Homework 4

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1 Problem 1

2 Problem 2

3 Problem 3

4 Programming Problem 1

4.1 Result

The Number of Iterations: 23 for ω_1 and ω_2, 16 for ω_3 and ω_2. From figures blow we can find that points of ω_3 and ω_2 are much more scattered, so that $\sum_{y \in Y} y$ will be farther away from current a. This will make a converge quicker.

Figure 1: Figure for samples belonging to ω_1 and ω_2

Figure 2: Figure for samples belonging to ω_3 and ω_2

4.2 Code

```
#!/usr/bin/python3
# coding=utf-8

import numpy as np
import matplotlib.pyplot as plt

# Samples
omega1 = np.array([
    [1.58, 2.32, -5.8],
    [0.67, 1.58, -4.78],
    [1.04, 1.01, -3.63],
    [-1.49, 2.18, -3.39],
    [-0.41, 1.21, -4.73],
```

```
    [1.39, 3.16, 2.87],
    [1.20, 1.40, -1.89],
    [-0.92, 1.44, -3.22],
    [0.45, 1.33, -4.38],
    [-0.76, 0.84, -1.96]
])
omega2 = np.array([
    [0.21, 0.03, -2.21],
    [0.37, 0.28, -1.8],
    [0.18, 1.22, 0.16],
    [-0.24, 0.93, -1.01],
    [-1.18, 0.39, -0.39],
    [0.74, 0.96, -1.16],
    [-0.38, 1.94, -0.48],
    [0.02, 0.72, -0.17],
    [0.44, 1.31, -0.14],
    [0.46, 1.49, 0.68]
])
omega3 = np.array([
    [-1.54, 1.71, 0.64],
    [5.41, 3.45, -1.33],
    [1.55, 0.99, 2.69],
    [1.86, 3.19, 1.51],
    [1.68, 1.70, -0.87],
    [3.51, -0.22, -1.39],
    [1.40, -0.44, 0.92],
    [0.44, 0.83, 1.97],
    [0.25, 0.68, -0.99],
    [0.66, -0.45, 0.08]
])


# Constants
sita = 1.5  # When J(w) < sita, training stops.
w_0 = 10  # The initial weight is a uniform U(-w_0, w_0)


def init_weight():
    return np.random.uniform(-w_0, w_0)


if __name__ == '__main__':
    print(init_weight())
```