Programming Exercise 1

Complete the following problems.
This assignment is due by 11:59 pm on January 28, 2019.

This programming exercise involves reading data from user-provided input files and works with matrices. Input files and an initial version of the first required program are provided in each student's `ProgrammingExercises` repository available on the course GitHub site.

1. Write and compile a program named `pgrm_01_01.exe` that reads a 3×3 matrix of real numbers from a user-defined file and prints the matrix back to the screen. An initial draft source code file named `pgrm_01_01.f90` is provided in your GitHub `ProgrammingExercises` repository.

    The repository includes the sample input file `input_01_01.txt`, which should give the following output:

    ```
    Printing Matrix
       0.1    0.4    0.7
       0.2    0.5    0.8
       0.3    0.6    0.9
    ```

2. Write and compile a program named `pgrm_01_02.exe` that reads two 3×3 matrices of real numbers from user-defined files and prints the two matrices back to the screen. Begin by copying `pgrm_01_01.f90` to `pgrm_01_02.f90`. The matrix printing subroutine does *not* need to be modified; all necessary modifications should be made to the main program code. The variable declaration section of the main program should have the following form:

    ```
            Program pgrm_01_02
    !
    !       This program reads two 3x3 matrices from a user-provided input files.
    !       After the files are opened and read, they are closed and the matrices
    !       printed.
    !
            implicit none
            integer,parameter::inFileUnitA=10,inFileUnitB=11
            integer::errorFlag,i
            real,dimension(3,3)::matrixInA,matrixInB
            character(len=128)::fileNameA,filenameB
    !
    ```

    The repository includes the sample input files `input_01_01.txt` and `input_01_02.txt`, which should give the following output:

    ```
    Printing Matrix
       0.1    0.4    0.7
       0.2    0.5    0.8
       0.3    0.6    0.9
    Printing Matrix
       1.5    2.1    1.7
    ```

```
          3.3     1.5     2.8
          1.1     2.6     2.2
```

3. Write and compile a program named `pgrm_01_03.exe` that reads two 3×3 matrices of real numbers from user-defined files, prints the two matrices back to the screen, forms the product of the two matrices, and then prints the matrix product using the same subroutine has used in the previous two programs. Begin by copying `pgrm_01_02.f90` to `pgrm_01_03.f90`. The matrix printing subroutine does *not* need to be modified; all necessary modifications should be made to the main program code. The variable declaration section of the main program should have the following form:

```
      Program pgrm_01_03
!
!     This program reads two 3x3 matrices from a user-provided input files.
!     After the files are opened and read, they are closed and the matrices
!     printed. Finally, the matrix product of these two matrices is formed using
!     the f90 intrinsic function MatMul. This final matrix is also printed.
!
      implicit none
      integer,parameter::inFileUnitA=10,inFileUnitB=11
      integer::errorFlag,i
      real,dimension(3,3)::matrixInA,matrixInB,matrixProduct
      character(len=128)::fileNameA,filenameB
!
```

and the bottom of the main program should look like:

```
!
!     Call the subroutine PrintMatrix to print matrixInA and matrixInB.
!
      call PrintMatrix3x3(matrixInA)
      call PrintMatrix3x3(matrixInB)
!
!     Form matrixProduct using the intrinsic function MatMul. Then, print the
!     result.
!
      matrixProduct = MatMul(matrixInA,matrixInB)
      call PrintMatrix3x3(matrixProduct)
!
  999 continue
      End Program pgrm_01_03
```

The two input files used in the previous problems, `input_01_01.txt` and `input_01_02.txt`, should give the following output:

```
  Printing Matrix
      0.1     0.4     0.7
      0.2     0.5     0.8
      0.3     0.6     0.9
```

```
Printing Matrix
  1.5    2.1    1.7
  3.3    1.5    2.8
  1.1    2.6    2.2
Printing Matrix
  2.2    2.6    2.8
  2.8    3.3    3.5
  3.4    3.9    4.2
```