CSEN3253: Machine Learning Laboratory
B.Tech. CSE (AI & ML) 6th Semester, Session: 2024-25
Assignment 2: Multi-Variable Linear Regression

1. **Objective**: Introduce the concept of multi-variable linear regression and its' application in fitting a hyperplane to a set of data points.

2. **Problem Statement:** Given The Boston Housing Price database from Keras, estimate the median values of owner-occupied homes, in thousands of dollars.

   Sample Code Snippet

```
from keras.datasets import boston_housing

#load the Boston housing dataset
(train_data, train_targets), (test_data, test_targets) = boston_housing.load_data()
```

3. **Data Preparation:** Describe the dataset in terms of number of training samples, test samples, and number of features. Identify the features with highest and lowest variance in the database.

4. **Model Development:** Given the linear equation form of $f(X) = XW$ and loss function $E(W) = (1/N) \{(Y - XW)^T (Y - XW)\}$,

   i. Compute the optimum weight parameters using analytic formulation.

   ii. Use the obtained weight parameter to calculate the optimum loss value.

   iii. Find out the optimal weight vector and the corresponding loss values using Gradient – Descent algorithm. At each iteration, compute the gradient of error function and update the weight values using learning rate and momentum hyper-parameters.

5. **Model Evaluation:**

   i. Visualize the convergence of the algorithm with reference to the epochs.

   ii. Plot the regression line for the given weight values obtained at the final epoch of the algorithm.