Department of Information Technology – University of the Punjab
Programming for AI – MPhil/PhD (AI) F22
Lab-03

Max Time: 2.5 hours **Date: 21-12-2022**

Topics: Problem solving, operators, basic constructs, selection, repetition

Instructions:

- Please provide your own solutions and **DO NOT COPY** the code from your colleagues or the web.
- You can discuss your problems only with the teachers.
- All tasks carry equal points.

Task 0 [5]

Write a program that calculates the total of the following series of numbers.

$$1/30 + 2/29 + 3/28 +, \dots , + 30/1$$

Task 1 [10]

A prime number is a number that is only evenly divisible by itself and 1. For example, the number 5 is prime because it can only be evenly divided by 1 and 5. The number 6, however, is not prime because it can be divided evenly by 1, 2, 3, and 6.

Write a Boolean function named *is_prime* which takes an integer as an argument and returns true if the argument is a prime number, or false otherwise. Use the function in program that prompts the user to enter a number then displays a message indicating whether the number is prime.

Task 2 [5]

Extend "Task 1" in which you have already written the is_prime function by inputting two integer numbers *startingNum* and *endingNum*. The program should display all of the prime numbers from *startingNum* to *endingNum*. The program should have a loop that calls the is_prime function.

Task 3 [10]

Write a program that asks the user to enter the monthly costs for the following expenses incurred from operating his or her automobile: loan payment, insurance, gas, oil, tires, and maintenance. The program should then display the total monthly cost of these expenses, and the total annual cost of these expenses.

Task 4 [10]

Write a program that asks the user for the name of a file. The program should display the contents of the file with each line preceded with a line number followed by a colon. The line numbering should start at 1.

Task 5 [10]

Write a program that uses a dictionary to assign "codes" to each letter of the alphabet. For example:
codes = {'a' : '!', 'b' : '@', 'c' : '#', 'd' : '1', etc . . .}, as described in Lab03Task5.xlsx

Using this example, the letter a would be assigned the symbol !, the letter b would be

assigned the symbol @, the letter c would be assigned the symbol #, and so forth.
The program should open a specified text file (Lab03Task5.txt), read its contents, then use the dictionary to write an encrypted version of the file's contents to a second file (Lab03Task5_encrypted.txt). Each character in the second file should contain the code for the corresponding character in the first file.

Task 6 [10]

Write a second program that opens an encrypted file and displays its decrypted contents on the screen

Task 7 [15]

The file named Lab03Task7_population.txt contains the midyear population of a country, in thousands, during the years 1950 through 1990. The first line in the file contains the population for 1950, the second line contains the population for 1951, and so forth. Write a program that reads the file's contents into a list. The program should display the following data:

1. The average annual change in population during the time period
2. The year with the greatest increase in population during the time period
3. The year with the smallest increase in population during the time period

Note: The following task is **mandatory for PhD students.** However, MPhil students can perform this task as a bonus task.

Task 8 [15]

Write a program that reads the contents of two text files and compares them in the following ways:

1. It should display a list of all the unique words contained in both files.
2. It should display a list of the words that appear in both files.
3. It should display a list of the words that appear in the first file but not the second.
4. It should display a list of the words that appear in the second file but not the first.
5. It should display a list of the words that appear in either the first or second file, but not
6. both.