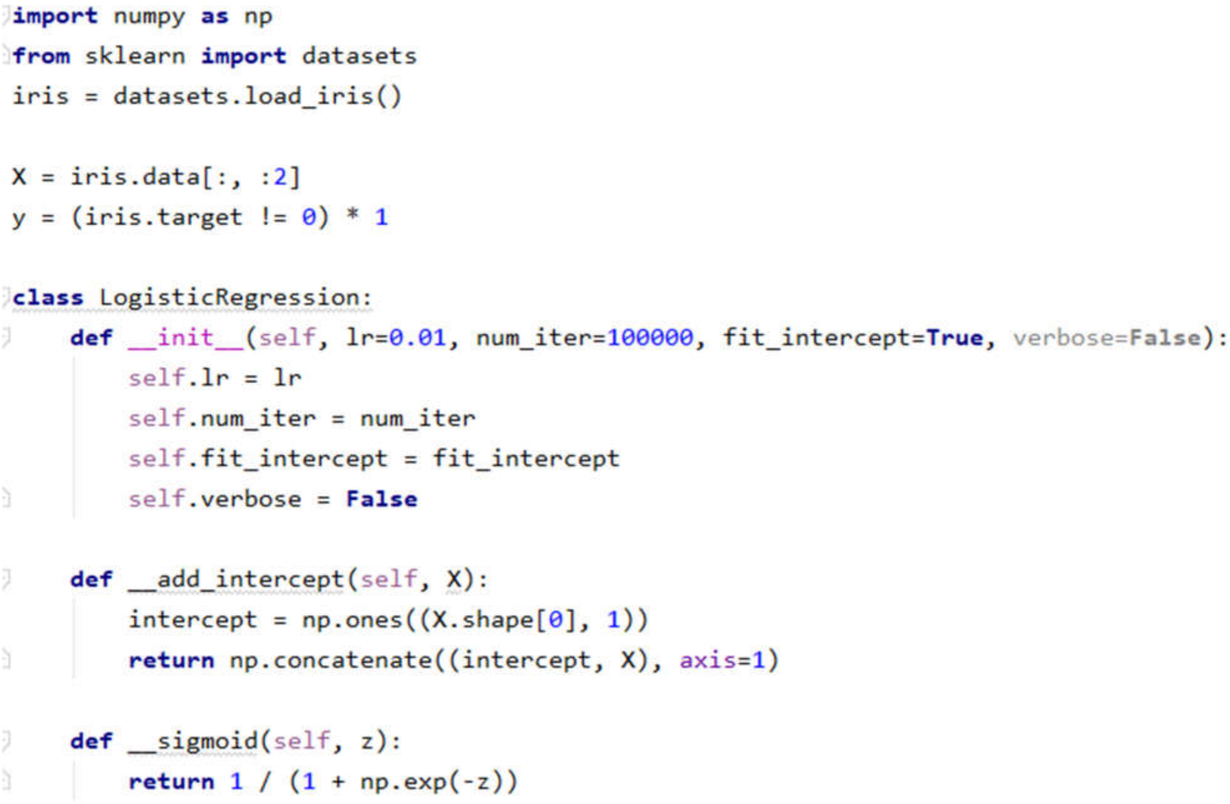
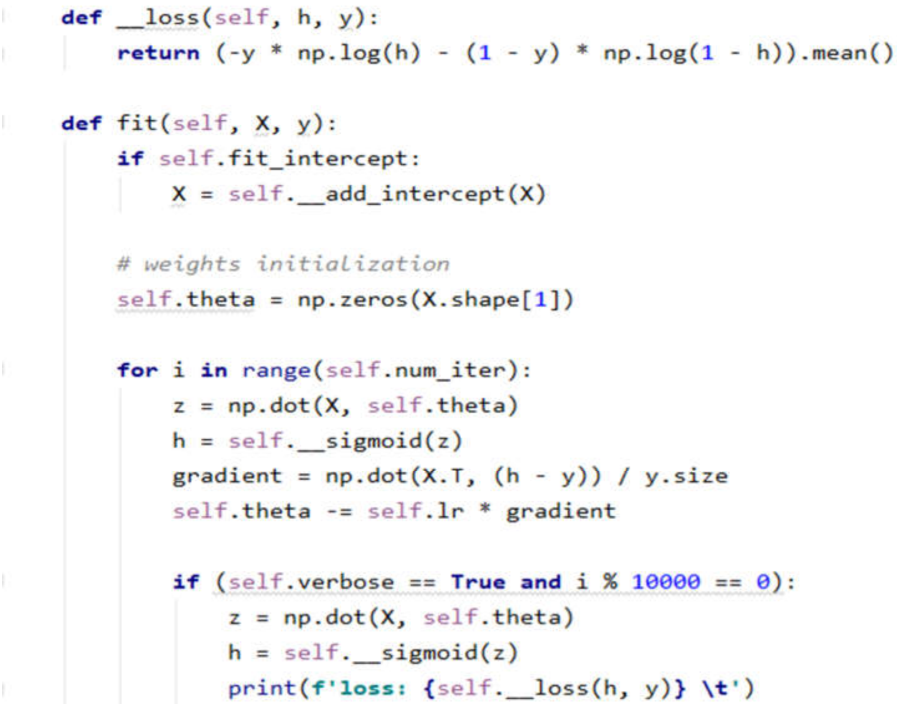
Task 1: **Exploring the working of “Logistic Regression” with respect to a sample dataset.**

