Importing the dataset

In [1]:
```
#Importing Pandas module
import csv
import pandas as pd

#Add header names
headers =  ['age', 'sex','chest_pain','resting_blood_pressure',
        'serum_cholestoral', 'fasting_blood_sugar', 'resting_ecg_results',
        'max_heart_rate_achieved', 'exercise_induced_angina', 'oldpeak',"slope of the peak",
        'num_of_major_vessels','thal', 'heart_disease']

#Import dataset in the form of a dataframe
heart_df = pd.read_csv('heart.dat', sep=' ', names=headers)

#Looking at the first five rows of the dataset
heart_df.head()
```

Out[1]:

	age	sex	chest_pain	resting_blood_pressure	serum_cholestoral	fasting_blood_sugar	resting_ecg_results	max_heart_rate_achieved	e
0	70.0	1.0	4.0	130.0	322.0	0.0	2.0	109.0	
1	67.0	0.0	3.0	115.0	564.0	0.0	2.0	160.0	
2	57.0	1.0	2.0	124.0	261.0	0.0	0.0	141.0	
3	64.0	1.0	4.0	128.0	263.0	0.0	0.0	105.0	
4	74.0	0.0	2.0	120.0	269.0	0.0	2.0	121.0	

In [2]:
```
#Getting shape of the data
heart_df.shape
```

Out[2]: (270, 14)

In [3]:
```
#Looking for the null values through the dataset because neural net require non null variables
heart_df.isna().sum()
```

Out[3]:
```
age                        0
sex                        0
chest_pain                 0
resting_blood_pressure     0
serum_cholestoral          0
fasting_blood_sugar        0
resting_ecg_results        0
max_heart_rate_achieved    0
exercise_induced_angina    0
oldpeak                    0
slope of the peak          0
num_of_major_vessels       0
thal                       0
heart_disease              0
dtype: int64
```

Splitting the dataset into training and test parts

In [4]:
```
#Importing essential packages
import numpy as np
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
import warnings
warnings.filterwarnings("ignore")

#Splitting data into independant and depedant variables

X = heart_df.drop(columns=['heart_disease']) #Independant data variables

#replace target class with 0 and 1
#1 means "have heart disease" and 0 means "do not have heart disease"
heart_df['heart_disease'] = heart_df['heart_disease'].replace(1, 0)
heart_df['heart_disease'] = heart_df['heart_disease'].replace(2, 1)

y_label = heart_df['heart_disease'].values.reshape(X.shape[0], 1) #Dependant or target variable

#Split data into train and test set
Xtrain, Xtest, ytrain, ytest = train_test_split(X, y_label, test_size=0.2, random_state=2)

#Standardize the dataset
sc = StandardScaler()
sc.fit(Xtrain)
Xtrain = sc.transform(Xtrain)
Xtest = sc.transform(Xtest)

print(f"Shape of train set is {Xtrain.shape}")
print(f"Shape of test set is {Xtest.shape}")
print(f"Shape of train label is {ytrain.shape}")
print(f"Shape of test labels is {ytest.shape}")
```

```
Shape of train set is (216, 13)
Shape of test set is (54, 13)
Shape of train label is (216, 1)
Shape of test labels is (54, 1)
```

Implementing Neural network class

In [5]:

```
class NeuralNet():
    '''
    A two layer neural network
    '''

    def __init__(self, layers=[13,8,1], learning_rate=0.001, iterations=100):
        self.params = {}
        self.learning_rate = learning_rate
        self.iterations = iterations
        self.loss = []
        self.sample_size = None
        self.layers = layers
        self.X = None
        self.y = None

    def init_weights(self):
        '''
        Initialize the weights from a random normal distribution
        '''
        np.random.seed(1) # Seed the random number generator
        self.params["W1"] = np.random.randn(self.layers[0], self.layers[1])
        self.params['b1']  =np.random.randn(self.layers[1],)
        self.params['W2'] = np.random.randn(self.layers[1],self.layers[2])
        self.params['b2'] = np.random.randn(self.layers[2],)

    def relu(self,Z):
        '''
        The ReLu activation function is to performs a threshold
        operation to each input element where values less
        than zero are set to zero.
        '''
        return np.maximum(0,Z)

    def sigmoid(self,Z):
        '''
        The sigmoid function takes in real numbers in any range and
        squashes it to a real-valued output between 0 and 1.
        '''
        return 1.0/(1.0+np.exp(-Z))

    def entropy_loss(self,y, yhat):
```

