# Programming Assignment 4
*# Import required packages*

## Question 1

Implement the multiplicative NMF algorithm discussed in class. Write a function lee_seung(V, k, maxiteration) that takes a nonnegative matrix V and returns W and H. For test, create a random nonnegative matrix of dimension 200x500 where the elements are uniformly distributed in [0,1]. Print the value of the relative error $|V-WH|_F /|V|_F$.

Use the ScikitLearn NMF class for the same factorization and compare the relative error.

*# Your code comes here*

## Question 2

Find the nonnegative basis representation of images from one of the following databases or some other facial databases. Show a comparison of some sample images with their reconstruction from the basis.

- The ORL database of faces at Kaggle.
- The CBCL database of faces at MIT link.
- Yale faces B facial images at Kaggle.

*# Your code starts here.*

## Question 3

Set up a linear regression model for the miles per gallon on the data at automobile UCI. **Discard** the categorical data.

1. Get feature matrix X, and target variable y.
2. Split data into training and testing.
3. Normalize data using MinMaxScaler.
4. Creat a LinearRegression object for modeling.
5. Train the model with training data.
6. Look at $R^2$ score for the goodness of fit for the train and test data.
7. Present a graphical comparison of true and observed responses for the test data.