.4, 5.5, 10.5, 17.8, 29.0], [50.0, 23.0, 8.0, 30.0, 18.0, 25.0, 7.0, 7.0, 1.0, 3.0, 1.0, 1.0, 2.7, 68.5, 35.1, 24.1, 16.6, 10.5, 10.6, 7.7, 11.4, 25.0, 38.8], [45.0, 25.0, 7.0, 23.0, 13.0, 23.0, 6.0, 10.0, 0.0, 0.0, 3.0, 4.0, 2.7, 58.5, 32.7, 17.9, 11.6, 7.3, 7.0, 5.0, 7.9, 16.9, 27.0], [41.0, 23.0, 7.0, 21.0, 13.0, 26.0, 5.0, 8.0, 1.0, 1.0, 2.0, 5.0, 2.6, 55.0, 31.1, 18.3, 12.0, 8.0, 7.3, 5.3, 9.7, 19.2, 29.2], [45.0, 25.0, 8.0, 32.0, 18.0, 22.0, 6.0, 4.0, 1.0, 2.0, 2.0, 1.0, 2.0, 72.5, 40.0, 23.3, 14.3, 8.9, 9.0, 6.4, 9.9, 22.4, 33.0], [48.0, 25.0, 8.0, 28.0, 14.0, 25.0, 5.0, 9.0, 2.0, 2.0, 2.0, 4.0, 2.6, 56.0, 32.2, 17.5, 12.3, 7.9, 8.5, 6.0, 7.8, 17.5, 29.0], [48.0, 25.0, 9.0, 31.0, 20.0, 24.0, 6.0, 2.0, 1.0, 2.0, 1.0, 1.0, 2.8, 72.0, 40.6, 21.6, 14.3, 9.0, 9.2, 6.5, 10.0, 23.4, 35.5], [50.0, 24.0, 8.0, 25.0, 14.0, 19.0, 6.0, 10.0, 1.0, 2.0, 2.0, 3.0, 2.7, 61.0, 30.0, 21.2, 14.0, 9.4, 8.6, 5.8, 11.2, 20.5, 31.0], [44.0, 24.0, 5.0, 24.0, 17.0, 19.0, 6.0, 9.0, 0.0, 0.0, 3.0, 4.0, 3.0, 52.0, 25.4, 17.3, 11.7, 7.8, 6.8, 5.5, 10.0, 19.0, 29.8], [43.0, 23.0, 7.0, 20.0, 16.0, 24.0, 5.0, 9.0, 0.0, 0.0, 2.0, 4.0, 2.7, 56.5, 27.5, 19.1, 12.6, 8.4, 7.5, 5.7, 9.7, 20.0, 29.5], [46.0, 27.0, 7.0, 24.0, 15.0, 26.0, 5.0, 7.0, 2.0, 2.0, 2.0, 4.0, 2.7, 55.0, 30.5, 16.8, 10.7, 7.3, 7.1, 4.8, 7.6, 17.5, 26.7], [38.0, 21.0, 5.0, 19.0, 9.0, 20.0, 6.0, 1.0, 0.0, 2.0, 2.0, 1.0, 2.0, 38.0, 24.1, 16.2, 11.1, 7.4, 7.1, 5.5, 7.4, 16.8, 25.3], [51.0, 23.0, 8.0, 32.0, 19.0, 27.0, 7.0, 7.0, 2.0, 3.0, 1.0, 1.0, 2.6, 48.5, 23.7, 16.8, 11.3, 7.3, 7.0, 5.2, 8.0, 17.6, 28.4], [49.0, 23.0, 8.0, 32.0, 19.0, 24.0, 6.0, 6.0, 2.0, 2.0, 1.0, 1.0, 2.9, 62.0, 30.9, 20.4, 14.2, 9.1, 9.7, 7.2, 10.1, 23.2, 37.4]]

## Question 5:

TrainX: [[50.0, 26.0, 9.0, 23.0, 16.0, 23.0, 6.0, 8.0, 1.0, 4.0, 2.0, 3.0, 2.5, 54.9, 31.1, 17.8, 11.2, 5.4, 6.7, 5.3, 9.4, 15.9, 27.1], [59.0, 22.0, 11.0, 23.0, 21.0, 28.0, 5.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.0, 59.8, 30.0, 20.0, 13.8, 7.6, 8.2, 5.1, 12.1, 19.8, 35.2], [43.0, 27.0, 9.0, 23.0, 18.0, 21.0, 6.0, 4.0, 0.0, 1.0, 2.0, 3.0, 2.0, 55.0, 27.8, 17.5, 11.6, 7.4, 6.8, 5.1, 9.8, 19.0, 28.7], [46.0, 22.0, 7.0, 23.0, 15.0, 26.0, 6.0, 9.0, 1.0, 2.0, 3.0, 3.0, 2.6, 57.0, 29.0, 19.3, 13.1, 8.7, 7.5, 5.4, 10.5, 20.0, 28.8], [51.0, 28.0, 10.0, 28.0, 17.0, 19.0, 7.0, 10.0, 1.0, 2.0, 2.0, 5.0, 2.0, 55.3, 28.2, 18.0, 12.0, 7.4, 7.2, 4.0, 8.5, 18.0, 28.6], [43.0, 25.0, 8.0, 23.0, 15.0, 20.0, 6.0, 6.0, 0.0, 1.0, 2.0, 4.0, 2.3, 62.0, 30.5, 18.5, 12.8, 8.0, 7.6, 5.7, 11.0, 20.0, 29.7], [55.0, 27.0, 11.0, 26.0, 19.0, 19.0, 6.0, 13.0, 2.0, 2.0, 2.0, 6.0, 2.2, 57.7, 31.4, 17.5, 12.1, 7.8, 6.7, 5.0, 9.9, 18.2, 27.6], [49.0, 22.0, 9.0, 24.0, 17.0, 25.0, 6.0, 11.0, 2.0, 2.0, 2.0, 5.0, 2.1, 55.8, 28.0, 18.8, 12.6, 7.2, 8.2, 4.6, 11.5, 18.2, 31.0], [45.0, 24.0, 7.0, 23.0, 15.0, 27.0, 7.0, 9.0, 1.0, 1.0, 3.0, 4.0, 2.7, 56.5, 30.2, 19.6, 12.8, 8.9, 7.5, 5.7, 10.4, 21.0, 29.0], [49.0, 22.0, 10.0, 27.0, 18.0, 25.0, 6.0, 2.0, 2.0, 2.0, 2.0, 2.0, 2.5, 72.0, 35.0, 25.7, 16.8, 11.0, 11.5, 6.7, 11.6, 26.4, 35.3], [53.0, 26.0, 10.0, 24.0, 20.0, 27.0, 7.0, 13.0, 1.0, 4.0, 2.0, 2.0, 2.0, 45.8, 23.2, 15.3, 10.4, 5.0, 6.0, 3.2, 7.0, 15.0, 25.5], [48.0, 25.0, 9.0, 31.0, 20.0, 24.0, 6.0, 2.0, 1.0, 2.0, 1.0, 1.0, 2.8, 72.0, 40.6, 21.6, 14.3, 9.0, 9.2, 6.5, 10.0, 23.4, 35.5], [42.0, 27.0, 10.0, 24.0, 18.0, 21.0, 6.0, 8.0, 0.0, 1.0, 3.0, 4.0, 2.1, 56.3, 28.0, 17.7, 11.3, 7.5, 7.2, 5.2, 10.1, 18.4, 29.0], [50.0, 23.0, 8.0, 30.0, 18.0, 25.0, 7.0, 7.0, 1.0, 3.0, 1.0, 1.0, 2.7, 68.5, 35.1, 24.1, 16.6, 10.5, 10.6, 7.7, 11.4, 25.0, 38.8], [43.0, 23.0, 8.0, 23.0, 14.0, 23.0, 6.0, 12.0, 1.0, 2.0, 2.0, 3.0, 2.4, 56.0, 27.8, 18.9, 12.9, 8.4, 8.0, 5.4, 9.5, 19.0, 29.0], [37.0, 25.0, 5.0, 18.0, 9.0, 20.0, 6.0, 3.0, 1.0, 3.0, 2.0, 3.0, 2.7, 58.0, 33.9, 16.6, 11.1, 7.2, 7.4, 5.8, 7.6, 17.2, 24.4], [45.0, 23.0, 7.0, 23.0, 16.0, 26.0, 5.0, 6.0, 1.0, 4.0, 2.0, 4.0, 2.6, 49.0, 25.9, 17.9, 11.3, 7.6, 7.4, 5.1, 8.4, 17.6, 27.7], [44.0, 22.0, 9.0, 23.0, 14.0, 26.0, 5.0, 12.0, 1.0, 2.0, 3.0, 3.0, 2.5, 56.0, 31.5, 20.3, 12.4, 9.0, 7.7, 5.5, 10.7, 21.1, 33.4], [41.0, 25.0, 7.0, 21.0, 9.0, 22.0, 5.0, 0.0, 0.0, 0.0, 2.0, 1.0, 2.0, 51.5, 30.8, 15.2, 10.4, 6.9, 7.2, 5.1, 7.3, 17.6, 24.6], [41.0, 25.0, 8.0, 20.0, 16.0, 25.0, 6.0, 8.0, 0.0, 0.0, 2.0, 4.0, 2.6, 50.0, 29.0, 15.6, 10.7, 7.0, 6.3, 4.8, 7.7, 17.6, 27.5], [49.0, 23.0, 10.0, 25.0, 18.0, 23.0, 6.0, 12.0, 0.0, 1.0, 1.0, 3.0, 2.0, 51.0, 25.0, 17.2, 11.8, 6.2, 7.5, 4.1, 10.4, 17.4, 29.0], [42.0, 25.0, 7.0, 21.0, 15.0, 25.0, 5.0, 9.0, 0.0, 0.0, 3.0, 4.0, 3.0, 50.0, 30.6, 17.5, 10.9, 7.1, 6.7, 4.7, 8.1, 17.9, 27.3], [43.0, 24.0, 7.0, 23.0, 16.0, 26.0, 6.0, 12.0, 2.0, 3.0, 3.0, 2.0, 2.7, 52.0, 27.6, 18.8, 12.3, 7.8, 7.9, 5.6, 8.0, 18.3, 31.5], [44.0, 23.0, 8.0, 19.0, 15.0, 25.0, 6.0, 10.0, 1.0, 1.0, 2.0, 4.0, 2.8, 53.0, 31.9, 17.9, 12.9, 8.6, 7.4, 5.2, 10.1, 20.7, 28.7], [51.0, 22.0, 10.0, 23.0, 19.0, 25.0, 6.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.2, 57.2, 28.5, 20.5, 13.9, 5.5, 8.0, 4.3, 12.2, 19.2, 32.2], [44.0, 24.0, 9.0, 23.0, 15.0, 26.0, 5.0, 7.0, 1.0, 2.0, 2.0, 2.0, 2.8, 56.5, 30.7, 17.8, 11.3, 7.4, 7.9, 5.5, 7.7, 18.9, 28.1], [45.0, 22.0, 7.0, 23.0, 16.0, 25.0, 4.0, 6.0, 0.0, 2.0, 3.0, 6.0, 3.0, 55.0, 29.7, 19.6, 12.9, 8.6, 7.4, 5.4, 10.7, 20.0, 29.8], [49.0, 23.0, 9.0, 24.0, 14.0, 19.0, 6.0, 8.0, 2.0, 4.0, 2.0, 5.0, 3.2, 57.0, 28.2, 19.2, 12.9, 8.5, 7.6, 5.3, 10.2, 19.7, 30.3], [39.0, 23.0, 4.0, 18.0, 11.0, 23.0, 6.0, 1.0, 1.0, 1.0, 2.0, 1.0, 2.9, 53.0, 28.7, 18.7, 11.9, 7.9, 8.0, 5.4, 8.7, 19.5, 27.2], [48.0, 23.0, 8.0, 26.0, 17.0, 26.0, 6.0, 11.0, 1.0, 2.0, 2.0, 4.0, 2.6, 56.5, 29.6, 19.0, 13.0, 8.7, 8.5, 5.9, 7.9, 19.2, 31.6], [45.0, 23.0, 8.0, 22.0, 15.0, 25.0, 6.0, 11.0, 1.0, 3.0, 2.0, 3.0, 2.9, 59.5, 28.8, 20.4, 13.4, 9.3, 8.0, 5.2, 10.8, 21.3, 29.5], [44.0, 27.0, 9.0, 23.0, 17.0, 20.0, 5.0, 6.0, 1.0, 2.0, 2.0, 3.0, 2.1, 59.7, 31.0, 18.4, 12.2, 7.8, 7.6, 5.2, 10.0, 19.8, 28.6], [42.0, 24.0, 8.0, 25.0, 15.0, 18.0, 5.0, 6.0, 0.0, 2.0, 3.0, 4.0, 2.9, 56.5, 26.6, 19.5, 12.7, 8.5, 7.8, 5.8, 11.0, 20.6, 31.4], [52.0, 25.0, 8.0, 25.0, 17.0, 26.0, 6.0, 12.0, 2.0, 2.0, 1.0, 5.0, 2.8, 54.2, 30.2, 17.3, 12.0, 6.4, 7.9, 5.4, 10.5, 17.2, 28.8], [47.0, 24.0, 9.0, 21.0, 16.0, 22.0, 6.0, 10.0, 1.0, 2.0, 1.0, 4.0, 2.2, 51.5, 27.8, 16.0, 11.0, 5.1, 7.5, 4.5, 10.0, 17.2, 27.8], [50.0, 25.0, 9.0, 25.0, 19.0, 27.0, 6.0, 12.0, 1.0, 2.0, 2.0, 2.0, 2.3, 60.0, 29.5, 19.9, 13.9, 7.5, 8.6, 4.9, 11.0, 19.9, 34.0], [44.0, 26.0, 9.0, 21.0, 16.0, 20.0, 6.0, 3.0, 0.0, 1.0, 2.0, 4.0, 2.3, 53.9, 27.4, 17.6, 11.4, 7.5, 7.0, 5.0, 9.6, 17.5, 26.0], [43.0, 25.0, 5.0, 24.0, 15.0, 27.0, 4.0, 10.0, 1.0, 1.0, 2.0, 2.0, 2.5, 57.0, 32.2, 18.0, 11.8, 7.9, 7.4, 5.3, 7.9, 16.7, 27.4], [50.0, 25.0, 10.0, 31.0, 16.0, 25.0, 6.0, 5.0, 2.0, 3.0, 2.0, 1.0, 2.8, 70.0, 40.0, 21.8, 14.4, 9.0, 9.4, 6.4, 10.0, 22.5, 33.0], [47.0, 28.0, 8.0, 27.0, 21.0, 22.0, 6.0, 8.0, 1.0, 2.0, 1.0, 3.0, 2.3, 62.6, 35.6, 22.9, 13.9, 6.7, 9.8, 6.5, 10.0, 23.6, 32.4], [44.0, 28.0, 9.0, 22.0, 16.0, 19.0, 6.0, 5.0, 0.0, 2.0, 1.0, 3.0, 2.3, 64.5, 34.0, 18.8, 12.6, 8.3, 8.5, 6.0, 10.3, 21.2, 29.1], [49.0, 24.0, 10.0, 29.0, 19.0, 25.0, 6.0, 6.0, 2.0, 2.0, 1.0, 1.0, 2.8, 50.0, 25.9, 17.2, 11.7, 7.7, 7.6, 5.0, 8.4, 16.5, 28.5], [46.0, 25.0, 11.0, 33.0, 20.0, 24.0, 7.0, 8.0, 2.0, 2.0, 1.0, 1.0, 2.2, 70.0, 39.0, 23.8, 16.4, 10.2, 10.6, 7.5, 11.4, 25.5, 40.5], [40.0, 26.0, 6.0, 22.0, 15.0, 23.0, 6.0, 10.0, 1.0, 2.0, 2.0, 3.0, 2.6, 55.0, 30.1, 16.6, 11.5, 7.3, 7.2, 4.8, 7.0, 19.1, 28.0], [43.0, 24.0, 7.0, 22.0, 14.0, 25.0, 6.0, 5.0, 1.0, 2.0, 2.0, 3.0, 2.8, 56.0, 32.3, 17.6, 11.6, 7.7, 7.4, 5.2, 8.3, 18.2, 28.3], [46.0, 26.0, 9.0, 25.0, 15.0, 24.0, 6.0, 11.0, 0.0, 0.0, 2.0, 2.0, 2.7, 55.0, 32.6, 18.6, 11.3, 7.2, 7.0, 4.4, 7.8, 17.4, 25.9], [43.0, 28.0, 8.0, 23.0, 16.0, 18.0, 5.0, 5.0, 1.0, 1.0, 1.0, 2.0, 2.3, 60.8, 28.5, 18.6, 12.7, 8.4, 7.6, 5.6, 10.6, 19.8, 31.0], [60.0, 23.0, 10.0, 24.0, 21.0, 27.0, 6.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.2, 58.0, 29.1, 20.2, 13.9, 7.2, 9.7, 4.9, 11.2, 20.9, 33.5], [46.0, 25.0, 8.0, 28.0, 15.0, 21.0, 7.0, 10.0, 2.0, 1.0, 2.0, 3.0, 3.0, 54.0, 31.0, 18.8, 12.5, 8.1, 7.4, 5.5, 10.5, 17.8, 29.0], [44.0, 27.0, 9.0, 23.0, 17.0, 20.0, 6.0, 4.0, 1.0, 1.0, 1.0, 4.0, 2.1, 58.4, 31.3, 17.4, 11.8, 7.6, 7.1, 4.8, 9.7, 18.7, 28.3], [43.0, 27.0, 9.0, 25.0, 16.0, 20.0, 6.0, 5.0, 1.0, 1.0, 1.0, 3.0, 2.3, 53.2, 26.5, 18.3, 11.6, 7.7, 6.9, 4.9, 9.1, 19.0, 27.3], [46.0, 29.0, 9.0, 24.0, 17.0, 19.0, 6.0, 3.0, 0.0, 2.0, 2.0, 3.0, 2.0, 56.0, 27.5, 17.3, 11.3, 7.3, 7.3, 4.8, 9.6, 18.0, 27.7], [42.0, 26.0, 10.0, 23.0, 16.0, 19.0, 5.0, 7.0, 1.0, 1.0, 3.0, 4.0, 2.0, 54.0, 27.1, 17.7, 11.6, 7.4, 7.5, 4.9, 10.0, 17.2, 28.0], [42.0, 25.0, 11.0, 20.0, 14.0, 19.0, 4.0, 3.0, 1.0, 1.0, 2.0, 4.0, 2.0, 50.5, 23.1, 17.2, 12.1, 7.8, 7.3, 5.2, 9.5, 17.6, 28.1], [40.0, 26.0, 8.0, 23.0, 16.0, 27.0, 6.0, 8.0, 1.0, 2.0, 2.0, 3.0, 2.8, 56.5, 31.4, 16.6, 11.6, 7.3, 7.2, 4.7, 8.2, 18.9, 28.2], [45.0, 26.0, 9.0, 32.0, 19.0, 25.0, 6.0, 5.0, 1.0, 2.0, 2.0, 1.0, 2.9, 68.0, 38.8, 22.0, 13.6, 8.6, 9.0, 6.0, 9.1, 23.0, 34.0], [43.0, 24.0, 9.0, 23.0, 14.0, 26.0, 7.0, 10.0, 1.0, 2.0, 3.0, 4.0, 3.0, 57.5, 31.8, 19.8, 13.0, 8.7, 7.0, 5.4, 10.2, 20.0, 31.5], [54.0, 24.0, 9.0, 28.0, 20.0, 24.0, 6.0, 11.0, 1.0, 2.0, 2.0, 4.0, 2.5, 56.0, 28.0, 19.6, 13.2, 7.0, 8.0, 4.9, 10.7, 18.3, 27.0], [51.0, 24.0, 9.0, 27.0, 19.0, 26.0, 5.0, 12.0, 1.0, 2.0, 2.0, 4.0, 2.0, 39.1, 19.4, 14.0, 9.5, 5.1, 6.4, 3.0, 9.1, 12.0, 21.9], [52.0, 21.0, 9.0,