Solution:

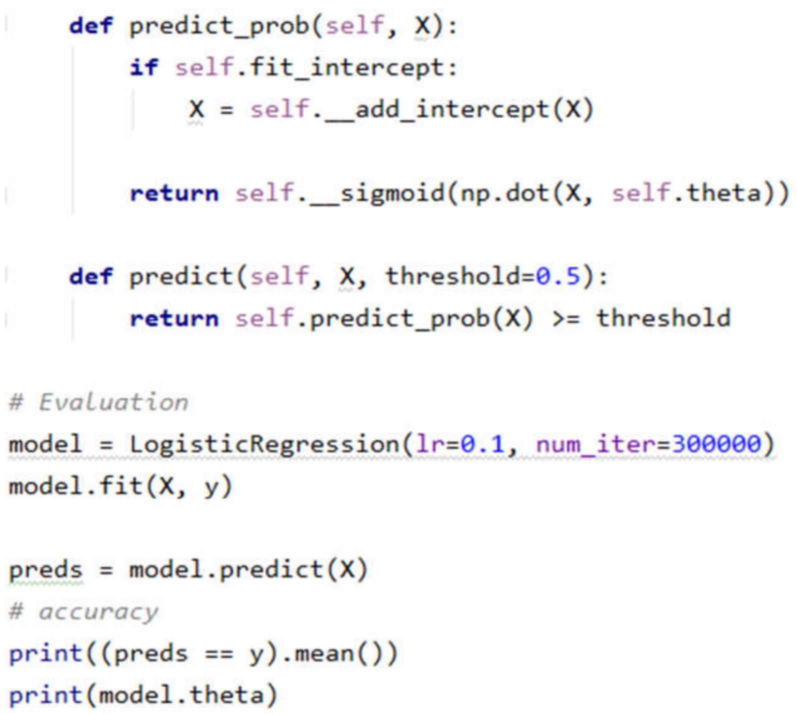


```
import numpy as np
from sklearn import datasets
iris = datasets.load_iris()

X = iris.data[:, :2]
y = (iris.target != 0) * 1

class LogisticRegression:
    def __init__(self, lr=0.01, num_iter=100000, fit_intercept=True, verbose=False):
        self.lr = lr
        self.num_iter = num_iter
        self.fit_intercept = fit_intercept
        self.verbose = False

    def __add_intercept(self, X):
        intercept = np.ones((X.shape[0], 1))
        return np.concatenate((intercept, X), axis=1)

    def __sigmoid(self, z):
        return 1 / (1 + np.exp(-z))
```



```
    def __loss(self, h, y):
        return (-y * np.log(h) - (1 - y) * np.log(1 - h)).mean()

    def fit(self, X, y):
        if self.fit_intercept:
            X = self.__add_intercept(X)

        # weights initialization
        self.theta = np.zeros(X.shape[1])

        for i in range(self.num_iter):
            z = np.dot(X, self.theta)
            h = self.__sigmoid(z)
            gradient = np.dot(X.T, (h - y)) / y.size
            self.theta -= self.lr * gradient

            if (self.verbose == True and i % 10000 == 0):
                z = np.dot(X, self.theta)
                h = self.__sigmoid(z)
                print(f'loss: {self.__loss(h, y)} \t')
```

Source code credit: Martin



```
    def predict_prob(self, X):
        if self.fit_intercept:
            X = self.__add_intercept(X)

        return self.__sigmoid(np.dot(X, self.theta))

    def predict(self, X, threshold=0.5):
        return self.predict_prob(X) >= threshold

# Evaluation
model = LogisticRegression(lr=0.1, num_iter=300000)
model.fit(X, y)

preds = model.predict(X)
# accuracy
print((preds == y).mean())
print(model.theta)
```