United International University
Department of Computer Science and Engineering

DS 1501: Programming for Data Science
Final Examination : Spring 2024
Total Marks: 40 Time: 2 hours

Answer all 4 questions. Numbers to the right of the questions denote their marks.
Any examinee found adopting unfair means will be expelled from
the trimester / program as per UIU disciplinary rules.

1. (a) You are given a file named `input.txt` containing a list of student names and their corresponding scores in the format: [6]

input.txt

```
Alice 95
Bob 87
Carol 92
David 78
```

Write a Python program to perform the following tasks:

i. Read the contents of `input.txt` and store the student names and scores in an appropriate data structure.
ii. Calculate the following statistics:
- The average score of all students.
- The highest score and the name of the student who achieved it.
- The lowest score and the name of the student who achieved it.

iii. Save the statistics in a new file named `statistics.txt` as shown below.

statistics.txt

```
Average score: 88.0
Highest score: 95 (Alice)
Lowest score: 78 (David)
```

(b) Manually trace the following Python code and show the output of it. [4]

```
def manipulate_string(s):
    s = s.lower()
    v = "aeiou"
    result = ""
    for char in s:
        if char not in v:
            result += char.upper()

    result = result[::-1]
    return result

string = manipulate_string("Hello,World!")
print(string)
```

2. You are provided with a dataset (a list of tuples) representing the connections between users in a social network. Each user has a unique ID, and the dataset contains pairs of user IDs representing friendships. Your task is to create a Python program to analyze various aspects of this social network.

```
dataset = [(1, 2), (1, 3), (2, 3), (2, 4), (3, 4), (4, 5)]
```

(a) What is the primary difference between a list and a dictionary? How do you create an empty dictionary? [2]

(b) Create a function build_network(dataset) that takes a list dataset containing tuples representing friendships as input and returns a dictionary where keys are user IDs and values are lists containing the IDs of their friends. Example output: [4]

```
network = build_network(dataset)
print(network)
# Output: {1: [2, 3], 2: [1, 3, 4], 3: [1, 2, 4], 4: [2, 3, 5], 5: [4]}
```

(c) Implement a function find_mutual_friends(network, user1, user2) that takes the social network dictionary network and two user IDs user1 and user2 as input and returns a list of mutual friends between the two users. Example output: [4]

```
print(find_mutual_friends(network, 1, 2))
# Output: [3]
```

3. (a) Write a Python program that takes two sentences as input. Your task is to find the common words between these two sentences and determine the total number of unique words across both sentences. [5]

Sample Input	Sample Output
Sentence 1: "The quick brown fox jumps over the lazy dog" Sentence 2: "A quick brown dog chases the fox"	Common Words: ['fox', 'the', 'dog', 'quick', 'brown'] Total Number of Unique Words: 10

(b) What will be the output of the following code? [2]

```
words = ["hello world", "good", "python programming!"]
result = []
for word in words:
    if len(word) % 2 != 0:
        result.append(word.upper().split())
    else:
        result.append(word.lower())
print(result)
```

(c) What will be the output of the following code? [3]

```
import numpy as np

arr = np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]])
result = arr[:, 1]
print("Result:", result)

linspace_array = np.linspace(np.min(result), np.max(result), len(result))
print(linspace_array)

sum_result = np.sum(result)
sum_linspace_array = np.sum(linspace_array)

print(sum_result)
print(sum_linspace_array)
```

4. (a) You are tasked with implementing a function `modify_list(lst)` that takes a list of integers as input and modifies it in such a way that all even numbers are doubled and all odd numbers are replaced with their squares. However, when you call this function, you notice that the changes made inside the function are reflected outside as well, even though you didn't explicitly return anything.

Explain why this happens briefly and provide a solution to avoid modifying the original list while still achieving the desired functionality. [5]

(b) Find the output of the following code: [5]

```
x = 10
def first_func():
    return x**2

def second_func(arg1, arg2, *arg):
    y = 20
    global x
    x=first_func()
    print(x)

    x += arg1
    y += arg2

    for a in arg:
        print(a)
        x += a
    return y

result = second_func(5, 10, 15, 20)
print(x)
print(result)
```