21.0, 18.0, 25.0, 7.0, 10.0, 1.0, 3.0, 2.0, 3.0, 2.2, 58.0, 32.2, 18.3, 12.1, 5.7, 7.7, 4.3, 10.7, 16.3, 28.0], [49.0, 24.0, 10.0, 31.0, 18.0, 24.0, 6.0, 6.0, 1.0, 2.0, 1.0, 1.0, 2.9, 71.5, 37.0, 24.1, 17.0,
11.0, 9.5, 7.2, 12.8, 27.4, 40.4], [56.0, 29.0, 12.0, 28.0, 17.0, 19.0, 6.0, 12.0, 2.0, 2.0, 2.0, 5.0, 2.1, 60.1, 33.4, 16.7, 11.7, 7.7, 6.4, 4.6, 9.6, 17.8, 27.2], [48.0, 25.0, 7.0, 21.0, 15.0, 23.0, 5.0,
9.0, 2.0, 2.0, 2.0, 4.0, 2.7, 55.5, 30.0, 18.3, 12.2, 8.2, 7.0, 5.1, 9.2, 20.0, 30.2], [48.0, 23.0, 10.0, 32.0, 20.0, 24.0, 7.0, 3.0, 2.0, 3.0, 1.0, 1.0, 2.8, 71.0, 36.9, 25.0, 16.5, 10.4, 11.0, 7.7, 11.7,
26.6, 41.3], [45.0, 24.0, 8.0, 21.0, 15.0, 26.0, 4.0, 10.0, 1.0, 2.0, 2.0, 4.0, 3.0, 53.0, 30.0, 17.5, 12.0, 8.6, 6.8, 4.8, 9.3, 18.2, 26.5], [49.0, 25.0, 9.0, 30.0, 19.0, 25.0, 7.0, 5.0, 1.0, 2.0, 1.0, 3.0,
2.0, 72.5, 38.6, 23.8, 16.9, 10.7, 10.9, 7.6, 14.2, 24.7, 42.9], [50.0, 25.0, 8.0, 31.0, 18.0, 25.0, 7.0, 3.0, 1.0, 2.0, 2.0, 1.0, 2.5, 48.0, 24.4, 16.3, 10.8, 7.0, 7.0, 4.9, 7.7, 17.3, 27.0], [43.0, 27.0,
8.0, 23.0, 16.0, 20.0, 7.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.2, 59.0, 31.0, 18.1, 12.9, 8.4, 7.1, 5.8, 10.1, 20.8, 29.8], [52.0, 25.0, 8.0, 24.0, 16.0, 20.0, 6.0, 10.0, 1.0, 1.0, 1.0, 4.0, 2.7, 47.5, 23.8, 16.1,
11.3, 6.1, 7.6, 5.1, 9.4, 16.2, 25.5], [41.0, 24.0, 8.0, 24.0, 16.0, 19.0, 5.0, 11.0, 1.0, 1.0, 2.0, 3.0, 2.9, 58.0, 31.7, 20.7, 13.5, 9.0, 7.5, 5.4, 9.9, 21.0, 29.0], [49.0, 27.0, 8.0, 30.0, 20.0, 25.0,
7.0, 5.0, 2.0, 1.0, 1.0, 1.0, 2.7, 62.0, 32.9, 20.0, 13.0, 7.8, 8.5, 5.6, 8.7, 21.7, 32.6], [39.0, 22.0, 5.0, 19.0, 10.0, 23.0, 6.0, 5.0, 1.0, 2.0, 2.0, 1.0, 2.2, 46.0, 23.5, 17.0, 10.8, 7.3, 7.1, 5.1, 7.1,
16.9, 25.2], [39.0, 25.0, 9.0, 21.0, 8.0, 16.0, 5.0, 4.0, 1.0, 1.0, 2.0, 3.0, 2.0, 60.0, 33.7, 18.0, 11.8, 7.7, 7.0, 5.6, 9.8, 17.0, 27.4], [52.0, 22.0, 10.0, 24.0, 18.0, 27.0, 5.0, 9.0, 2.0, 3.0, 2.0, 4.0,
2.3, 61.0, 30.5, 20.2, 14.5, 7.1, 8.1, 5.1, 13.3, 19.5, 34.8], [40.0, 23.0, 7.0, 21.0, 16.0, 24.0, 6.0, 10.0, 1.0, 1.0, 2.0, 4.0, 2.4, 55.0, 32.8, 20.2, 13.1, 8.7, 7.3, 5.3, 9.8, 20.7, 30.5], [50.0, 22.0,
9.0, 23.0, 16.0, 22.0, 6.0, 10.0, 2.0, 2.0, 1.0, 5.0, 2.3, 54.0, 26.0, 18.1, 12.2, 6.6, 8.1, 4.1, 10.2, 17.9, 30.0], [46.0, 24.0, 9.0, 32.0, 20.0, 23.0, 7.0, 4.0, 1.0, 2.0, 1.0, 3.0, 2.6, 73.0, 36.9, 25.0,
16.3, 10.3, 10.9, 7.6, 11.4, 25.4, 39.6], [43.0, 27.0, 6.0, 24.0, 14.0, 25.0, 7.0, 12.0, 0.0, 0.0, 2.0, 1.0, 2.4, 59.5, 31.8, 18.8, 11.9, 8.0, 7.7, 5.3, 8.3, 18.3, 28.7], [44.0, 24.0, 7.0, 23.0, 18.0, 26.0,
6.0, 7.0, 0.0, 2.0, 2.0, 4.0, 3.0, 55.0, 27.2, 17.9, 12.9, 8.4, 8.4, 6.3, 8.6, 18.2, 31.7], [51.0, 24.0, 9.0, 31.0, 19.0, 24.0, 6.0, 7.0, 1.0, 2.0, 2.0, 3.0, 2.0, 61.5, 34.7, 20.0, 14.8, 9.2, 10.2, 6.7, 9.5,
23.0, 35.9], [37.0, 24.0, 7.0, 17.0, 16.0, 19.0, 6.0, 13.0, 0.0, 1.0, 2.0, 4.0, 2.1, 53.0, 29.0, 15.8, 11.5, 7.5, 6.7, 5.0, 9.2, 19.3, 30.0], [49.0, 25.0, 8.0, 29.0, 18.0, 22.0, 5.0, 10.0, 0.0, 0.0, 2.0,
5.0, 2.9, 54.0, 28.6, 18.7, 12.5, 18.5, 7.7, 5.3, 10.5, 20.7, 30.2], [46.0, 27.0, 9.0, 22.0, 15.0, 22.0, 6.0, 11.0, 2.0, 3.0, 2.0, 4.0, 2.1, 57.1, 36.3, 16.9, 10.5, 5.3, 7.2, 5.2, 9.2, 15.5, 24.7], [48.0,
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31.0, 19.0, 25.0, 6.0, 2.0, 1.0, 2.0, 1.0, 1.0, 2.5, 72.0, 39.5, 24.4, 17.3, 10.7, 10.6, 7.9, 12.5, 26.3, 38.5], [50.0, 28.0, 10.0, 33.0, 20.0, 24.0, 7.0, 4.0, 1.0, 3.0, 3.0, 1.0, 2.8, 73.0, 41.5, 21.2, 14.5, 8.7, 9.2, 6.3, 10.5, 23.3, 34.6], [52.0, 23.0, 7.0, 23.0, 17.0, 25.0, 5.0, 10.0, 1.0, 1.0, 1.0, 3.0, 2.7, 51.5, 31.2, 16.0, 10.6, 5.2, 6.6, 4.5, 9.5, 15.8, 23.3], [50.0, 24.0, 9.0, 24.0, 17.0, 24.0, 6.0, 11.0, 1.0, 4.0, 2.0, 4.0, 2.0, 58.6, 33.4, 20.2, 13.5, 6.8, 9.1, 6.5, 11.8, 20.9, 31.0], [44.0, 28.0, 11.0, 21.0, 15.0, 19.0, 6.0, 5.0, 1.0, 0.0, 1.0, 3.0, 2.0, 58.3, 30.8, 17.3, 11.9, 7.5, 7.8, 5.5, 9.9, 19.5, 28.2], [45.0, 25.0, 7.0, 25.0, 18.0, 27.0, 6.0, 11.0, 0.0, 2.0, 2.0, 2.0, 2.7, 56.5, 32.8, 19.0, 11.9, 7.5, 7.5, 5.4, 7.8, 17.8, 28.9], [48.0, 25.0, 8.0, 28.0, 14.0, 25.0, 5.0, 9.0, 2.0, 2.0, 2.0, 4.0, 2.6, 56.0, 32.2, 17.5, 12.3, 7.9, 8.5, 6.0, 7.8, 17.5, 29.0], [44.0, 26.0, 10.0, 25.0, 15.0, 20.0, 6.0, 4.0, 1.0, 1.0, 1.0, 3.0, 2.2, 59.5, 30.0, 19.6, 12.4, 8.0, 6.8, 4.7, 10.0, 20.5, 27.0], [39.0, 24.0, 5.0, 18.0, 9.0, 21.0, 6.0, 1.0, 1.0, 2.0, 2.0, 3.0, 2.2, 46.0, 25.7, 15.1, 9.5, 6.4, 6.6, 4.5, 6.6, 16.0, 21.9], [43.0, 27.0, 9.0, 23.0, 16.0, 20.0, 4.0, 7.0, 1.0, 1.0, 1.0, 4.0, 2.0, 54.2, 31.1, 17.1, 11.7, 7.4, 7.2, 5.1, 9.4, 17.8, 27.9], [44.0, 27.0, 9.0, 23.0, 17.0, 21.0, 6.0, 7.0, 1.0, 0.0, 1.0, 4.0, 2.2, 59.8, 30.5, 20.3, 13.0, 8.8, 7.1, 4.5, 11.1, 20.7, 30.7], [41.0, 23.0, 6.0, 20.0, 8.0, 24.0, 6.0, 6.0, 1.0, 2.0, 3.0, 3.0, 2.6, 50.0, 25.8, 17.3, 10.6, 6.7, 7.2, 5.4, 8.3, 18.2, 25.8], [46.0, 22.0, 8.0, 24.0, 15.0, 26.0, 7.0, 10.0, 1.0, 3.0, 3.0, 3.0, 3.0, 53.5, 28.0, 18.8, 12.4, 18.6, 7.4, 5.2, 9.1, 18.5, 30.2], [42.0, 26.0, 9.0, 26.0, 17.0, 27.0, 5.0, 6.0, 1.0, 2.0, 2.0, 1.0, 3.0, 63.0, 31.0, 22.0, 14.0, 9.3, 7.9, 6.0, 9.7, 22.4, 32.0], [51.0, 28.0, 11.0, 26.0, 18.0, 20.0, 6.0, 11.0, 1.0, 2.0, 2.0, 5.0, 2.0, 60.0, 30.4, 19.2, 12.2, 7.7, 7.1, 4.5, 10.5, 20.2, 30.0], [52.0, 25.0, 11.0, 30.0, 20.0, 26.0, 6.0, 4.0, 2.0, 2.0, 1.0, 1.0, 2.5, 54.0, 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4.0, 0.0, 1.0, 2.0, 4.0, 2.8, 60.0, 29.5, 19.8, 12.7, 7.7, 7.7, 6.0, 10.0, 21.0, 30.0], [57.0, 23.0, 11.0, 27.0, 20.0, 26.0, 6.0, 10.0, 1.0, 2.0, 1.0, 4.0, 2.3, 60.0, 29.0, 21.0, 14.9, 7.8, 9.2, 5.0, 13.0, 18.8, 35.6], [45.0, 22.0, 8.0, 22.0, 15.0, 28.0, 5.0, 4.0, 1.0, 2.0, 2.0, 4.0, 3.2, 59.0, 32.0, 20.5, 13.0, 8.7, 7.7, 5.5, 10.5, 21.0, 30.5], [47.0, 25.0, 9.0, 30.0, 18.0, 25.0, 7.0, 3.0, 1.0, 3.0, 2.0, 1.0, 2.3, 74.0, 38.9, 14.9, 9.2, 10.3, 9.4, 6.8, 11.4, 23.0, 37.1], [43.0, 27.0, 8.0, 23.0, 16.0, 21.0, 5.0, 4.0, 1.0, 1.0, 1.0, 2.0, 2.2, 61.6, 30.4, 18.8, 12.8, 7.9, 7.8, 4.5, 11.9, 20.3, 29.9], [51.0, 26.0, 8.0, 31.0, 19.0, 25.0, 8.0, 6.0, 1.0, 2.0, 1.0, 1.0, 2.6, 72.5, 32.5, 24.4, 17.0, 10.7, 10.9, 7.8, 11.9, 25.6, 38.5], [38.0, 26.0, 7.0, 23.0, 7.0, 16.0, 6.0, 2.0, 1.0, 3.0, 3.0, 3.0, 2.0, 51.0, 31.0, 17.0, 10.5, 7.0, 6.2, 4.8, 9.0, 15.3, 24.0], [48.0, 24.0, 9.0, 28.0, 17.0, 22.0, 6.0, 12.0, 2.0, 3.0, 1.0, 5.0, 2.7, 53.6, 31.3, 18.6, 12.3, 6.0, 8.3, 5.5, 12.0, 17.3, 29.0], [54.0, 27.0, 11.0, 25.0, 19.0, 20.0, 6.0, 14.0, 1.0, 2.0, 2.0, 5.0, 2.2, 59.0, 30.5, 18.8, 12.0, 7.5, 6.6, 4.5, 10.7, 18.6, 27.7], [43.0, 22.0, 8.0, 24.0, 16.0, 21.0, 6.0, 9.0, 1.0, 2.0, 2.0, 5.0, 3.0, 56.0, 28.0, 19.6, 13.0, 8.7, 7.6, 5.9, 9.6, 19.8, 28.5], [43.0, 22.0, 8.0, 22.0, 14.0, 26.0, 7.0, 9.0, 1.0, 2.0, 2.0, 3.0, 3.0, 52.0, 29.1, 16.9, 12.0, 7.9, 7.5, 5.2, 9.3, 20.2, 29.3], [48.0, 24.0, 10.0, 30.0, 21.0, 28.0, 6.0, 4.0, 1.0, 3.0, 3.0, 2.0, 2.9, 74.0, 37.6, 25.8, 16.7, 10.9, 11.4, 6.9, 12.3, 25.8, 39.3], [51.0, 24.0, 8.0, 26.0, 16.0, 23.0, 5.0, 7.0, 1.0, 0.0, 2.0, 3.0, 2.9, 61.0, 32.2, 18.8, 13.4, 8.6, 9.3, 6.0, 9.7, 19.0, 30.7], [56.0, 25.0, 10.0, 25.0, 19.0, 25.0, 8.0, 12.0, 3.0, 6.0, 2.0, 3.0, 2.7, 59.4, 33.1, 20.3, 13.2, 7.1, 9.2, 6.5, 10.7, 20.0, 30.6], [51.0, 27.0, 8.0, 29.0, 18.0, 25.0, 6.0, 4.0, 2.0, 2.0, 2.0, 1.0, 2.6, 74.0, 42.6, 21.6, 14.4, 9.2, 9.6, 6.4, 10.5, 22.9, 31.1], [45.0, 25.0, 9.0, 27.0, 18.0, 23.0, 6.0, 4.0, 1.0, 2.0, 2.0, 5.0, 2.4, 73.0, 37.2, 22.9, 15.1, 9.6, 9.3, 6.1, 11.0, 22.6, 33.4], [40.0, 24.0, 7.0, 20.0, 13.0, 26.0, 6.0, 10.0, 1.0, 1.0, 3.0, 2.0, 2.9, 56.0, 31.8, 19.0, 11.3, 7.3, 7.5, 4.8, 7.9, 17.8, 26.3], [44.0, 28.0, 8.0, 24.0, 16.0, 20.0, 5.0, 6.0, 1.0, 1.0, 1.0, 3.0, 2.0, 60.6, 29.3, 19.2, 12.4, 12.7, 7.1, 5.3, 9.7, 20.0, 29.3], [51.0, 25.0, 8.0, 24.0, 17.0, 23.0, 6.0, 12.0, 1.0, 2.0, 1.0, 4.0, 2.8, 49.7, 27.9, 16.6, 11.6, 6.0, 7.4, 4.7, 9.7, 15.8, 25.5], [44.0, 22.0, 8.0, 22.0, 16.0, 27.0, 6.0, 8.0, 1.0, 3.0, 2.0, 4.0, 2.8, 49.0, 23.4, 17.2, 11.7, 7.8, 7.6, 5.5, 7.7, 18.4, 30.0], [51.0, 22.0, 9.0, 27.0, 17.0, 25.0, 5.0, 9.0, 2.0, 4.0, 2.0, 3.0, 2.1, 53.3, 26.0, 19.4, 12.8, 6.8, 8.0, 4.8, 11.1, 19.2, 30.0], [46.0, 24.0, 8.0, 30.0, 19.0, 23.0, 6.0, 4.0, 1.0, 2.0, 1.0, 1.0, 2.6, 54.0, 27.6, 19.5, 12.9, 8.3, 8.3, 6.0, 9.5, 19.1, 33.2], [46.0, 22.0, 8.0, 22.0, 14.0, 28.0, 6.0, 9.0, 1.0, 2.0, 2.0, 3.0, 2.9, 54.5, 27.9, 18.4, 12.8, 8.2, 8.3, 5.5, 9.2, 18.6, 30.3], [52.0, 27.0, 7.0, 31.0, 17.0, 25.0, 7.0, 3.0, 2.0, 2.0, 1.0, 1.0, 3.0, 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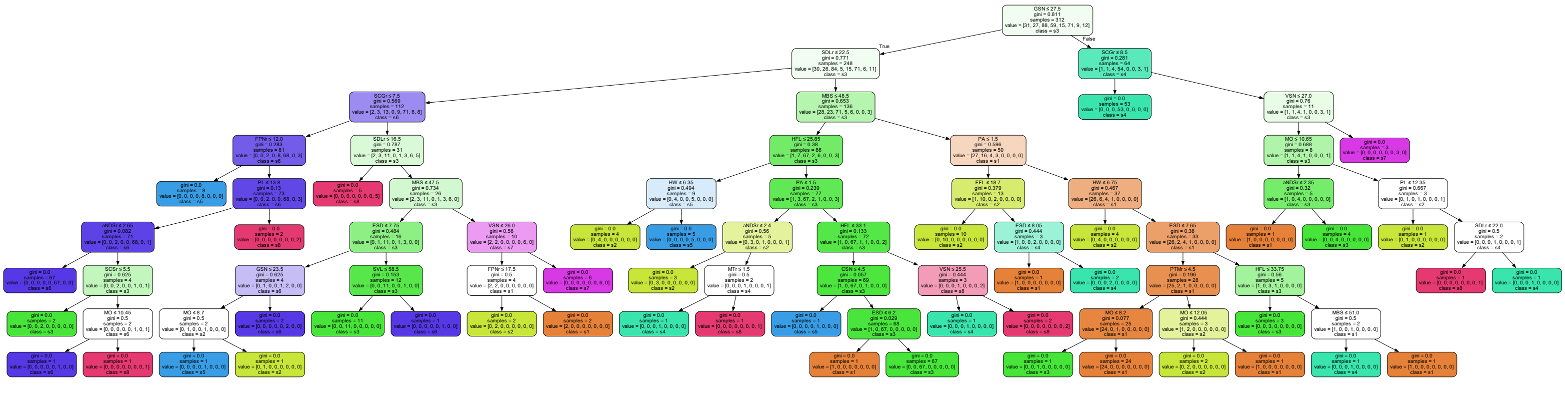
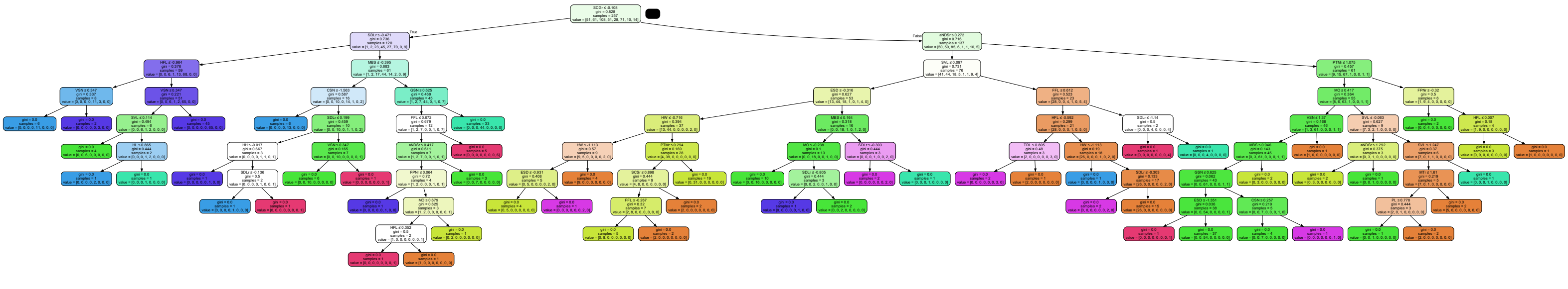
[53.0, 23.0, 10.0, 25.0, 19.0, 24.0, 6.0, 11.0, 2.0, 2.0, 1.0, 6.0, 2.1, 52.2, 27.0, 17.0, 12.2, 6.0, 8.2, 4.3, 11.2, 17.0, 29.8], [38.0, 24.0, 5.0, 19.0, 8.0, 23.0, 5.0, 1.0, 0.0, 0.0, 2.0, 1.0, 2.1, 55.0, 29.4, 17.9, 10.7, 7.5, 6.9, 5.1, 7.0, 17.4, 25.1], [43.0, 26.0, 9.0, 23.0, 16.0, 19.0, 5.0, 3.0, 1.0, 1.0, 3.0, 5.0, 2.2, 59.3, 29.5, 19.0, 12.4, 8.3, 7.4, 5.4, 10.9, 19.8, 30.5], [50.0, 22.0, 10.0, 28.0, 19.0, 26.0, 7.0, 6.0, 2.0, 2.0, 1.0, 3.0, 2.2, 66.5, 33.9, 22.0, 16.2, 11.2, 11.0, 8.6, 10.8, 25.7, 38.3], [51.0, 28.0, 9.0, 30.0, 18.0, 23.0, 7.0, 4.0, 2.0, 3.0, 2.0, 2.0, 2.7, 70.0, 42.8, 21.5, 14.5, 9.2, 9.7, 6.8, 9.3, 22.7, 35.5], [45.0, 26.0, 10.0, 23.0, 17.0, 19.0, 6.0, 7.0, 1.0, 1.0, 1.0, 4.0, 2.1, 60.0, 29.8, 19.8, 12.7, 7.9, 7.8, 5.3, 10.3, 19.2, 29.4], [47.0, 26.0, 8.0, 30.0, 16.0, 23.0, 6.0, 5.0, 1.0, 3.0, 2.0, 3.0, 2.4, 75.0, 45.3, 20.4, 15.0, 9.9, 9.4, 6.7, 10.2, 22.1, 35.9], [50.0, 23.0, 11.0, 26.0, 19.0, 23.0, 6.0, 3.0, 2.0, 3.0, 1.0, 1.0, 2.7, 64.5, 33.9, 22.5, 14.8, 9.4, 9.9, 7.0, 10.7, 26.0, 37.3], [42.0, 24.0, 8.0, 21.0, 14.0, 20.0, 5.0, 6.0, 1.0, 1.0, 2.0, 3.0, 2.2, 59.8, 30.7, 18.4, 12.8, 8.7, 8.7, 4.6, 10.9, 21.5, 30.3], [48.0, 24.0, 7.0, 30.0, 18.0, 25.0, 6.0, 6.0, 2.0, 3.0, 2.0, 1.0, 2.9, 47.0, 24.2, 16.4, 11.6, 7.0, 7.4, 5.3, 7.7, 16.6, 27.5], [42.0, 27.0, 9.0, 24.0, 16.0, 19.0, 5.0, 7.0, 1.0, 1.0, 1.0, 3.0, 2.5, 62.7, 32.5, 19.3, 12.3, 7.8, 7.4, 4.7, 9.6, 20.6, 29.8], [43.0, 26.0, 9.0, 25.0, 16.0, 17.0, 6.0, 4.0, 1.0, 1.0, 2.0, 3.0, 2.3, 58.5, 31.4, 18.1, 11.8, 7.3, 6.6, 4.8, 10.0, 19.7, 29.7], [45.0, 23.0, 7.0, 22.0, 16.0, 25.0, 6.0, 7.0, 1.0, 2.0, 2.0, 4.0, 3.1, 52.5, 29.0, 18.9, 12.5, 8.3, 6.8, 5.1, 9.7, 20.0, 29.5], [41.0, 24.0, 7.0, 21.0, 16.0, 26.0, 5.0, 4.0, 0.0, 0.0, 2.0, 3.0, 2.7, 57.0, 33.1, 18.4, 12.1, 7.6, 7.9, 4.8, 8.8, 15.6, 27.5], [45.0, 25.0, 7.0, 20.0, 15.0, 18.0, 7.0, 11.0, 2.0, 3.0, 2.0, 4.0, 2.7, 55.0, 27.3, 18.5, 12.4, 8.4, 7.6, 5.1, 9.9, 20.2, 28.2], [45.0, 27.0, 10.0, 23.0, 16.0, 20.0, 6.0, 9.0, 1.0, 1.0, 2.0, 3.0, 2.5, 58.6, 31.7, 17.8, 12.3, 8.0, 7.9, 5.3, 10.4, 20.1, 30.2], [46.0, 24.0, 8.0, 25.0, 17.0, 28.0, 5.0, 5.0, 2.0, 2.0, 2.0, 1.0, 2.9, 60.0, 30.9, 20.3, 13.5, 8.9, 8.8, 6.4, 9.3, 20.6, 32.8], [47.0, 25.0, 10.0, 27.0, 18.0, 25.0, 6.0, 4.0, 0.0, 0.0, 1.0, 1.0, 2.7, 71.0, 37.6, 24.2, 15.7, 11.1, 9.9, 7.2, 11.3, 25.3, 42.0], [44.0, 29.0, 9.0, 25.0, 16.0, 21.0, 6.0, 5.0, 1.0, 1.0, 2.0, 4.0, 2.5, 51.8, 24.7, 12.7, 11.3, 7.4, 7.1, 4.7, 9.3, 17.6, 28.0], [45.0, 25.0, 9.0, 25.0, 17.0, 19.0, 6.0, 6.0, 0.0, 1.0, 1.0, 4.0, 2.9, 49.2, 22.2, 16.2, 11.6, 7.2, 7.0, 4.7, 9.9, 18.8, 27.8], [49.0, 21.0, 9.0, 24.0, 17.0, 24.0, 4.0, 10.0, 0.0, 1.0, 1.0, 5.0, 2.0, 58.0, 28.2, 19.9, 13.0, 6.8, 8.2, 4.9, 12.5, 18.0, 30.5], [52.0, 24.0, 11.0, 25.0, 17.0, 25.0, 5.0, 6.0, 1.0, 2.0, 1.0, 4.0, 2.3, 57.5, 29.0, 19.8, 13.3, 6.8, 8.8, 4.9, 11.5, 17.0, 31.5], [43.0, 26.0, 8.0, 25.0, 17.0, 24.0, 6.0, 7.0, 1.0, 2.0, 2.0, 3.0, 2.5, 51.0, 25.4, 17.4, 10.9, 5.3, 7.6, 4.9, 7.7, 20.6, 26.0], [49.0, 26.0, 11.0, 29.0, 17.0, 26.0, 7.0, 3.0, 1.0, 2.0, 3.0, 1.0, 2.6, 70.0, 38.3, 24.0, 15.9, 10.4, 9.7, 7.0, 11.2, 25.5, 38.9], [53.0, 22.0, 8.0, 25.0, 16.0, 24.0, 6.0, 12.0, 2.0, 2.0, 1.0, 4.0, 2.3, 54.0, 26.2, 19.8, 13.4, 6.4, 9.2, 4.9, 13.0, 17.8, 30.5], [40.0, 26.0, 9.0, 19.0, 15.0, 26.0, 7.0, 7.0, 1.0, 1.0, 2.0, 2.0, 2.5, 61.0, 36.2, 18.5, 12.0, 8.1, 7.6, 5.6, 8.3, 19.0, 28.9], [44.0, 24.0, 5.0, 24.0, 17.0, 19.0, 6.0, 9.0, 0.0, 0.0, 3.0, 4.0, 3.0, 52.0, 25.4, 17.3, 11.7, 7.8, 6.8, 5.5, 10.0, 19.0, 29.8], [55.0, 25.0, 11.0, 25.0, 20.0, 26.0, 6.0, 10.0, 1.0, 4.0, 2.0, 2.0, 2.0, 61.7, 33.8, 20.9, 14.0, 7.6, 10.0, 6.0, 12.0, 18.6, 33.1], [43.0, 24.0, 9.0, 24.0, 16.0, 19.0, 6.0, 10.0, 1.0, 1.0, 2.0, 2.0, 2.5, 59.0, 32.0, 18.7, 13.1, 8.8, 7.5, 5.5, 10.1, 21.2, 29.8], [42.0, 27.0, 10.0, 22.0, 16.0, 19.0, 6.0, 5.0, 1.0, 1.0, 2.0, 4.0, 2.0, 58.2, 33.4, 18.4, 12.4, 7.9, 7.3, 5.0, 10.8, 19.8, 28.5], [44.0, 27.0, 9.0, 22.0, 15.0, 21.0, 6.0, 4.0, 1.0, 1.0, 2.0, 4.0, 2.0, 53.5, 26.4, 17.3, 11.3, 7.4, 7.3, 5.2, 10.4, 17.5, 27.6], [45.0, 28.0, 9.0, 25.0, 16.0, 19.0, 6.0, 6.0, 0.0, 1.0, 2.0, 3.0, 2.3, 64.0, 35.0, 19.2, 12.9, 8.4, 7.5, 5.5, 10.5, 20.0, 28.6], [45.0, 27.0, 10.0, 25.0, 15.0, 20.0, 6.0, 5.0, 1.0, 2.0, 1.0, 3.0, 2.2, 65.0, 34.4, 19.2, 12.7, 8.4, 7.7, 5.9, 10.2, 21.2, 30.6], [48.0, 23.0, 8.0, 23.0, 18.0, 26.0, 6.0, 6.0, 1.0, 1.0, 3.0, 4.0, 3.0, 55.0, 28.7, 18.6, 12.6, 8.3, 8.4, 5.7, 10.5, 18.0, 29.0], [45.0, 23.0, 7.0, 24.0, 16.0, 27.0, 4.0, 11.0, 1.0, 1.0, 3.0, 2.0, 3.0, 59.5, 30.0, 19.5, 13.2, 8.4, 8.5, 5.8, 9.3, 19.8, 30.5], [43.0, 27.0, 8.0, 23.0, 15.0, 19.0, 6.0, 5.0, 1.0, 1.0, 3.0, 3.0, 2.2, 48.0, 22.9, 16.7, 11.3, 7.3, 6.9, 4.8, 9.3, 16.6, 26.0]]

