

## Homework 2: Python Programming

*Instructor: Siheng Chen***YOUR NAME**

## Instruction

- This homework is due at 11:59:59 p.m. on \*\* May 30th, 2022.
- The write-up must be an electronic version edited by LATEX using **this template** and submitted in **pdf** format.
- Please DO NOT rename python files and their functions. Just fill it.
- The overall submission should be a .zip file named by xxx(student id)-xxx(name)-Assignment2.zip

**Python Environment.** We are using Python 3.7 for this course. We will use the following packages in this course: Numpy, SciPy, Matplotlib, Pytorch.

## Q1. Welcome to Python [20 points]

Use Python to achieve the following functionality. Given an array of integers *array* and an integer *goal*, return indices of the two numbers such that they add up to *goal*. We assume that each pair of input *array* and *goal* has one and only one solution, and you cannot use the same element twice. Please return the answer in an increasing order.

**Example 1:**

- Input: `array = [2,2]`, `goal = 4`
- Output: `[0,1]`
- Explanation: Because `array[0] + array[1] = 4`, we return `[0, 1]`.

**Example 2:**

- Input: `array = [2,3,11,15]`, `goal = 5`
- Output: `[0,1]`
- Explanation: Because `array[0] + array[1] = 5`, we return `[0, 1]`.

**Submission Format.** Please fill the `AddUp` function and submit `AddUp.py`.

## Q2. Numpy Crash [40 points]

The aim is to guide you to know the functionality of Numpy.

**Installation.** Please install Numpy and show your Numpy version in a screenshot.

**Task.** Please solve 20 problems in `numpy.py`. Many only need one-line code.

**Submission Format.** Please submit your filled numpy.py. Show your screenshot of Numpy version in the write-up.

### Q3. SciPy Crash [10 points]

The aim is to guide you to know the functionality of SciPy.

**Installation.** Please install SciPy and show your SciPy version in a screenshot.

**Task.** Please solve 5 problems in scipy.py. Many only need one-line code.

**Submission Format.** Please submit your filled scipy.py. Show your screenshot of Scipy version in the write-up.

### Q4. Matplotlib Crash [10 points]

The aim is to guide you to know the functionality of Matplotlib.

**Installation.** Please install Matplotlib and show your Matplotlib version in a screenshot.

**Task.** Please solve 5 plotting tasks in matplotlib.py.

**Submission Format.** Please submit your filled matplotlib.py. Show your screenshot of Matplotlib version and results of function w1-w5 in the write-up.

### Q5. Introduction to Pytorch [20 points]

The aim is to guide you to know the functionality of Pytorch.

**Installation.** Please install Pytorch and show your Pytorch version in a screenshot.

**Task.** Please follow the instruction and fill in blanks in pytorch.py and complete your first convolutional neural network to handle image classification.

- Read the demo code and fill in the blank noted by `""" xxx here """` in pytorch.py
- Vary the training epoch as 1, 2, 4, 8, 16 and plot the accuracy of the “plane” category as a function of the training epoch.
- Vary the learning rate as  $[10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}, 10^{-1}, 1]$  and plot the accuracy of the “ship” category as a function of the learning rate.
- Let’s try another loss function: Mean Squared Error(MSE loss). Compare the performances.

**Submission Format.** Please submit your filled pytorch.py. Show your screenshot of Pytorch version in the write-up. Write and analyze your experiment results of above tasks in the write-up.