Assignment 01
Second Year BS (Honours) 2020-2021
Course Title: Math Lab II (Fortran), Course Code: AMTH 250
Department of Applied Mathematics, University of Dhaka

Name: **Roll No:**   **Group:**

*[Write a FORTRAN program to solve each of the following problems. **Use files for input/output unless specified otherwise**. Name the files and the code according to the assignment and problem no., e.g., for problem no. **Y** of assignment **X**, input & output file names must be 'inXqY.txt' and 'outXqY.txt' respectively.]*

Day-1

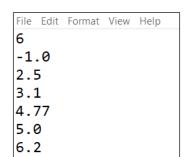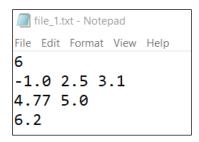1. Create and save these four text files containing the data as exactly as follows: **[8]**

    InputFile_1.txt   *InputFile_2.txt*

    ```
    file_1.txt - Notepad
    File  Edit  Format  View  Help
    6 a b c d e f
    ```

    ```
    File  Edit  Format  View  Help
    6
    -1 2 3 -4 5 -6
    ```

    InputFile_3.txt   *InputFile_4.txt*

    ```
    File  Edit  Format  View  Help
    6
    -1.0
    2.5
    3.1
    4.77
    5.0
    6.2
    ```

    ```
    file_1.txt - Notepad
    File  Edit  Format  View  Help
    6
    -1.0 2.5 3.1
    4.77 5.0
    6.2
    ```

    Write a program to read these data and store them in suitable one dimensional arrays where the length of the array is the first value in the file. Then print all the data in a single output file as exactly as they were.

2. Write a code to read your full name from a file and then print it   **[12]**

    (i)   without spaces,

    (ii)   without the vowels,

    (iii)   in capital (upper case) letters,

    (iv)   in reverse order.

3. Write a code using loop to create 20 text files named *'File_N.txt'* containing the line   **[5]**
    'This is file number N*'* where N = 01, 02, …, 20.

4. Let $M = \begin{bmatrix} -2 & 2.5 - i & -5 - 1.1i \\ 2.5 + i & 3 & -i \\ 5 - 1.1i & i & 4 \end{bmatrix}$. Write a program to evaluate the followings: **[15]**

(i)   modulus and argument of each element,

(ii)   the sum and product of the elements of the minor diagonal,

(iii)   product of M and complex conjugate of M.

(iv)   determine whether M is a Hermitian matrix or not.

Day-2

5. Write a Fortran program to generate a square matrix of 36 random real numbers **[15]** between 100 and 200 inclusive. Print the matrix appropriately in three different files named '*ot_a1q3_F.txt*', '*ot_a1q3_E.txt*', '*ot_a1q3_ES.txt*', respectively using:

    (i)   the F descriptor, corrected up to 8 decimal places

    (ii)   the E descriptor, corrected up to 7 decimal places

    (iii)   the ES descriptor, corrected up to 7 decimal places

    In the same program, use a subroutine to sort those numbers in ascending order using the bubble sort algorithm and then print them in a file named *ot_a1q3_sorted.txt*.

6. Suppose A, B, C contains three positive real numbers. Write a Fortran code to **[10]** determine whether A, B, C can form the sides of a triangle. If not, print the message '*Not a triangle*'. If yes, determine whether it is

    (i)   an isosceles triangle,

    (ii)   an equilateral triangle,

    (iii)   a right-angled triangle.

    In each case, print an appropriate message.

7. A *happy number* is a number such that if you square its digits and add them **[15]** together, then take the result and square the result's digits and add them together, then take the result again and keep doing the process similarly, you will finally end up with the number 1. For example, 19 is a happy number, since the above process for 19 ends in 1 as follows:

$$1^2 + 9^2 = 82,$$
$$8^2 + 2^2 = 68,$$
$$6^2 + 8^2 = 100,$$
$$1^2 + 0^2 + 0^2 = 1.$$

    Given any two digit number n, write a Fortran code to check whether n is happy. *[Consider maximum iterations = 100]*