TestY: [4, 3, 11, 10, 10, 5, 4, 3, 2, 10, 8, 6, 3, 4, 4, 7, 11, 7, 10, 4, 1, 7, 2, 1, 10, 3, 7, 1, 1, 0, 6, 2, 10, 0, 10, 8, 10, 7, 6, 2, 10, 8, 4, 4, 10, 1, 5, 0, 10, 0, 0, 5, 6, 2, 0, 4, 4, 5, 10, 13, 0, 7, 7, 10, 0, 0, 0, 7, 11, 4, 10, 3, 6, 5, 2, 10, 10, 10, 10, 10, 3, 10, 1, 5, 4, 10, 5, 2, 6, 0, 11, 4, 10, 2, 10, 10, 7, 10, 2, 8, 5, 6, 3, 11, 11, 4, 2, 10, 12, 4, 7, 2, 0, 7, 5, 4, 5, 0, 10, 4, 12, 11, 10, 6, 10, 5, 4, 7, 4, 4, 4, 4, 10, 6, 5, 0, 10, 12, 4, 12, 10, 11, 4, 5, 11, 10, 7, 2, 10, 10, 7, 4, 10, 11, 10, 9, 8, 2, 2, 5, 13, 0, 10, 4, 2, 4, 0, 7, 10, 1, 2, 7, 12, 10, 6, 10, 5, 10, 13, 5, 0, 2, 4, 2, 10, 6, 4, 4, 7, 7, 2, 9, 10, 6, 7, 10, 7, 6, 10, 7, 10, 10, 4, 5, 4, 10, 4, 6, 10, 10, 2, 2, 12, 6, 2, 5, 4, 0, 10, 10, 10, 10, 10, 4, 4, 10]