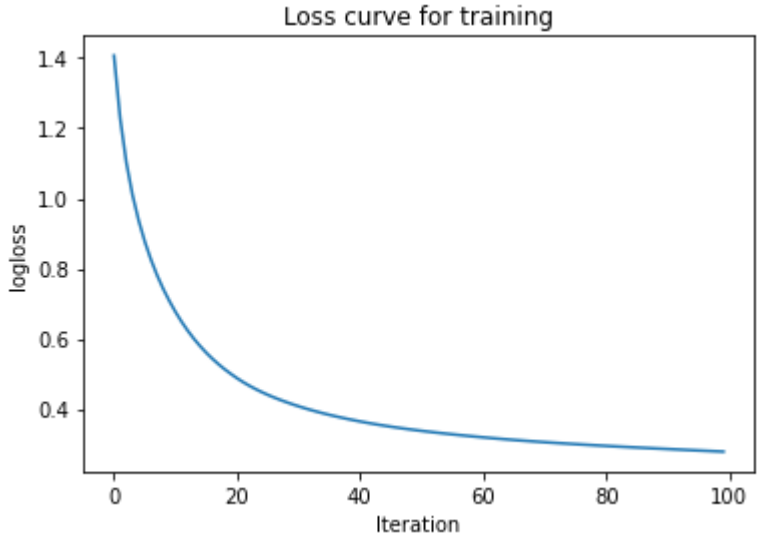
```
        nsample = len(y)
        loss = -1/nsample * (np.sum(np.multiply(np.log(yhat), y) + np.multiply((1 - y), np.log(1 - yhat))))
        return loss

    def forward_propagation(self):
        '''
        Performs the forward propagation
        '''

        Z1 = self.X.dot(self.params['W1']) + self.params['b1']
        A1 = self.relu(Z1)
        Z2 = A1.dot(self.params['W2']) + self.params['b2']
        yhat = self.sigmoid(Z2)
        loss = self.entropy_loss(self.y,yhat)

        # save calculated parameters
        self.params['Z1'] = Z1
        self.params['Z2'] = Z2
        self.params['A1'] = A1

        return yhat,loss

    def back_propagation(self,yhat):
        '''
        Computes the derivatives and update weights and bias according.
        '''
        def dRelu(x):
            x[x<=0] = 0
            x[x>0] = 1
            return x

        dl_wrt_yhat = -(np.divide(self.y,yhat) - np.divide((1 - self.y),(1-yhat)))
        dl_wrt_sig = yhat * (1-yhat)
        dl_wrt_z2 = dl_wrt_yhat * dl_wrt_sig

        dl_wrt_A1 = dl_wrt_z2.dot(self.params['W2'].T)
        dl_wrt_w2 = self.params['A1'].T.dot(dl_wrt_z2)
        dl_wrt_b2 = np.sum(dl_wrt_z2, axis=0)

        dl_wrt_z1 = dl_wrt_A1 * dRelu(self.params['Z1'])
        dl_wrt_w1 = self.X.T.dot(dl_wrt_z1)
        dl_wrt_b1 = np.sum(dl_wrt_z1, axis=0)
```

```
        #update the weights and bias
        self.params['W1'] = self.params['W1'] - self.learning_rate * dl_wrt_w1
        self.params['W2'] = self.params['W2'] - self.learning_rate * dl_wrt_w2
        self.params['b1'] = self.params['b1'] - self.learning_rate * dl_wrt_b1
        self.params['b2'] = self.params['b2'] - self.learning_rate * dl_wrt_b2


    def fit(self, X, y):
        '''
        Trains the neural network using the specified data and labels
        '''
        self.X = X
        self.y = y
        self.init_weights() #initialize weights and bias


        for i in range(self.iterations):
            yhat, loss = self.forward_propagation()
            self.back_propagation(yhat)
            self.loss.append(loss)

    def predict(self, X):
        '''
        Predicts on a test data
        '''
        Z1 = X.dot(self.params['W1']) + self.params['b1']
        A1 = self.relu(Z1)
        Z2 = A1.dot(self.params['W2']) + self.params['b2']
        pred = self.sigmoid(Z2)
        return np.round(pred)

    def acc(self, y, yhat):
        '''
        Calculates the accuracy between the predicted value and the truth labels
        '''
        acc = int(sum(y == yhat) / len(y) * 100)
        return acc


    def plot_loss(self):
        '''
        Plots the loss curve
        '''
```

```
        plt.plot(self.loss)
        plt.xlabel("Iteration")
        plt.ylabel("logloss")
        plt.title("Loss curve for training")
        plt.show()
```

In [6]:
```
#Create object of class Neural net
nn = NeuralNet(layers=[13,8,1], learning_rate=0.001, iterations=100) # create the NN model

#Fit the train dataset to this object - training the model
nn.fit(Xtrain, ytrain) #train the model
```

In [7]:
```
#Plot the loss
nn.plot_loss()
```



In [8]:
```
#Predict the train and test data
train_pred = nn.predict(Xtrain)
test_pred = nn.predict(Xtest)

#Calculate the accuracy of the train and test datasets
print("Train accuracy is {}".format(nn.acc(ytrain, train_pred)))
print("Test accuracy is {}".format(nn.acc(ytest, test_pred)))
```

```
Train accuracy is 87
Test accuracy is 75
```