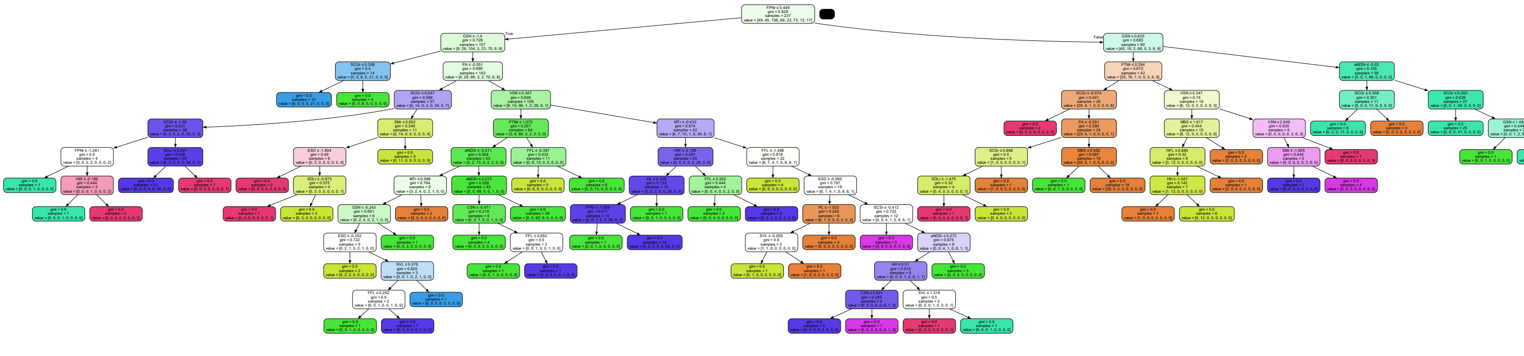
## 7.3 Complete Decision Tree

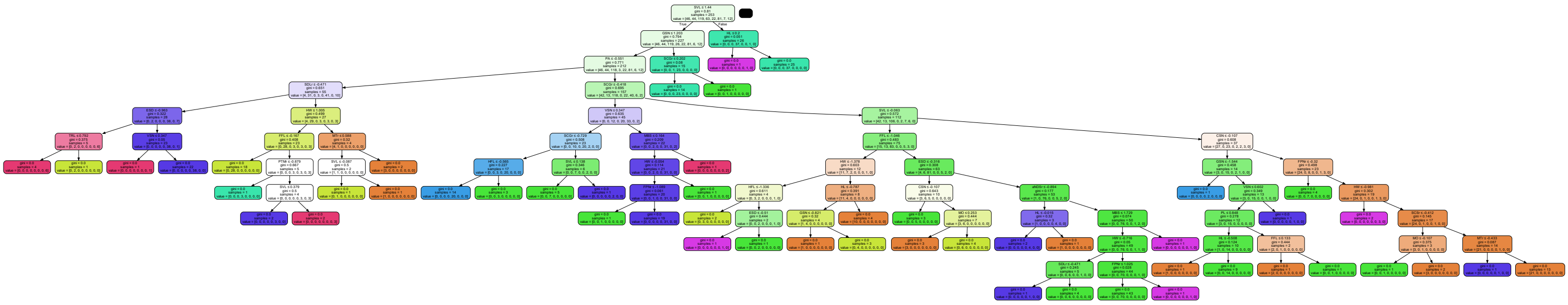

GSN ≤ 27.5
gini = 0.811
samples = 312
value = [31, 27, 88, 59, 15, 71, 9, 12]
class = s3
True
False
SDLr ≤ 22.5
gini = 0.771
samples = 248
value = [30, 26, 84, 5, 15, 71, 6, 11]
class = s3
SCGr ≤ 8.5
gini = 0.281
samples = 64
value = [1, 1, 4, 54, 0, 0, 3, 1]
class = s4
SCGr ≤ 7.5
gini = 0.569
samples = 112
value = [2, 3, 13, 0, 9, 71, 6, 8]
class = s6
MBS ≤ 48.5
gini = 0.653
samples = 136
value = [28, 23, 71, 5, 6, 0, 0, 3]
class = s3
gini = 0.0
samples = 53
value = [0, 0, 0, 53, 0, 0, 0, 0]
class = s4
VSN ≤ 27.0
gini = 0.76
samples = 11
value = [1, 1, 4, 1, 0, 0, 3, 1]
class = s3
FPNr ≤ 12.0
gini = 0.283
samples = 81
value = [0, 0, 2, 0, 8, 68, 0, 3]
class = s6
SDLr ≤ 16.5
gini = 0.787
samples = 31
value = [2, 3, 11, 0, 1, 3, 6, 5]
class = s3
HFL ≤ 25.85
gini = 0.38
samples = 86
value = [1, 7, 67, 2, 6, 0, 0, 3]
class = s3
PA ≤ 1.5
gini = 0.596
samples = 50
value = [27, 16, 4, 3, 0, 0, 0, 0]
class = s1
MO ≤ 10.65
gini = 0.688
samples = 8
value = [1, 1, 4, 1, 0, 0, 0, 1]
class = s3
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 3, 0]
class = s7
gini = 0.0
samples = 8
value = [0, 0, 0, 0, 8, 0, 0, 0]
class = s5
PL ≤ 13.8
gini = 0.13
samples = 73
value = [0, 0, 2, 0, 0, 68, 0, 3]
class = s6
gini = 0.0
samples = 5
value = [0, 0, 0, 0, 0, 0, 0, 5]
class = s8
MBS ≤ 47.5
gini = 0.734
samples = 26
value = [2, 3, 11, 0, 1, 3, 6, 0]
class = s3
HW ≤ 6.35
gini = 0.494
samples = 9
value = [0, 4, 0, 0, 5, 0, 0, 0]
class = s5
PA ≤ 1.5
gini = 0.239
samples = 77
value = [1, 3, 67, 2, 1, 0, 0, 3]
class = s3
FFL ≤ 18.7
gini = 0.379
samples = 13
value = [1, 10, 0, 2, 0, 0, 0, 0]
class = s2
HW ≤ 6.75
gini = 0.467
samples = 37
value = [26, 6, 4, 1, 0, 0, 0, 0]
class = s1
aNDSr ≤ 2.35
gini = 0.32
samples = 5
value = [1, 0, 4, 0, 0, 0, 0, 0]
class = s3
PL ≤ 12.35
gini = 0.667
samples = 3
value = [0, 1, 0, 1, 0, 0, 0, 1]
class = s2
aNDSr ≤ 2.65
gini = 0.082
samples = 71
value = [0, 0, 2, 0, 0, 68, 0, 1]
class = s6
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 2]
class = s8
ESD ≤ 7.75
gini = 0.484
samples = 16
value = [0, 1, 11, 0, 1, 3, 0, 0]
class = s3
VSN ≤ 26.0
gini = 0.56
samples = 10
value = [2, 2, 0, 0, 0, 0, 6, 0]
class = s7
gini = 0.0
samples = 4
value = [0, 4, 0, 0, 0, 0, 0, 0]
class = s2
gini = 0.0
samples = 5
value = [0, 0, 0, 0, 5, 0, 0, 0]
class = s5
aNDSr ≤ 2.4
gini = 0.56
samples = 5
value = [0, 3, 0, 1, 0, 0, 0, 1]
class = s2
HFL ≤ 33.1
gini = 0.133
samples = 72
value = [1, 0, 67, 1, 1, 0, 0, 2]
class = s3
gini = 0.0
samples = 10
value = [0, 10, 0, 0, 0, 0, 0, 0]
class = s2
ESD ≤ 8.05
gini = 0.444
samples = 3
value = [1, 0, 0, 2, 0, 0, 0, 0]
class = s4
gini = 0.0
samples = 4
value = [0, 4, 0, 0, 0, 0, 0, 0]
class = s2
ESD ≤ 7.65
gini = 0.36
samples = 33
value = [26, 2, 4, 1, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 4
value = [0, 0, 4, 0, 0, 0, 0, 0]
class = s3
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
class = s2
SDLr ≤ 22.0
gini = 0.5
samples = 2
value = [0, 0, 0, 1, 0, 0, 0, 1]
class = s4
gini = 0.0
samples = 67
value = [0, 0, 0, 0, 0, 67, 0, 0]
class = s6
SCSr ≤ 5.5
gini = 0.625
samples = 4
value = [0, 0, 2, 0, 0, 1, 0, 1]
class = s3
GSN ≤ 23.5
gini = 0.625
samples = 4
value = [0, 1, 0, 0, 1, 2, 0, 0]
class = s6
SVL ≤ 58.5
gini = 0.153
samples = 12
value = [0, 0, 11, 0, 0, 1, 0, 0]
class = s3
FPNr ≤ 17.5
gini = 0.5
samples = 4
value = [2, 2, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 6
value = [0, 0, 0, 0, 0, 0, 6, 0]
class = s7
gini = 0.0
samples = 3
value = [0, 3, 0, 0, 0, 0, 0, 0]
class = s2
MTr ≤ 1.5
gini = 0.5
samples = 2
value = [0, 0, 0, 1, 0, 0, 0, 1]
class = s4
CSN ≤ 4.5
gini = 0.057
samples = 69
value = [1, 0, 67, 0, 1, 0, 0, 0]
class = s3
VSN ≤ 25.5
gini = 0.444
samples = 3
value = [0, 0, 0, 1, 0, 0, 0, 2]
class = s8
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 2
value = [0, 0, 0, 2, 0, 0, 0, 0]
class = s4
PTMr ≤ 4.5
gini = 0.196
samples = 28
value = [25, 2, 1, 0, 0, 0, 0, 0]
class = s1
HFL ≤ 33.75
gini = 0.56
samples = 5
value = [1, 0, 3, 1, 0, 0, 0, 0]
class = s3
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
class = s8
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
class = s4
gini = 0.0
samples = 2
value = [0, 0, 2, 0, 0, 0, 0, 0]
class = s3
MO ≤ 10.45
gini = 0.5
samples = 2
value = [0, 0, 0, 0, 0, 1, 0, 1]
class = s6
MO ≤ 8.7
gini = 0.5
samples = 2
value = [0, 1, 0, 0, 1, 0, 0, 0]
class = s2
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 2, 0, 0]
class = s6
gini = 0.0
samples = 11
value = [0, 0, 11, 0, 0, 0, 0, 0]
class = s3
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
class = s6
gini = 0.0
samples = 2
value = [0, 2, 0, 0, 0, 0, 0, 0]
class = s2
gini = 0.0
samples = 2
value = [2, 0, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
class = s4
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
class = s8
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
class = s5
ESD ≤ 6.2
gini = 0.029
samples = 68
value = [1, 0, 67, 0, 0, 0, 0, 0]
class = s3
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
class = s4
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 2]
class = s8
MO ≤ 8.2
gini = 0.077
samples = 25
value = [24, 0, 1, 0, 0, 0, 0, 0]
class = s1
MO ≤ 12.05
gini = 0.444
samples = 3
value = [1, 2, 0, 0, 0, 0, 0, 0]
class = s2
gini = 0.0
samples = 3
value = [0, 0, 3, 0, 0, 0, 0, 0]
class = s3
MBS ≤ 51.0
gini = 0.5
samples = 2
value = [1, 0, 0, 1, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
class = s6
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
class = s8
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
class = s5
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
class = s2
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 67
value = [0, 0, 67, 0, 0, 0, 0, 0]
class = s3
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
class = s3
gini = 0.0
samples = 24
value = [24, 0, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 2
value = [0, 2, 0, 0, 0, 0, 0, 0]
class = s2
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
class = s1
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
class = s4
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
class = s1

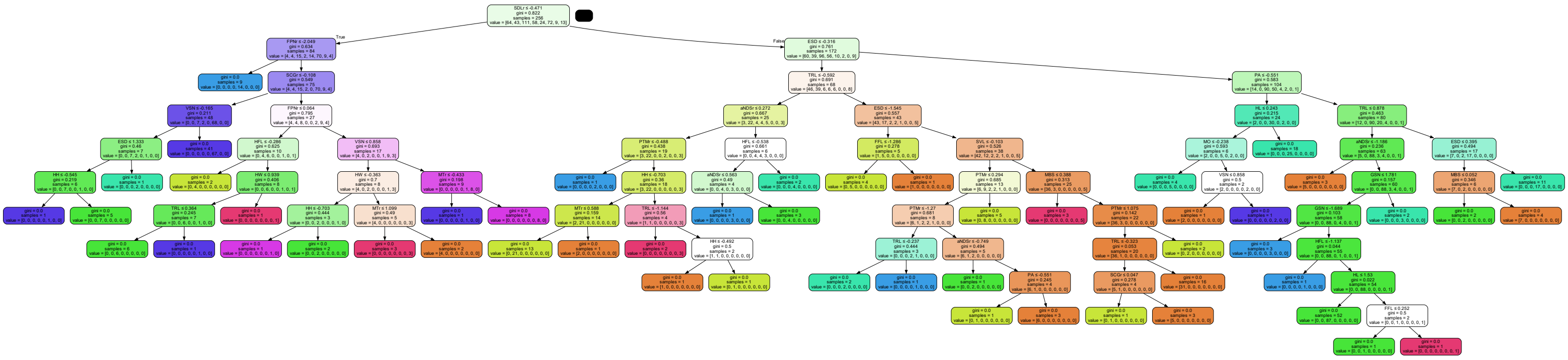
## 7.4 Complete Random Forest for Species

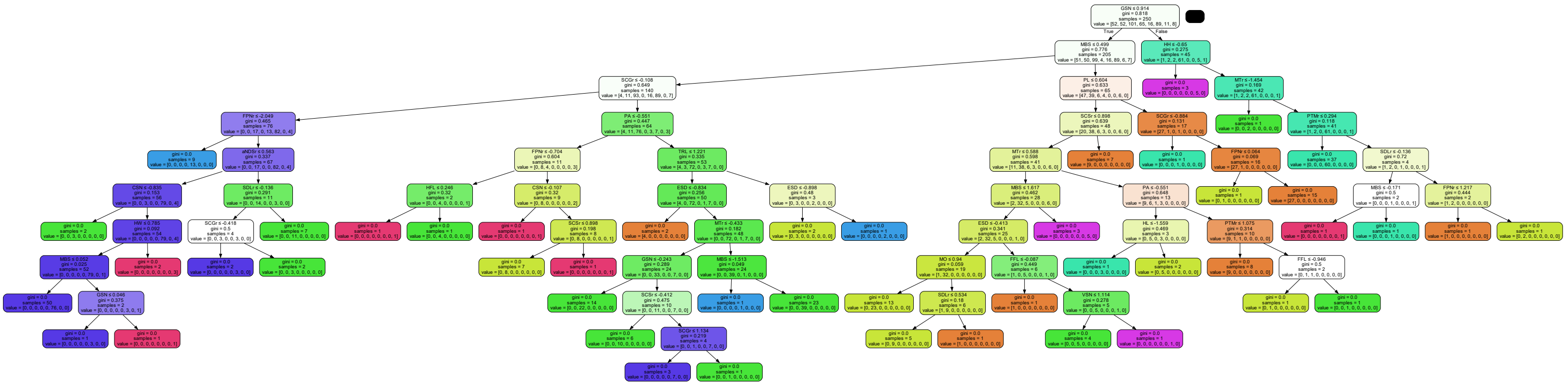


SCGr ≤ -0.108
gini = 0.828
samples = 257
value = [51, 61, 108, 51, 28, 71, 10, 14]
True
False

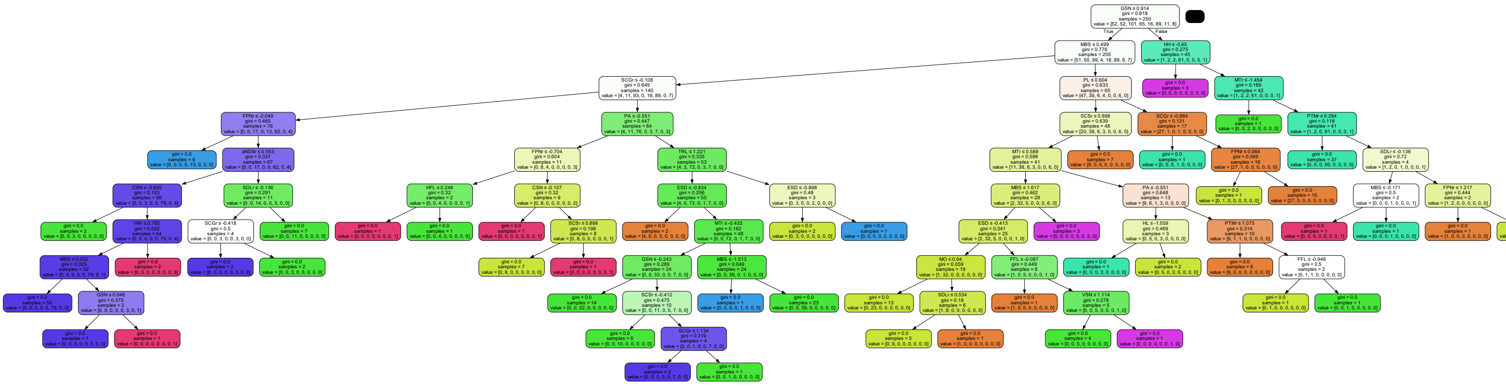

FPNr ≤ 0.449 gini = 0.828 samples = 237 value = [49, 45, 106, 69, 23, 73, 12, 17]
[redacted]
True
GSN ≤ -1.4 gini = 0.728 samples = 157 value = [9, 29, 104, 3, 23, 70, 6, 8]
False
GSN ≤ 0.625 gini = 0.685 samples = 80 value = [40, 16, 2, 66, 0, 3, 6, 9]
SCGr ≤ 0.358 gini = 0.4 samples = 14 value = [0, 0, 8, 0, 21, 0, 0, 0]
PA ≤ -0.551 gini = 0.695 samples = 143 value = [9, 29, 96, 3, 2, 70, 6, 8]
PTMr ≤ 0.294 gini = 0.672 samples = 42 value = [35, 16, 1, 0, 0, 3, 6, 9]
aNDSr ≤ -0.02 gini = 0.155 samples = 38 value = [5, 0, 1, 66, 0, 0, 0, 0]
gini = 0.0 samples = 10 value = [0, 0, 0, 0, 21, 0, 0, 0]
gini = 0.0 samples = 4 value = [0, 0, 8, 0, 0, 0, 0, 0]
SCGr ≤ 0.047 gini = 0.568 samples = 37 value = [0, 14, 0, 2, 0, 34, 0, 7]
VSN ≤ 0.347 gini = 0.606 samples = 106 value = [9, 15, 96, 1, 2, 36, 6, 1]
SCGr ≤ -0.574 gini = 0.441 samples = 26 value = [29, 4, 1, 0, 0, 0, 0, 6]
VSN ≤ 0.347 gini = 0.74 samples = 16 value = [6, 12, 0, 0, 0, 3, 6, 3]
SCGr ≤ 0.358 gini = 0.351 samples = 11 value = [5, 0, 0, 17, 0, 0, 0, 0]
SCGr ≤ 0.202 gini = 0.039 samples = 27 value = [0, 0, 1, 49, 0, 0, 0, 0]
SCGr ≤ -1.35 gini = 0.231 samples = 26 value = [0, 0, 0, 2, 0, 34, 0, 3]
SMr ≤ 0.652 gini = 0.346 samples = 11 value = [0, 14, 0, 0, 0, 0, 0, 4]
PTMr ≤ 1.075 gini = 0.267 samples = 64 value = [3, 8, 86, 0, 2, 2, 0, 0]
MTr ≤ -0.433 gini = 0.674 samples = 42 value = [6, 7, 10, 1, 0, 34, 6, 1]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 0, 0, 5]
PA ≤ -0.551 gini = 0.299 samples = 24 value = [29, 4, 1, 0, 0, 0, 0, 1]
MBS ≤ 1.617 gini = 0.444 samples = 10 value = [6, 12, 0, 0, 0, 0, 0, 0]
VSN ≤ 2.649 gini = 0.625 samples = 6 value = [0, 0, 0, 0, 0, 3, 6, 3]
gini = 0.0 samples = 8 value = [0, 0, 0, 17, 0, 0, 0, 0]
gini = 0.0 samples = 3 value = [5, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 25 value = [0, 0, 0, 47, 0, 0, 0, 0]
GSN ≤ 1.492 gini = 0.444 samples = 2 value = [0, 0, 1, 2, 0, 0, 0, 0]
FPNr ≤ -1.281 gini = 0.5 samples = 4 value = [0, 0, 0, 2, 0, 0, 0, 2]
SDLr ≤ 0.031 gini = 0.056 samples = 22 value = [0, 0, 0, 0, 0, 34, 0, 1]
ESD ≤ -1.804 gini = 0.49 samples = 6 value = [0, 3, 0, 0, 0, 0, 0, 4]
gini = 0.0 samples = 5 value = [0, 11, 0, 0, 0, 0, 0, 0]
aNDSr ≤ -0.311 gini = 0.204 samples = 53 value = [3, 2, 73, 0, 2, 2, 0, 0]
FFL ≤ -0.387 gini = 0.432 samples = 11 value = [0, 6, 13, 0, 0, 0, 0, 0]
HW ≤ -0.186 gini = 0.291 samples = 20 value = [0, 0, 6, 0, 0, 28, 0, 0]
FFL ≤ -1.486 gini = 0.818 samples = 22 value = [6, 7, 4, 1, 0, 6, 6, 1]
SCSr ≤ 0.898 gini = 0.5 samples = 5 value = [1, 4, 0, 0, 0, 0, 0, 1]
MBS ≤ 0.052 gini = 0.067 samples = 19 value = [28, 0, 1, 0, 0, 0, 0, 0]
HFL ≤ 0.884 gini = 0.32 samples = 8 value = [3, 12, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [3, 0, 0, 0, 0, 0, 0, 0]
SMr ≤ -1.005 gini = 0.444 samples = 5 value = [0, 0, 0, 0, 0, 3, 6, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 2, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
HW ≤ -0.186 gini = 0.444 samples = 3 value = [0, 0, 0, 1, 0, 0, 0, 2]
gini = 0.0 samples = 21 value = [0, 0, 0, 0, 0, 34, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 0, 0, 3]
SDLr ≤ -0.973 gini = 0.375 samples = 4 value = [0, 3, 0, 0, 0, 0, 0, 1]
MTr ≤ 0.588 gini = 0.764 samples = 8 value = [3, 2, 4, 0, 2, 1, 0, 0]
aNDSr ≤ 0.272 gini = 0.028 samples = 45 value = [0, 0, 69, 0, 0, 1, 0, 0]
gini = 0.0 samples = 5 value = [0, 6, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 6 value = [0, 0, 13, 0, 0, 0, 0, 0]
HL ≤ 0.329 gini = 0.133 samples = 16 value = [0, 0, 2, 0, 0, 26, 0, 0]
FFL ≤ 0.252 gini = 0.444 samples = 4 value = [0, 0, 4, 0, 0, 2, 0, 0]
gini = 0.0 samples = 4 value = [0, 6, 0, 0, 0, 0, 0, 0]
ESD ≤ -0.995 gini = 0.797 samples = 18 value = [6, 1, 4, 1, 0, 6, 6, 1]
SDLr ≤ -1.475 gini = 0.32 samples = 4 value = [0, 4, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 18 value = [28, 0, 0, 0, 0, 0, 0, 0]
HH ≤ -1.547 gini = 0.142 samples = 7 value = [1, 12, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [2, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 4 value = [0, 0, 0, 0, 0, 0, 6, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 0, 0, 2]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 3 value = [0, 3, 0, 0, 0, 0, 0, 0]
GSN ≤ -0.243 gini = 0.691 samples = 6 value = [0, 2, 4, 0, 2, 1, 0, 0]
gini = 0.0 samples = 2 value = [3, 0, 0, 0, 0, 0, 0, 0]
CSN ≤ -0.471 gini = 0.219 samples = 6 value = [0, 0, 7, 0, 0, 1, 0, 0]
gini = 0.0 samples = 39 value = [0, 0, 62, 0, 0, 0, 0, 0]
FPNr ≤ -1.089 gini = 0.071 samples = 15 value = [0, 0, 1, 0, 0, 26, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 2, 0, 0]
PL ≤ -1.033 gini = 0.245 samples = 6 value = [6, 1, 0, 0, 0, 0, 0, 0]
SCSr ≤ -0.412 gini = 0.722 samples = 12 value = [0, 0, 4, 1, 0, 6, 6, 1]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 3 value = [0, 4, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 6 value = [0, 12, 0, 0, 0, 0, 0, 0]
ESD ≤ -0.252 gini = 0.722 samples = 5 value = [0, 2, 1, 0, 2, 1, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0 samples = 4 value = [0, 0, 6, 0, 0, 0, 0, 0]
FFL ≤ 0.692 gini = 0.5 samples = 2 value = [0, 0, 1, 0, 0, 1, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 14 value = [0, 0, 0, 0, 0, 26, 0, 0]
SVL ≤ -0.055 gini = 0.5 samples = 2 value = [1, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 4 value = [5, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
aNDSr ≤ 0.272 gini = 0.675 samples = 9 value = [0, 0, 4, 1, 0, 6, 1, 1]
gini = 0.0 samples = 2 value = [0, 2, 0, 0, 0, 0, 0, 0]
SVL ≤ 0.379 gini = 0.625 samples = 3 value = [0, 0, 1, 0, 2, 1, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
HH ≤ 0.51 gini = 0.519 samples = 6 value = [0, 0, 0, 1, 0, 6, 1, 1]
gini = 0.0 samples = 3 value = [0, 0, 4, 0, 0, 0, 0, 0]
FFL ≤ 0.252 gini = 0.5 samples = 2 value = [0, 0, 1, 0, 0, 1, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 2, 0, 0, 0]
CSN ≤ 0.621 gini = 0.245 samples = 4 value = [0, 0, 0, 0, 0, 6, 1, 0]
SVL ≤ 1.319 gini = 0.5 samples = 2 value = [0, 0, 0, 1, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 6, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]


SVL ≤ 1.44
gini = 0.81
samples = 253
value = [46, 44, 119, 63, 22, 81, 7, 12]
True
False
GSN ≤ 1.203
gini = 0.794
samples = 227
value = [46, 44, 119, 26, 22, 81, 6, 12]
HL ≤ 0.2
gini = 0.051
samples = 26
value = [0, 0, 0, 37, 0, 0, 1, 0]
PA ≤ -0.551
gini = 0.771
samples = 212
value = [46, 44, 118, 3, 22, 81, 6, 12]
SCGr ≤ 0.202
gini = 0.08
samples = 15
value = [0, 0, 1, 23, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0
samples = 25
value = [0, 0, 0, 37, 0, 0, 0, 0]
SCGr ≤ -0.418
gini = 0.695
samples = 157
value = [42, 13, 118, 0, 22, 40, 6, 2]
gini = 0.0
samples = 14
value = [0, 0, 0, 23, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
SDLr ≤ -0.471
gini = 0.651
samples = 55
value = [4, 31, 0, 3, 0, 41, 0, 10]
VSN ≤ 0.347
gini = 0.635
samples = 45
value = [0, 0, 12, 0, 20, 33, 0, 2]
SVL ≤ -0.063
gini = 0.572
samples = 112
value = [42, 13, 106, 0, 2, 7, 6, 0]
ESD ≤ -0.963
gini = 0.322
samples = 28
value = [0, 2, 0, 0, 0, 38, 0, 7]
HW ≤ 1.005
gini = 0.499
samples = 27
value = [4, 29, 0, 3, 0, 3, 0, 3]
SCGr ≤ -0.729
gini = 0.508
samples = 23
value = [0, 0, 10, 0, 20, 2, 0, 0]
MBS ≤ 0.164
gini = 0.209
samples = 22
value = [0, 0, 2, 0, 0, 31, 0, 2]
FFL ≤ -1.046
gini = 0.483
samples = 75
value = [15, 13, 83, 0, 0, 5, 3, 0]
CSN ≤ -0.107
gini = 0.608
samples = 37
value = [27, 0, 23, 0, 2, 2, 3, 0]
TRL ≤ 0.792
gini = 0.375
samples = 5
value = [0, 2, 0, 0, 0, 0, 0, 6]
VSN ≤ 0.347
gini = 0.05
samples = 23
value = [0, 0, 0, 0, 0, 38, 0, 1]
FFL ≤ -0.167
gini = 0.408
samples = 23
value = [0, 28, 0, 3, 0, 3, 0, 3]
MTr ≤ 0.588
gini = 0.32
samples = 4
value = [4, 1, 0, 0, 0, 0, 0, 0]
HFL ≤ -0.565
gini = 0.227
samples = 17
value = [0, 0, 3, 0, 20, 0, 0, 0]
SVL ≤ 0.138
gini = 0.346
samples = 6
value = [0, 0, 7, 0, 0, 2, 0, 0]
HW ≤ -0.054
gini = 0.114
samples = 21
value = [0, 0, 2, 0, 0, 31, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 2]
HW ≤ -1.378
gini = 0.603
samples = 12
value = [11, 7, 2, 0, 0, 0, 1, 0]
ESD ≤ -0.316
gini = 0.308
samples = 63
value = [4, 6, 81, 0, 0, 5, 2, 0]
GSN ≤ -1.544
gini = 0.458
samples = 14
value = [3, 0, 15, 0, 2, 1, 0, 0]
FPNr ≤ -0.32
gini = 0.498
samples = 23
value = [24, 0, 8, 0, 0, 1, 3, 0]
gini = 0.0
samples = 4
value = [0, 0, 0, 0, 0, 0, 0, 6]
gini = 0.0
samples = 1
value = [0, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 22
value = [0, 0, 0, 0, 0, 38, 0, 0]
gini = 0.0
samples = 18
value = [0, 28, 0, 0, 0, 0, 0, 0]
PTMr ≤ -0.879
gini = 0.667
samples = 5
value = [0, 0, 0, 3, 0, 3, 0, 3]
SVL ≤ -0.087
gini = 0.5
samples = 2
value = [1, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [3, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 14
value = [0, 0, 0, 0, 20, 0, 0, 0]
gini = 0.0
samples = 3
value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0
samples = 5
value = [0, 0, 7, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 2, 0, 0]
FPNr ≤ -1.089
gini = 0.061
samples = 20
value = [0, 0, 1, 0, 0, 31, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
HFL ≤ -1.336
gini = 0.611
samples = 4
value = [0, 3, 2, 0, 0, 0, 1, 0]
HL ≤ -0.787
gini = 0.391
samples = 8
value = [11, 4, 0, 0, 0, 0, 0, 0]
CSN ≤ -0.107
gini = 0.643
samples = 10
value = [3, 6, 5, 0, 0, 0, 0, 0]
aNDSr ≤ -0.894
gini = 0.177
samples = 53
value = [1, 0, 76, 0, 0, 5, 2, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 2, 0, 0, 0]
VSN ≤ 0.602
gini = 0.349
samples = 13
value = [3, 0, 15, 0, 0, 1, 0, 0]
gini = 0.0
samples = 4
value = [0, 0, 7, 0, 0, 0, 0, 0]
HW ≤ -0.981
gini = 0.302
samples = 19
value = [24, 0, 1, 0, 0, 1, 3, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 3, 0, 0, 0, 0]
SVL ≤ 0.379
gini = 0.5
samples = 4
value = [0, 0, 0, 0, 0, 3, 0, 3]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 19
value = [0, 0, 0, 0, 0, 31, 0, 0]
gini = 0.0
samples = 2
value = [0, 3, 0, 0, 0, 0, 0, 0]
ESD ≤ -0.51
gini = 0.444
samples = 2
value = [0, 0, 2, 0, 0, 0, 1, 0]
GSN ≤ -0.821
gini = 0.32
samples = 4
value = [1, 4, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [10, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 3
value = [0, 0, 5, 0, 0, 0, 0, 0]
MO ≤ 0.253
gini = 0.444
samples = 7
value = [3, 6, 0, 0, 0, 0, 0, 0]
HL ≤ -0.015
gini = 0.32
samples = 3
value = [1, 0, 0, 0, 0, 4, 0, 0]
MBS ≤ 1.729
gini = 0.074
samples = 50
value = [0, 0, 76, 0, 0, 1, 2, 0]
PL ≤ 0.848
gini = 0.278
samples = 12
value = [3, 0, 15, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 3, 0]
SCSr ≤ -0.412
gini = 0.145
samples = 17
value = [24, 0, 1, 0, 0, 1, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 0, 2, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 3
value = [0, 4, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 3
value = [3, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [0, 6, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 4, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
HW ≤ -0.716
gini = 0.05
samples = 49
value = [0, 0, 76, 0, 0, 1, 1, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
HL ≤ -0.508
gini = 0.124
samples = 10
value = [1, 0, 14, 0, 0, 0, 0, 0]
FFL ≤ 0.133
gini = 0.444
samples = 2
value = [2, 0, 1, 0, 0, 0, 0, 0]
MO ≤ -0.107
gini = 0.375
samples = 3
value = [3, 0, 1, 0, 0, 0, 0, 0]
MTr ≤ -0.433
gini = 0.087
samples = 14
value = [21, 0, 0, 0, 0, 1, 0, 0]
SDLr ≤ -0.471
gini = 0.245
samples = 5
value = [0, 0, 6, 0, 0, 1, 0, 0]
FPNr ≤ 1.025
gini = 0.028
samples = 44
value = [0, 0, 70, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 9
value = [0, 0, 14, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [2, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [3, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0
samples = 13
value = [21, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0
samples = 4
value = [0, 0, 6, 0, 0, 0, 0, 0]
gini = 0.0
samples = 43
value = [0, 0, 70, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]

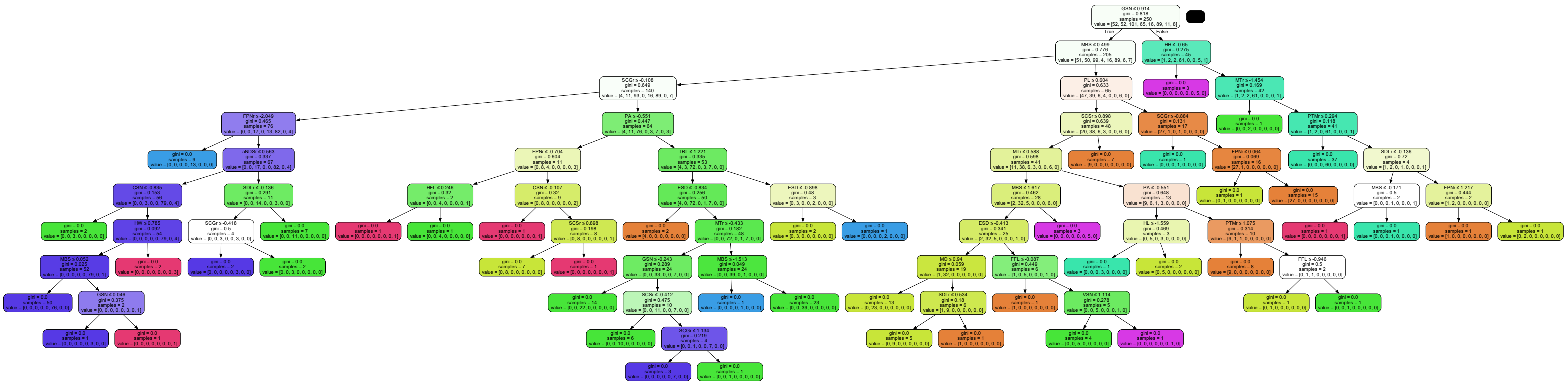

SDLr ≤ -0.471
gini = 0.822
samples = 256
value = [64, 43, 111, 58, 24, 72, 9, 13]
True
False
FPNr ≤ -2.049
gini = 0.634
samples = 84
value = [4, 4, 15, 2, 14, 70, 9, 4]
gini = 0.0
samples = 9
value = [0, 0, 0, 0, 14, 0, 0, 0]
SCGr ≤ -0.108
gini = 0.549
samples = 75
value = [4, 4, 15, 2, 0, 70, 9, 4]
VSN ≤ -0.165
gini = 0.211
samples = 48
value = [0, 0, 7, 2, 0, 68, 0, 0]
ESD ≤ 1.333
gini = 0.46
samples = 7
value = [0, 0, 7, 2, 0, 1, 0, 0]
HH ≤ -0.545
gini = 0.219
samples = 6
value = [0, 0, 7, 0, 0, 1, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0
samples = 5
value = [0, 0, 7, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 2, 0, 0, 0, 0]
gini = 0.0
samples = 41
value = [0, 0, 0, 0, 0, 67, 0, 0]
FPNr ≤ 0.064
gini = 0.795
samples = 27
value = [4, 4, 8, 0, 0, 2, 9, 4]
HFL ≤ -0.286
gini = 0.625
samples = 10
value = [0, 4, 6, 0, 0, 1, 0, 1]
gini = 0.0
samples = 2
value = [0, 4, 0, 0, 0, 0, 0, 0]
HW ≤ 0.939
gini = 0.406
samples = 8
value = [0, 0, 6, 0, 0, 1, 0, 1]
TRL ≤ 0.364
gini = 0.245
samples = 7
value = [0, 0, 6, 0, 0, 1, 0, 0]
gini = 0.0
samples = 6
value = [0, 0, 6, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
VSN ≤ 0.858
gini = 0.693
samples = 17
value = [4, 0, 2, 0, 0, 1, 9, 3]
HW ≤ -0.363
gini = 0.7
samples = 8
value = [4, 0, 2, 0, 0, 0, 1, 3]
HH ≤ -0.703
gini = 0.444
samples = 3
value = [0, 0, 2, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0
samples = 2
value = [0, 0, 2, 0, 0, 0, 0, 0]
MTr ≤ 1.099
gini = 0.49
samples = 5
value = [4, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 2
value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433
gini = 0.198
samples = 9
value = [0, 0, 0, 0, 0, 1, 8, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 1, 0, 0]
gini = 0.0
samples = 8
value = [0, 0, 0, 0, 0, 0, 8, 0]
ESD ≤ -0.316
gini = 0.761
samples = 172
value = [60, 39, 96, 56, 10, 2, 0, 9]
TRL ≤ -0.592
gini = 0.691
samples = 68
value = [46, 39, 6, 6, 6, 0, 0, 8]
aNDSr ≤ 0.272
gini = 0.667
samples = 25
value = [3, 22, 4, 4, 5, 0, 0, 3]
PTMr ≤ -0.488
gini = 0.438
samples = 19
value = [3, 22, 0, 0, 2, 0, 0, 3]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 2, 0, 0, 0]
HH ≤ -0.703
gini = 0.36
samples = 18
value = [3, 22, 0, 0, 0, 0, 0, 3]
MTr ≤ 0.588
gini = 0.159
samples = 14
value = [2, 21, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 13
value = [0, 21, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [2, 0, 0, 0, 0, 0, 0, 0]
TRL ≤ -1.144
gini = 0.56
samples = 4
value = [1, 1, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 3]
HH ≤ -0.492
gini = 0.5
samples = 2
value = [1, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
HFL ≤ -0.538
gini = 0.661
samples = 6
value = [0, 0, 4, 4, 3, 0, 0, 0]
aNDSr ≤ 0.563
gini = 0.49
samples = 4
value = [0, 0, 4, 0, 3, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 3, 0, 0, 0]
gini = 0.0
samples = 3
value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 0, 4, 0, 0, 0, 0]
ESD ≤ -1.545
gini = 0.557
samples = 43
value = [43, 17, 2, 2, 1, 0, 0, 5]
FFL ≤ -1.286
gini = 0.278
samples = 5
value = [1, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
SVL ≤ -0.103
gini = 0.526
samples = 38
value = [42, 12, 2, 2, 1, 0, 0, 5]
PTMr ≤ 0.294
gini = 0.685
samples = 13
value = [6, 9, 2, 2, 1, 0, 0, 0]
PTMr ≤ -1.27
gini = 0.681
samples = 8
value = [6, 1, 2, 2, 1, 0, 0, 0]
TRL ≤ -0.237
gini = 0.444
samples = 3
value = [0, 0, 0, 2, 1, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 0, 2, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
aNDSr ≤ -0.749
gini = 0.494
samples = 5
value = [6, 1, 2, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 2, 0, 0, 0, 0, 0]
PA ≤ -0.551
gini = 0.245
samples = 4
value = [6, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 3
value = [6, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 5
value = [0, 8, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.388
gini = 0.313
samples = 25
value = [36, 3, 0, 0, 0, 0, 0, 5]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 0, 5]
PTMr ≤ 1.075
gini = 0.142
samples = 22
value = [36, 3, 0, 0, 0, 0, 0, 0]
TRL ≤ -0.323
gini = 0.053
samples = 20
value = [36, 1, 0, 0, 0, 0, 0, 0]
SCGr ≤ 0.047
gini = 0.278
samples = 4
value = [5, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 3
value = [5, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 16
value = [31, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 2, 0, 0, 0, 0, 0, 0]
PA ≤ -0.551
gini = 0.583
samples = 104
value = [14, 0, 90, 50, 4, 2, 0, 1]
HL ≤ 0.243
gini = 0.215
samples = 24
value = [2, 0, 0, 30, 0, 2, 0, 0]
MO ≤ -0.238
gini = 0.593
samples = 6
value = [2, 0, 0, 5, 0, 2, 0, 0]
gini = 0.0
samples = 4
value = [0, 0, 0, 5, 0, 0, 0, 0]
VSN ≤ 0.858
gini = 0.5
samples = 2
value = [2, 0, 0, 0, 0, 2, 0, 0]
gini = 0.0
samples = 1
value = [2, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 2, 0, 0]
gini = 0.0
samples = 18
value = [0, 0, 0, 25, 0, 0, 0, 0]
TRL ≤ 0.878
gini = 0.463
samples = 80
value = [12, 0, 90, 20, 4, 0, 0, 1]
aNDSr ≤ -1.186
gini = 0.236
samples = 63
value = [5, 0, 88, 3, 4, 0, 0, 1]
gini = 0.0
samples = 3
value = [5, 0, 0, 0, 0, 0, 0, 0]
GSN ≤ 1.781
gini = 0.157
samples = 60
value = [0, 0, 88, 3, 4, 0, 0, 1]
GSN ≤ -1.689
gini = 0.103
samples = 58
value = [0, 0, 88, 0, 4, 0, 0, 1]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 3, 0, 0, 0]
HFL ≤ -1.137
gini = 0.044
samples = 55
value = [0, 0, 88, 0, 1, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
HL ≤ 1.53
gini = 0.022
samples = 54
value = [0, 0, 88, 0, 0, 0, 0, 1]
gini = 0.0
samples = 52
value = [0, 0, 87, 0, 0, 0, 0, 0]
FFL ≤ 0.252
gini = 0.5
samples = 2
value = [0, 0, 1, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 2
value = [0, 0, 0, 3, 0, 0, 0, 0]
ESD ≤ 0.395
gini = 0.494
samples = 17
value = [7, 0, 2, 17, 0, 0, 0, 0]
MBS ≤ 0.052
gini = 0.346
samples = 6
value = [7, 0, 2, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 2, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [7, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 11
value = [0, 0, 0, 17, 0, 0, 0, 0]

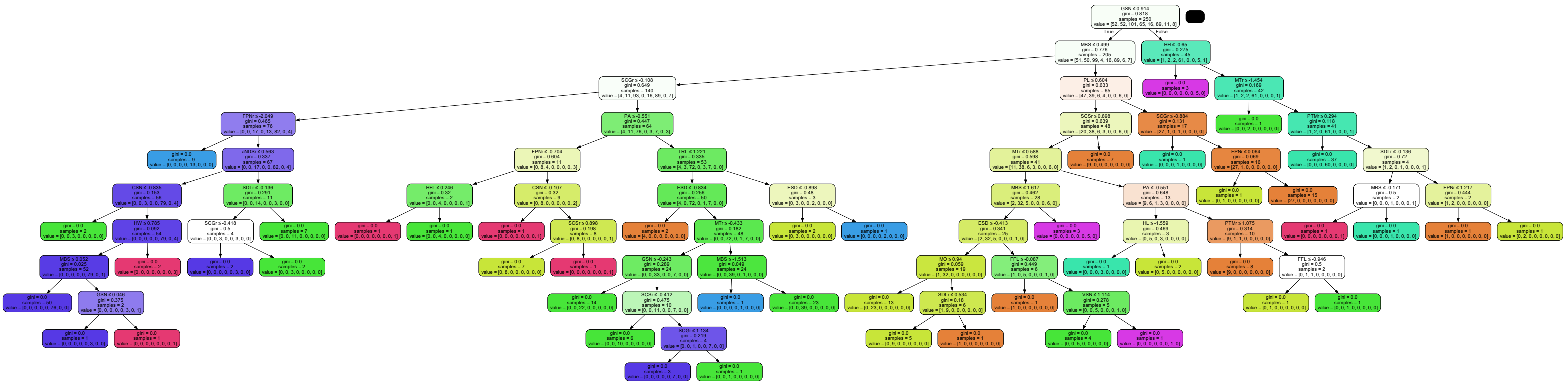

GSN ≤ 0.914
gini = 0.818
samples = 250
value = [52, 52, 101, 65, 16, 89, 11, 8]
True
False
MBS ≤ 0.499
gini = 0.776
samples = 205
value = [51, 50, 99, 4, 16, 89, 6, 7]
HH ≤ -0.65
gini = 0.275
samples = 45
value = [1, 2, 2, 61, 0, 0, 5, 1]
SCGr ≤ -0.108
gini = 0.649
samples = 140
value = [4, 11, 93, 0, 16, 89, 0, 7]
PL ≤ 0.604
gini = 0.633
samples = 65
value = [47, 39, 6, 4, 0, 0, 6, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 5, 0]
MTr ≤ -1.454
gini = 0.169
samples = 42
value = [1, 2, 2, 61, 0, 0, 0, 1]
FPNr ≤ -2.049
gini = 0.465
samples = 76
value = [0, 0, 17, 0, 13, 82, 0, 4]
PA ≤ -0.551
gini = 0.447
samples = 64
value = [4, 11, 76, 0, 3, 7, 0, 3]
SCSr ≤ 0.898
gini = 0.639
samples = 48
value = [20, 38, 6, 3, 0, 0, 6, 0]
SCGr ≤ -0.884
gini = 0.131
samples = 17
value = [27, 1, 0, 1, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 2, 0, 0, 0, 0, 0]
PTMr ≤ 0.294
gini = 0.118
samples = 41
value = [1, 2, 0, 61, 0, 0, 0, 1]
gini = 0.0
samples = 9
value = [0, 0, 0, 0, 13, 0, 0, 0]
aNDSr ≤ 0.563
gini = 0.337
samples = 67
value = [0, 0, 17, 0, 0, 82, 0, 4]
FPNr ≤ -0.704
gini = 0.604
samples = 11
value = [0, 8, 4, 0, 0, 0, 0, 3]
TRL ≤ 1.221
gini = 0.335
samples = 53
value = [4, 3, 72, 0, 3, 7, 0, 0]
MTr ≤ 0.588
gini = 0.598
samples = 41
value = [11, 38, 6, 3, 0, 0, 6, 0]
gini = 0.0
samples = 7
value = [9, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
FPNr ≤ 0.064
gini = 0.069
samples = 16
value = [27, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 37
value = [0, 0, 0, 60, 0, 0, 0, 0]
SDLr ≤ -0.136
gini = 0.72
samples = 4
value = [1, 2, 0, 1, 0, 0, 0, 1]
CSN ≤ -0.835
gini = 0.153
samples = 56
value = [0, 0, 3, 0, 0, 79, 0, 4]
SDLr ≤ -0.136
gini = 0.291
samples = 11
value = [0, 0, 14, 0, 0, 3, 0, 0]
HFL ≤ 0.246
gini = 0.32
samples = 2
value = [0, 0, 4, 0, 0, 0, 0, 1]
CSN ≤ -0.107
gini = 0.32
samples = 9
value = [0, 8, 0, 0, 0, 0, 0, 2]
ESD ≤ -0.834
gini = 0.256
samples = 50
value = [4, 0, 72, 0, 1, 7, 0, 0]
ESD ≤ -0.898
gini = 0.48
samples = 3
value = [0, 3, 0, 0, 2, 0, 0, 0]
MBS ≤ 1.617
gini = 0.462
samples = 28
value = [2, 32, 5, 0, 0, 0, 6, 0]
PA ≤ -0.551
gini = 0.648
samples = 13
value = [9, 6, 1, 3, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 15
value = [27, 0, 0, 0, 0, 0, 0, 0]
MBS ≤ -0.171
gini = 0.5
samples = 2
value = [0, 0, 0, 1, 0, 0, 0, 1]
FPNr ≤ 1.217
gini = 0.444
samples = 2
value = [1, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 3, 0, 0, 0, 0, 0]
HW ≤ 0.785
gini = 0.092
samples = 54
value = [0, 0, 0, 0, 0, 79, 0, 4]
SCGr ≤ -0.418
gini = 0.5
samples = 4
value = [0, 0, 3, 0, 0, 3, 0, 0]
gini = 0.0
samples = 7
value = [0, 0, 11, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
SCSr ≤ 0.898
gini = 0.198
samples = 8
value = [0, 8, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 2
value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433
gini = 0.182
samples = 48
value = [0, 0, 72, 0, 1, 7, 0, 0]
gini = 0.0
samples = 2
value = [0, 3, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 2, 0, 0, 0]
ESD ≤ -0.413
gini = 0.341
samples = 25
value = [2, 32, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 5, 0]
HL ≤ -1.559
gini = 0.469
samples = 3
value = [0, 5, 0, 3, 0, 0, 0, 0]
PTMr ≤ 1.075
gini = 0.314
samples = 10
value = [9, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 2, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.052
gini = 0.025
samples = 52
value = [0, 0, 0, 0, 0, 79, 0, 1]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0
samples = 7
value = [0, 8, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
GSN ≤ -0.243
gini = 0.289
samples = 24
value = [0, 0, 33, 0, 0, 7, 0, 0]
MBS ≤ -1.513
gini = 0.049
samples = 24
value = [0, 0, 39, 0, 1, 0, 0, 0]
MO ≤ 0.94
gini = 0.059
samples = 19
value = [1, 32, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.087
gini = 0.449
samples = 6
value = [1, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 3, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 8
value = [9, 0, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.946
gini = 0.5
samples = 2
value = [0, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 50
value = [0, 0, 0, 0, 0, 76, 0, 0]
GSN ≤ 0.046
gini = 0.375
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 1]
gini = 0.0
samples = 14
value = [0, 0, 22, 0, 0, 0, 0, 0]
SCSr ≤ -0.412
gini = 0.475
samples = 10
value = [0, 0, 11, 0, 0, 7, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
gini = 0.0
samples = 23
value = [0, 0, 39, 0, 0, 0, 0, 0]
gini = 0.0
samples = 13
value = [0, 23, 0, 0, 0, 0, 0, 0]
SDLr ≤ 0.534
gini = 0.18
samples = 6
value = [1, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
VSN ≤ 1.114
gini = 0.278
samples = 5
value = [0, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 6
value = [0, 0, 10, 0, 0, 0, 0, 0]
SCGr ≤ 1.134
gini = 0.219
samples = 4
value = [0, 0, 1, 0, 0, 7, 0, 0]
gini = 0.0
samples = 5
value = [0, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [0, 0, 5, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 7, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]

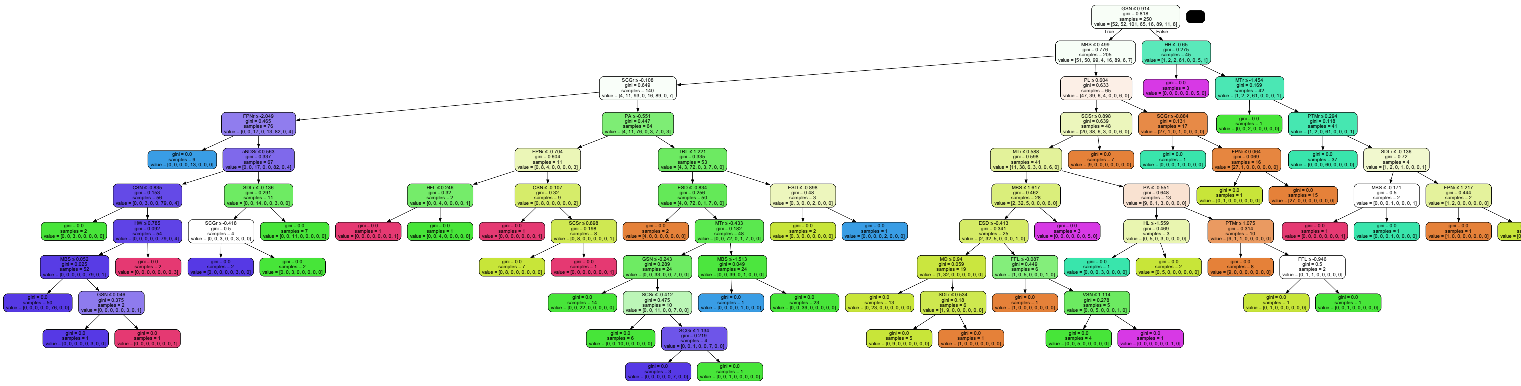
## 7.5 Complete Random Forest for Gender

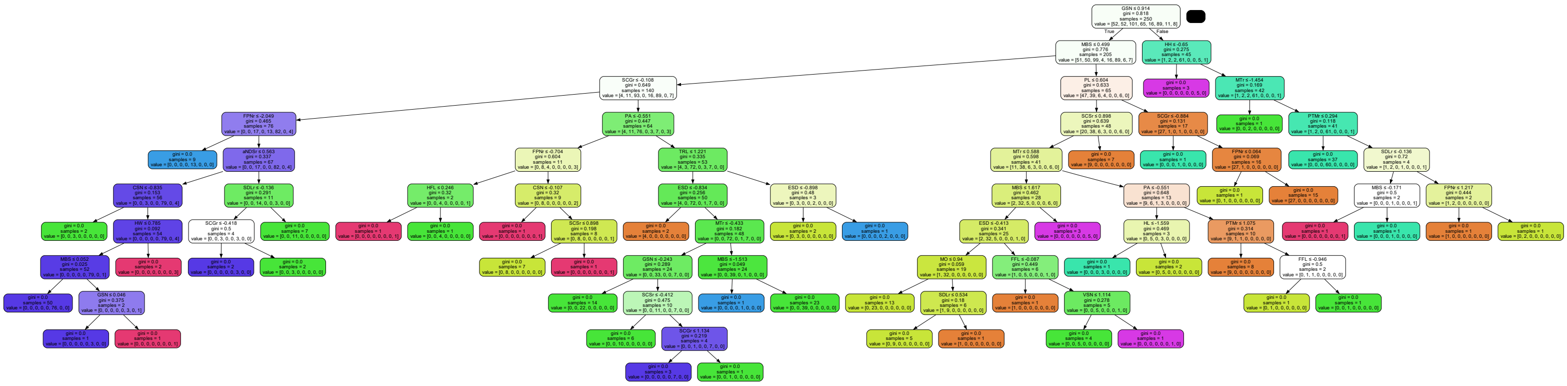

GSN ≤ 0.914 gini = 0.818 samples = 250 value = [52, 52, 101, 65, 16, 89, 11, 8]
True
False
MBS ≤ 0.499 gini = 0.776 samples = 205 value = [51, 50, 99, 4, 16, 89, 6, 7]
HH ≤ -0.65 gini = 0.275 samples = 45 value = [1, 2, 2, 61, 0, 0, 5, 1]
SCGr ≤ -0.108 gini = 0.649 samples = 140 value = [4, 11, 93, 0, 16, 89, 0, 7]
PL ≤ 0.604 gini = 0.633 samples = 65 value = [47, 39, 6, 4, 0, 0, 6, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
MTr ≤ -1.454 gini = 0.169 samples = 42 value = [1, 2, 2, 61, 0, 0, 0, 1]
FPNr ≤ -2.049 gini = 0.465 samples = 76 value = [0, 0, 17, 0, 13, 82, 0, 4]
PA ≤ -0.551 gini = 0.447 samples = 64 value = [4, 11, 76, 0, 3, 7, 0, 3]
SCSr ≤ 0.898 gini = 0.639 samples = 48 value = [20, 38, 6, 3, 0, 0, 6, 0]
SCGr ≤ -0.884 gini = 0.131 samples = 17 value = [27, 1, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 2, 0, 0, 0, 0, 0]
PTMr ≤ 0.294 gini = 0.118 samples = 41 value = [1, 2, 0, 61, 0, 0, 0, 1]
gini = 0.0 samples = 9 value = [0, 0, 0, 0, 13, 0, 0, 0]
aNDSr ≤ 0.563 gini = 0.337 samples = 67 value = [0, 0, 17, 0, 0, 82, 0, 4]
FPNr ≤ -0.704 gini = 0.604 samples = 11 value = [0, 8, 4, 0, 0, 0, 0, 3]
TRL ≤ 1.221 gini = 0.335 samples = 53 value = [4, 3, 72, 0, 3, 7, 0, 0]
MTr ≤ 0.588 gini = 0.598 samples = 41 value = [11, 38, 6, 3, 0, 0, 6, 0]
gini = 0.0 samples = 7 value = [9, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
FPNr ≤ 0.064 gini = 0.069 samples = 16 value = [27, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 37 value = [0, 0, 0, 60, 0, 0, 0, 0]
SDLr ≤ -0.136 gini = 0.72 samples = 4 value = [1, 2, 0, 1, 0, 0, 0, 1]
CSN ≤ -0.835 gini = 0.153 samples = 56 value = [0, 0, 3, 0, 0, 79, 0, 4]
SDLr ≤ -0.136 gini = 0.291 samples = 11 value = [0, 0, 14, 0, 0, 3, 0, 0]
HFL ≤ 0.246 gini = 0.32 samples = 2 value = [0, 0, 4, 0, 0, 0, 0, 1]
CSN ≤ -0.107 gini = 0.32 samples = 9 value = [0, 8, 0, 0, 0, 0, 0, 2]
ESD ≤ -0.834 gini = 0.256 samples = 50 value = [4, 0, 72, 0, 1, 7, 0, 0]
ESD ≤ -0.898 gini = 0.48 samples = 3 value = [0, 3, 0, 0, 2, 0, 0, 0]
MBS ≤ 1.617 gini = 0.462 samples = 28 value = [2, 32, 5, 0, 0, 0, 6, 0]
PA ≤ -0.551 gini = 0.648 samples = 13 value = [9, 6, 1, 3, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 15 value = [27, 0, 0, 0, 0, 0, 0, 0]
MBS ≤ -0.171 gini = 0.5 samples = 2 value = [0, 0, 0, 1, 0, 0, 0, 1]
FPNr ≤ 1.217 gini = 0.444 samples = 2 value = [1, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 3, 0, 0, 0, 0, 0]
HW ≤ 0.785 gini = 0.092 samples = 54 value = [0, 0, 0, 0, 0, 79, 0, 4]
SCGr ≤ -0.418 gini = 0.5 samples = 4 value = [0, 0, 3, 0, 0, 3, 0, 0]
gini = 0.0 samples = 7 value = [0, 0, 11, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
SCSr ≤ 0.898 gini = 0.198 samples = 8 value = [0, 8, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 2 value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433 gini = 0.182 samples = 48 value = [0, 0, 72, 0, 1, 7, 0, 0]
gini = 0.0 samples = 2 value = [0, 3, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 2, 0, 0, 0]
ESD ≤ -0.413 gini = 0.341 samples = 25 value = [2, 32, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
HL ≤ -1.559 gini = 0.469 samples = 3 value = [0, 5, 0, 3, 0, 0, 0, 0]
PTMr ≤ 1.075 gini = 0.314 samples = 10 value = [9, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 2, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.052 gini = 0.025 samples = 52 value = [0, 0, 0, 0, 0, 79, 0, 1]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0 samples = 7 value = [0, 8, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
GSN ≤ -0.243 gini = 0.289 samples = 24 value = [0, 0, 33, 0, 0, 7, 0, 0]
MBS ≤ -1.513 gini = 0.049 samples = 24 value = [0, 0, 39, 0, 1, 0, 0, 0]
MO ≤ 0.94 gini = 0.059 samples = 19 value = [1, 32, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.087 gini = 0.449 samples = 6 value = [1, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 3, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 8 value = [9, 0, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.946 gini = 0.5 samples = 2 value = [0, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 50 value = [0, 0, 0, 0, 0, 76, 0, 0]
GSN ≤ 0.046 gini = 0.375 samples = 2 value = [0, 0, 0, 0, 0, 3, 0, 1]
gini = 0.0 samples = 14 value = [0, 0, 22, 0, 0, 0, 0, 0]
SCSr ≤ -0.412 gini = 0.475 samples = 10 value = [0, 0, 11, 0, 0, 7, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 1, 0, 0, 0]
gini = 0.0 samples = 23 value = [0, 0, 39, 0, 0, 0, 0, 0]
gini = 0.0 samples = 13 value = [0, 23, 0, 0, 0, 0, 0, 0]
SDLr ≤ 0.534 gini = 0.18 samples = 6 value = [1, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
VSN ≤ 1.114 gini = 0.278 samples = 5 value = [0, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 6 value = [0, 0, 10, 0, 0, 0, 0, 0]
SCGr ≤ 1.134 gini = 0.219 samples = 4 value = [0, 0, 1, 0, 0, 7, 0, 0]
gini = 0.0 samples = 5 value = [0, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 4 value = [0, 0, 5, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 7, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]

[redacted]


GSN ≤ 0.914 gini = 0.818 samples = 250 value = [52, 52, 101, 65, 16, 89, 11, 8]
True
False
MBS ≤ 0.499 gini = 0.776 samples = 205 value = [51, 50, 99, 4, 16, 89, 6, 7]
HH ≤ -0.65 gini = 0.275 samples = 45 value = [1, 2, 2, 61, 0, 0, 5, 1]
SCGr ≤ -0.108 gini = 0.649 samples = 140 value = [4, 11, 93, 0, 16, 89, 0, 7]
PL ≤ 0.604 gini = 0.633 samples = 65 value = [47, 39, 6, 4, 0, 0, 6, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
MTr ≤ -1.454 gini = 0.169 samples = 42 value = [1, 2, 2, 61, 0, 0, 0, 1]
FPNr ≤ -2.049 gini = 0.465 samples = 76 value = [0, 0, 17, 0, 13, 82, 0, 4]
PA ≤ -0.551 gini = 0.447 samples = 64 value = [4, 11, 76, 0, 3, 7, 0, 3]
SCSr ≤ 0.898 gini = 0.639 samples = 48 value = [20, 38, 6, 3, 0, 0, 6, 0]
SCGr ≤ -0.884 gini = 0.131 samples = 17 value = [27, 1, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 2, 0, 0, 0, 0, 0]
PTMr ≤ 0.294 gini = 0.118 samples = 41 value = [1, 2, 0, 61, 0, 0, 0, 1]
gini = 0.0 samples = 9 value = [0, 0, 0, 0, 13, 0, 0, 0]
aNDSr ≤ 0.563 gini = 0.337 samples = 67 value = [0, 0, 17, 0, 0, 82, 0, 4]
FPNr ≤ -0.704 gini = 0.604 samples = 11 value = [0, 8, 4, 0, 0, 0, 0, 3]
TRL ≤ 1.221 gini = 0.335 samples = 53 value = [4, 3, 72, 0, 3, 7, 0, 0]
MTr ≤ 0.588 gini = 0.598 samples = 41 value = [11, 38, 6, 3, 0, 0, 6, 0]
gini = 0.0 samples = 7 value = [9, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
FPNr ≤ 0.064 gini = 0.069 samples = 16 value = [27, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 37 value = [0, 0, 0, 60, 0, 0, 0, 0]
SDLr ≤ -0.136 gini = 0.72 samples = 4 value = [1, 2, 0, 1, 0, 0, 0, 1]
CSN ≤ -0.835 gini = 0.153 samples = 56 value = [0, 0, 3, 0, 0, 79, 0, 4]
SDLr ≤ -0.136 gini = 0.291 samples = 11 value = [0, 0, 14, 0, 0, 3, 0, 0]
HFL ≤ 0.246 gini = 0.32 samples = 2 value = [0, 0, 4, 0, 0, 0, 0, 1]
CSN ≤ -0.107 gini = 0.32 samples = 9 value = [0, 8, 0, 0, 0, 0, 0, 2]
ESD ≤ -0.834 gini = 0.256 samples = 50 value = [4, 0, 72, 0, 1, 7, 0, 0]
ESD ≤ -0.898 gini = 0.48 samples = 3 value = [0, 3, 0, 0, 2, 0, 0, 0]
MBS ≤ 1.617 gini = 0.462 samples = 28 value = [2, 32, 5, 0, 0, 0, 6, 0]
PA ≤ -0.551 gini = 0.648 samples = 13 value = [9, 6, 1, 3, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 15 value = [27, 0, 0, 0, 0, 0, 0, 0]
MBS ≤ -0.171 gini = 0.5 samples = 2 value = [0, 0, 0, 1, 0, 0, 0, 1]
FPNr ≤ 1.217 gini = 0.444 samples = 2 value = [1, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 3, 0, 0, 0, 0, 0]
HW ≤ 0.785 gini = 0.092 samples = 54 value = [0, 0, 0, 0, 0, 79, 0, 4]
SCGr ≤ -0.418 gini = 0.5 samples = 4 value = [0, 0, 3, 0, 0, 3, 0, 0]
gini = 0.0 samples = 7 value = [0, 0, 11, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
SCSr ≤ 0.898 gini = 0.198 samples = 8 value = [0, 8, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 2 value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433 gini = 0.182 samples = 48 value = [0, 0, 72, 0, 1, 7, 0, 0]
gini = 0.0 samples = 2 value = [0, 3, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 2, 0, 0, 0]
ESD ≤ -0.413 gini = 0.341 samples = 25 value = [2, 32, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
HL ≤ -1.559 gini = 0.469 samples = 3 value = [0, 5, 0, 3, 0, 0, 0, 0]
PTMr ≤ 1.075 gini = 0.314 samples = 10 value = [9, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 2, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.052 gini = 0.025 samples = 52 value = [0, 0, 0, 0, 0, 79, 0, 1]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0 samples = 7 value = [0, 8, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
GSN ≤ -0.243 gini = 0.289 samples = 24 value = [0, 0, 33, 0, 0, 7, 0, 0]
MBS ≤ -1.513 gini = 0.049 samples = 24 value = [0, 0, 39, 0, 1, 0, 0, 0]
MO ≤ 0.94 gini = 0.059 samples = 19 value = [1, 32, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.087 gini = 0.449 samples = 6 value = [1, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 3, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 8 value = [9, 0, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.946 gini = 0.5 samples = 2 value = [0, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 50 value = [0, 0, 0, 0, 0, 76, 0, 0]
GSN ≤ 0.046 gini = 0.375 samples = 2 value = [0, 0, 0, 0, 0, 3, 0, 1]
gini = 0.0 samples = 14 value = [0, 0, 22, 0, 0, 0, 0, 0]
SCSr ≤ -0.412 gini = 0.475 samples = 10 value = [0, 0, 11, 0, 0, 7, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 1, 0, 0, 0]
gini = 0.0 samples = 23 value = [0, 0, 39, 0, 0, 0, 0, 0]
gini = 0.0 samples = 13 value = [0, 23, 0, 0, 0, 0, 0, 0]
SDLr ≤ 0.534 gini = 0.18 samples = 6 value = [1, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
VSN ≤ 1.114 gini = 0.278 samples = 5 value = [0, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 6 value = [0, 0, 10, 0, 0, 0, 0, 0]
SCGr ≤ 1.134 gini = 0.219 samples = 4 value = [0, 0, 1, 0, 0, 7, 0, 0]
gini = 0.0 samples = 5 value = [0, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 4 value = [0, 0, 5, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 7, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]


GSN ≤ 0.914
gini = 0.818
samples = 250
value = [52, 52, 101, 65, 16, 89, 11, 8]
True
False
MBS ≤ 0.499
gini = 0.776
samples = 205
value = [51, 50, 99, 4, 16, 89, 6, 7]
HH ≤ -0.65
gini = 0.275
samples = 45
value = [1, 2, 2, 61, 0, 0, 5, 1]
SCGr ≤ -0.108
gini = 0.649
samples = 140
value = [4, 11, 93, 0, 16, 89, 0, 7]
PL ≤ 0.604
gini = 0.633
samples = 65
value = [47, 39, 6, 4, 0, 0, 6, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 5, 0]
MTr ≤ -1.454
gini = 0.169
samples = 42
value = [1, 2, 2, 61, 0, 0, 0, 1]
FPNr ≤ -2.049
gini = 0.465
samples = 76
value = [0, 0, 17, 0, 13, 82, 0, 4]
PA ≤ -0.551
gini = 0.447
samples = 64
value = [4, 11, 76, 0, 3, 7, 0, 3]
SCSr ≤ 0.898
gini = 0.639
samples = 48
value = [20, 38, 6, 3, 0, 0, 6, 0]
SCGr ≤ -0.884
gini = 0.131
samples = 17
value = [27, 1, 0, 1, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 2, 0, 0, 0, 0, 0]
PTMr ≤ 0.294
gini = 0.118
samples = 41
value = [1, 2, 0, 61, 0, 0, 0, 1]
gini = 0.0
samples = 9
value = [0, 0, 0, 0, 13, 0, 0, 0]
aNDSr ≤ 0.563
gini = 0.337
samples = 67
value = [0, 0, 17, 0, 0, 82, 0, 4]
FPNr ≤ -0.704
gini = 0.604
samples = 11
value = [0, 8, 4, 0, 0, 0, 0, 3]
TRL ≤ 1.221
gini = 0.335
samples = 53
value = [4, 3, 72, 0, 3, 7, 0, 0]
MTr ≤ 0.588
gini = 0.598
samples = 41
value = [11, 38, 6, 3, 0, 0, 6, 0]
gini = 0.0
samples = 7
value = [9, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
FPNr ≤ 0.064
gini = 0.069
samples = 16
value = [27, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 37
value = [0, 0, 0, 60, 0, 0, 0, 0]
SDLr ≤ -0.136
gini = 0.72
samples = 4
value = [1, 2, 0, 1, 0, 0, 0, 1]
CSN ≤ -0.835
gini = 0.153
samples = 56
value = [0, 0, 3, 0, 0, 79, 0, 4]
SDLr ≤ -0.136
gini = 0.291
samples = 11
value = [0, 0, 14, 0, 0, 3, 0, 0]
HFL ≤ 0.246
gini = 0.32
samples = 2
value = [0, 0, 4, 0, 0, 0, 0, 1]
CSN ≤ -0.107
gini = 0.32
samples = 9
value = [0, 8, 0, 0, 0, 0, 0, 2]
ESD ≤ -0.834
gini = 0.256
samples = 50
value = [4, 0, 72, 0, 1, 7, 0, 0]
ESD ≤ -0.898
gini = 0.48
samples = 3
value = [0, 3, 0, 0, 2, 0, 0, 0]
MBS ≤ 1.617
gini = 0.462
samples = 28
value = [2, 32, 5, 0, 0, 0, 6, 0]
PA ≤ -0.551
gini = 0.648
samples = 13
value = [9, 6, 1, 3, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 15
value = [27, 0, 0, 0, 0, 0, 0, 0]
MBS ≤ -0.171
gini = 0.5
samples = 2
value = [0, 0, 0, 1, 0, 0, 0, 1]
FPNr ≤ 1.217
gini = 0.444
samples = 2
value = [1, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 3, 0, 0, 0, 0, 0]
HW ≤ 0.785
gini = 0.092
samples = 54
value = [0, 0, 0, 0, 0, 79, 0, 4]
SCGr ≤ -0.418
gini = 0.5
samples = 4
value = [0, 0, 3, 0, 0, 3, 0, 0]
gini = 0.0
samples = 7
value = [0, 0, 11, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
SCSr ≤ 0.898
gini = 0.198
samples = 8
value = [0, 8, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 2
value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433
gini = 0.182
samples = 48
value = [0, 0, 72, 0, 1, 7, 0, 0]
gini = 0.0
samples = 2
value = [0, 3, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 2, 0, 0, 0]
ESD ≤ -0.413
gini = 0.341
samples = 25
value = [2, 32, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 5, 0]
HL ≤ -1.559
gini = 0.469
samples = 3
value = [0, 5, 0, 3, 0, 0, 0, 0]
PTMr ≤ 1.075
gini = 0.314
samples = 10
value = [9, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 2, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.052
gini = 0.025
samples = 52
value = [0, 0, 0, 0, 0, 79, 0, 1]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0
samples = 7
value = [0, 8, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
GSN ≤ -0.243
gini = 0.289
samples = 24
value = [0, 0, 33, 0, 0, 7, 0, 0]
MBS ≤ -1.513
gini = 0.049
samples = 24
value = [0, 0, 39, 0, 1, 0, 0, 0]
MO ≤ 0.94
gini = 0.059
samples = 19
value = [1, 32, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.087
gini = 0.449
samples = 6
value = [1, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 3, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 8
value = [9, 0, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.946
gini = 0.5
samples = 2
value = [0, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 50
value = [0, 0, 0, 0, 0, 76, 0, 0]
GSN ≤ 0.046
gini = 0.375
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 1]
gini = 0.0
samples = 14
value = [0, 0, 22, 0, 0, 0, 0, 0]
SCSr ≤ -0.412
gini = 0.475
samples = 10
value = [0, 0, 11, 0, 0, 7, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
gini = 0.0
samples = 23
value = [0, 0, 39, 0, 0, 0, 0, 0]
gini = 0.0
samples = 13
value = [0, 23, 0, 0, 0, 0, 0, 0]
SDLr ≤ 0.534
gini = 0.18
samples = 6
value = [1, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
VSN ≤ 1.114
gini = 0.278
samples = 5
value = [0, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 6
value = [0, 0, 10, 0, 0, 0, 0, 0]
SCGr ≤ 1.134
gini = 0.219
samples = 4
value = [0, 0, 1, 0, 0, 7, 0, 0]
gini = 0.0
samples = 5
value = [0, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [0, 0, 5, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 7, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]


GSN ≤ 0.914 gini = 0.818 samples = 250 value = [52, 52, 101, 65, 16, 89, 11, 8]
True
False
MBS ≤ 0.499 gini = 0.776 samples = 205 value = [51, 50, 99, 4, 16, 89, 6, 7]
HH ≤ -0.65 gini = 0.275 samples = 45 value = [1, 2, 2, 61, 0, 0, 5, 1]
SCGr ≤ -0.108 gini = 0.649 samples = 140 value = [4, 11, 93, 0, 16, 89, 0, 7]
PL ≤ 0.604 gini = 0.633 samples = 65 value = [47, 39, 6, 4, 0, 0, 6, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
MTr ≤ -1.454 gini = 0.169 samples = 42 value = [1, 2, 2, 61, 0, 0, 0, 1]
FPNr ≤ -2.049 gini = 0.465 samples = 76 value = [0, 0, 17, 0, 13, 82, 0, 4]
PA ≤ -0.551 gini = 0.447 samples = 64 value = [4, 11, 76, 0, 3, 7, 0, 3]
SCSr ≤ 0.898 gini = 0.639 samples = 48 value = [20, 38, 6, 3, 0, 0, 6, 0]
SCGr ≤ -0.884 gini = 0.131 samples = 17 value = [27, 1, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 2, 0, 0, 0, 0, 0]
PTMr ≤ 0.294 gini = 0.118 samples = 41 value = [1, 2, 0, 61, 0, 0, 0, 1]
gini = 0.0 samples = 9 value = [0, 0, 0, 0, 13, 0, 0, 0]
aNDSr ≤ 0.563 gini = 0.337 samples = 67 value = [0, 0, 17, 0, 0, 82, 0, 4]
FPNr ≤ -0.704 gini = 0.604 samples = 11 value = [0, 8, 4, 0, 0, 0, 0, 3]
TRL ≤ 1.221 gini = 0.335 samples = 53 value = [4, 3, 72, 0, 3, 7, 0, 0]
MTr ≤ 0.588 gini = 0.598 samples = 41 value = [11, 38, 6, 3, 0, 0, 6, 0]
gini = 0.0 samples = 7 value = [9, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
FPNr ≤ 0.064 gini = 0.069 samples = 16 value = [27, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 37 value = [0, 0, 0, 60, 0, 0, 0, 0]
SDLr ≤ -0.136 gini = 0.72 samples = 4 value = [1, 2, 0, 1, 0, 0, 0, 1]
CSN ≤ -0.835 gini = 0.153 samples = 56 value = [0, 0, 3, 0, 0, 79, 0, 4]
SDLr ≤ -0.136 gini = 0.291 samples = 11 value = [0, 0, 14, 0, 0, 3, 0, 0]
HFL ≤ 0.246 gini = 0.32 samples = 2 value = [0, 0, 4, 0, 0, 0, 0, 1]
CSN ≤ -0.107 gini = 0.32 samples = 9 value = [0, 8, 0, 0, 0, 0, 0, 2]
ESD ≤ -0.834 gini = 0.256 samples = 50 value = [4, 0, 72, 0, 1, 7, 0, 0]
ESD ≤ -0.898 gini = 0.48 samples = 3 value = [0, 3, 0, 0, 2, 0, 0, 0]
MBS ≤ 1.617 gini = 0.462 samples = 28 value = [2, 32, 5, 0, 0, 0, 6, 0]
PA ≤ -0.551 gini = 0.648 samples = 13 value = [9, 6, 1, 3, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 15 value = [27, 0, 0, 0, 0, 0, 0, 0]
MBS ≤ -0.171 gini = 0.5 samples = 2 value = [0, 0, 0, 1, 0, 0, 0, 1]
FPNr ≤ 1.217 gini = 0.444 samples = 2 value = [1, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 3, 0, 0, 0, 0, 0]
HW ≤ 0.785 gini = 0.092 samples = 54 value = [0, 0, 0, 0, 0, 79, 0, 4]
SCGr ≤ -0.418 gini = 0.5 samples = 4 value = [0, 0, 3, 0, 0, 3, 0, 0]
gini = 0.0 samples = 7 value = [0, 0, 11, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
SCSr ≤ 0.898 gini = 0.198 samples = 8 value = [0, 8, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 2 value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433 gini = 0.182 samples = 48 value = [0, 0, 72, 0, 1, 7, 0, 0]
gini = 0.0 samples = 2 value = [0, 3, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 2, 0, 0, 0]
ESD ≤ -0.413 gini = 0.341 samples = 25 value = [2, 32, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 0, 5, 0]
HL ≤ -1.559 gini = 0.469 samples = 3 value = [0, 5, 0, 3, 0, 0, 0, 0]
PTMr ≤ 1.075 gini = 0.314 samples = 10 value = [9, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 1 value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 2, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.052 gini = 0.025 samples = 52 value = [0, 0, 0, 0, 0, 79, 0, 1]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0 samples = 2 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 2 value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0 samples = 7 value = [0, 8, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
GSN ≤ -0.243 gini = 0.289 samples = 24 value = [0, 0, 33, 0, 0, 7, 0, 0]
MBS ≤ -1.513 gini = 0.049 samples = 24 value = [0, 0, 39, 0, 1, 0, 0, 0]
MO ≤ 0.94 gini = 0.059 samples = 19 value = [1, 32, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.087 gini = 0.449 samples = 6 value = [1, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 3, 0, 0, 0, 0]
gini = 0.0 samples = 2 value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 8 value = [9, 0, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.946 gini = 0.5 samples = 2 value = [0, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 50 value = [0, 0, 0, 0, 0, 76, 0, 0]
GSN ≤ 0.046 gini = 0.375 samples = 2 value = [0, 0, 0, 0, 0, 3, 0, 1]
gini = 0.0 samples = 14 value = [0, 0, 22, 0, 0, 0, 0, 0]
SCSr ≤ -0.412 gini = 0.475 samples = 10 value = [0, 0, 11, 0, 0, 7, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 1, 0, 0, 0]
gini = 0.0 samples = 23 value = [0, 0, 39, 0, 0, 0, 0, 0]
gini = 0.0 samples = 13 value = [0, 23, 0, 0, 0, 0, 0, 0]
SDLr ≤ 0.534 gini = 0.18 samples = 6 value = [1, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
VSN ≤ 1.114 gini = 0.278 samples = 5 value = [0, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0 samples = 1 value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0 samples = 6 value = [0, 0, 10, 0, 0, 0, 0, 0]
SCGr ≤ 1.134 gini = 0.219 samples = 4 value = [0, 0, 1, 0, 0, 7, 0, 0]
gini = 0.0 samples = 5 value = [0, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0 samples = 4 value = [0, 0, 5, 0, 0, 0, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0 samples = 3 value = [0, 0, 0, 0, 0, 7, 0, 0]
gini = 0.0 samples = 1 value = [0, 0, 1, 0, 0, 0, 0, 0]


GSN ≤ 0.914
gini = 0.818
samples = 250
value = [52, 52, 101, 65, 16, 89, 11, 8]
True
False
MBS ≤ 0.499
gini = 0.776
samples = 205
value = [51, 50, 99, 4, 16, 89, 6, 7]
HH ≤ -0.65
gini = 0.275
samples = 45
value = [1, 2, 2, 61, 0, 0, 5, 1]
SCGr ≤ -0.108
gini = 0.649
samples = 140
value = [4, 11, 93, 0, 16, 89, 0, 7]
PL ≤ 0.604
gini = 0.633
samples = 65
value = [47, 39, 6, 4, 0, 0, 6, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 5, 0]
MTr ≤ -1.454
gini = 0.169
samples = 42
value = [1, 2, 2, 61, 0, 0, 0, 1]
FPNr ≤ -2.049
gini = 0.465
samples = 76
value = [0, 0, 17, 0, 13, 82, 0, 4]
PA ≤ -0.551
gini = 0.447
samples = 64
value = [4, 11, 76, 0, 3, 7, 0, 3]
SCSr ≤ 0.898
gini = 0.639
samples = 48
value = [20, 38, 6, 3, 0, 0, 6, 0]
SCGr ≤ -0.884
gini = 0.131
samples = 17
value = [27, 1, 0, 1, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 2, 0, 0, 0, 0, 0]
PTMr ≤ 0.294
gini = 0.118
samples = 41
value = [1, 2, 0, 61, 0, 0, 0, 1]
gini = 0.0
samples = 9
value = [0, 0, 0, 0, 13, 0, 0, 0]
aNDSr ≤ 0.563
gini = 0.337
samples = 67
value = [0, 0, 17, 0, 0, 82, 0, 4]
FPNr ≤ -0.704
gini = 0.604
samples = 11
value = [0, 8, 4, 0, 0, 0, 0, 3]
TRL ≤ 1.221
gini = 0.335
samples = 53
value = [4, 3, 72, 0, 3, 7, 0, 0]
MTr ≤ 0.588
gini = 0.598
samples = 41
value = [11, 38, 6, 3, 0, 0, 6, 0]
gini = 0.0
samples = 7
value = [9, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
FPNr ≤ 0.064
gini = 0.069
samples = 16
value = [27, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 37
value = [0, 0, 0, 60, 0, 0, 0, 0]
SDLr ≤ -0.136
gini = 0.72
samples = 4
value = [1, 2, 0, 1, 0, 0, 0, 1]
CSN ≤ -0.835
gini = 0.153
samples = 56
value = [0, 0, 3, 0, 0, 79, 0, 4]
SDLr ≤ -0.136
gini = 0.291
samples = 11
value = [0, 0, 14, 0, 0, 3, 0, 0]
HFL ≤ 0.246
gini = 0.32
samples = 2
value = [0, 0, 4, 0, 0, 0, 0, 1]
CSN ≤ -0.107
gini = 0.32
samples = 9
value = [0, 8, 0, 0, 0, 0, 0, 2]
ESD ≤ -0.834
gini = 0.256
samples = 50
value = [4, 0, 72, 0, 1, 7, 0, 0]
ESD ≤ -0.898
gini = 0.48
samples = 3
value = [0, 3, 0, 0, 2, 0, 0, 0]
MBS ≤ 1.617
gini = 0.462
samples = 28
value = [2, 32, 5, 0, 0, 0, 6, 0]
PA ≤ -0.551
gini = 0.648
samples = 13
value = [9, 6, 1, 3, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 15
value = [27, 0, 0, 0, 0, 0, 0, 0]
MBS ≤ -0.171
gini = 0.5
samples = 2
value = [0, 0, 0, 1, 0, 0, 0, 1]
FPNr ≤ 1.217
gini = 0.444
samples = 2
value = [1, 2, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 3, 0, 0, 0, 0, 0]
HW ≤ 0.785
gini = 0.092
samples = 54
value = [0, 0, 0, 0, 0, 79, 0, 4]
SCGr ≤ -0.418
gini = 0.5
samples = 4
value = [0, 0, 3, 0, 0, 3, 0, 0]
gini = 0.0
samples = 7
value = [0, 0, 11, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 4, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
SCSr ≤ 0.898
gini = 0.198
samples = 8
value = [0, 8, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 2
value = [4, 0, 0, 0, 0, 0, 0, 0]
MTr ≤ -0.433
gini = 0.182
samples = 48
value = [0, 0, 72, 0, 1, 7, 0, 0]
gini = 0.0
samples = 2
value = [0, 3, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 2, 0, 0, 0]
ESD ≤ -0.413
gini = 0.341
samples = 25
value = [2, 32, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 0, 5, 0]
HL ≤ -1.559
gini = 0.469
samples = 3
value = [0, 5, 0, 3, 0, 0, 0, 0]
PTMr ≤ 1.075
gini = 0.314
samples = 10
value = [9, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 1
value = [0, 0, 0, 1, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 2, 0, 0, 0, 0, 0, 0]
MBS ≤ 0.052
gini = 0.025
samples = 52
value = [0, 0, 0, 0, 0, 79, 0, 1]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 0, 0, 3]
gini = 0.0
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 2
value = [0, 0, 3, 0, 0, 0, 0, 0]
gini = 0.0
samples = 7
value = [0, 8, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
GSN ≤ -0.243
gini = 0.289
samples = 24
value = [0, 0, 33, 0, 0, 7, 0, 0]
MBS ≤ -1.513
gini = 0.049
samples = 24
value = [0, 0, 39, 0, 1, 0, 0, 0]
MO ≤ 0.94
gini = 0.059
samples = 19
value = [1, 32, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.087
gini = 0.449
samples = 6
value = [1, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 3, 0, 0, 0, 0]
gini = 0.0
samples = 2
value = [0, 5, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 8
value = [9, 0, 0, 0, 0, 0, 0, 0]
FFL ≤ -0.946
gini = 0.5
samples = 2
value = [0, 1, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 50
value = [0, 0, 0, 0, 0, 76, 0, 0]
GSN ≤ 0.046
gini = 0.375
samples = 2
value = [0, 0, 0, 0, 0, 3, 0, 1]
gini = 0.0
samples = 14
value = [0, 0, 22, 0, 0, 0, 0, 0]
SCSr ≤ -0.412
gini = 0.475
samples = 10
value = [0, 0, 11, 0, 0, 7, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 1, 0, 0, 0]
gini = 0.0
samples = 23
value = [0, 0, 39, 0, 0, 0, 0, 0]
gini = 0.0
samples = 13
value = [0, 23, 0, 0, 0, 0, 0, 0]
SDLr ≤ 0.534
gini = 0.18
samples = 6
value = [1, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
VSN ≤ 1.114
gini = 0.278
samples = 5
value = [0, 0, 5, 0, 0, 0, 1, 0]
gini = 0.0
samples = 1
value = [0, 1, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 3, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 0, 1]
gini = 0.0
samples = 6
value = [0, 0, 10, 0, 0, 0, 0, 0]
SCGr ≤ 1.134
gini = 0.219
samples = 4
value = [0, 0, 1, 0, 0, 7, 0, 0]
gini = 0.0
samples = 5
value = [0, 9, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [1, 0, 0, 0, 0, 0, 0, 0]
gini = 0.0
samples = 4
value = [0, 0, 5, 0, 0, 0, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 0, 0, 0, 0, 1, 0]
gini = 0.0
samples = 3
value = [0, 0, 0, 0, 0, 7, 0, 0]
gini = 0.0
samples = 1
value = [0, 0, 1, 0, 0, 0, 0, 0]